

图书情报专题研究

最新学科研究热点与前沿
(2021)

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前 言

《图书情报专题研究》的宗旨是为我校师生开展学术研究提供有价值的参考信息，此项工作由图书馆信息咨询服务部承担。“最新学科研究热点与前沿”根据学校所购买的数字资源，通过分析其深层次的功能，从数据库中组织整理出了与我校学科领域相关的最新学科热点研究论文、最新研究前沿及最新国际会议信息等，以期能对我校师生开展学术研究、项目立项、开题等学术研究活动提供帮助。

本期收集整理了如下七个方面的热点文献和前沿信息：

- 1、Nature Latest Research, Nature Engineering 最新研究进展；
- 2、IEL Top25, IEL 数据库下载最多的 25 篇论文；
- 3、ESI (Essential Science Indicators) HOT PAPERS, 按照 ESI 某一学科热点论文被引频次排名选取前 25 篇；
- 4、ESI (Essential Science Indicators) HIGHLY CITED PAPERS, 按照 ESI 某一学科高被引论文被引频次排名选取前 25 篇；
- 5、AIAA、IAF 最新会议，由 AIAA、IAF 主站提供的最新会议信息，可供相关研究者参考；
- 6、ACM 最新会议，根据 ACM 主页所提供的最新会议信息整理所得，可供相关研究者参考；
- 7、IQPC 最新会议，由国际质量与竞争力中心 (IQPC: International Quality and Productivity Center) 提供的最新国际会议，内容涉及国防、能源、工业、科技、电信等领域。IQPC 是国际顶级的会议展览策划公司，于 1973 年成立于美国，旨在为全球业务主管提供量身定制的会议、大型会展以及培训课程，积极为行业人士的相互交流创建平台，使业内人士能够随时掌握行业发展的最新趋势及技术创新。

如果您对我们的栏目设置、内容编排等有好的意见和建议，欢迎与我们联系 (电话：88492928)，我们将积极采纳，使这份电子刊物日臻完善，共同为把我校建成学科特色鲜明的世界一流大学而努力。

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Nature Latest Research(Engineering)

来源: <https://www.nature.com/nenergy/>

- 标题:** Nickel ferrocyanide as a high-performance urea oxidation electrocatalyst
作者: Shi-Kui Geng, Yao Zheng, Shan-Qing Li, Hui Su, Xu Zhao, Jun Hu, Hai-Bo Shu, Mietek Jaroniec, Ping Chen, Qing-Hua Liu & Shi-Zhang Qiao
摘要: Urea is often present in waste water but can be used in powering fuel cells and as an alternative oxidation substrate to water in an electrolyser. However, an insufficient mechanistic understanding and the lack of efficient catalysts for the urea oxidation reaction have hampered the development of such applications. Here we demonstrate that a nickel ferrocyanide (Ni₂Fe(CN)₆) catalyst supported on Ni foam can drive the urea oxidation reaction with a higher activity and better stability than those of conventional Ni-based catalysts. Our experimental and computational data suggest a urea oxidation reaction pathway different from most other Ni-based catalysts that comprise NiOOH derivatives as the catalytically active compound. Ni₂Fe(CN)₆ appears to be able to directly facilitate a two-stage reaction pathway that involves an intermediate ammonia production (on the Ni site) and its decomposition to N₂ (on the Fe site). Owing to the different rate-determining steps with more favourable thermal/kinetic energetics, Ni₂Fe(CN)₆ achieves a 100 mA cm⁻² anodic current density at a potential of 1.35 V (equal to an overpotential of 0.98 V).
链接: <https://www.nature.com/articles/s41560-021-00899-2>
- 标题:** Inequitable access to distributed energy resources due to grid infrastructure limits in California
作者: Anna M. Brockway, Jennifer Conde & Duncan Callaway
摘要: Persistent social disparities in the adoption of distributed energy resources (DERs) have prompted calls for enabling more equitable uptake. However, there are indications that limits inherent to grid infrastructure may hinder DER adoption. In this study we analysed grid limits to new DER integration across California's two largest utility territories. We found that grid limits reduce access to solar photovoltaics to less than half of households served by these two utilities, and may hinder California's electric vehicle adoption and residential load electrification goals. We connected these results to demographic characteristics and found that grid limits also exacerbate existing inequities: households in increasingly Black-identifying and disadvantaged census block groups have disproportionately less access to new solar photovoltaic capacity based on circuit hosting capacity. Our results illuminate the need for equity goals to be an input in the design of policies for prioritizing grid upgrades.
链接: <https://www.nature.com/articles/s41560-021-00887-6>

3. **标题:** Variation of public discourse about the impacts of fracking with geographic scale and proximity to proposed development

作者: Fedor A. Dokshin

摘要: Public response to energy projects affects the emergence of new technologies and the distribution of their risks and benefits. Here we use thousands of individually authored comments submitted during a regulatory review of unconventional shale gas development in New York State to reconcile previous, inconsistent results about the relationship between proximity and opposition to energy projects. We find that members of the public opposed unconventional shale gas development for different reasons, which varied systematically with proximity to unconventional gas wells. Public discourse in proximate communities was diverse, invoking environmental, social, economic and political impacts, and was anchored by concerns specific to a particular place. By contrast, a few nationally salient environmental concerns dominated public discourse in communities farther from development. Our results demonstrate that public response reflects the mobilization of alternative constituencies with unique understandings of the issue. Distinguishing among these is critical for understanding the nature of public response.

链接: <https://www.nature.com/articles/s41560-021-00886-7>

4. **标题:** Electrochemical synthesis of continuous metal–organic framework membranes for separation of hydrocarbons

作者: Sheng Zhou, Osama Shekhah, Jiangtao Jia, Justyna Czaban-Jóźwiak, Prashant M. Bhatt, Adrian Ramírez, Jorge Gascon & Mohamed Eddaoudi

摘要: Membrane-based approaches can offer energy-efficient and cost-effective methods for various separation processes. Practical membranes must have high permselectivity at industrially relevant high pressures and under aggressive conditions, and be manufacturable in a scalable and robust fashion. We report a versatile electrochemical directed-assembly strategy to fabricate polycrystalline metal–organic framework membranes for separation of hydrocarbons. We fabricate a series of face-centred cubic metal–organic framework membranes based on 12-connected rare-earth or zirconium hexanuclear clusters with distinct ligands. In particular, the resultant fumarate-based membranes containing contracted triangular apertures as sole entrances to the pore system enable molecular-sieving separation of propylene/propane and butane/isobutane mixtures. Prominently, increasing the feed pressure to the industrially practical value of 7 atm promoted a desired enhancement in both the total flux and separation selectivity. Process design analysis demonstrates that, for propylene/propane separation, the deployment of such face-centred cubic Zr-fumarate-based metal–organic framework membranes in a hybrid membrane–distillation system offers the potential to decrease the energy input by nearly 90% relative to a conventional single distillation process.

链接: <https://www.nature.com/articles/s41560-021-00881-y>

5. **标题:** High-performing commercial Fe–N–C cathode electrocatalyst for anion-exchange membrane fuel cells

作者: Horie Adabi, Abolfazl Shakouri, Noor Ul Hassan, John R. Varcoe, Barr Zulevi, Alexey Serov, John R. Regalbuto & William E. Mustain

摘要: To reduce the cost of fuel cell stacks and systems, it is important to create commercial

catalysts that are free of platinum group metals (PGMs). To do this, such catalysts must have very high activity, but also have the correct microstructure to facilitate the transport of reactants and products. Here, we show a high-performing commercial oxygen reduction catalyst that was specifically developed for operation in alkaline media and is demonstrated in the cathode of operating anion-exchange membrane fuel cells (AEMFCs). With H₂/O₂ reacting gases, AEMFCs made with Fe–N–C cathodes achieved a peak power density exceeding 2 W cm⁻² (>1 W cm⁻² with H₂/air) and operated with very good voltage durability for more than 150 h. These AEMFCs also realized an iR-corrected current density at 0.9 V of 100 mA cm⁻². Finally, in a second configuration, Fe–N–C cathodes paired with low-loading PtRu/C anodes (0.125 mg PtRu per cm², 0.08 mg Pt per cm²) demonstrated a specific power of 10.4 W per mg PGM (16.25 W per mg Pt).

链接: <https://www.nature.com/articles/s41560-021-00878-7>

6. 标题: Global scenarios of household access to modern energy services under climate mitigation policy

作者: Miguel Poblete-Cazenave, Shonali Pachauri, Edward Byers, Alessio Mastrucci & Bas van Ruijven

摘要: Emission reduction scenarios to meet climate change mitigation policy goals rarely explore the differential impact of alternative pathways on access to energy for different economic strata of society across countries. Here we show that even under optimistic socioeconomic growth scenarios, inequalities in use of modern energy in homes could persist. We find that, although access improves in high growth scenarios, over 10% of populations in sub-Saharan Africa and South Asia could lack access to energy services for thermal comfort, food preparation and conservation, and cleaning in 2050. Ambitious climate mitigation scenarios do not substantially alter household access to energy services in the Global South, and only affect gas consumption in high-income regions. Our work suggests that efforts to meet climate mitigation policy goals are not at odds with progress towards universal access to modern energy services in the Global South, however, directed policy will be needed to meet access goals.

链接: <https://www.nature.com/articles/s41560-021-00871-0>

7. 标题: Symmetry-breaking design of an organic iron complex catholyte for a long cyclability aqueous organic redox flow battery

作者: Xiang Li, Peiyuan Gao, Yun-Yu Lai, J. David Bazak, Aaron Hollas, Heng-Yi Lin, Vijayakumar Murugesan, Shuyuan Zhang, Chung-Fu Cheng, Wei-Yao Tung, Yueh-Ting Lai, Ruozhu Feng, Jin Wang, Chien-Lung Wang, Wei Wang & Yu Zhu

摘要: The limited availability of a high-performance catholyte has hindered the development of aqueous organic redox flow batteries (AORFB) for large-scale energy storage. Here we report a symmetry-breaking design of iron complexes with 2,2'-bipyridine-4,4'-dicarboxylic (Dcbpy) acid and cyanide ligands. By introducing two ligands to the metal centre, the complex compounds (M₄[FeII(Dcbpy)₂(CN)₂], M = Na, K) exhibited up to a 4.2 times higher solubility (1.22 M) than that of M₄[FeII(Dcbpy)₃] and a 50% increase in potential compared with that of ferrocyanide. The AORFBs with 0.1 M Na₄[FeII(Dcbpy)₂(CN)₂] as the catholyte were demonstrated for 6,000 cycles with a capacity fading rate of 0.00158% per cycle (0.217% per day). Even at a concentration near the solubility limit (1 M Na₄[FeII(Dcbpy)₂(CN)₂]), the flow battery exhibited

a capacity fading rate of 0.008% per cycle (0.25% per day) in the first 400 cycles. The AORFB cell with a nearly 1:1 catholyte:anolyte electron ratio achieved a cell voltage of 1.2 V and an energy density of 12.5 Wh l⁻¹.

链接: <https://www.nature.com/articles/s41560-021-00879-6>

8. 标题: Greenhouse-inspired supra-photothermal CO₂ catalysis

作者: Mujin Cai, Zhiyi Wu, Zhao Li, Lu Wang, Wei Sun, Athanasios A. Tountas, Chaoran Li, Shenghua Wang, Kai Feng, Ao-Bo Xu, Sanli Tang, Alexandra Tavasoli, Meiwen Peng, Wenxuan Liu, Amr S. Helmy, Le He, Geoffrey A. Ozin & Xiaohong Zhang

摘要: Converting carbon dioxide photocatalytically into fuels using solar energy is an attractive route to move away from a reliance on fossil fuels. Photothermal CO₂ catalysis is one approach to achieve this, but improved materials that can more efficiently harvest and use solar energy are needed. Here, we report a supra-photothermal catalyst architecture—inspired by the greenhouse effect—that boosts the performance of a catalyst for CO₂ hydrogenation compared to traditional photothermal catalyst designs. The catalyst consists of a nanoporous-silica-encapsulated nickel nanocrystal (Ni@p-SiO₂), which is active for methanation and reverse water–gas shift reactions. Under illumination, the local temperatures achieved by Ni@p-SiO₂ exceed those of Ni-based catalysts without the SiO₂ shell. We suggest that the heat insulation and infrared shielding effects of the SiO₂ sheath confine the photothermal energy of the nickel core, enabling a supra-photothermal effect. Catalyst sintering and coking is also lessened in Ni@p-SiO₂, which may be due to spatial confinement effects.

链接: <https://www.nature.com/articles/s41560-021-00867-w>

9. 标题: Applying responsible algorithm design to neighbourhood-scale batteries in Australia

作者: Hedda Ransan-Cooper, Björn C. P. Sturmberg, Marnie E. Shaw & Lachlan Blackhall

摘要: The digital energy era presents at least three systemic concerns to the design and operation of algorithms: bias of considerations towards the easily quantifiable; inhibition of explainability; and undermining of trust and inclusion, as well as energy users' autonomy and control. Here we examine these tensions through an interdisciplinary study that reveals the diversity of possible algorithms and their accompanying material effects, focused on neighbourhood-scale batteries (NSBs) in Australia. We conducted qualitative research with energy sector professionals and citizens to understand the range of perceived benefits and risks of NSBs and the algorithms that drive their behaviour. Issues raised by stakeholders were integrated into NSB optimization algorithms whose effects on NSB owners and customers were quantified through techno-economic modelling. Our results show the allocation of benefits and risks vary considerably between different algorithm designs. This indicates a need to improve energy algorithm governance, enabling accountability and responsiveness across the design and use of algorithms so that the digitization of energy technology does not lead to adverse public outcomes.

链接: <https://www.nature.com/articles/s41560-021-00868-9>

10. **标题:** National growth dynamics of wind and solar power compared to the growth required for global climate targets

作者: Aleh Cherp, Vadim Vinichenko, Jale Tosun, Joel A. Gordon & Jessica Jewell

摘要: Climate mitigation scenarios envision considerable growth of wind and solar power, but scholars disagree on how this growth compares with historical trends. Here we fit growth models to wind and solar trajectories to identify countries in which growth has already stabilized after the initial acceleration. National growth has followed S-curves to reach maximum annual rates of 0.8% (interquartile range of 0.6–1.1%) of the total electricity supply for onshore wind and 0.6% (0.4–0.9%) for solar. In comparison, one-half of 1.5 °C-compatible scenarios envision global growth of wind power above 1.3% and of solar power above 1.4%, while one-quarter of these scenarios envision global growth of solar above 3.3% per year. Replicating or exceeding the fastest national growth globally may be challenging because, so far, countries that introduced wind and solar power later have not achieved higher maximum growth rates, despite their generally speedier progression through the technology adoption cycle.

链接: <https://www.nature.com/articles/s41560-021-00863-0>

11. **标题:** Redox-neutral electrochemical conversion of CO₂ to dimethyl carbonate

作者: Kyu Min Lee, Jun Ho Jang, Mani Balamurugan, Jeong Eun Kim, Young In Jo & Ki Tae Nam

摘要: The electrochemical reduction of CO₂ to value-added products is a promising approach for using CO₂. However, the products are limited to reduced forms, such as CO, HCOOH and C₂H₄. Decreasing the anodic overpotential and designing membrane-separated systems are important determinants of the overall efficiency of the process. In this study we explored the use of redox-neutral reactions in electrochemical CO₂ reduction to expand the product scope and achieve higher efficiency. We combined the CO₂ reduction reaction with two redox cycles in an undivided cell so that the input electrons are carried through the electrolyte rather than settling in CO₂. As a result, dimethyl carbonate—a useful fuel additive—has been synthesized directly from CO₂ in methanol solvent with a Faradaic efficiency of 60% at room temperature. Our study shows that the formation of methoxide intermediates and the cyclic regeneration of the uniformly dispersed palladium catalyst by in situ-generated oxidants are important for dimethyl carbonate synthesis at room temperature. Furthermore, we successfully synthesized diethyl carbonate from CO₂ and ethanol, demonstrating the generality and expandability of our system.

链接: <https://www.nature.com/articles/s41560-021-00862-1>

12. **标题:** Balancing interfacial reactions to achieve long cycle life in high-energy lithium metal batteries

作者: Chaojiang Niu, Dianying Liu, Joshua A. Lochala, Cassidy S. Anderson, Xia Cao, Mark E. Gross, Wu Xu, Ji-Guang Zhang, M. Stanley Whittingham, Jie Xiao & Jun Liu

摘要: The rechargeable lithium metal battery has attracted wide attention as a next-generation energy storage technology. However, simultaneously achieving high cell-level energy density and long cycle life in realistic batteries is still a great challenge. Here we investigate the degradation mechanisms of Li || LiNi_{0.6}Mn_{0.2}Co_{0.2}O₂ pouch cells and present fundamental linkages among Li thickness, electrolyte depletion and the structure evolution of solid–electrolyte interphase layers.

Different cell failure processes are discovered when tuning the anode to cathode capacity ratio in compatible electrolytes. An optimal anode to cathode capacity ratio of 1:1 emerges because it balances well the rates of Li consumption, electrolyte depletion and solid–electrolyte interphase construction, thus decelerating the increase of cell polarization and extending cycle life. Contrary to conventional wisdom, long cycle life is observed by using ultra-thin Li (20 μm) in balanced cells. A prototype 350 Wh kg^{-1} pouch cell (2.0 Ah) achieves over 600 long stable cycles with 76% capacity retention without a sudden cell death.

链接: <https://www.nature.com/articles/s41560-021-00852-3>

13. 标题: Low-temperature and effective ex situ group V doping for efficient polycrystalline CdSeTe solar cells

作者: Deng-Bing Li, Canglang Yao, S. N. Vijayaraghavan, Rasha A. Awni, Kamala K. Subedi, Randy J. Ellingson, Lin Li, Yanfa Yan & Feng Yan

摘要: CdTe solar cell technology is one of the lowest-cost methods of generating electricity in the solar industry, benefiting from fast CdTe absorber deposition, CdCl_2 treatment and Cu doping. However, Cu doping has low photovoltage and issues with instability. Doping group V elements into CdTe is therefore a promising route to address these challenges. Although high-temperature in situ group V doped CdSeTe devices have demonstrated efficiencies exceeding 20%, they face obstacles including post-deposition doping activation processes, short carrier lifetimes and low activation ratios. Here, we demonstrate low-temperature and effective ex situ group V doping for CdSeTe solar cells using group V chlorides. For AsCl_3 doped CdSeTe solar cells, the dopant activation ratio can be 5.88%, hole densities reach $>2 \times 10^{15} \text{ cm}^{-3}$ and carrier lifetime is longer than 20 ns. Thus, ex situ As doped CdSeTe solar cells show open-circuit voltages $\sim 863 \text{ mV}$, compared to the highest open-circuit voltage of 852 mV for Cu doped CdSeTe solar cells.

链接: <https://www.nature.com/articles/s41560-021-00848-z>

14. 标题: Heavy-duty truck electrification and the impacts of depot charging on electricity distribution systems

作者: Brennan Borlaug, Matteo Muratori, Madeline Gilleran, David Woody, William Muston, Thomas Canada, Andrew Ingram, Hal Gresham & Charlie McQueen

摘要: Major technological advancements and recent policy support are improving the outlook for heavy-duty truck electrification in the United States. In particular, short-haul operations (≤ 200 miles ($\leq 322 \text{ km}$)) are prevalent and early candidates for plug-in electric vehicles (EVs) given their short, predictable routes and return-to-base applications, which allows vehicles to recharge when off shift at their depots. Although previous studies investigated the impacts of added electrical loads on distribution systems, which included light-duty EVs, the implications for heavy-duty EV charging are underexplored. Here we summarize the causes, costs and lead times of distribution system upgrades anticipated for depot charging. We also developed synthetic depot charging load profiles for heavy-duty trucks from real-world operating schedules, and found that charging requirements are met at common light-duty EV charging rates ($\leq 100 \text{ kW}$ per vehicle). Finally, we applied depot charging load profiles to 36 distribution real-world substations, which showed that most can accommodate high levels of heavy-duty EV charging without upgrades.

链接: <https://www.nature.com/articles/s41560-021-00855-0>

15. **标题:** A high-energy-density and long-life initial-anode-free lithium battery enabled by a Li₂O sacrificial agent

作者: Yu Qiao, Huijun Yang, Zhi Chang, Han Deng, Xiang Li & Haoshen Zhou

摘要: Equipped with a fully lithiated cathode with a bare anode current collector, the anode-free lithium cell architecture presents remarkable advantages in terms of both energy density and safety compared with conventional lithium-ion cells. However, it is challenging to realize high Li reversibility, especially considering the limited Li reservoir (typically zero lithium excess) in the cell configuration. In this study we have introduced Li₂O as a preloaded sacrificial agent on a LiNi_{0.8}Co_{0.1}Mn_{0.1}O₂ cathode, providing an additional Li source to offset the irreversible loss of Li during long-term cycling in an initial-anode-free cell. We show that O₂⁻ species, released through Li₂O oxidation, are synergistically neutralized by a fluorinated ether additive. This leads to the construction of a LiF-based layer at the cathode/electrolyte interface, which passivates the cathode surface and restrains the detrimental oxidative decomposition of ether solvents. We have achieved a long-life 2.46 Ah initial-anode-free pouch cell with a gravimetric energy density of 320 Wh kg⁻¹, maintaining 80% capacity after 300 cycles.

链接: <https://www.nature.com/articles/s41560-021-00839-0>

16. **标题:** The critical role of composition-dependent intragrain planar defects in the performance of MA_{1-x}FA_xPbI₃ perovskite solar cells

作者: Wei Li, Mathias Uller Rothmann, Ye Zhu, Weijian Chen, Chenquan Yang, Yongbo Yuan, Yen Yee Choo, Xiaoming Wen, Yi-Bing Cheng, Udo Bach & Joanne Etheridge

摘要: Perovskite solar cells show excellent power conversion efficiencies, long carrier diffusion lengths and low recombination rates. This encourages a view that intragrain defects are electronically benign with little impact on device performance. In this study we varied the methylammonium (MA)/formamidinium (FA) composition in MA_{1-x}FA_xPbI₃ (x = 0–1), and compared the structure and density of the intragrain planar defects with device performance, otherwise keeping the device nominally the same. We found that charge carrier lifetime, open-circuit voltage deficit and current density–voltage hysteresis correlate empirically with the density and structure of {111}_c planar defects (x = 0.5–1) and {112}_t twin boundaries (x = 0–0.1). The best performance parameters were found when essentially no intragrain planar defects were evident (x = 0.2). Similarly, reducing the density of {111}_c planar defects through MASCN vapour treatment of FAPbI₃ (x ≈ 1) also improved performance. These observations suggest that intragrain defect control can provide an important route for improving perovskite solar cell performance, in addition to well-established parameters such as grain boundaries and interfaces.

链接: <https://www.nature.com/articles/s41560-021-00830-9>

17. **标题:** Persistent and partially mobile oxygen vacancies in Li-rich layered oxides

作者: Peter M. Csernica, Samanbir S. Kalirai, William E. Gent, Kipil Lim, Young-Sang Yu, Yunzhi Liu, Sung-Jin Ahn, Emma Kaeli, Xin Xu, Kevin H. Stone, Ann F. Marshall, Robert Sinclair, David A. Shapiro, Michael F. Toney & William C. Chueh

摘要: Increasing the energy density of layered oxide battery electrodes is challenging as accessing high states of delithiation often triggers voltage degradation and oxygen release. Here we utilize



transmission-based X-ray absorption spectromicroscopy and ptychography on mechanically cross-sectioned $\text{Li}_{1.18-x}\text{Ni}_{0.21}\text{Mn}_{0.53}\text{Co}_{0.08}\text{O}_{2-\delta}$ electrodes to quantitatively profile the oxygen deficiency over cycling at the nanoscale. The oxygen deficiency penetrates into the bulk of individual primary particles (~ 200 nm) and is well-described by oxygen vacancy diffusion. Using an array of characterization techniques, we demonstrate that, surprisingly, bulk oxygen vacancies that persist within the native layered phase are indeed responsible for the observed spectroscopic changes. We additionally show that the arrangement of primary particles within secondary particles (~ 5 μm) causes considerable heterogeneity in the extent of oxygen release between primary particles. Our work merges an ensemble of length-spanning characterization methods and informs promising approaches to mitigate the deleterious effects of oxygen release in lithium-ion battery electrodes.

链接: <https://www.nature.com/articles/s41560-021-00832-7>

18. 标题: A unified description of non-radiative voltage losses in organic solar cells

作者: Xian-Kai Chen, Deping Qian, Yuming Wang, Thomas Kirchartz, Wolfgang Tress, Huifeng Yao, Jun Yuan, Markus Hülsbeck, Maojie Zhang, Yingping Zou, Yanming Sun, Yongfang Li, Jianhui Hou, Olle Inganäs, Veaceslav Coropceanu, Jean-Luc Bredas & Feng Gao

摘要: Recent advances in organic solar cells based on non-fullerene acceptors (NFAs) come with reduced non-radiative voltage losses (ΔV_{nr}). Here we show that, in contrast to the energy-gap-law dependence observed in conventional donor:fullerene blends, the ΔV_{nr} values in state-of-the-art donor:NFA organic solar cells show no correlation with the energies of charge-transfer electronic states at donor:acceptor interfaces. By combining temperature-dependent electroluminescence experiments and dynamic vibronic simulations, we provide a unified description of ΔV_{nr} for both fullerene- and NFA-based devices. We highlight the critical role that the thermal population of local exciton states plays in low- ΔV_{nr} systems. An important finding is that the photoluminescence yield of the pristine materials defines the lower limit of ΔV_{nr} . We also demonstrate that the reduction in ΔV_{nr} (for example, < 0.2 V) can be obtained without sacrificing charge generation efficiency. Our work suggests designing donor and acceptor materials with high luminescence efficiency and complementary optical absorption bands extending into the near-infrared region.

链接: <https://www.nature.com/articles/s41560-021-00843-4>

19. 标题: Scenicness assessment of onshore wind sites with geotagged photographs and impacts on approval and cost-efficiency

作者: R. McKenna, J. M. Weinand, I. Mulalic, S. Petrović, K. Mainzer, T. Preis & H. S. Moat

摘要: Cost-efficiency and public acceptance are competing objectives for onshore wind locations. The impact of 'scenicness' on these two objectives has been difficult to quantify for wind projects. We analyse the link between economic wind resources and beautiful landscapes with over 1.5 million 'scenicness' ratings of around 200,000 geotagged photographs from across Great Britain. We find evidence that planning applications for onshore wind are more likely to be rejected when proposed in more scenic areas. Compared to the technical potential of onshore wind of 1,700 TWh at a total cost of £280 billion, removing the 10% most scenic areas implies about 18% lower generation potential and 8–26% higher costs. We also consider connection distances to the nearest



electricity network transformer, showing that the connection costs constitute up to half of the total costs. The results provide a quantitative framework for researchers and policymakers to consider the trade-offs between cost-efficiency and public acceptance for onshore wind.

链接: <https://www.nature.com/articles/s41560-021-00842-5>

20. 标题: Pt/Fe₂O₃ with Pt–Fe pair sites as a catalyst for oxygen reduction with ultralow Pt loading

作者: Ruijie Gao, Jian Wang, Zhen-Feng Huang, Rongrong Zhang, Wei Wang, Lun Pan, Junfeng Zhang, Weikang Zhu, Xiangwen Zhang, Chengxiang Shi, Jongwoo Lim & Ji-Jun Zou

摘要: Platinum is the archetypal electrocatalyst for oxygen reduction—a key reaction in fuel cells and zinc–air batteries. Although dispersing platinum as single atoms on a support is a promising way to minimize the amount required, catalytic activity and selectivity are often low due to unfavourable O₂ adsorption. Here we load platinum onto α -Fe₂O₃ to construct a highly active and stable catalyst with dispersed Pt–Fe pair sites. We propose that the Pt–Fe pair sites have partially occupied orbitals driven by strong electronic coupling, and can cooperatively adsorb O₂ and dissociate the O=O bond, whereas OH* can desorb from the platinum site. In alkaline conditions, the catalyst exhibits onset and half-wave potentials of 1.15 V and 1.05 V (versus the reversible hydrogen electrode), respectively, mass activity of 14.9 A mg⁻¹Pt (at 0.95 V) and negligible activity decay after 50,000 cycles. It also shows better performance than 20% Pt/C in a zinc–air battery and H₂–O₂ fuel cell in terms of specific energy density and platinum utilization efficiency.

链接: <https://www.nature.com/articles/s41560-021-00826-5>

IEL Top25

(来源: <http://ieeexplore.ieee.org/>)

1. **标题:** 6G Wireless Systems: Vision, Requirements, Challenges, Insights, and Opportunities

出处: Proceedings of the IEEE

作者: Harsh Tataria; Mansoor Shafi; Andreas F. Molisch; Mischa Dohler; Henrik Sjöland; Fredrik Tufvesson

摘要: Mobile communications have been undergoing a generational change every ten years or so. However, the time difference between the so-called “G’s” is also decreasing. While fifth-generation (5G) systems are becoming a commercial reality, there is already significant interest in systems beyond 5G, which we refer to as the sixth generation (6G) of wireless systems. In contrast to the already published papers on the topic, we take a top-down approach to 6G. More precisely, we present a holistic discussion of 6G systems beginning with lifestyle and societal changes driving the need for next-generation networks. This is followed by a discussion into the technical requirements needed to enable 6G applications, based on which we dissect key challenges and possibilities for practically realizable system solutions across all layers of the Open Systems Interconnection stack (i.e., from applications to the physical layer). Since many of the 6G applications will need access to an order-of-magnitude more spectrum, utilization of frequencies between 100 GHz and 1 THz becomes of paramount importance. As such, the 6G ecosystem will feature a diverse range of frequency bands, ranging from below 6 GHz up to 1 THz. We comprehensively characterize the limitations that must be overcome to realize working systems in these bands and provide a unique perspective on the physical and higher layer challenges relating to the design of next-generation core networks, new modulation and coding methods, novel multiple-access techniques, antenna arrays, wave propagation, radio frequency transceiver design, and real-time signal processing. We rigorously discuss the fundamental changes required in the core networks of the future, such as the redesign or significant reduction of the transport architecture that serves as a major source of latency for time-sensitive applications. This is in sharp contrast to the present hierarchical network architectures that are not suitable to realize many of the anticipated 6G services. While evaluating the strengths and weaknesses of key candidate 6G technologies, we differentiate what may be practically achievable over the next decade, relative to what is possible in theory. Keeping this in mind, we present concrete research challenges for each of the discussed system aspects, providing inspiration for what follows.

链接: <https://ieeexplore.ieee.org/document/9390169>

2. **标题:** Security and Privacy in Smart Farming: Challenges and Opportunities

出处: IEEE Access

作者: Maanak Gupta; Mahmoud Abdelsalam; Sajad Khorsandroo; Sudip Mittal

摘要: Internet of Things (IoT) and smart computing technologies have revolutionized every

sphere of 21 st century humans. IoT technologies and the data driven services they offer were beyond imagination just a decade ago. Now, they surround us and influence a variety of domains such as automobile, smart home, healthcare, etc. In particular, the Agriculture and Farming industries have also embraced this technological intervention. Smart devices are widely used by a range of people from farmers to entrepreneurs. These technologies are used in a variety of ways, from finding real-time status of crops and soil moisture content to deploying drones to assist with tasks such as applying pesticide spray. However, the use of IoT and smart communication technologies introduce a vast exposure to cybersecurity threats and vulnerabilities in smart farming environments. Such cyber attacks have the potential to disrupt the economies of countries that are widely dependent on agriculture. In this paper, we present a holistic study on security and privacy in a smart farming ecosystem. The paper outlines a multi layered architecture relevant to the precision agriculture domain and discusses the security and privacy issues in this dynamic and distributed cyber physical environment. Further more, the paper elaborates on potential cyber attack scenarios and highlights open research challenges and future directions.

链接: <https://ieeexplore.ieee.org/document/9003290>

3. **标题:** Screen-Printed, Flexible, Parasitic Beam-Switching Millimeter-Wave Antenna Array for Wearable Applications

出处: IEEE Open Journal of Antennas and Propagation

作者: Azat Meredov; Kirill Klionovski; Atif Shamim

摘要: Millimeter wave antennas have applications in several sensing and communication systems. Such antennas, designed for modern miniaturized devices and systems, must be low profile, flexible, and low cost. Some applications also require beam steering for detection purposes. Combining all these features into an antenna system and delivering decent antenna performance is challenging. In this study, we combined a partially reflective surface with a parasitic patch array to create a simple beam-switching, low-profile, and flexible wearable detection system. To ensure lower costs as well as compatibility with wearable systems, screen printing was utilized on a flexible substrate. The antenna array was optimized for the 77 GHz band and had a high gain of 11.2 dBi. The designed system has three independent beams, which can be oriented from bore-sight to $\pm 32^\circ$ through a simple switching mechanism. The antenna array maintains its performance in both flat and flexed conditions. Finally, the antenna array was tested in the field to successfully detect objects moving in three different directions.

链接: <https://ieeexplore.ieee.org/document/8911223>

4. **标题:** An automatic analysis approach toward indistinguishability of sampling on the LWE problem

出处: Tsinghua Science and Technology

作者: Shuaishuai Zhu; Yiliang Han; Xiaoyuan Yang

摘要: Learning With Errors (LWE) is one of the Non-Polynomial (NP)-hard problems applied in cryptographic primitives against quantum attacks. However, the security and efficiency of schemes based on LWE are closely affected by the error sampling algorithms. The existing pseudo-random sampling methods potentially have security leaks that can fundamentally influence the security levels of previous cryptographic primitives. Given that these primitives are proved

semantically secure, directly deducing the influences caused by leaks of sampling algorithms may be difficult. Thus, we attempt to use the attack model based on automatic learning system to identify and evaluate the practical security level of a cryptographic primitive that is semantically proved secure in indistinguishable security models. In this paper, we first analyzed the existing major sampling algorithms in terms of their security and efficiency. Then, concentrating on the Indistinguishability under Chosen-Plaintext Attack (IND-CPA) security model, we realized the new attack model based on the automatic learning system. The experimental data demonstrates that the sampling algorithms perform a key role in LWE-based schemes with significant disturbance of the attack advantages, which may potentially compromise security considerably. Moreover, our attack model is achievable with acceptable time and memory costs.

链接: <https://ieeexplore.ieee.org/document/9036133>

5. **标题:** High performance frequent subgraph mining on transaction datasets: A survey and performance comparison

出处: Big Data Mining and Analytics

作者: Bismita S. Jena; Cynthia Khan; Rajshekhar Sunderraman

摘要: Graph data mining has been a crucial as well as inevitable area of research. Large amounts of graph data are produced in many areas, such as Bioinformatics, Cheminformatics, Social Networks, etc. Scalable graph data mining methods are getting increasingly popular and necessary due to increased graph complexities. Frequent subgraph mining is one such area where the task is to find overly recurring patterns/subgraphs. To tackle this problem, many main memory-based methods were proposed, which proved to be inefficient as the data size grew exponentially over time. In the past few years, several research groups have attempted to handle the Frequent Subgraph Mining (FSM) problem in multiple ways. Many authors have tried to achieve better performance using Graphic Processing Units (GPUs) which has multi-fold improvement over in-memory while dealing with large datasets. Later, Google's MapReduce model with the Hadoop framework proved to be a major breakthrough in high performance large batch processing. Although MapReduce came with many benefits, its disk I/O and noniterative style model could not help much for FSM domain since subgraph mining process is an iterative approach. In recent years, Spark has emerged to be the De Facto industry standard with its distributed in-memory computing capability. This is a right fit solution for iterative style of programming as well. In this survey, we cover how high-performance computing has helped in improving the performance tremendously in the transactional directed and undirected aspect of graphs and performance comparisons of various FSM techniques are done based on experimental results.

链接: <https://ieeexplore.ieee.org/document/8681052>

6. **标题:** Modified multi-key fully homomorphic encryption based on NTRU cryptosystem without key-switching

出处: Tsinghua Science and Technology

作者: Xiaoliang Che; Tanping Zhou; Ningbo Li; Haonan Zhou; Zhenhua Chen; Xiaoyuan Yang

摘要: The Multi-Key Fully Homomorphic Encryption (MKFHE) based on the NTRU cryptosystem is an important alternative to the post-quantum cryptography due to its simple scheme form, high efficiency, and fewer ciphertexts and keys. In 2012, Lopez-Alt et al. proposed

the first NTRU-type MKFHE scheme, the LTV12 scheme, using the key-switching and modulus-reduction techniques, whose security relies on two assumptions: the Ring Learning With Error (RLWE) assumption and the Decisional Small Polynomial Ratio (DSPR) assumption. However, the LTV12 and subsequent NTRU-type schemes are restricted to the family of power-of-2 cyclotomic rings, which may affect the security in the case of subfield attacks. Moreover, the key-switching technique of the LTV12 scheme requires a circular application of evaluation keys, which causes rapid growth of the error and thus affects the circuit depth. In this paper, an NTRU-type MKFHE scheme over prime cyclotomic rings without key-switching is proposed, which has the potential to resist the subfield attack and decrease the error exponentially during the homomorphic evaluating process. First, based on the RLWE and DSPR assumptions over the prime cyclotomic rings, a detailed analysis of the factors affecting the error during the homomorphic evaluations in the LTV12 scheme is provided. Next, a Low Bit Discarded & Dimension Expansion of Ciphertexts (LBD&DEC) technique is proposed, and the inherent homomorphic multiplication decryption structure of the NTRU is proposed, which can eliminate the key-switching operation in the LTV12 scheme. Finally, a leveled NTRU-type MKFHE scheme is developed using the LBD&DEC and modulus-reduction techniques. The analysis shows that the proposed scheme compared to the LTV12 scheme can decrease the magnitude of the error exponentially and minimize the dimension of ciphertexts.

链接: <https://ieeexplore.ieee.org/document/9036134>

7. 标题: Auxo: a temporal graph management system

出处: Big Data Mining and Analytics

作者: Wentao Han; Kaiwei Li; Shimin Chen; Wenguang Chen

摘要: As real-world graphs are often evolving over time, interest in analyzing the temporal behavior of graphs has grown. Herein, we propose Auxo, a novel temporal graph management system to support temporal graph analysis. It supports both efficient global and local queries with low space overhead. Auxo organizes temporal graph data in spatio-temporal chunks. A chunk spans a particular time interval and covers a set of vertices in a graph. We propose chunk layout and chunk splitting designs to achieve the desired efficiency and the above-mentioned goals. First, by carefully choosing the time split policy, Auxo achieves linear complexity in both space usage and query time. Second, graph splitting further improves the worst-case query time, and reduces the performance variance introduced by splitting operations. Third, Auxo optimizes the data layout inside chunks, thereby significantly improving the performance of traverse-based graph queries. Experimental evaluation showed that Auxo achieved $2.9\times$ to $12.1\times$ improvement for global queries, and $1.7\times$ to $2.7\times$ improvement for local queries, as compared with state-of-the-art open-source solutions.

链接: <https://ieeexplore.ieee.org/document/8486795>

8. 标题: Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI)

出处: IEEE Access

作者: Amina Adadi; Mohammed Berrada

摘要: At the dawn of the fourth industrial revolution, we are witnessing a fast and widespread adoption of artificial intelligence (AI) in our daily life, which contributes to accelerating the shift

towards a more algorithmic society. However, even with such unprecedented advancements, a key impediment to the use of AI-based systems is that they often lack transparency. Indeed, the black-box nature of these systems allows powerful predictions, but it cannot be directly explained. This issue has triggered a new debate on explainable AI (XAI). A research field holds substantial promise for improving trust and transparency of AI-based systems. It is recognized as the sine qua non for AI to continue making steady progress without disruption. This survey provides an entry point for interested researchers and practitioners to learn key aspects of the young and rapidly growing body of research related to XAI. Through the lens of the literature, we review the existing approaches regarding the topic, discuss trends surrounding its sphere, and present major research trajectories.

链接: <https://ieeexplore.ieee.org/document/8466590>

9. 标题: SegNet: A Deep Convolutional Encoder-Decoder Architecture for Image Segmentation

出处: IEEE Transactions on Pattern Analysis and Machine Intelligence

作者: Vijay Badrinarayanan; Alex Kendall; Roberto Cipolla

摘要: We present a novel and practical deep fully convolutional neural network architecture for semantic pixel-wise segmentation termed SegNet. This core trainable segmentation engine consists of an encoder network, a corresponding decoder network followed by a pixel-wise classification layer. The architecture of the encoder network is topologically identical to the 13 convolutional layers in the VGG16 network [1]. The role of the decoder network is to map the low resolution encoder feature maps to full input resolution feature maps for pixel-wise classification. The novelty of SegNet lies in the manner in which the decoder upsamples its lower resolution input feature map(s). Specifically, the decoder uses pooling indices computed in the max-pooling step of the corresponding encoder to perform non-linear upsampling. This eliminates the need for learning to upsample. The upsampled maps are sparse and are then convolved with trainable filters to produce dense feature maps. We compare our proposed architecture with the widely adopted FCN [2] and also with the well known DeepLab-LargeFOV [3], DeconvNet [4] architectures. This comparison reveals the memory versus accuracy trade-off involved in achieving good segmentation performance. SegNet was primarily motivated by scene understanding applications. Hence, it is designed to be efficient both in terms of memory and computational time during inference. It is also significantly smaller in the number of trainable parameters than other competing architectures and can be trained end-to-end using stochastic gradient descent. We also performed a controlled benchmark of SegNet and other architectures on both road scenes and SUN RGB-D indoor scene segmentation tasks. These quantitative assessments show that SegNet provides good performance with competitive inference time and most efficient inference memory-wise as compared to other architectures. We also provide a Caffe implementation of SegNet and a web demo at <http://mi.eng.cam.ac.uk/projects/segnet/>.

链接: <https://ieeexplore.ieee.org/document/7803544>

10. 标题: Hybrid recommender system for tourism based on big data and AI: A conceptual framework

出处: Big Data Mining and Analytics

作者: Khalid Al Fararni; Fouad Nafis; Badraddine Aghoutane; Ali Yahyaouy; Jamal Riffi;

Abdelouahed Sabri

摘要: With the development of the Internet, technology, and means of communication, the production of tourist data has multiplied at all levels (hotels, restaurants, transport, heritage, tourist events, activities, etc.), especially with the development of Online Travel Agency (OTA). However, the list of possibilities offered to tourists by these Web search engines (or even specialized tourist sites) can be overwhelming and relevant results are usually drowned in informational "noise", which prevents, or at least slows down the selection process. To assist tourists in trip planning and help them to find the information they are looking for, many recommender systems have been developed. In this article, we present an overview of the various recommendation approaches used in the field of tourism. From this study, an architecture and a conceptual framework for tourism recommender system are proposed, based on a hybrid recommendation approach. The proposed system goes beyond the recommendation of a list of tourist attractions, tailored to tourist preferences. It can be seen as a trip planner that designs a detailed program, including heterogeneous tourism resources, for a specific visit duration. The ultimate goal is to develop a recommender system based on big data technologies, artificial intelligence, and operational research to promote tourism in Morocco, specifically in the Daraa-Tafilalet region.

链接: <https://ieeexplore.ieee.org/document/9321202>

11. **标题:** Text-based price recommendation system for online rental houses

出处: Big Data Mining and Analytics

作者: Lujia Shen; Qianjun Liu; Gong Chen; Shouling Ji

摘要: Online short-term rental platforms, such as Airbnb, have been becoming popular, and a better pricing strategy is imperative for hosts of new listings. In this paper, we analyzed the relationship between the description of each listing and its price, and proposed a text-based price recommendation system called TAPE to recommend a reasonable price for newly added listings. We used deep learning techniques (e.g., feedforward network, long short-term memory, and mean shift) to design and implement TAPE. Using two chronologically extracted datasets of the same four cities, we revealed important factors (e.g., indoor equipment and high-density area) that positively or negatively affect each property's price, and evaluated our preliminary and enhanced models. Our models achieved a Root-Mean-Square Error (RMSE) of 33.73 in Boston, 20.50 in London, 34.68 in Los Angeles, and 26.31 in New York City, which are comparable to an existing model that uses more features.

链接: <https://ieeexplore.ieee.org/document/9007875>

12. **标题:** Big data analytics for healthcare industry: impact, applications, and tools

出处: Big Data Mining and Analytics

作者: Sunil Kumar; Maninder Singh

摘要: In recent years, huge amounts of structured, unstructured, and semi-structured data have been generated by various institutions around the world and, collectively, this heterogeneous data is referred to as big data. The health industry sector has been confronted by the need to manage the big data being produced by various sources, which are well known for producing high volumes of heterogeneous data. Various big-data analytics tools and techniques have been developed for handling these massive amounts of data, in the healthcare sector. In this paper, we discuss the

impact of big data in healthcare, and various tools available in the Hadoop ecosystem for handling it. We also explore the conceptual architecture of big data analytics for healthcare which involves the data gathering history of different branches, the genome database, electronic health records, text/imagery, and clinical decisions support system.

链接: <https://ieeexplore.ieee.org/document/8486794>

13. 标题: Internet of Things for Smart Cities

出处: IEEE Internet of Things Journal

作者: Andrea Zanella; Nicola Bui; Angelo Castellani; Lorenzo Vangelista; Michele Zorzi

摘要: The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. In this paper, we focus specifically to an urban IoT system that, while still being quite a broad category, are characterized by their specific application domain. Urban IoTs, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This paper hence provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. Furthermore, the paper will present and discuss the technical solutions and best-practice guidelines adopted in the Padova Smart City project, a proof-of-concept deployment of an IoT island in the city of Padova, Italy, performed in collaboration with the city municipality.

链接: <https://ieeexplore.ieee.org/document/6740844>

14. 标题: Clinical big data and deep learning: Applications, challenges, and future outlooks

出处: Big Data Mining and Analytics

作者: Ying Yu; Min Li; Liangliang Liu; Yaohang Li; Jianxin Wang

摘要: The explosion of digital healthcare data has led to a surge of data-driven medical research based on machine learning. In recent years, as a powerful technique for big data, deep learning has gained a central position in machine learning circles for its great advantages in feature representation and pattern recognition. This article presents a comprehensive overview of studies that employ deep learning methods to deal with clinical data. Firstly, based on the analysis of the characteristics of clinical data, various types of clinical data (e.g., medical images, clinical notes, lab results, vital signs and demographic informatics) are discussed and details provided of some public clinical datasets. Secondly, a brief review of common deep learning models and their characteristics is conducted. Then, considering the wide range of clinical research and the diversity of data types, several deep learning applications for clinical data are illustrated: auxiliary diagnosis, prognosis, early warning, and other tasks. Although there are challenges involved in applying deep learning techniques to clinical data, it is still worthwhile to look forward to a promising future for deep learning applications in clinical big data in the direction of precision medicine.

链接: <https://ieeexplore.ieee.org/document/8787233>

15. 标题: Principle Guidelines for Safe Power Supply Systems Development

出处: IEEE Access

作者: Philipp Kilian; Armin Köhler; Patrick Van Bergen; Carsten Gebauer; Bernd Pfeufer; Oliver Koller; Bernd Bert

摘要: The relevance of safety applications within the automotive industry is increasing continuously, e.g. due to vehicle automation and decreasing relevance of mechanical backups. To cope with these trends, the power input of safety-related electrical and/or electronic systems needs to be ensured by the power supply system – leading to increased functional safety requirements. Compliance with ISO 26262 will be more in focus in the future. Currently, the compliance with ISO 26262 may be used to argue the state of the art focusing on product liability – however, it will become mandatory for homologation. Thereby, the power supply system is a crucial point since faults of the power supply system are currently the major contributor for vehicle breakdowns with increasing tendency. So far, there is no standard approach within the automotive industry how to ensure functional safety for power supply systems. To fill this gap, this technical elaboration evaluates functional safety with focus on power supply systems development. Hence, guidelines on how to apply the ISO 26262 are provided based on discussions within the automotive industry and research institutes. The focus is on the concept phase, i.e. item definition, hazard analysis and risk assessment, and the functional safety concept. The functional safety concept is based on a structured hierarchical breakdown to systematically derive safety requirements from the item level down to the power supply system level. The essential safety requirement – beside the safe power feed and safe power distribution – is to assure the freedom from interference between the safety and non-safety relevant components.

链接: <https://ieeexplore.ieee.org/document/9499031>

16. 标题: A Comprehensive Survey on Graph Neural Networks

出处: IEEE Transactions on Neural Networks and Learning Systems

作者: Zonghan Wu; Shirui Pan; Fengwen Chen; Guodong Long; Chengqi Zhang; Philip S. Yu

摘要: Deep learning has revolutionized many machine learning tasks in recent years, ranging from image classification and video processing to speech recognition and natural language understanding. The data in these tasks are typically represented in the Euclidean space. However, there is an increasing number of applications, where data are generated from non-Euclidean domains and are represented as graphs with complex relationships and interdependency between objects. The complexity of graph data has imposed significant challenges on the existing machine learning algorithms. Recently, many studies on extending deep learning approaches for graph data have emerged. In this article, we provide a comprehensive overview of graph neural networks (GNNs) in data mining and machine learning fields. We propose a new taxonomy to divide the state-of-the-art GNNs into four categories, namely, recurrent GNNs, convolutional GNNs, graph autoencoders, and spatial-temporal GNNs. We further discuss the applications of GNNs across various domains and summarize the open-source codes, benchmark data sets, and model evaluation of GNNs. Finally, we propose potential research directions in this rapidly growing field.

链接: <https://ieeexplore.ieee.org/document/9046288>

17. **标题:** Artificial Intelligence and COVID-19: Deep Learning Approaches for Diagnosis and Treatment

出处: IEEE Access

作者: Mohammad Jamshidi; Ali Lalbakhsh; Jakub Talla; Zdeněk Peroutka; Farimah Hadjilooei; Pedram Lalbakhsh

摘要: COVID-19 outbreak has put the whole world in an unprecedented difficult situation bringing life around the world to a frightening halt and claiming thousands of lives. Due to COVID-19's spread in 212 countries and territories and increasing numbers of infected cases and death tolls mounting to 5,212,172 and 334,915 (as of May 22 2020), it remains a real threat to the public health system. This paper renders a response to combat the virus through Artificial Intelligence (AI). Some Deep Learning (DL) methods have been illustrated to reach this goal, including Generative Adversarial Networks (GANs), Extreme Learning Machine (ELM), and Long/Short Term Memory (LSTM). It delineates an integrated bioinformatics approach in which different aspects of information from a continuum of structured and unstructured data sources are put together to form the user-friendly platforms for physicians and researchers. The main advantage of these AI-based platforms is to accelerate the process of diagnosis and treatment of the COVID-19 disease. The most recent related publications and medical reports were investigated with the purpose of choosing inputs and targets of the network that could facilitate reaching a reliable Artificial Neural Network-based tool for challenges associated with COVID-19. Furthermore, there are some specific inputs for each platform, including various forms of the data, such as clinical data and medical imaging which can improve the performance of the introduced approaches toward the best responses in practical applications.

链接: <https://ieeexplore.ieee.org/document/9115663>

18. **标题:** COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings

出处: IEEE Open Journal of Engineering in Medicine and Biology

作者: Jordi Laguarda; Ferran Hueto; Brian Subirana

摘要: Goal: We hypothesized that COVID-19 subjects, especially including asymptomatics, could be accurately discriminated only from a forced-cough cell phone recording using Artificial Intelligence. To train our MIT Open Voice model we built a data collection pipeline of COVID-19 cough recordings through our website (opensigma.mit.edu) between April and May 2020 and created the largest audio COVID-19 cough balanced dataset reported to date with 5,320 subjects. Methods: We developed an AI speech processing framework that leverages acoustic biomarker feature extractors to pre-screen for COVID-19 from cough recordings, and provide a personalized patient saliency map to longitudinally monitor patients in real-time, non-invasively, and at essentially zero variable cost. Cough recordings are transformed with Mel Frequency Cepstral Coefficient and inputted into a Convolutional Neural Network (CNN) based architecture made up of one Poisson biomarker layer and 3 pre-trained ResNet50's in parallel, outputting a binary pre-screening diagnostic. Our CNN-based models have been trained on 4256 subjects and tested on the remaining 1064 subjects of our dataset. Transfer learning was used to learn biomarker features on larger datasets, previously successfully tested in our Lab on Alzheimer's, which significantly improves the COVID-19 discrimination accuracy of our architecture. Results: When



validated with subjects diagnosed using an official test, the model achieves COVID-19 sensitivity of 98.5% with a specificity of 94.2% (AUC: 0.97). For asymptomatic subjects it achieves sensitivity of 100% with a specificity of 83.2%. Conclusions: AI techniques can produce a free, non-invasive, real-time, any-time, instantly distributable, large-scale COVID-19 asymptomatic screening tool to augment current approaches in containing the spread of COVID-19. Practical use cases could be for daily screening of students, workers, and public as schools, jobs, and transport reopen, or for pool testing to quickly alert of outbreaks in groups. General speech biomarkers may exist that cover several disease categories, as we demonstrated using the same ones for COVID-19 and Alzheimer's.

链接: <https://ieeexplore.ieee.org/document/9208795>

19. **标题:** A Comprehensive Review of the COVID-19 Pandemic and the Role of IoT, Drones, AI, Blockchain, and 5G in Managing its Impact

出处: IEEE Access

作者: Vinay Chamola; Vikas Hassija; Vatsal Gupta; Mohsen Guizani

摘要: The unprecedented outbreak of the 2019 novel coronavirus, termed as COVID-19 by the World Health Organization (WHO), has placed numerous governments around the world in a precarious position. The impact of the COVID-19 outbreak, earlier witnessed by the citizens of China alone, has now become a matter of grave concern for virtually every country in the world. The scarcity of resources to endure the COVID-19 outbreak combined with the fear of overburdened healthcare systems has forced a majority of these countries into a state of partial or complete lockdown. The number of laboratory-confirmed coronavirus cases has been increasing at an alarming rate throughout the world, with reportedly more than 3 million confirmed cases as of 30 April 2020. Adding to these woes, numerous false reports, misinformation, and unsolicited fears in regards to coronavirus, are being circulated regularly since the outbreak of the COVID-19. In response to such acts, we draw on various reliable sources to present a detailed review of all the major aspects associated with the COVID-19 pandemic. In addition to the direct health implications associated with the outbreak of COVID-19, this study highlights its impact on the global economy. In drawing things to a close, we explore the use of technologies such as the Internet of Things (IoT), Unmanned Aerial Vehicles (UAVs), blockchain, Artificial Intelligence (AI), and 5G, among others, to help mitigate the impact of COVID-19 outbreak.

链接: <https://ieeexplore.ieee.org/document/9086010>

20. **标题:** A Survey on Transfer Learning

出处: IEEE Transactions on Knowledge and Data Engineering

作者: Sinno Jialin Pan; Qiang Yang

摘要: A major assumption in many machine learning and data mining algorithms is that the training and future data must be in the same feature space and have the same distribution. However, in many real-world applications, this assumption may not hold. For example, we sometimes have a classification task in one domain of interest, but we only have sufficient training data in another domain of interest, where the latter data may be in a different feature space or follow a different data distribution. In such cases, knowledge transfer, if done successfully, would greatly improve the performance of learning by avoiding much expensive data-labeling efforts. In

recent years, transfer learning has emerged as a new learning framework to address this problem. This survey focuses on categorizing and reviewing the current progress on transfer learning for classification, regression, and clustering problems. In this survey, we discuss the relationship between transfer learning and other related machine learning techniques such as domain adaptation, multitask learning and sample selection bias, as well as covariate shift. We also explore some potential future issues in transfer learning research.

链接: <https://ieeexplore.ieee.org/document/5288526>

21. 标题: The Impact of COVID-19 on Consumers: Preparing for Digital Sales

出处: IEEE Engineering Management Review

作者: Rae Yule Kim

摘要: COVID-19 has affected everyone's daily lives. At least 316 million people in 42 states have been asked to stay at home to slow down the pandemic. In this aspect, businesses have been susceptible to make substantial transformations. Workplace operations of many businesses went virtual. The effect of the digital transformation on productivity and corporate culture has been studied extensively. Meanwhile, how COVID-19 has influenced consumers and the consumption culture has received relatively limited attention. Managers often take a wait-and-see approach on the impact of COVID-19 on sales. It is often uncertain whether and how many customers will return after the pandemic passes. Consumers live through the pandemic, and some changes might be long-lasting even after the situation eases. We examine the pandemic as an accelerator of the structural change in consumption and the digital transformation in the marketplace. Managers might adapt to the digital transformation in the market to recover or even grow further the sales after COVID-19.

链接: <https://ieeexplore.ieee.org/document/9076858>

22. 标题: Toward Causal Representation Learning

出处: Proceedings of the IEEE

作者: Bernhard Schölkopf; Francesco Locatello; Stefan Bauer; Nan Rosemary Ke; Nal Kalchbrenner; Anirudh Goyal

摘要: The two fields of machine learning and graphical causality arose and are developed separately. However, there is, now, cross-pollination and increasing interest in both fields to benefit from the advances of the other. In this article, we review fundamental concepts of causal inference and relate them to crucial open problems of machine learning, including transfer and generalization, thereby assaying how causality can contribute to modern machine learning research. This also applies in the opposite direction: we note that most work in causality starts from the premise that the causal variables are given. A central problem for AI and causality is, thus, causal representation learning, that is, the discovery of high-level causal variables from low-level observations. Finally, we delineate some implications of causality for machine learning and propose key research areas at the intersection of both communities.

链接: <https://ieeexplore.ieee.org/document/9363924>

23. **标题:** VINS-Mono: A Robust and Versatile Monocular Visual-Inertial State Estimator
出处: IEEE Transactions on Robotics
作者: Tong Qin; Peiliang Li; Shaojie Shen
摘要: One camera and one low-cost inertial measurement unit (IMU) form a monocular visual-inertial system (VINS), which is the minimum sensor suite (in size, weight, and power) for the metric six degrees-of-freedom (DOF) state estimation. In this paper, we present VINS-Mono: a robust and versatile monocular visual-inertial state estimator. Our approach starts with a robust procedure for estimator initialization. A tightly coupled, nonlinear optimization-based method is used to obtain highly accurate visual-inertial odometry by fusing preintegrated IMU measurements and feature observations. A loop detection module, in combination with our tightly coupled formulation, enables relocalization with minimum computation. We additionally perform 4-DOF pose graph optimization to enforce the global consistency. Furthermore, the proposed system can reuse a map by saving and loading it in an efficient way. The current and previous maps can be merged together by the global pose graph optimization. We validate the performance of our system on public datasets and real-world experiments and compare against other state-of-the-art algorithms. We also perform an onboard closed-loop autonomous flight on the microaerial-vehicle platform and port the algorithm to an iOS-based demonstration. We highlight that the proposed work is a reliable, complete, and versatile system that is applicable for different applications that require high accuracy in localization. We open source our implementations for both PCs (<https://github.com/HKUST-Aerial-Robotics/VINS-Mono>) and iOS mobile devices (<https://github.com/HKUST-Aerial-Robotics/VINS-Mobile>).
链接: <https://ieeexplore.ieee.org/document/8421746>
24. **标题:** A Systematic Review of Bio-Cyber Interface Technologies and Security Issues for Internet of Bio-Nano Things
出处: IEEE Access
作者: Sidra Zafar; Mohsin Nazir; Taimur Bakhshi; Hasan Ali Khattak; Sarmadullah Khan; Muhammad Bilal; Kim
摘要: Advances in synthetic biology and nanotechnology have contributed to the design of tools that can be used to control, reuse, modify, and re-engineer cells' structure, as well as enabling engineers to effectively use biological cells as programmable substrates to realize Bio-NanoThings (biological embedded computing devices). Bio-NanoThings are generally tiny, non-intrusive, and concealable devices that can be used for in-vivo applications such as intra-body sensing and actuation networks, where the use of artificial devices can be detrimental. Such (nano-scale) devices can be used in various healthcare settings such as continuous health monitoring, targeted drug delivery, and nano-surgeries. These services can also be grouped to form a collaborative network (i.e., nanonetwork), whose performance can potentially be improved when connected to higher bandwidth external networks such as the Internet, say via 5G. However, to realize the IoBNT paradigm, it is also important to seamlessly connect the biological environment with the technological landscape by having a dynamic interface design to convert biochemical signals from the human body into an equivalent electromagnetic signal (and vice versa). This, unfortunately, risks the exposure of internal biological mechanisms to cyber-based sensing and medical actuation, with potential security and privacy implications. This paper comprehensively reviews bio-cyber



interface for IoBNT architecture, focusing on bio-cyber interfacing options for IoBNT like biologically inspired bio-electronic devices, RFID enabled implantable chips, and electronic tattoos. This study also identifies known and potential security and privacy vulnerabilities and mitigation strategies for consideration in future IoBNT designs and implementations.

链接: <https://ieeexplore.ieee.org/document/9467302>

25. 标题: Effective Heart Disease Prediction Using Hybrid Machine Learning Techniques

出处: IEEE Access

作者: Senthilkumar Mohan; Chandrasegar Thirumalai; Gautam Srivastava

摘要: Heart disease is one of the most significant causes of mortality in the world today. Prediction of cardiovascular disease is a critical challenge in the area of clinical data analysis. Machine learning (ML) has been shown to be effective in assisting in making decisions and predictions from the large quantity of data produced by the healthcare industry. We have also seen ML techniques being used in recent developments in different areas of the Internet of Things (IoT). Various studies give only a glimpse into predicting heart disease with ML techniques. In this paper, we propose a novel method that aims at finding significant features by applying machine learning techniques resulting in improving the accuracy in the prediction of cardiovascular disease. The prediction model is introduced with different combinations of features and several known classification techniques. We produce an enhanced performance level with an accuracy level of 88.7% through the prediction model for heart disease with the hybrid random forest with a linear model (HRFLM).

链接: <https://ieeexplore.ieee.org/document/8740989>

ESI HOT PAPERS

(Engineering Science)

(来源: <http://esi.incites.thomsonreuters.com>)

1 被引频次: 1550

题目: Squeeze-and-Excitation Networks

作者: HU, J;SHEN, L;ALBANIE, S;SUN, G;WU, EH

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 42 (8): 2011-2023 AUG. 1 2020

摘要: The central building block of convolutional neural networks (CNNs) is the convolution operator, which enables networks to construct informative features by fusing both spatial and channel-wise information within local receptive fields at each layer. A broad range of prior research has investigated the spatial component of this relationship, seeking to strengthen the representational power of a CNN by enhancing the quality of spatial encodings throughout its feature hierarchy. In this work, we focus instead on the channel relationship and propose a novel architectural unit, which we term the "Squeeze-and-Excitation" (SE) block, that adaptively recalibrates channel-wise feature responses by explicitly modelling interdependencies between channels. We show that these blocks can be stacked together to form SENet architectures that generalise extremely effectively across different datasets. We further demonstrate that SE blocks bring significant improvements in performance for existing state-of-the-art CNNs at slight additional computational cost. Squeeze-and-Excitation Networks formed the foundation of our ILSVRC 2017 classification submission which won first place and reduced the top-5 error to 2.251 percent, surpassing the winning entry of 2016 by a relative improvement of similar to 25 percent. Models and code are available at <https://github.com/hujie-frank/SENet>.

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2 被引频次: 1189

题目: Focal Loss for Dense Object Detection

作者: LIN, TY;GOYAL, P;GIRSHICK, R;HE, KM;DOLLAR, P

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 42 (2): 318-327 FEB 2020

摘要: The highest accuracy object detectors to date are based on a two-stage approach popularized by R-CNN, where a classifier is applied to a sparse set of candidate object locations.

In contrast, one-stage detectors that are applied over a regular, dense sampling of possible object locations have the potential to be faster and simpler, but have trailed the accuracy of two-stage detectors thus far. In this paper, we investigate why this is the case. We discover that the extreme foreground-background class imbalance encountered during training of dense detectors is the central cause. We propose to address this class imbalance by reshaping the standard cross entropy loss such that it down-weights the loss assigned to well-classified examples. Our novel Focal Loss focuses training on a sparse set of hard examples and prevents the vast number of easy negatives from overwhelming the detector during training. To evaluate the effectiveness of our loss, we design and train a simple dense detector we call RetinaNet. Our results show that when trained with the focal loss, RetinaNet is able to match the speed of previous one-stage detectors while surpassing the accuracy of all existing state-of-the-art two-stage detectors. Code is at: <https://github.com/facebookresearch/Detectron>.

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3 被引频次: 1077

题目: Urban Traffic Control in Software Defined Internet of Things via a Multi-Agent Deep Reinforcement Learning Approach

作者: YANG, JC;ZHANG, JP;WANG, HH

出处: IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS 22 (6): 3742-3754 JUN 2021

摘要: As the growth of vehicles and the acceleration of urbanization, the urban traffic congestion problem becomes a burning issue in our society. Constructing a software defined Internet of things(SD-IoT) with a proper traffic control scheme is a promising solution for this issue. However, existing traffic control schemes do not make the best of the advances of the multi-agent deep reinforcement learning area. Furthermore, existing traffic congestion solutions based on deep reinforcement learning(DRL) only focus on controlling the signal of traffic lights, while ignore controlling vehicles to cooperate traffic lights. So the effect of urban traffic control is not comprehensive enough. In this article, we propose Modified Proximal Policy Optimization (Modified PPO) algorithm. This algorithm is ideally suited as the traffic control scheme of SD-IoT. We adaptively adjust the clip hyperparameter to limit the bound of the distance between the next policy and the current policy. What's more, based on the collected data of SD-IoT, the proposed algorithm controls traffic lights and vehicles in a global view to advance the performance of urban traffic control. Experimental results under different vehicle numbers show that the proposed method is more competitive and stable than the original algorithm. Our proposed method improves the performance of SD-IoT to relieve traffic congestion.

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4 被引频次: 554

题目: Grad-CAM: Visual Explanations from Deep Networks via Gradient-Based Localization

作者: SELVARAJU, RR;COGSWELL, M;DAS, A;VEDANTAM, R;PARIKH, D;BATRA, D

出处: INTERNATIONAL JOURNAL OF COMPUTER VISION 128 (2): 336-359 FEB 2020

摘要: We propose a technique for producing 'visual explanations' for decisions from a large class of Convolutional Neural Network (CNN)-based models, making them more transparent and explainable. Our approach-Gradient-weighted Class Activation Mapping (Grad-CAM), uses the gradients of any target concept (say 'dog' in a classification network or a sequence of words in captioning network) flowing into the final convolutional layer to produce a coarse localization map highlighting the important regions in the image for predicting the concept. Unlike previous approaches, Grad-CAM is applicable to a wide variety of CNN model-families: (1) CNNs with fully-connected layers (e.g.VGG), (2) CNNs used for structured outputs (e.g.captioning), (3) CNNs used in tasks with multi-modal inputs (e.g.visual question answering) or reinforcement learning, all without architectural changes or re-training. We combine Grad-CAM with existing fine-grained visualizations to create a high-resolution class-discriminative visualization, Guided Grad-CAM, and apply it to image classification, image captioning, and visual question answering (VQA) models, including ResNet-based architectures. In the context of image classification models, our visualizations (a) lend insights into failure modes of these models (showing that seemingly unreasonable predictions have reasonable explanations), (b) outperform previous methods on the ILSVRC-15 weakly-supervised localization task, (c) are robust to adversarial perturbations, (d) are more faithful to the underlying model, and (e) help achieve model generalization by identifying dataset bias. For image captioning and VQA, our visualizations show that even non-attention based models learn to localize discriminative regions of input image. We devise a way to identify important neurons through Grad-CAM and combine it with neuron names (Bau et al. in Computer vision and pattern recognition, 2017) to provide textual explanations for model decisions. Finally, we design and conduct human studies to measure if Grad-CAM explanations help users establish appropriate trust in predictions from deep networks and show that Grad-CAM helps untrained users successfully discern a 'stronger' deep network from a 'weaker' one even when both make identical predictions. Our code is available at [https://github.com/roozbehk/grad-cam](#), along with a demo on CloudCV (Agrawal et al., in: Mobile cloud visual media computing, pp 265-290. Springer, 2015) ([https://www.cloudcv.com](#)) and a video at [https://www.youtube.com/watch?v=8811811811](#).

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5 被引频次: 440

题目: Location-Aware Deep Collaborative Filtering for Service Recommendation

作者: ZHANG, YW;YIN, CH;WU, QL;HE, Q;ZHU, HB

出处: IEEE TRANSACTIONS ON SYSTEMS MAN CYBERNETICS-SYSTEMS 51 (6): 3796-3807 JUN 2021

摘要: With the widespread application of service-oriented architecture (SOA), a flood of

similarly functioning services have been deployed online. How to recommend services to users to meet their individual needs becomes the key issue in service recommendation. In recent years, methods based on collaborative filtering (CF) have been widely proposed for service recommendation. However, traditional CF typically exploits only low-dimensional and linear interactions between users and services and is challenged by the problem of data sparsity in the real world. To address these issues, inspired by deep learning, this article proposes a new deep CF model for service recommendation, named location-aware deep CF (LDCF). This model offers the following innovations: 1) the location features are mapped into high-dimensional dense embedding vectors; 2) the multilayer-perceptron (MLP) captures the high-dimensional and nonlinear characteristics; and 3) the similarity adaptive corrector (AC) is first embedded in the output layer to correct the predictive quality of service. Equipped with these, LDCF can not only learn the high-dimensional and nonlinear interactions between users and services but also significantly alleviate the data sparsity problem. Through substantial experiments conducted on a real-world Web service dataset, results indicate that LDCF's recommendation performance obviously outperforms nine state-of-the-art service recommendation methods.

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6 被引频次: 431

题目: Methylammonium Chloride Induces Intermediate Phase Stabilization for Efficient Perovskite Solar Cells

作者: KIM, M; KIM, GH; LEE, TK; CHOI, IW; CHOI, HW; JO, Y; YOON, YJ; KIM, JW; LEE, J; HUH, D; LEE, H; KWAK, SK; KIM, JY; KIM, DS

出处: JOULE 3 (9): 2179-2192 SEP 18 2019

摘要: One of the most effective methods to achieve high-performance perovskite solar cells has been to include additives that serve as dopants, crystallization agents, or passivate defect sites. Cl-based additives are among the most prevalent in literature, yet their exact role is still uncertain. In this work, we systematically study the function of methylammonium chloride (MACl) additive in formamidinium lead iodide (FAPbI₃)-based perovskite. Using density functional theory, we provide a theoretical framework for understanding the interaction of MACl with a perovskite. We show that MACl successfully induces an intermediate to the pure FAPbI₃ alpha-phase without annealing. The formation energy is related to the amount of incorporated MACl. By tuning the incorporation of MACl, the perovskite film quality can be significantly improved, exhibiting a 6 x increase in grain size, a 3 x increase in phase crystallinity, and a 4.3 x increase in photoluminescence lifetime. The optimized solar cells achieved a certified efficiency of 23.48%.

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7 被引频次: 364

题目: Experimental Treatment with Favipiravir for COVID-19: An Open-Label Control Study

作者: CAI, QX; YANG, MH; LIU, DJ; CHEN, J; SHU, D; XIA, JX; LIAO, XJ; GU, YB; CAI, Q; YANG, Y; SHEN, CG; LI, XH; PENG, L; HUANG, DL; ZHANG, J; ZHANG, SR; WANG, FX; LIU, JY; CHEN, L; CHEN,

出处: ENGINEERING 6 (10): 1192-1198 OCT 2020

摘要: There is currently an outbreak of respiratory disease caused by a novel coronavirus. The virus has been named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease it causes has been named coronavirus disease 2019 (COVID-19). More than 16% of patients developed acute respiratory distress syndrome, and the fatality ratio was 1%-2%. No specific treatment has been reported. Herein, we examined the effects of favipiravir (FPV) versus lopinavir (LPV)/ritonavir (RTV) for the treatment of COVID-19. Patients with laboratory-confirmed COVID-19 who received oral FPV (Day 1: 1600 mg twice daily; Days 2-14: 600 mg twice daily) plus interferon (IFN)-alpha by aerosol inhalation (5 million international unit (IU) twice daily) were included in the FPV arm of this study, whereas patients who were treated with LPV/RTV (Days 1-14: 400 mg/100 mg twice daily) plus IFN-alpha by aerosol inhalation (5 million IU twice daily) were included in the control arm. Changes in chest computed tomography (CT), viral clearance, and drug safety were compared between the two groups. For the 35 patients enrolled in the FPV arm and the 45 patients in the control arm, all baseline characteristics were comparable between the two arms. A shorter viral clearance median time was found for the FPV arm versus the control arm (4 d (interquartile range (IQR): 2.5-9) versus 11 d (IQR: 8-13), $P < 0.001$). The FPV arm also showed significant improvement in chest CT compared with the control arm, with an improvement rate of 91.43% versus 62.22% ($P = 0.004$). After adjustment for potential confounders, the FPV arm also showed a significantly higher improvement rate in chest CT. Multivariable Cox regression showed that FPV was independently associated with faster viral clearance. In addition, fewer adverse events were found in the FPV arm than in the control arm. In this open-label before-after controlled study, FPV showed better therapeutic responses on COVID-19 in terms of disease progression and viral clearance. These preliminary clinical results provide useful information of treatments for SARS-CoV-2 infection. (c) 2020 THE AUTHORS. Published by Elsevier LTD on behalf of Chinese Academy of Engineering and Higher Education Press Limited Company. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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8 被引频次: 357

题目: Solar cell efficiency tables (version 54)

作者: GREEN, MA; DUNLOP, ED; LEVI, DH; HOHL-EBINGER, J; YOSHITA, M; HO-BAILLIE, AWY

出处: PROGRESS IN PHOTOVOLTAICS 27 (7): 565-575 JUL 2019

摘要: Consolidated tables showing an extensive listing of the highest independently confirmed efficiencies for solar cells and modules are presented. Guidelines for inclusion of results into these tables are outlined, and new entries since January 2019 are reviewed.

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9 被引频次: 300

题目: Advances and challenges in understanding the electrocatalytic conversion of carbon dioxide to fuels

作者: BIRDJA,YY;PEREZ-GALLENTE,E;FIGUEIREDO,MC;GOTTLE, AJ;CALLE-VALLEJO, F;KOPER, MTM

出处: NATURE ENERGY 4 (9): 732-745 SEP 2019

摘要: The electrocatalytic reduction of carbon dioxide is a promising approach for storing (excess) renewable electricity as chemical energy in fuels. Here, we review recent advances and challenges in the understanding of electrochemical CO₂ reduction. We discuss existing models for the initial activation of CO₂ on the electrocatalyst and their importance for understanding selectivity. Carbon-carbon bond formation is also a key mechanistic step in CO₂ electroreduction to high-density and high-value fuels. We show that both the initial CO₂ activation and C-C bond formation are influenced by an intricate interplay between surface structure (both on the nano- and on the mesoscale), electrolyte effects (pH, buffer strength, ion effects) and mass transport conditions. This complex interplay is currently still far from being completely understood. In addition, we discuss recent progress in in situ spectroscopic techniques and computational techniques for mechanistic work. Finally, we identify some challenges in furthering our understanding of these themes.

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10 被引频次: 293

题目: GMC: Graph-Based Multi-View Clustering

作者: WANG, H;YANG, Y;LIU, B

出处: IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING 32 (6): 1116-1129 JUN 1 2020

摘要: Multi-view graph-based clustering aims to provide clustering solutions to multi-view data. However, most existing methods do not give sufficient consideration to weights of different views and require an additional clustering step to produce the final clusters. They also usually optimize their objectives based on fixed graph similarity matrices of all views. In this paper, we propose a general Graph-based Multi-view Clustering (GMC) to tackle these problems. GMC takes the data graph matrices of all views and fuses them to generate a unified graph matrix. The unified graph matrix in turn improves the data graph matrix of each view, and also gives the final clusters directly. The key novelty of GMC is its learning method, which can help the learning of each view graph matrix and the learning of the unified graph matrix in a mutual reinforcement manner. A novel multi-view fusion technique can automatically weight each data graph matrix to derive the unified graph matrix. A rank constraint without introducing a tuning parameter is also imposed on the graph Laplacian matrix of the unified matrix, which helps partition the data points naturally into the required number of clusters. An alternating iterative optimization algorithm is presented to optimize the objective function. Experimental results using both toy data and real-world data demonstrate that the proposed method outperforms state-of-the-art baselines markedly.

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11 被引频次: 276

题目: ALKYL CHAIN TUNING OF SMALL MOLECULE ACCEPTORS FOR EFFICIENT ORGANIC SOLAR CELLS

作者: JIANG, K;WEI, QY;LAI, JYL;PENG, ZX;KIM, H;YUAN, J;YE, L;ADE, H;ZOU, YP;YAN, H

出处: JOULE 3 (12): 3020-3033 DEC 18 2019

摘要: The field of organic solar cells has seen rapid developments after the report of a high-efficiency (15.7%) small molecule acceptor (SMA) named Y6. In this paper, we design and synthesize a family of SMAs with an aromatic backbone identical to that of Y6 but with different alkyl chains to investigate the influence of alkyl chains on the properties and performance of the SMAs. First, we show that it is beneficial to use branched alkyl chains on the nitrogen atoms of the pyrrole motif of the Y6. In addition, the branching position of the alkyl chains also has a major influence on material and device properties. The SMA with 3rd-position branched alkyl chains (named N3) exhibits optimal solubility and electronic and morphological properties, thus yielding the best performance. Further device optimization using a ternary strategy allows us to achieve a high efficiency of 16.74% (and a certified efficiency of 16.42%).

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12 被引频次: 275

题目: Solar cell efficiency tables (Version 55)

作者: GREEN,MA;DUNLOP,ED;LEVI,DH;HOHL-EBINGER,J;YOSHITA, M;HO-BAILLIE, AWY

出处: PROGRESS IN PHOTOVOLTAICS 28 (1): 3-15 JAN 2020

摘要: Consolidated tables showing an extensive listing of the highest independently confirmed efficiencies for solar cells and modules are presented. Guidelines for inclusion of results into these tables are outlined, and new entries since July 2019 are reviewed.

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13 被引频次: 272

题目: Challenges and opportunities towards fast-charging battery materials

作者: LIU, YY;ZHU, YY;CUI, Y

摘要: Extreme fast charging, with a goal of 15 minutes recharge time, is poised to accelerate mass market adoption of electric vehicles, curb greenhouse gas emissions and, in turn, provide nations with greater energy security. However, the realization of such a goal requires research and development across multiple levels, with battery technology being a key technical barrier. The present-day high-energy lithium-ion batteries with graphite anodes and transition metal oxide cathodes in liquid electrolytes are unable to achieve the fast-charging goal without negatively affecting electrochemical performance and safety. Here we discuss the challenges and future research directions towards fast charging at the level of battery materials from mass transport, charge transfer and thermal management perspectives. Moreover, we highlight advanced characterization techniques to fundamentally understand the failure mechanisms of batteries during fast charging, which in turn would inform more rational battery designs.

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14 被引频次: 238

题目: Preparation, modification and environmental application of biochar: A review

作者: WANG, JL;WANG, SZ

出处: Biochar is a carbon-rich material which can be prepared from various organic waste feedstock, such as agricultural wastes and municipal sewage sludge. Biochar has received increasing attention due to its unique feature such as high carbon content and cation exchange capacity, large specific surface area and stable structure. This review systematically analyzed and summarized the preparation, characterization, modification, and especially environmental application of biochar, based on more than 200 papers published in recent 10 year, to provide an overview of biochar with a particular on its environmental application. The physiochemical properties of biochar varies with the types of feedstocks. Pyrolysis, gasification and hydrothermal

carbonization are the common methods for biochar preparation. Biochar can be modified by acid, alkali, oxidizing agents, metal ions, carbonaceous materials, steam and gas purging. The selection of modification methods depends on the environmental application fields. The biochar has been used for soil remediation and amelioration, carbon sequestration, organic solid waste composting, decontamination of water and wastewater, catalyst and activator, electrode materials and electrode modifier, which were discussed in detail. The application of biochar in the carbon sequestration should be further investigated at similar experimental conditions to obtain the consistent results. The effect of biochar on soil microbes should be further investigated to elucidate the dominant reason for the improvement of soil fertility based on different soil and feedstock. In addition, more attention should be paid to the release of heavy metals and polycyclic aromatic hydrocarbons (PAHs) from biochar to the environment when biochar is practically used for the environmental remediation. The relationship between biochar structure and activation capability should be further investigated to clarify the activation mechanism of persulfate by biochar when it is used as activator. In summary, biochar has wide application prospect in environmental remediation, and the mechanism of biochar in environmental application should be further investigated. (C) 2019 Elsevier Ltd. All rights reserved.

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15 被引频次: 234

题目: Monolithic all-perovskite tandem solar cells with 24.8% efficiency exploiting comproportionation to suppress Sn(II) oxidation in precursor ink

作者: LIN, RX; XIAO, K; QIN, ZY; HAN, QL; ZHANG, CF; WEI, MY; SAIDAMINOV, MI; GAO, Y; XU, J; XIAO, M; LI, AD; ZHU, J; SARGENT, EH; TAN, HR

出处: NATURE ENERGY 4 (10): 864-873 OCT 2019

摘要: Combining wide-bandgap and narrow-bandgap perovskites to construct monolithic all-perovskite tandem solar cells offers avenues for continued increases in photovoltaic (PV) power conversion efficiencies (PCEs). However, actual efficiencies today are diminished by the subpar performance of narrow-bandgap subcells. Here we report a strategy to reduce Sn vacancies in mixed Pb-Sn narrow-bandgap perovskites that use metallic tin to reduce the Sn⁴⁺ (an oxidation product of Sn²⁺) to Sn²⁺ via a comproportionation reaction. We increase, thereby, the charge-carrier diffusion length in narrow-bandgap perovskites to 3 μm for the best materials. We obtain a PCE of 21.1% for 1.22-eV narrow-bandgap solar cells. We fabricate monolithic all-perovskite tandem cells with certified PCEs of 24.8% for small-area devices (0.049 cm²) and of 22.1% for large-area devices (1.05 cm²). The tandem cells retain 90% of their performance following 463 h of operation at the maximum power point under full 1-sun illumination.

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16 被引频次: 234

题目: Recycling lithium-ion batteries from electric vehicles

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摘要: Rapid growth in the market for electric vehicles is imperative, to meet global targets for reducing greenhouse gas emissions, to improve air quality in urban centres and to meet the needs of consumers, with whom electric vehicles are increasingly popular. However, growing numbers of electric vehicles present a serious waste-management challenge for recyclers at end-of-life. Nevertheless, spent batteries may also present an opportunity as manufacturers require access to strategic elements and critical materials for key components in electric-vehicle manufacture: recycled lithium-ion batteries from electric vehicles could provide a valuable secondary source of materials. Here we outline and evaluate the current range of approaches to electric-vehicle lithium-ion battery recycling and re-use, and highlight areas for future progress.

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17 被引频次: 233

题目: Optimal sizing and location based on economic parameters for an off-grid application of a hybrid system with photovoltaic, battery and diesel technology

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出处: ENERGY 201: - JUN 15 2020

摘要: Off-grid solar/diesel systems have been widely utilized in remote and rural settings. Some of the main challenges for solar-diesel energies are determining the appropriate capacity and location in rural areas. Therefore, an efficient framework is needed for using off-grid solar/diesel systems. For the optimal sizing and location of off-grid photovoltaic (PV)-diesel schemes in rural areas, a new framework is proposed. In this framework, a geographic information system module is utilized to identify the best location based on technical, economic, reliability, social, and environmental criteria. Then, a hybrid optimization algorithm is utilized to determine the appropriate capacity for continuously meeting of the load via total life cycle cost minimization. A

real case study in South Khorasan is considered, in order to illustrate the proposed framework and its effectiveness. The effectiveness of the applied approach is investigated by comparing the outcomes with the results obtained by other heuristic methods. Also, the impacts are investigated of fuel cost variations, initial PV and battery costs, and interest rate on the economics of the hybrid scheme. The simulation results demonstrate that the hybrid algorithm obtains results that are more accurate (by 14.1%) than other applied algorithms, and show that the use of solar energy with a diesel generator, compared to the diesel only system, significantly reduces greenhouse gas emissions (by 59.6%) and supply costs (by 22.2%). The results thus demonstrate the benefits of utilizing the proposed framework for the hybrid system. These results are expected to help enhance acceptance and utilization of cleaner production systems. (C) 2020 Elsevier Ltd. All rights reserved.

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18 被引频次: 227

题目: Synthesis of lightweight N-doped graphene foams with open reticular structure for high-efficiency electromagnetic wave absorption

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摘要: Chemical doping of graphene with heteroatoms is expected to be a promising strategy to enhance the electromagnetic wave attenuation capability, however, the intrinsic mechanism is not investigated in-depth. In this manuscript, ultra-lightweight N-doped graphene foams ($\rho = 10.5\text{-}16.6\text{ mg/cm}^3$) with high porosity and open reticular structures are prepared via a self-assembled hydrothermal reaction and a freeze-drying process. Compared with pure graphene foams, the presence of N heteroatoms helps to build open reticular walls and tailors the electrical properties, leading to strong electromagnetic wave absorption capacity and broad absorption bandwidth simultaneously, and meanwhile, the investigation of N bonding configurations illustrates that the presence of pyrrolic/pyridinic N are mainly essential for the dipolar relaxation loss whereas graphitic N is beneficial to the conduction loss. When the bulk density is 11.6 mg/cm^3 , the maximum reflection loss of the absorber is -53.9 dB at 3.5 mm with a low filler loading of only $5\text{ wt}\%$, and the absorption bandwidth exceeding -10 dB is 4.56 GHz with a thickness of 2 mm , the highly efficient electromagnetic wave absorption performance strongly originates from the enhanced dipolar/interfacial polarizations, the multiple scatterings, the microscale circular conductive structures as well as the balanced impedance match. Furthermore,



this monocomponent absorber can be an optimal candidate for ultra-lightweight and high-efficiency electromagnetic wave absorber without decorating other nanomaterials.

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19 被引频次: 221

题目: Managing grains and interfaces via ligand anchoring enables 22.3%-efficiency inverted perovskite solar cells

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出处: NATURE ENERGY 5 (2): 131-140 FEB 2020

摘要: Inverted perovskite solar cells have attracted increasing attention because they have achieved long operating lifetimes. However, they have exhibited significantly inferior power conversion efficiencies compared to regular perovskite solar cells. Here we reduce this efficiency gap using a trace amount of surface-anchoring alkylamine ligands (AALs) with different chain lengths as grain and interface modifiers. We show that long-chain AALs added to the precursor solution suppress nonradiative carrier recombination and improve the optoelectronic properties of mixed-cation mixed-halide perovskite films. The resulting AAL surface-modified films exhibit a prominent (100) orientation and lower trap-state density as well as enhanced carrier mobilities and diffusion lengths. These translate into a certified stabilized power conversion efficiency of 22.3% (23.0% power conversion efficiency for lab-measured champion devices). The devices operate for over 1,000 h at the maximum power point under simulated AM1.5 illumination, without loss of efficiency. While perovskite solar cells with an inverted architecture hold great promise for operation stability, their power conversion efficiency lags behind that of conventional cells. Here, Zheng et al. achieve a certified 22.34% efficiency, exploiting alkylamine ligands as grain and interface modifiers.

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20 被引频次: 218

题目: Covid-19: automatic detection from X-ray images utilizing transfer learning with convolutional neural networks

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出处: PHYSICAL AND ENGINEERING SCIENCES IN MEDICINE 43 (2): 635-640 JUN

2020

摘要: In this study, a dataset of X-ray images from patients with common bacterial pneumonia, confirmed Covid-19 disease, and normal incidents, was utilized for the automatic detection of the Coronavirus disease. The aim of the study is to evaluate the performance of state-of-the-art convolutional neural network architectures proposed over the recent years for medical image classification. Specifically, the procedure called Transfer Learning was adopted. With transfer learning, the detection of various abnormalities in small medical image datasets is an achievable target, often yielding remarkable results. The datasets utilized in this experiment are two. Firstly, a collection of 1427 X-ray images including 224 images with confirmed Covid-19 disease, 700 images with confirmed common bacterial pneumonia, and 504 images of normal conditions. Secondly, a dataset including 224 images with confirmed Covid-19 disease, 714 images with confirmed bacterial and viral pneumonia, and 504 images of normal conditions. The data was collected from the available X-ray images on public medical repositories. The results suggest that Deep Learning with X-ray imaging may extract significant biomarkers related to the Covid-19 disease, while the best accuracy, sensitivity, and specificity obtained is 96.78%, 98.66%, and 96.46% respectively. Since by now, all diagnostic tests show failure rates such as to raise concerns, the probability of incorporating X-rays into the diagnosis of the disease could be assessed by the medical community, based on the findings, while more research to evaluate the X-ray approach from different aspects may be conducted.

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21 被引频次: 218

题目: Monarch butterfly optimization

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出处: NEURAL COMPUTING & APPLICATIONS 31 (7): 1995-2014 JUL 2019

摘要: In nature, the eastern North American monarch population is known for its southward migration during the late summer/autumn from the northern USA and southern Canada to Mexico, covering thousands of miles. By simplifying and idealizing the migration of monarch butterflies, a new kind of nature-inspired metaheuristic algorithm, called monarch butterfly optimization (MBO), a first of its kind, is proposed in this paper. In MBO, all the monarch butterfly individuals are located in two distinct lands, viz. southern Canada and the northern USA (Land 1) and Mexico (Land 2). Accordingly, the positions of the monarch butterflies are updated in two ways. Firstly, the offsprings are generated (position updating) by migration operator, which can be adjusted by the migration ratio. It is followed by tuning the positions for other butterflies by means of butterfly adjusting operator. In order to keep the population unchanged and minimize fitness evaluations, the sum of the newly generated butterflies in these two ways remains equal to the original population. In order to demonstrate the superior performance of the MBO algorithm, a comparative study with five other metaheuristic algorithms through thirty-eight benchmark problems is carried out. The results clearly exhibit the capability of the MBO method toward finding the enhanced function values on most of the benchmark problems with respect to the other five algorithms. Note that the source codes of the proposed MBO algorithm are publicly available



at GitHub (<https://github.com/ggw0122/Monarch-Butterfly-Optimization>, C++/MATLAB) and MATLAB Central (<http://www.mathworks.com/matlabcentral/fileexchange/50828-monarch-butterfly-optimization>, MATLAB).

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22 被引频次: 214

题目: Cd-Free Cu(In,Ga)(Se,S)(2) Thin-Film Solar Cell With Record Efficiency of 23.35%

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出处: IEEE JOURNAL OF PHOTOVOLTAICS 9 (6): 1863-1867 NOV 2019

摘要: In this article, the excellent properties of state-of-the-art Cd-free Cu(In,Ga)(Se,S)(2) (CIGSSe) solar cells with Zn(O,S,OH) x/Zn-0.8 Mg0.2O double buffer layers, deposited by a combination of chemical bath deposition and atomic layer deposition techniques, are presented. By the replacement of conventional CdS buffer layers with this double buffer layer, the open-circuit voltage (V-oc) deficit of the devices could be significantly reduced, and V-oc increased by approximately 15 mV. In addition, the fill factor and short-circuit current were also improved, increasing the device efficiency by approximately 0.5 absolute percent compared with devices with CdS buffers. The Cd-free double buffer layer improved the device efficiency regardless of the bandgap of the CIGSSe absorber. The minority carrier lifetime (τ) measured via time-resolved photoluminescence became longer, indicating that carrier recombination is mitigated using the double buffer layer. Based on the device parameters extracted by fitting the Suns-V-oc characteristics to the double-diode model, the longer τ could be attributed to the decreased recombination rate in the space-charge region, rather than in the bulk and at the interface. The best performing cell was evaluated by a reliable third party, the National Institute of Advanced Industrial Science and Technology; this cell achieved a new world record efficiency of 23.35% for 1-cm(2)-sized thin-film polycrystalline solar cells. The device parameters of this cell are also discussed in this article.

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23 被引频次: 211

题目: Automatic classification of pavement crack using deep convolutional neural network

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出处: INTERNATIONAL JOURNAL OF PAVEMENT ENGINEERING 21 (4): 457-463 MAR 20 2020

摘要: The classification of pavement crack heavily relies on the engineers' experience or the

hand-crafted algorithms. Convolutional Neural Network (CNN) has demonstrated to be useful for image classification, which provides an alternative to traditional imaging classification algorithms. This paper proposes a novel method using deep CNN to automatically classify image patches cropped from 3D pavement images. In all, four supervised CNNs with different sizes of receptive field are successfully trained. The experimental results demonstrate that all the proposed CNNs can perform the classification with a high accuracy. Overall classification accuracy of each proposed CNN is above 94%. Upon the evaluation of these neural networks with respect to accuracy and training time, we find that the size of receptive field has a slight effect on the classification accuracy. However, the CNNs with smaller size of receptive field require more training times than others.

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24 被引频次: 201

题目: Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case

作者: IVANOV, D

出处: TRANSPORTATION RESEARCH PART E-LOGISTICS AND TRANSPORTATION REVIEW 136: - APR 2020

摘要: Epidemic outbreaks are a special case of supply chain (SC) risks which is distinctively characterized by a long-term disruption existence, disruption propagations (i.e., the ripple effect), and high uncertainty. We present the results of a simulation study that opens some new research tensions on the impact of COVID-19 (SARS-CoV-2) on the global SCs. First, we articulate the specific features that frame epidemic outbreaks as a unique type of SC disruption risks. Second, we demonstrate how simulation-based methodology can be used to examine and predict the impacts of epidemic outbreaks on the SC performance using the example of coronavirus COVID-19 and anyLogistix simulation and optimization software. We offer an analysis for observing and predicting both short-term and long-term impacts of epidemic outbreaks on the SCs along with managerial insights. A set of sensitivity experiments for different scenarios allows illustrating the model's behavior and its value for decision-makers. The major observation from the simulation experiments is that the timing of the closing and opening of the facilities at different echelons might become a major factor that determines the epidemic outbreak impact on the SC performance rather than an upstream disruption duration or the speed of epidemic propagation. Other important factors are lead-time, speed of epidemic propagation, and the upstream and downstream disruption durations in the SC. The outcomes of this research can be used by decision-makers to predict the operative and long-term impacts of epidemic outbreaks on the SCs and develop pandemic SC plans. Our approach can also help to identify the successful and wrong elements of risk mitigation/preparedness and recovery policies in case of epidemic outbreaks. The paper is concluded by summarizing the most important insights and outlining future research agenda.

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25 被引频次: 193

题目: Deep Learning for Generic Object Detection: A Survey

作者: LIU, L;OUYANG, WL;WANG, XG;FIEGUTH, P;CHEN, J;LIU, XW;PIETIKAINEN, M

出处: Object detection, one of the most fundamental and challenging problems in computer vision, seeks to locate object instances from a large number of predefined categories in natural images. Deep learning techniques have emerged as a powerful strategy for learning feature representations directly from data and have led to remarkable breakthroughs in the field of generic object detection. Given this period of rapid evolution, the goal of this paper is to provide a comprehensive survey of the recent achievements in this field brought about by deep learning techniques. More than 300 research contributions are included in this survey, covering many aspects of generic object detection: detection frameworks, object feature representation, object proposal generation, context modeling, training strategies, and evaluation metrics. We finish the survey by identifying promising directions for future research.

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1 被引频次: 15357

题目: Deep learning

作者: LECUN, Y;BENGIO, Y;HINTON, G

出处: NATURE 521 (7553): 436-444 MAY 28 2015

摘要: Deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. These methods have dramatically improved the state-of-the-art in speech recognition, visual object recognition, object detection and many other domains such as drug discovery and genomics. Deep learning discovers intricate structure in large data sets by using the backpropagation algorithm to indicate how a machine should change its internal parameters that are used to compute the representation in each layer from the representation in the previous layer. Deep convolutional nets have brought about breakthroughs in processing images, video, speech and audio, whereas recurrent nets have shone light on sequential data such as text and speech.

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2 被引频次: 5125

题目: ImageNet Large Scale Visual Recognition Challenge

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出处: INTERNATIONAL JOURNAL OF COMPUTER VISION 115 (3): 211-252 DEC 2015

摘要: The ImageNet Large Scale Visual Recognition Challenge is a benchmark in object category classification and detection on hundreds of object categories and millions of images. The challenge has been run annually from 2010 to present, attracting participation from more than fifty institutions. This paper describes the creation of this benchmark dataset and the advances in object recognition that have been possible as a result. We discuss the challenges of collecting large-scale ground truth annotation, highlight key breakthroughs in categorical object recognition, provide a detailed analysis of the current state of the field of large-scale image classification and object detection, and compare the state-of-the-art computer vision accuracy with human accuracy. We conclude with lessons learned in the 5 years of the challenge, and propose future directions and improvements.



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3 被引频次: 4120

题目: Opportunities and challenges for a sustainable energy future

作者: CHU, S;MAJUMDAR, A

出处: NATURE 488 (7411): 294-303 AUG 16 2012

摘要: Access to clean, affordable and reliable energy has been a cornerstone of the world's increasing prosperity and economic growth since the beginning of the industrial revolution. Our use of energy in the twenty-first century must also be sustainable. Solar and water-based energy generation, and engineering of microbes to produce biofuels are a few examples of the alternatives. This Perspective puts these opportunities into a larger context by relating them to a number of aspects in the transportation and electricity generation sectors. It also provides a snapshot of the current energy landscape and discusses several research and development opportunities and pathways that could lead to a prosperous, sustainable and secure energy future for the world.

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4 被引频次: 3019

题目: Human-level control through deep reinforcement learning

作者: MNIH, V;KAVUKCUOGLU, K;SILVER, D;RUSU, AA;VENESS, J;BELLEMARE, MG;GRAVES, A;RIEDMILLER, M;FIDJELAND, AK;OSTROVSKI, G;PETERSEN, S;BEATTIE, C;SADIK, A;ANTONOGLOU,

出处: NATURE 518 (7540): 529-533 FEB 26 2015

摘要: The theory of reinforcement learning provides a normative account', deeply rooted in psychological' and neuroscientific perspectives on animal behaviour, of how agents may optimize their control of an environment. To use reinforcement learning successfully in situations approaching real-world complexity, however, agents are confronted with a difficult task: they must derive efficient representations of the environment from high-dimensional sensory inputs, and use these to generalize past experience to new situations. Remarkably, humans and other animals seem to solve this problem through a harmonious combination of reinforcement learning and hierarchical sensory processing systems^{4,5}, the former evidenced by a wealth of neural data revealing notable parallels between the phasic signals emitted by dopaminergic neurons and temporal difference reinforcement learning algorithms'. While reinforcement learning agents have achieved some successes in a variety of domains", their applicability has previously been limited to domains in which useful features can be handcrafted, or to domains with fully observed, low-dimensional state spaces. Here we use recent advances in training deep neural networks" to develop a novel artificial agent, termed a deep Q-network, that can learn successful policies directly from high-dimensional sensory inputs using end-to-end reinforcement learning. We tested this agent on the challenging domain of classic Atari 2600 games". We demonstrate that the deep Q-network agent, receiving only the pixels and the game score as inputs, was able to surpass the



performance of all previous algorithms and achieve a level comparable to that of a professional human games tester across a set of 49 games, using the same algorithm, network architecture and hyperparameters. This work bridges the divide between high-dimensional sensory inputs and actions, resulting in the first artificial agent that is capable of learning to excel at a diverse array of challenging tasks.

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5 被引频次: 2479

题目: Representation Learning: A Review and New Perspectives

作者: BENGIO, Y;COURVILLE, A;VINCENT, P

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 35 (8): 1798-1828 AUG 2013

摘要: The success of machine learning algorithms generally depends on data representation, and we hypothesize that this is because different representations can entangle and hide more or less the different explanatory factors of variation behind the data. Although specific domain knowledge can be used to help design representations, learning with generic priors can also be used, and the quest for AI is motivating the design of more powerful representation-learning algorithms implementing such priors. This paper reviews recent work in the area of unsupervised feature learning and deep learning, covering advances in probabilistic models, autoencoders, manifold learning, and deep networks. This motivates longer term unanswered questions about the appropriate objectives for learning good representations, for computing representations (i.e., inference), and the geometrical connections between representation learning, density estimation, and manifold learning.

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6 被引频次: 2430

题目: SLIC Superpixels Compared to State-of-the-Art Superpixel Methods

作者: ACHANTA, R;SHAJI, A;SMITH, K;LUCCHI, A;FUA, P;SUSSTRUNK, S

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 34 (11): 2274-2281 NOV 2012

摘要: Computer vision applications have come to rely increasingly on superpixels in recent years, but it is not always clear what constitutes a good superpixel algorithm. In an effort to understand the benefits and drawbacks of existing methods, we empirically compare five state-of-the-art superpixel algorithms for their ability to adhere to image boundaries, speed, memory efficiency, and their impact on segmentation performance. We then introduce a new superpixel algorithm, simple linear iterative clustering (SLIC), which adapts a k-means clustering approach to efficiently generate superpixels. Despite its simplicity, SLIC adheres to boundaries as well as or better than previous methods. At the same time, it is faster and more memory efficient, improves segmentation performance, and is straightforward to extend to supervoxel generation.



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7 被引频次: 2312

题目: DeepLab: Semantic Image Segmentation with Deep Convolutional Nets, Atrous Convolution, and Fully Connected CRFs

作者: CHEN, LC;PAPANDREOU, G;KOKKINOS, I;MURPHY, K;YUILLE, AL

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 40 (4): 834-848 APR 2018

摘要: In this work we address the task of semantic image segmentation with Deep Learning and make three main contributions that are experimentally shown to have substantial practical merit. First, we highlight convolution with upsampled filters, or 'atrous convolution', as a powerful tool in dense prediction tasks. Atrous convolution allows us to explicitly control the resolution at which feature responses are computed within Deep Convolutional Neural Networks. It also allows us to effectively enlarge the field of view of filters to incorporate larger context without increasing the number of parameters or the amount of computation. Second, we propose atrous spatial pyramid pooling (ASPP) to robustly segment objects at multiple scales. ASPP probes an incoming convolutional feature layer with filters at multiple sampling rates and effective fields-of-views, thus capturing objects as well as image context at multiple scales. Third, we improve the localization of object boundaries by combining methods from DCNNs and probabilistic graphical models. The commonly deployed combination of max-pooling and downsampling in DCNNs achieves invariance but has a toll on localization accuracy. We overcome this by combining the responses at the final DCNN layer with a fully connected Conditional Random Field (CRF), which is shown both qualitatively and quantitatively to improve localization performance. Our proposed "DeepLab" system sets the new state-of-art at the PASCAL VOC-2012 semantic image segmentation task, reaching 79.7 percent mIOU in the test set, and advances the results on three other datasets: PASCAL-Context, PASCAL-Person-Part, and Cityscapes. All of our code is made publicly available online.

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8 被引频次: 2308

题目: Extreme Learning Machine for Regression and Multiclass Classification

作者: HUANG, GB;ZHOU, HM;DING, XJ;ZHANG, R

出处: IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART

B-CYBERNETICS 42 (2): 513-529 SP. ISS. SI APR 2012

摘要: Due to the simplicity of their implementations, least square support vector machine (LS-SVM) and proximal support vector machine (PSVM) have been widely used in binary classification applications. The conventional LS-SVM and PSVM cannot be used in regression and multiclass classification applications directly, although variants of LS-SVM and PSVM have been proposed to handle such cases. This paper shows that both LS-SVM and PSVM can be simplified further and a unified learning framework of LS-SVM, PSVM, and other regularization algorithms referred to extreme learning machine (ELM) can be built. ELM works for the "generalized" single-hidden-layer feedforward networks (SLFNs), but the hidden layer (or called feature mapping) in ELM need not be tuned. Such SLFNs include but are not limited to SVM, polynomial network, and the conventional feedforward neural networks. This paper shows the following: 1) ELM provides a unified learning platform with a widespread type of feature mappings and can be applied in regression and multiclass classification applications directly; 2) from the optimization method point of view, ELM has milder optimization constraints compared to LS-SVM and PSVM; 3) in theory, compared to ELM, LS-SVM and PSVM achieve suboptimal solutions and require higher computational complexity; and 4) in theory, ELM can approximate any target continuous function and classify any disjoint regions. As verified by the simulation results, ELM tends to have better scalability and achieve similar (for regression and binary class cases) or much better (for multiclass cases) generalization performance at much faster learning speed (up to thousands times) than traditional SVM and LS-SVM.

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9 被引频次: 2280

题目: Deep Neural Networks for Acoustic Modeling in Speech Recognition

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出处: IEEE SIGNAL PROCESSING MAGAZINE 29 (6): 82-97 NOV 2012

摘要: Catalysts for oxygen reduction and evolution reactions are at the heart of key renewable-energy technologies including fuel cells and water splitting. Despite tremendous efforts, developing oxygen electrode catalysts with high activity at low cost remains a great challenge. Here, we report a hybrid material consisting of Co₃O₄ nanocrystals grown on reduced graphene oxide as a high-performance bi-functional catalyst for the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER). Although Co₃O₄ or graphene oxide alone has little catalytic activity, their hybrid exhibits an unexpected, surprisingly high ORR activity that is further enhanced by nitrogen doping of graphene. The Co₃O₄/N-doped graphene hybrid exhibits similar catalytic activity but superior stability to Pt in alkaline solutions. The same hybrid is also highly active for OER, making it a high-performance non-precious metal-based bi-catalyst for both ORR and OER. The unusual catalytic activity arises from synergetic chemical coupling effects between



Co3O4 and graphene.

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10 被引频次: 2278

题目: SegNet: A Deep Convolutional Encoder-Decoder Architecture for Image Segmentati

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出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 39 (12): 2481-2495 DEC 2017

摘要: We present a novel and practical deep fully convolutional neural network architecture for semantic pixel-wise segmentation termed SegNet. This core trainable segmentation engine consists of an encoder network, a corresponding decoder network followed by a pixel-wise classification layer. The architecture of the encoder network is topologically identical to the 13 convolutional layers in the VGG16 network [1]. The role of the decoder network is to map the low resolution encoder feature maps to full input resolution feature maps for pixel-wise classification. The novelty of SegNet lies in the manner in which the decoder upsamples its lower resolution input feature map(s). Specifically, the decoder uses pooling indices computed in the max-pooling step of the corresponding encoder to perform non-linear upsampling. This eliminates the need for learning to upsample. The upsampled maps are sparse and are then convolved with trainable filters to produce dense feature maps. We compare our proposed architecture with the widely adopted FCN [2] and also with the well known DeepLab-LargeFOV [3], DeconvNet [4] architectures. This comparison reveals the memory versus accuracy trade-off involved in achieving good segmentation performance. SegNet was primarily motivated by scene understanding applications. Hence, it is designed to be efficient both in terms of memory and computational time during inference. It is also significantly smaller in the number of trainable parameters than other competing architectures and can be trained end-to-end using stochastic gradient descent. We also performed a controlled benchmark of SegNet and other architectures on both road scenes and SUN RGB-D indoor scene segmentation tasks. These quantitative assessments show that SegNet provides good performance with competitive inference time and most efficient inference memory-wise as compared to other architectures. We also provide a Caffe implementation of SegNet and a web demo at <http://mi.eng.cam.ac.uk/projects/segnet/>.

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11 被引频次: 1993

题目: Millimeter Wave Mobile Communications for 5G Cellular: It Will Work!

作者: RAPPAPORT, TS; SUN, S; MAYZUS, R; ZHAO, H; AZAR, Y; WANG, K; WONG, GN; SCHULZ, JK; SAMIMI, M; GUTIERREZ, F

出处: IEEE ACCESS 1: 335-349 2013

摘要: The global bandwidth shortage facing wireless carriers has motivated the exploration of the underutilized millimeter wave (mm-wave) frequency spectrum for future broadband cellular



communication networks. There is, however, little knowledge about cellular mm-wave propagation in densely populated indoor and outdoor environments. Obtaining this information is vital for the design and operation of future fifth generation cellular networks that use the mm-wave spectrum. In this paper, we present the motivation for new mm-wave cellular systems, methodology, and hardware for measurements and offer a variety of measurement results that show 28 and 38 GHz frequencies can be used when employing steerable directional antennas at base stations and mobile devices.

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12 被引频次: 1800

题目: Scaling Up MIMO

作者: RUSEK, F;PERSSON, D;LAU, BK;LARSSON, EG;MARZETTA, TL;EDFORS, O;TUFVESSON, F

出处: IEEE SIGNAL PROCESSING MAGAZINE 30 (1): 40-60 JAN 2013

摘要: 无

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13 被引频次: 1788

题目: Overview of the High Efficiency Video Coding (HEVC) Standard

作者: SULLIVAN, GJ;OHM, JR;HAN, WJ;WIEGAND, T

出处: IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY 22 (12): 1649-1668 DEC 2012

摘要: High Efficiency Video Coding (HEVC) is currently being prepared as the newest video coding standard of the ITU-T Video Coding Experts Group and the ISO/IEC Moving Picture Experts Group. The main goal of the HEVC standardization effort is to enable significantly improved compression performance relative to existing standards-in the range of 50% bit-rate reduction for equal perceptual video quality. This paper provides an overview of the technical features and characteristics of the HEVC standard.

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14 被引频次: 1779

题目: MATPOWER: Steady-State Operations, Planning, and Analysis Tools for Power Systems Research and Education

作者: ZIMMERMAN, RD;MURILLO-SANCHEZ, CE;THOMAS, RJ

出处: IEEE TRANSACTIONS ON POWER SYSTEMS 26 (1): 12-19 FEB 2011

摘要: MATPOWER is an open-source Matlab-based power system simulation package that provides a high-level set of power flow, optimal power flow (OPF), and other tools targeted toward researchers, educators, and students. The OPF architecture is designed to be extensible, making it easy to add user-defined variables, costs, and constraints to the standard OPF problem. This paper presents the details of the network modeling and problem formulations used by MATPOWER, including its extensible OPF architecture. This structure is used internally to implement several extensions to the standard OPF problem, including piece-wise linear cost functions, dispatchable loads, generator capability curves, and branch angle difference limits. Simulation results are presented for a number of test cases comparing the performance of several available OPF solvers and demonstrating MATPOWER's ability to solve large-scale AC and DC OPF problems.

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15 被引频次: 1761

题目: A comprehensive review on PEM water electrolysis

作者: CARMO, M;FRITZ, DL;MERGE, J;STOLTEN, D

出处: INTERNATIONAL JOURNAL OF HYDROGEN ENERGY 38 (12): 4901-4934 APR 22 2013

摘要: Hydrogen is often considered the best means by which to store energy coming from renewable and intermittent power sources. With the growing capacity of localized renewable energy sources surpassing the gigawatt range, a storage system of equal magnitude is required. PEM electrolysis provides a sustainable solution for the production of hydrogen, and is well suited to couple with energy sources such as wind and solar. However, due to low demand in electrolytic hydrogen in the last century, little research has been done on PEM electrolysis with many challenges still unexplored. The ever increasing desire for green energy has rekindled the interest on PEM electrolysis, thus the compilation and recovery of past research and developments is important and necessary. In this review, PEM water electrolysis is comprehensively highlighted and discussed. The challenges new and old related to electrocatalysts, solid electrolyte, current collectors, separator plates and modeling efforts will also be addressed. The main message is to clearly set the state-of-the-art for the PEM electrolysis technology, be insightful of the research that is already done and the challenges that still exist. This information will provide several future

research directions and a road map in order to aid scientists in establishing PEM electrolysis as a commercially viable hydrogen production solution. Copyright (C) 2013, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

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16 被引频次: 1682

题目: Image Super-Resolution Using Deep Convolutional Networks

作者: DONG, C;LOY, CC;HE, KM;TANG, XO

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 38 (2): 295-307 FEB 2016

摘要: We propose a deep learning method for single image super-resolution (SR). Our method directly learns an end-to-end mapping between the low/high-resolution images. The mapping is represented as a deep convolutional neural network (CNN) that takes the low-resolution image as the input and outputs the high-resolution one. We further show that traditional sparse-coding-based SR methods can also be viewed as a deep convolutional network. But unlike traditional methods that handle each component separately, our method jointly optimizes all layers. Our deep CNN has a lightweight structure, yet demonstrates state-of-the-art restoration quality, and achieves fast speed for practical on-line usage. We explore different network structures and parameter settings to achieve trade-offs between performance and speed. Moreover, we extend our network to cope with three color channels simultaneously, and show better overall reconstruction quality.

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17 被引频次: 1673

题目: Efficient organic solar cells processed from hydrocarbon solvents

作者: ZHAO, JB;LI, YK;YANG, GF;JIANG, K;LIN, HR;ADE, H;MA, W;YAN, H

出处: NATURE ENERGY 1: - JAN 25 2016

摘要: Organic solar cells have desirable properties, including low cost of materials, high-throughput roll-to-roll production, mechanical flexibility and light weight. However, all top-performance devices are at present processed using halogenated solvents, which are environmentally hazardous and would thus require expensive mitigation to contain the hazards. Attempts to process organic solar cells from non-halogenated solvents lead to inferior performance. Overcoming this hurdle, here we present a hydrocarbon-based processing system that is not only more environmentally friendly but also yields cells with power conversion efficiencies of up to 11.7%. Our processing system incorporates the synergistic effects of a hydrocarbon solvent, a novel additive, a suitable choice of polymer side chain, and strong temperature-dependent aggregation of the donor polymer. Our results not only demonstrate a method of producing active layers of organic solar cells in an environmentally friendly way, but also provide important scientific insights that will facilitate further improvement of the

morphology and performance of organic solar cells.

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18 被引频次: 1670

题目: Single-Junction Organic Solar Cell with over 15% Efficiency Using Fused-Ring Acceptor with Electron-Deficient Core

作者: YUAN, J; ZHANG, YQ; ZHOU, LY; ZHANG, GC; YIP, HL; LAU, TK; LU, XH; ZHU, C; PENG, HJ; JOHNSON, PA; LECLERC, M; CAO, Y; ULANSKI, J; LI, YF; ZOU, YP

出处: JOULE 3 (4): 1140-1151 APR 17 2019

摘要: Recently, non-fullerene n-type organic semiconductors have attracted significant attention as acceptors in organic photovoltaics (OPVs) due to their great potential to realize high-power conversion efficiencies. The rational design of the central fused ring unit of these acceptor molecules is crucial to maximize device performance. Here, we report a new class of non-fullerene acceptor, Y6, that employs a ladder-type electron-deficient-core-based central fused ring (dithienothiophen[3.2-b]-pyrrolobenzothiadiazole) with a benzothiadiazole (BT) core to fine-tune its absorption and electron affinity. OPVs made from Y6 in conventional and inverted architectures each exhibited a high efficiency of 15.7%, measured in two separate labs. Inverted device structures were certified at Enli Tech Laboratory demonstrated an efficiency of 14.9%. We further observed that the Y6-based devices maintain a high efficiency of 13.6% with an active layer thickness of 300 nm. The electron-deficient-core-based fused ring reported in this work opens a new door in the molecular design of high-performance acceptors for OPVs.

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19 被引频次: 1666

题目: A review of polymer electrolyte membrane fuel cells: Technology, applications, and needs on fundamental research

作者: WANG, Y; CHEN, KS; MISHLER, J; CHO, SC; ADROHER, XC

出处: APPLIED ENERGY 88 (4): 981-1007 APR 2011

摘要: Polymer electrolyte membrane (PEM) fuel cells, which convert the chemical energy

stored in hydrogen fuel directly and efficiently to electrical energy with water as the only byproduct, have the potential to reduce our energy use, pollutant emissions, and dependence on fossil fuels. Great deal of efforts has been made in the past, particularly during the last couple of decades or so, to advance the PEM fuel cell technology and fundamental research. Factors such as durability and cost still remain as the major barriers to fuel cell commercialization. In the past two years, more than 35% cost reduction has been achieved in fuel cell fabrication, the current status of \$61/kW (2009) for transportation fuel cell is still over 50% higher than the target of the US Department of Energy (DOE), i.e. \$30/kW by 2015, in order to compete with the conventional technology of internal-combustion engines. In addition, a lifetime of similar to 2500 h (for transportation PEM fuel cells) was achieved in 2009, yet still needs to be doubled to meet the DOE's target, i.e. 5000 h. Breakthroughs are urgently needed to overcome these barriers. In this regard, fundamental studies play an important and indeed critical role. Issues such as water and heat management, and new material development remain the focus of fuel-cell performance improvement and cost reduction. Previous reviews mostly focus on one aspect, either a specific fuel cell application or a particular area of fuel cell research. The objective of this review is three folds: (1) to present the latest status of PEM fuel cell technology development and applications in the transportation, stationary, and portable/micro power generation sectors through an overview of the state-of-the-art and most recent technical progress; (2) to describe the need for fundamental research in this field and fill the gap of addressing the role of fundamental research in fuel cell technology; and (3) to outline major challenges in fuel cell technology development and the needs for fundamental research for the near future and prior to fuel cell commercialization. (C) 2010 Elsevier Ltd. All rights reserved.

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20 被引频次: 1550

题目: Squeeze-and-Excitation Networks

作者: HU, J;SHEN, L;ALBANIE, S;SUN, G;WU, EH

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 42 (8): 2011-2023 AUG. 1 2020

摘要: The central building block of convolutional neural networks (CNNs) is the convolution operator, which enables networks to construct informative features by fusing both spatial and channel-wise information within local receptive fields at each layer. A broad range of prior research has investigated the spatial component of this relationship, seeking to strengthen the representational power of a CNN by enhancing the quality of spatial encodings throughout its feature hierarchy. In this work, we focus instead on the channel relationship and propose a novel architectural unit, which we term the "Squeeze-and-Excitation" (SE) block, that adaptively recalibrates channel-wise feature responses by explicitly modelling interdependencies between channels. We show that these blocks can be stacked together to form SENet architectures that generalise extremely effectively across different datasets. We further demonstrate that SE blocks bring significant improvements in performance for existing state-of-the-art CNNs at slight



additional computational cost. Squeeze-and-Excitation Networks formed the foundation of our ILSVRC 2017 classification submission which won first place and reduced the top-5 error to 2.251 percent, surpassing the winning entry of 2016 by a relative improvement of similar to 25 percent. Models and code are available at <https://github.com/hujie-frank/SENet>.

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21 被引频次: 1487

题目: High-Speed Tracking with Kernelized Correlation Filters

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出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 37 (3): 583-596 MAR 2015

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22 被引频次: 1479

题目: FSIM: A Feature Similarity Index for Image Quality AssessmentLS

作者: ZHANG, L;ZHANG, L;MOU, XQ;ZHANG, D

出处: IEEE TRANSACTIONS ON IMAGE PROCESSING 20 (8): 2378-2386 AUG 2011

摘要: Image quality assessment (IQA) aims to use computational models to measure the image quality consistently with subjective evaluations. The well-known structural similarity index brings IQA from pixel- to structure-based stage. In this paper, a novel feature similarity (FSIM) index for full reference IQA is proposed based on the fact that human visual system (HVS) understands an image mainly according to its low-level features. Specifically, the phase congruency (PC), which is a dimensionless measure of the significance of a local structure, is used as the primary feature in FSIM. Considering that PC is contrast invariant while the contrast information does affect HVS' perception of image quality, the image gradient magnitude (GM) is employed as the secondary feature in FSIM. PC and GM play complementary roles in characterizing the image local quality. After obtaining the local quality map, we use PC again as a weighting function to derive a single quality score. Extensive experiments performed on six benchmark IQA databases demonstrate that FSIM can achieve much higher consistency with the subjective evaluations than state-of-the-art IQA metrics.

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23 被引频次: 1469

题目: Guided Image Filtering

作者: HE, KM;SUN, J;TANG, XO

出处: IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 35 (6): 1397-1409 JUN 2013

摘要: In this paper, we propose a novel explicit image filter called guided filter. Derived from a local linear model, the guided filter computes the filtering output by considering the content of a guidance image, which can be the input image itself or another different image. The guided filter can be used as an edge-preserving smoothing operator like the popular bilateral filter [1], but it has better behaviors near edges. The guided filter is also a more generic concept beyond smoothing: It can transfer the structures of the guidance image to the filtering output, enabling new filtering applications like dehazing and guided feathering. Moreover, the guided filter naturally has a fast and nonapproximate linear time algorithm, regardless of the kernel size and the intensity range. Currently, it is one of the fastest edge-preserving filters. Experiments show that the guided filter is both effective and efficient in a great variety of computer vision and computer graphics applications, including edge-aware smoothing, detail enhancement, HDR compression, image matting/ feathering, dehazing, joint upsampling, etc.

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24 被引频次: 1454

题目: New world record efficiency for Cu(In,Ga)Se-2 thin-film solar cells beyond 20%

作者: JACKSON, P;HARISKOS, D;LOTTER, E;PAETEL, S;WUERZ, R;MENNER, R;WISCHMANN, W;POWALLA, M

出处: PROGRESS IN PHOTOVOLTAICS 19 (7): 894-897 SP. ISS. SI NOV 2011

摘要: In this contribution, we present a new certified world record efficiency of 20.1 and 20.3% for Cu(In,Ga)Se-2 thin-film solar cells. We analyse the characteristics of solar cells on such a performance level and demonstrate a high degree of reproducibility. Copyright (C) 2011 John Wiley & Sons, Ltd.

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25 被引频次: 1431

题目: Clustering by fast search and find of density peaks

作者: RODRIGUEZ, A;LAIO, A

出处: SCIENCE 344 (6191): 1492-1496 JUN 27 2014

摘要: a Cluster analysis is aimed at classifying elements into categories on the basis of their similarity. Its applications range from astronomy to bioinformatics, bibliometrics, and pattern



recognition. We propose an approach based on the idea that cluster centers are characterized by a higher density than their neighbors and by a relatively large distance from points with higher densities. This idea forms the basis of a clustering procedure in which the number of clusters arises intuitively, outliers are automatically spotted and excluded from the analysis, and clusters are recognized regardless of their shape and of the dimensionality of the space in which they are embedded. We demonstrate the power of the algorithm on several test cases.

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AIAA、IAF 最新会议

AIAA

(AIAA 来源: <http://www.aiaa.org/>)

1. 会议名称: 72nd International Astronautical Congress – IAC 2021

会议时间: 25 October - 29 October 2021

会议地点: Dubai, U.A.E.

会议简介: The dates for the 72nd International Astronautical Congress have been set for 25–29 October 2021. The IAC 2021 will take place in Dubai, U.A.E. Please mark these important dates on your calendar.

链接:

<https://www.aiaa.org/events-learning/event/2021/10/25/default-calendar/72nd-international-astronautical-congress-iac-2021>

2. 会议名称: ASCEND 2021 (Accelerating Space Commerce, Exploration, and New Discovery)

会议时间: 8 November - 17 November 2021

会议地点: Las Vegas, Nevada & ONLINE

会议简介: Building a sustainable off-world future requires the collective effort of a diverse global community of students and professionals with the ideas, skills and passions to solve complex problems and inspire new ways of thinking. That's why more than 3,000 technical experts, executives, entrepreneurs, and engineers — from classrooms through careers — attended the inaugural 2020 ASCEND last November. Plan now to join us for the 2021 edition. The universe is expanding, and ASCEND is your space.

链接: <https://www.aiaa.org/events-learning/event/2021/11/08/default-calendar/ascend-2021>

3. 会议名称: AIAA International Space Planes and Hypersonic Systems and Technologies Conference

会议时间: 15 November - 17 November 2021

会议地点: Las Vegas, Nevada & ONLINE

会议简介: The 24th AIAA International Space Planes and Hypersonic Systems and Technologies Conference, as a part of ASCEND 2021, provides a forum for discussion and exchange of information for attendees from across the globe about leading-edge research and development activities associated with space planes and hypersonic atmospheric flight vehicles and the technologies underpinning these capabilities. Presentations will be provided on national programs from North America, South America, Australia, Europe, and Asia and multiple opportunities for international collaboration will be discussed.

链接:

<https://www.aiaa.org/events-learning/event/2021/11/15/default-calendar/24th-aiaa-international-space-planes-and-hypersonic-systems-and-technologies-conference>



4. 会议名称: ASCEND - Accelerating Space Commerce, Exploration, and New Discovery
会议时间: 15 November - 17 November 2021
会议地点: Las Vegas, Nevada & ONLINE
会议简介: Building a sustainable off-world future requires the collective effort of a diverse global community of students and professionals with the ideas, skills and passions to solve complex problems and inspire new ways of thinking. That's why more than 3,000 technical experts, executives, entrepreneurs, and engineers — from classrooms through careers — attended the inaugural 2020 ASCEND last November. Plan now to join us for the 2021 edition. The universe is expanding, and ASCEND is your space.
链接: <https://www.aiaa.org/events-learning/event/2021/11/15/default-calendar/ascend-2021>

- 5.会议名称: 2021 Region VII Student Conference
会议时间: 29 November - 30 November 2021
会议地点: Las Vegas, Nevada & ONLINE
会议简介: AIAA is pleased to announce the Region VII/International Student Conference will be held virtually from 29–30 November 2021. This conference is intended for AIAA Region VII Students from around the world, with the exceptions of Canada and Mexico, which have been incorporated into AIAA's North America Regions.
链接: <https://www.aiaa.org/events-learning/event/2021/11/29/default-calendar/2021-region-vii-student-conference>

IAF

(IAF 来源: <http://www.iafastro.org/>)

- 会议名称: 72nd International Astronautical Congress 2021
会议时间: 25-29 October 2021
会议地点: Dubai, United Arab Emirates
会议简介: For the very first time, the IAC will open its doors to the global space community in the United Arab Emirates, the first Arab country to host the IAC since its establishment in 1950. The United Arab Emirates' interest in astronomy and space sciences dates back to the 1970's, when His Highness Sheikh Zayed bin Sultan Al Nahyan met with the NASA team responsible for the Apollo moon landing. This encounter sparked a national focus on space that began almost three decades ago, eventually leading to the birth of a national space sector. The IAC 2021 Host Organization – the Mohammed Bin Rashid Space Center (MBRSC) – member of the IAF since 2012, was established by the Dubai Government to serve as one of the main pillars to drive the establishment of the knowledge economy and sustainable development in the UAE.
With the theme “Inspire, Innovate & Discover for the Benefit of Humankind”, the IAC 2021 looks forward to making a contribution to humanity and to science by strengthening and enhancing cooperation between all countries in the space sector.
This is your chance to inspire the next generation, to architect the further development and expansion of the space sector's growing ecosystem. In fact, the IAC 2021 could be your



opportunity to contribute in breakthroughs that revolutionise the future of space exploration.

The IAC 2021 comes to the UAE at a fortuitous juncture: it will follow closely on the heels of the launch of the Emirates Mars Mission (Hope Probe), the Arab's first space exploration craft to Mars. It will also mark the anniversary of the return of the first Emirati astronaut from the International Space Station, and the second anniversary of the launch of KhalifaSat — the first Earth-observation satellite to be produced wholly by Emiratis. These achievements are symbolic of the beginning of a new era in the region; the IAC 2021 will be an opportunity to shed light on how space science and technology can contribute to a nation's progress.

链接: <https://www.iafastro.org/events/iac/iac-2021/>

ACM 最新会议

来源：<http://www.acm.org/>

1. 会议名称：ACM Advances in Financial Technologies - AFT 2021

会议时间：September 26-28, 2021.

会议地点：Online

会议简介：The third ACM conference on Advances in Financial Technologies (AFT'21) is a premier venue for presenting the latest developments in technologies related to novel financial infrastructure such as cryptocurrencies and their applications, blockchains, and exchanges.

链接：<https://aft.acm.org/aft21/index.html>

2. 会议名称：30th International Conference on Parallel Architectures and Compilation Techniques (PACT)

会议时间：Sep 26 - Sep 29, 2021

会议地点：Online

会议简介：The 30th International Conference on Parallel Architectures and Compilation Techniques (PACT) will be held during September 26-29, 2021. PACT is a long-running and unique conference at the intersection of classical parallel architectures and compilers that brings together researchers from architecture, compilers, programming languages, and applications to present and discuss their latest research results. Applications as a driver for innovations in architecture and compilers are an important theme of the conference.

链接：<http://pact21.snu.ac.kr/>

3. 会议名称：SIAM Conference on Geometric and Physical Modeling (GD/SPM21)

会议时间：August 1-4, 2021

会议地点：online

会议简介：The SIAM Special Interest Activity Group on Geometric Design (GD) and the Symposium on Solid and Physical Modeling (SPM) have a shared heritage dating back to the early 1980s. This joint conference (started in 2009) represents a historic union of these communities, their rich academic and industrial histories, as well as the common intellectual themes that continue to move them forward. The 2021 SIAM Conference on Geometric and Physical Modeling seeks high quality, original research contributions that strive to advance all aspects of geometric and physical modeling, and their application in design, analysis, and manufacturing, as well as in biomedical, geophysical, digital entertainment, and other areas (see the list of conference themes).

链接：<https://www.siam.org/conferences/cm/conference/gdspm21>

4. 会议名称: The 25th International Symposium on Distributed Simulation and Real Time Applications

会议时间: September 27-29, 2021

会议地点: Online

会议简介: The 2021 edition of the IEEE/ACM 25th International Symposium on Distributed Simulation and Real Time Applications (DS-RT) will be held in Valencia, Spain.

DS-RT 2021 serves as a forum for simulationists from academia, industry and research labs, for presenting recent research results in Distributed Simulation and Real Time Applications. DS-RT 2021 targets the growing overlap between large distributed simulations and real time applications, such as mirror world simulations and collaborative virtual environments.

The conference features prominent invited speakers as well as papers by top researchers in the field. DS-RT 2021 will include contributed technical papers, invited papers, and panel discussions. The proceedings will be published by IEEE-CS press.

This event is a wonderful opportunity to join the community of experts on related topics, share experiences, and have fruitful discussions. You are kindly invited to attend this prestigious conference, which this year celebrates its 25th anniversary.

链接: <http://ds-rt.com/2021/>

5. 会议名称: The ACM International Conference on Mobile Human-Computer Interaction

会议时间: Sept. 27 - Oct. 1, 2021

会议地点: Online

会议简介: We have published the full program. The conference will take place on Remo. You can contact our helpdesk by email: helpdesk2021@mobilehci.acm.org throughout the conference. Once in the main Remo event, during conference hours, you can also get help from our Student Volunteers in the Helpdesk on Floor 1 of the main even or via private chat (look for the helpdesk username).

链接: <https://mobilehci.acm.org/2021/>

6. 会议名称: 15th ACM Conference on Recommender Systems

会议时间: 27th September-1st October 2021

会议地点: Amsterdam, Netherlands

会议简介: The ACM Conference on Recommender Systems (RecSys) is the premier international forum for the presentation of new research results, systems and techniques in the broad field of recommender systems. RecSys brings together the major international research groups working on recommender systems, along with many of the world's leading companies active in e-commerce and other adjacent domains. It has become the most important annual conference for the presentation and discussion of recommender systems research. In recognition of the role of the conference in bringing the recommender systems community together, the theme of RecSys 2021 will be "A place to meet and exchange" and the conference venue will be the Amsterdam Stock Exchange Building, which has been transformed into the Amsterdam Conference Centre.

链接: <https://recsys.acm.org/recsys21/>

7. 会议名称: ACM/IEEE Joint Conference on Digital Libraries

会议时间: September 27 – 30, 2021

会议地点: Online

会议简介: The ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL) is a major international forum focusing on digital libraries and associated technical, practical, and social issues. Participation is sought from all parts of the world and from the full range of disciplines and professions involved in digital library research and practice, including computer science, information science, librarianship, archival science and practice, museum studies and practice, technology, medicine, social sciences, and humanities. Besides the main conference, JCDL 2021 will host specialized workshops, tutorials, panels, and a doctoral consortium. All domains—academics, government, industry, and others—are encouraged to participate as presenters or attendees.

链接: <https://2021.jcdl.org/>

8. 会议名称: The inaugural Conference on Equity and Access in Algorithms, Mechanisms, and Optimization

会议时间: September 27-30, 2021

会议地点: Paris, France(Online)

会议简介: Blockchain and Distributed Ledger Technologies (DLT) make global headlines daily electrifying the world by disrupting the techno-socio-economic fabric of our society including the coordination among autonomous resources. Other areas include finance and payments (e.g., Facebook Libra), but also networks (e.g., power grids or telecom networks), computing (e.g., brokering of edge resources), IoT (e.g., supply chain or industry 4.0) or service platforms (e.g., identity management). BRAINS conference series is dedicated to these new advances that could make the world of networks and services more secure, while enabling new distributed business models.

链接: <https://brains.dnac.org/>

9. 会议名称: First-Ever Hybrid ACM MMSys

会议时间: Sept. 28-Oct. 1

会议地点: Istanbul

会议简介: The ACM Multimedia Systems Conference (MMSys) provides a forum for researchers to present and share their latest research findings in multimedia systems. While research about specific aspects of multimedia systems are regularly published in the various proceedings and transactions of the networking, operating systems, real-time systems, databases, mobile computing, distributed systems, computer vision, and middleware communities, MMSys aims to cut across these domains in the context of multimedia data types. This provides a unique opportunity to investigate the intersections and the interplay of the various approaches and solutions developed across these domains to deal with multimedia data types.

链接: <https://2021.acmmmsys.org/>



10. 会议名称: Managed Programming Languages (MPLR) 2021 and Virtual Machine Meetup (VMM) 2021

会议时间: 29-30 September 2021

会议地点: Alexander-von-Humboldt Haus, Münster, Germany

会议简介: The 18th ACM SIGPLAN International Conference on Managed Programming Languages & Runtimes (MPLR'21, formerly ManLang, originally PPPJ) is a premier forum for presenting and discussing novel results in all aspects of managed programming languages and runtime systems, which serve as building blocks for some of the most important computing systems around, ranging from small-scale (embedded and real-time systems) to large-scale (cloud-computing and big-data platforms) and anything in between (mobile, IoT, and wearable applications).

链接: <https://wwuindico.uni-muenster.de/event/449/>



IQPC 最新国防会议(Defence)

IQPC 来源: <http://www.iqpc.com/>

1.会议名称: Defence Transformation Week Online

会议时间: 27 - 29 SEPTEMBER, 2021

会议地点: ONLINE

会议简介: Key NATO nations are prioritising digitisation, disruptive innovation, and the transformation of capability across ISR; C2; the manned/unmanned/autonomous mix on land, at sea, in the air and in space; and synthetic training for future multi-domain operations.

We have just released the agenda for our first Defence Transformation Week event in September 2021, combining Defence iQ's popular Disruptive Technology for Defence Transformation and Big Data for Defence conferences.

链接:

https://www.defenceiq.com/events-defencetransformationweek?mac=DFIQ_Homepage_EOI_Title_Listing&utm_medium=Portal&utm_source=defence-iq

2.会议名称: Hypersonic Weapons Summit

会议时间: September 28 - 29, 2021

会议地点: Digital Summit

会议简介: With the Pentagon's recent successful test of a hypersonic glide body in 2020, the path to hypersonic deployment seems closer than ever for the United States. However, there are many technological and operational decisions to be made before fielding an operational weapon. Meeting the pace at which the Services wants to test and field a hypersonic offensive capability will be a challenge, but doing so is critical to the National Defense Strategy of the United States Military. Join IDGA's Hypersonic Weapons Summit for the unique opportunity to understand US Military senior leadership approach to the ongoing global proliferation of hypersonic weapons and capabilities for FY2021 and beyond!

链接:

https://www.idga.org/events-hypersonic-weapons?mac=DFIQ_Homepage_EOI_Title_Listing&utm_medium=Portal&utm_source=defence-iq

3.会议名称: Coast Guard Capability

会议时间: 29 September, 2021

会议地点: Online

会议简介: As modern coast guards face increasingly varied and complex challenges, covering a wide range of operations, Coast Guard Capability Online has been specifically designed to help coast guards and related maritime organisations achieve mission success. Focusing on Interoperability, Search and Rescue, Border Security and Resource Protection, this one-day online



event will foster an environment of collaboration, providing an opportunity for participation in interactive discussions and high-level debates. Coast Guard Capability Online will promote international and inter-agency cooperation, as well as facilitate dialogue with industry leaders at the cutting-edge of next generation specialist equipment.

链接:

https://www.defenceiq.com/events-coastguardcapability?mac=DFIQ_Homepage_EOI_Title_Listing&utm_medium=Portal&utm_source=defence-iq

4.会议名称: Land Forces Training

会议时间: 20 - 21 October, 2021

会议地点: Online

会议简介: With a rapidly changing battlespace, it is integral that Allied forces are prepared for the next generation of warfare. Effective training must align appropriately with mission sets, manage costs and optimize soldiers to their highest potential. This conference will cover live training approaches, interoperability, simulation and synthetic training development, and new technology that allows for the leveraging of data to elevate training performance. This year's iteration of our Land Forces Training Summit will focus on discussions on how to deliver more effective training at the point of need to ensure that warfighters are ready to meet the challenge of future operations.

链接:

https://www.defenceiq.com/events-landforcestraining-online?mac=DFIQ_Homepage_EOI_Title_Listing&utm_medium=Portal&utm_source=defence-iq

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