Science Newsletter

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Contents

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Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2024/0112/c5474a174724/page.htm. If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Computer Science**:
We post several papers which are related to the top concerned topics of researches on Computer Science. The papers are classified in 5 categories, and they are: **Natural Language Processing, Artificial Intelligence Algorithms, Neural Networks, Data Mining** and **Parallel Processing**. Also, the listed papers are all arranged in a descending sort of JCR impact factor. If you want full pages of these papers, please contact us for help.

NATURAL LANGUAGE PROCESSING

Nucleic Acids Res (impact factor: 16.6) 2 区 TOP

miRTarBase 2025: updates to the collection of experimentally validated microRNA-target interactions.

Cui, Yu, Huang, et. al

Abstract:
MicroRNAs (miRNAs) are small non-coding RNAs (18-26 nucleotides) that regulate gene expression by interacting with target mRNAs, affecting various physiological and

pathological processes. miRTarBase, a database of experimentally validated miRNA-target interactions (MTIs), now features over 3 817 550 validated MTIs from 13 690 articles, significantly expanding its previous version. The updated database includes miRNA interactions with therapeutic agents, revealing roles in drug resistance and therapeutic strategies. It also highlights miRNAs as predictive, safety and monitoring biomarkers for toxicity assessment, clinical treatment guidance and therapeutic optimization. The expansion of miRNA-mRNA and miRNA-miRNA networks allows the identification of key regulatory genes and co-regulatory miRNAs, providing deeper insights into miRNA functions and critical target genes. Information on oxidized miRNA sequences has been added, shedding light on how oxidative modifications influence miRNA targeting and regulation. The integration of the LLAMA3 model into the NLP pipeline, alongside prompt engineering, enables the efficient identification of MTIs and miRNA-disease associations without large training datasets. An updated data integration and a redesigned user interface enhance accessibility, reinforcing miRTarBase as an essential resource for molecular oncology, drug development and related fields. The updated miRTarBase is available at https://mirtarbase.cuhk.edu.cn/~miRTarBase/miRTarBase_2025.© The Author(s) 2024. Published by Oxford University Press on behalf of Nucleic Acids Research.

J Eur Acad Dermatol Venereol (impact factor: 8.4) 2 ☒

Decoding the ABCs of natural language processing in dermatology.

Nambudiri, et. al

Abstract:

Dermatology is often characterized as a highly visual field; emphasis is placed on the recognition of subtle morphological clues that allow expert clinicians the ability to render a precise diagnosis from physical examination alone—or perhaps through adjunctive clinicopathological correlation with further image-rich information gleaned from histological specimens. While innovations in digital imaging are often the focus of emerging technologies within our field, we must not forget the adage that 'a picture is worth a thousand words': the clinical practice of dermatology generates vast amounts of verbal data that may be a powerful repository to be explored for unlocking diagnostic and therapeutic advances within our specialty.

Natural language processing (NLP) has emerged as a potent tool in the armamentarium of data scientists working at the intersection of human language and technology. At its most fundamental level, NLP leverages artificial intelligence and other computational analytics to interpret or understand human language, typically in its written form.1 Over the last decade, with the strides made in applications of artificial intelligence broadly and more specifically within healthcare, the applications of NLP have greatly expanded in both the clinical and research arenas.

In this issue, Paganelli et al.2 provide a systematic review of the literature regarding NLP techniques applied to dermatology, highlighting several key takeaways for practicing clinicians and researchers alike. Following a PRISMA-compliant, PICO-

structured search strategy, the authors identified 30 articles published through March 2024 meeting their inclusion criteria. A first observation to make here is the relative nascency of the literature using NLP specifically in dermatologic contexts; much opportunity exists to expand this emerging body of scholarly works that explore the potential use cases of this technology applied to dermatology. The authors note there has been an exponential growth of papers in the last 5 years and with the increasing accessibility of these technologies one would expect a continued trajectory of additional growth to follow in the coming years.

Unsurprisingly, the authors found that the most common diagnoses to which NLP had been applied included common dermatoses (atopic dermatitis and rosacea) as well as common skin malignancies (melanoma and non-melanoma skin cancers). However, diseases such as calciphylaxis and epidermolysis bullosa were also the subject of NLP analyses included in the systematic review, demonstrating a powerful potential application to focus this emerging analytical aid on rare, complex medical dermatologic conditions to advance our knowledge of diagnostic, prognostic or therapeutic information for these conditions. A second observation, thus, is that dermatologists and researchers should make note of such studies for their potential ability to be replicated in other rare or challenging-to-treat dermatological conditions, as insights for earlier recognition or enhanced therapeutics may be easier to harness following NLP analyses.

A final observation stems from the heterogeneity of the data sources used for NLP processing, ranging from clinical notes to social media posts. While the authors acknowledge this as a potential limitation of the analysis, an alternative insight is to view this as a reflection of the immense research creativity that undergirds our field; despite a small number of papers, the variety and breadth of data sources is robust and the number of individual data points in several of the studies stretches into the tens or hundreds of thousands. This variation can in fact be viewed as a strength of diversity within NLP's applications to dermatology and may serve as an inspiration to researchers at the nexus of dermatology and informatics to explore multiple potential future directions for further in-depth analysis.

Though the full potential for NLP to impact dermatology remains far from realized, the work by Paganelli and colleagues serves as a valuable snapshot of the exciting potential for applying this evolving technology in our field.

Artif Intell Med (impact factor: 6.1) 2 ☒

Generating synthetic clinical text with local large language models to identify misdiagnosed limb fractures in radiology reports.

Liu, Koopman, et. al

Abstract:

Large language models (LLMs) demonstrate impressive capabilities in generating human-like content and have much potential to improve the performance and efficiency of healthcare. An important application of LLMs is to generate synthetic clinical reports

that could alleviate the burden of annotating and collecting real-world data in training AI models. Meanwhile, there could be concerns and limitations in using commercial LLMs to handle sensitive clinical data. In this study, we examined the use of open-source LLMs as an alternative to generate synthetic radiology reports to supplement real-world annotated data. We found LLMs hosted locally can achieve similar performance compared to ChatGPT and GPT-4 in augmenting training data for the downstream report classification task of identifying misdiagnosed fractures. We also examined the predictive value of using synthetic reports alone for training downstream models, where our best setting achieved more than 90 % of the performance using real-world data. Overall, our findings show that open-source, local LLMs can be a favourable option for creating synthetic clinical reports for downstream tasks.Copyright © 2024 The Authors. Published by Elsevier B.V. All rights reserved.

ARTIFICIAL INTELLIGENCE ALGORITHMS

Sci Adv (impact factor: 11.7) 1 ☒

Submillimeter fiber robots capable of decoupled macro-micro motion for endoluminal manipulation.

Zhou, Xu, Lin, et. al

Abstract:

Endoluminal and endocavitary intervention via natural orifices of the body is an emerging trend in medicine, further underpinning the future of early intervention and precision surgery. This motivates the development of small continuum robots to navigate freely in confined and tortuous environment. The trade-off between a large range of motion and high precision with concomitant actuation cross-talk poses a major challenge. Here, we present a submillimeter-scale fiber robot (~1 mm) capable of decoupled macro and micro manipulations for intervention and operation. The thin optical fibers, working both as mechanical tendons and light waveguides, can be pulled/pushed to actuate the macro tendon-driven continuum robot and transmit light to actuate the liquid crystal elastomer-based micro built-in light-driven parallel robot. The combination of the decoupled macro and micro motions can accomplish accurate cross-scale motion from several millimeters down to tens of micrometers. In vivo animal studies are performed to demonstrate its positioning accuracy of precise micro operations in endoluminal or endocavitary intervention.

JAMA Netw Open (impact factor: 10.5) 1 ☒

Artificial Intelligence and Radiologist Burnout.

Liu, Ding, Li, et al

Abstract:

Understanding the association of artificial intelligence (AI) with physician burnout is crucial for fostering a collaborative interactive environment between physicians and AI.To estimate the association between AI use in radiology and radiologist burnout.This cross-sectional study conducted a questionnaire survey between May and October 2023, using the national quality control system of radiology in China. Participants included radiologists from 1143 hospitals. Radiologists reporting regular or consistent AI use were categorized as the AI group. Statistical analysis was performed from October 2023 to May 2024.AI use in radiology practice.Burnout was defined by emotional exhaustion (EE) or depersonalization according to the Maslach Burnout Inventory. Workload was assessed based on working hours, number of image interpretations, hospital level, device type, and role in the workflow. AI acceptance was determined via latent class analysis considering AI-related knowledge, attitude, confidence, and intention. Propensity score-based mixed-effect generalized linear logistic regression was used to estimate the associations between AI use and burnout and its components. Interactions of AI use, workload, and AI acceptance were assessed on additive and multiplicative scales.Among 6726 radiologists included in this study, 2376 (35.3%) were female and 4350 (64.7%) were male; the median (IQR) age was 41 (34-48) years; 3017 were in the AI group (1134 [37.6%] female; median [IQR] age, 40 [33-47] years) and 3709 in the non-AI group (1242 [33.5%] female; median [IQR] age, 42 [34-49] years). The weighted prevalence of burnout was significantly higher in the AI group compared with the non-AI group (40.9% vs 38.6%; P < .001). After adjusting for covariates, AI use was significantly associated with increased odds of burnout (odds ratio [OR], 1.20; 95% CI, 1.10-1.30), primarily driven by its association with EE (OR, 1.21; 95% CI, 1.10-1.34). A dose-response association was observed between the frequency of AI use and burnout (P for trend < .001). The associations were more pronounced among radiologists with high workload and lower AI acceptance. A significant negative interaction was noted between high AI acceptance and AI use.In this cross-sectional study of radiologist burnout, frequent AI use was associated with an increased risk of radiologist burnout, particularly among those with high workload or lower AI acceptance. Further longitudinal studies are needed to provide more evidence.

Brief Bioinform (impact factor: 6.8) 2 ☒ TOP

Methane fueled lake pelagic food webs in a Cretaceous greenhouse world.

Strudwick, Gardiner, Denning-James, et. al

Abstract:

Machine learning (ML) methods offer opportunities for gaining insights into the intricate workings of complex biological systems, and their applications are

increasingly prominent in the analysis of omics data to facilitate tasks, such as the identification of novel biomarkers and predictive modeling of phenotypes. For scientists and domain experts, leveraging user-friendly ML pipelines can be incredibly valuable, enabling them to run sophisticated, robust, and interpretable models without requiring in-depth expertise in coding or algorithmic optimization. By streamlining the process of model development and training, researchers can devote their time and energies to the critical tasks of biological interpretation and validation, thereby maximizing the scientific impact of ML-driven insights. Here, we present an entirely automated open-source explainable AI tool, AutoXAI4Omics, that performs classification and regression tasks from omics and tabular numerical data. AutoXAI4Omics accelerates scientific discovery by automating processes and decisions made by AI experts, e.g. selection of the best feature set, hyper-tuning of different ML algorithms and selection of the best ML model for a specific task and dataset. Prior to ML analysis AutoXAI4Omics incorporates feature filtering options that are tailored to specific omic data types. Moreover, the insights into the predictions that are provided by the tool through explainability analysis highlight associations between omic feature values and the targets under investigation, e.g. predicted phenotypes, facilitating the identification of novel actionable insights. AutoXAI4Omics is available at: https://github.com/IBM/AutoXAI4Omics.© The Author(s) 2024. Published by Oxford University Press.

NEURAL NETWORKS

ISA Trans (impact factor: 6.3) 2 ☒

Active disturbance rejection control with adaptive RBF neural network for a permanent magnet spherical motor.

Guo, Tan, Wang, et. al

Abstract:

In response to the issues of low tracking accuracy and poor robustness in the trajectory tracking control of a permanent magnet spherical motor (PMSpM), an active disturbance rejection control (ADRC) scheme combining neural networks is put forward in this research. The unknown total disturbance is approximated by employing a radial basis function (RBF) neural network, with weights updated by an adaptive law and compensated for through the nonlinear feedback loop. This approach addresses the problem of performance degradation of the extended state observer under severe total disturbance, thereby ensuring accurate tracking of the PMSpM. Comparative simulations are accomplished to evaluate the performance of the RBF-ADRC scheme in enhancing disturbance rejection capability and robustness. Experimental results from

the planar circular motion experiment on the PMSpM test platform validate the application value of the scheme.Copyright © 2024 ISA. Published by Elsevier Ltd. All rights reserved.

Commun Biol (impact factor: 5.2) 2 ☒

Claustrum modulation drives altered prefrontal cortex dynamics and connectivity

Zhang, Xue, et. al

Abstract:
This study delves into the claustrum's role in modulating spontaneous and sensory-evoked network activity across cortical regions. Using mesoscale calcium imaging and Gi and Gq DREADDs in anesthetized mice, we show that decreasing claustral activity enhances prefrontal cortical activity, while activation reduces prefrontal cortical activity. This claustrum modulation also caused changes to the brain's large-scale functional networks, emphasizing the claustrum's ability to influence long-range functional connectivity in the cortex. Claustrum inhibition increased the local coupling between frontal cortex areas, but reduced the correlation between anterior medial regions and lateral/posterior regions, while also enhancing sensory-evoked responses in the visual cortex. These findings indicate the claustrum can participate in orchestrating neural communication across cortical regions through modulation of prefrontal cortical activity. These insights deepen our understanding of the claustrum's impact on prefrontal connectivity, large-scale network dynamics, and sensory processing, positioning the claustrum as a key node modulating large-scale cortical dynamics.

PLoS One (impact factor: 2.9) 3 ☒

Construction of a CNN-SK weld penetration recognition model based on the Mel spectrum of a CMT arc sound signal.

Li, Chen, et. al

Abstract:
Arc sound signals are considered appropriate for detecting penetration states in cold metal transfer (CMT) welding because of their noninvasive nature and immunity to interference from splatter and arc light. Nevertheless, the stability of arc sound signals is suboptimal, the conventional feature extraction methods are inefficient, and the significance of arc sound attributes for determining penetration statuses is often overlooked. In this study, a compact convolutional neural network (CNN) model is proposed for the adaptive extraction of features from arc sound signals. The model uses the Mel spectrum diagram of an arc sound signal obtained through a short-time Fourier

transform (STFT) and a Mel filter bank conversion step as its input. To improve the recognition capabilities of the model, a novel CNN-selective kernel (SK) model for weld penetration recognition is introduced, which integrates the dynamic selection kernel network (SKNet) into the CNN architecture. The experimental results indicate that the CNN-SK model outperforms the traditional models, achieving an accuracy of 98.83% on the validation dataset. This model holds promise for assessing weld penetration in CMT welding applications. The project is available at https://github.com/ZWL58/data/tree/master.Copyright: © 2024 Zheng et al. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DATA MINING

Neural Netw (impact factor: 6) 1 ☒

Rethinking the impact of noisy labels in graph classification: A utility and privacy perspective.

Li, Li, Gan, et. al

Abstract

Graph neural networks (GNNs) based on message-passing mechanisms have achieved advanced results in graph classification tasks. However, their generalization performance degrades when noisy labels are present in the training data. Most existing noisy labeling approaches focus on the visual domain or graph node classification tasks and analyze the impact of noisy labels only from a utility perspective. Unlike existing work, in this paper, we measure the effects of noise labels on graph classification from data privacy and model utility perspectives. We find that noise labels degrade the model's generalization performance and enhance the ability of membership inference attacks on graph data privacy. To this end, we propose the robust graph neural network (RGLC) approach with noisy labeled graph classification. Specifically, we first accurately filter the noisy samples by high-confidence samples and the first feature principal component vector of each class. Then, the robust principal component vectors and the model output under data augmentation are utilized to achieve noise label correction guided by dual spatial information. Finally, supervised graph contrastive learning is introduced to enhance the embedding quality of the model and protect the privacy of the training graph data. The utility and privacy of the proposed method are validated by comparing twelve different methods on eight real graph classification datasets. Compared with the state-of-the-art methods, the RGLC method achieves at most and at least 7.8% and 0.8%

performance gain at 30% noisy labeling rate, respectively, and reduces the accuracy of privacy attacks to below 60%.Copyright © 2024 Elsevier Ltd. All rights reserved.

Neural Netw (impact factor: 6) 1 ☒

TV-Net: Temporal-Variable feature harmonizing Network for multivariate time series classification and interpretation.

Yue, Wang, Zhang, et. al

Abstract

Multivariate time series classification (MTSC), which identifies categories of multiple sensor signals recorded in continuous time, is widely used in various fields such as transportation, finance, and medical treatment. The focused challenge remains learning the dependencies between subsequences to capture discriminative patterns while providing convincing explanations. In this paper, we propose a temporal-variable parallel deep learning framework to mine global and local features to achieve a win-win situation in performance and interpretability. Specifically, for harmonizing the inattention blindness of global features, we introduce a graph attention mechanism with global awareness (GAT-g), where the learning of edge representations incorporates both inter-node relationships and the node-to-graph context. Furthermore, for evaluating the feature combinations utility, we exploit game interactions for the first time, which quantifies the utility of feature combination through Shapley values to illustrate the dynamically coordinating representation ability of the model for diverse time series features. In addition, the interpretation module leverages temporal and variable subspace attention distributions to provide instantiated explanations with additive computational complexity, enhancing the comprehension of prediction results. Experimental evaluation on the University of East Anglia (UEA) archive of 30 multivariate time series datasets shows that the proposed method outperforms 12 state-of-the-art methods on 11 datasets.Copyright © 2024 Elsevier Ltd. All rights reserved.

Microb Biotechnol (impact factor: 4.8) 2 ☒

Integrated genome and metabolome mining unveiled structure and biosynthesis of novel lipopeptides from a deep-sea Rhodococcus.

Ragozzino, Palma Esposito, et. al

Abstract

Microbial biosurfactants have garnered significant interest from industry due to their lower toxicity, biodegradability, activity at lower concentrations and higher resistance compared to synthetic surfactants. The deep-sea Rhodococcus sp. I2R has been identified as a producer of glycolipid biosurfactants, specifically succinoyl trehalolipids, which exhibit antiviral activity. However, genome mining of this bacterium has revealed a still unexplored repertoire of biosurfactants. The microbial genome was

found to host five non-ribosomal peptide synthetase (NRPS) gene clusters containing starter condensation domains that direct lipopeptide biosynthesis. Genomics and mass spectrometry (MS)-based metabolomics enabled the linking of two NRPS gene clusters to the corresponding lipopeptide families, leading to the identification of 20 new cyclolipopeptides, designated as rhodoheptins, and 33 new glycolipopeptides, designated as rhodamides. An integrated in silico gene cluster and high-resolution MS/MS data analysis allowed us to elucidate the planar structure, inference of stereochemistry and reconstruction of the biosynthesis of rhodoheptins and rhodamides. Rhodoheptins are cyclic heptapeptides where the N-terminus is bonded to a β-hydroxy fatty acid forming a macrolactone ring with the C-terminal amino acid residue. Rhodamides are linear 14-mer glycolipopeptides with a serine- and alanine-rich peptide backbone, featuring a distinctive pattern of acetylation, glycosylation and succinylation. These molecules exhibited biosurfactant activity in the oil-spreading assay and showed moderate antiproliferative effects against human A375 melanoma cells.© 2024 The Author(s). Microbial Biotechnology published by John Wiley & Sons Ltd.

PARALLEL PROCESSING

Nat Genet (impact factor: 31.7) 1 区 TOP

ChIP-DIP maps binding of hundreds of proteins to DNA simultaneously and identifies diverse gene regulatory elements

Andrew A. Perez, Isabel N. Goronzy, et. al

Abstract

Gene expression is controlled by dynamic localization of thousands of regulatory proteins to precise genomic regions. Understanding this cell type-specific process has been a longstanding goal yet remains challenging because DNA–protein mapping methods generally study one protein at a time. Here, to address this, we developed chromatin immunoprecipitation done in parallel (ChIP-DIP) to generate genome-wide maps of hundreds of diverse regulatory proteins in a single experiment. ChIP-DIP produces highly accurate maps within large pools (>160 proteins) for all classes of DNA-associated proteins, including modified histones, chromatin regulators and transcription factors and across multiple conditions simultaneously. First, we used ChIP-DIP to measure temporal chromatin dynamics in primary dendritic cells following LPS stimulation. Next, we explored quantitative combinations of histone modifications that define distinct classes of regulatory elements and characterized their functional activity in human and mouse cell lines. Overall, ChIP-DIP generates context-specific protein localization maps at consortium scale within any molecular biology laboratory and experimental system.

Cell Discov (impact factor: 13) 1 ☒

Cryo-EM structure of PML RBCC dimer reveals CC-mediated octopus-like nuclear body assembly mechanism

Yangxia Tan, Jiawei Li, et. al

Abstract:

Promyelocytic leukemia protein (PML) nuclear bodies (NBs) are essential in regulating tumor suppression, antiviral response, inflammation, metabolism, aging, and other important life processes. The re-assembly of PML NBs might lead to an ~100% cure of acute promyelocytic leukemia. However, until now, the molecular mechanism underpinning PML NB biogenesis remains elusive due to the lack of structural information. In this study, we present the cryo-electron microscopy (cryo-EM) structure of the PML dimer at an overall resolution of 5.3 Å, encompassing the RING, B-box1/2 and part of the coiled-coil (RBCC) domains. The integrated approach, combining crosslinking and mass spectrometry (XL-MS) and functional analyses, enabled us to observe a unique folding event within the RBCC domains. The RING and B-box1/2 domains fold around the α3 helix, and the α6 helix serves as a pivotal interface for PML dimerization. More importantly, further characterizations of the cryo-EM structure in conjugation with AlphaFold2 prediction, XL-MS, and NB formation assays, help unveil an unprecedented octopus-like mechanism in NB assembly, wherein each CC helix of a PML dimer (PML dimer A) interacts with a CC helix from a neighboring PML dimer (PML dimer B) in an anti-parallel configuration, ultimately leading to the formation of a 2 μm membrane-less subcellular organelle.

Small Methods (impact factor: 10.7) 2 ☒

Self-Powered Wearable Displacement Sensor for Continuous Respiratory Monitoring and Human-Machine Synchronous Control.

Shi, Li, Yang, et. al

Abstract:

Flexible wearable electronic devices play a vital role in daily monitoring, medical diagnosis, and human-computer interaction, and such devices have a great demand for portability, integration, comfort, and self-power. In this study, a triboelectric nanogenerator integrated into a flexible chest belt is proposed as a displacement sensor to monitor the displacement and frequency of thoracic expansion. Based on three parallel interpolation electrode structures with phase differences, the Triboelectric Nanogenerators's(TENG) output signal pulse number can characterize the sliding displacement, with a resolution of more than 1 mm and a durability of more than 700,000 cycles. Based on the flexible printed circuit processing technology, the volume of the sensor is less than 8.5 cm3, and the weight is less than 3.2 g, which improves the portability of the device. Based on wireless radio frequency technology, the collected

signals are transmitted to the upper computer, and then the monitoring of respiratory physiological signals and the human-machine synchronous control of the ventilator are achieved within the overshoot of 1.5% and the control error of 5% through a simulation machine. This work provides a sensing method for daily and medical respiratory monitoring and demonstrates the enormous potential of frictional electric sensors in intelligent medical applications.© 2024 Wiley‐VCH GmbH.

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Ⅱ Concentration

PHYSICS

A mechanical qubit

Yu Yang, Igor Kladarić, et al.

Abstract

Although strong nonlinear interactions between quantized excitations are an important resource for quantum technologies based on bosonic oscillator modes, most electromagnetic and mechanical nonlinearities are far too weak to allow for nonlinear effects to be observed at the single-quantum level. This limitation has been overcome in electromagnetic resonators by coupling them to other strongly nonlinear quantum systems such as atoms and superconducting qubits. We demonstrate the realization of the single-phonon nonlinear regime in a solid-state mechanical system. The single-phonon anharmonicity in our system exceeds the decoherence rate by a factor of 6.8, allowing us to use it as a mechanical qubit and demonstrate initialization, readout, and single-qubit gates. Our approach provides a powerful quantum acoustics platform for quantum simulations, sensing, and information processing.

Subambient daytime radiative cooling of vertical surfaces

Fei Xie, Weiliang Jin, et al.

Abstract

Subambient daytime radiative cooling enables temperatures to passively reach below ambient temperature, even under direct sunlight, by emitting thermal radiation toward outer space. This technology holds promise for numerous exciting applications. However, previous demonstrations of subambient daytime radiative cooling require surfaces that directly face the sky, and these cannot be applied to vertical surfaces that are ubiquitous in real-world scenarios such as buildings and vehicles. Here, we demonstrate subambient daytime radiative cooling of vertical surfaces under peak sunlight using a hierarchically designed, angularly asymmetric, spectrally selective thermal emitter. Under peak sunlight of about 920 watts per square meter, our emitter reaches a temperature that is about 2.5°C below ambient temperature, corresponding to a temperature reduction of about 4.3° and 8.9°C compared with a silica-polymer hybrid radiative cooler and commercial white paint, respectively.

Observation of vortices in a dipolar supersolid

Casotti, Eva, Poli, et al.

Abstract

Supersolids are states of matter that spontaneously break two continuous symmetries: translational invariance owing to the appearance of a crystal structure and phase invariance owing to phase locking of single-particle wavefunctions, responsible for superfluid phenomena. Although originally predicted to be present in solid helium[1,2,3,4,5], ultracold quantum gases provided a first platform to observe supersolids[6,7,8,9,10], with particular success coming from dipolar atoms[8,9,10,11,12]. Phase locking in dipolar supersolids has been investigated through, for example, measurements of the phase coherence[8,9,10] and gapless Goldstone modes[13], but quantized vortices, a hydrodynamic fingerprint of superfluidity, have not yet been observed. Here, with the prerequisite pieces at our disposal, namely a method to generate vortices in dipolar gases[14,15] and supersolids with two-dimensional crystalline order[11,16,17], we report on the theoretical investigation and experimental observation of vortices in the supersolid phase (SSP). Our work reveals a fundamental difference in vortex seeding dynamics between unmodulated and modulated quantum fluids. This opens the door to study the hydrodynamic properties of exotic quantum systems with numerous spontaneously broken symmetries, in disparate domains such as quantum crystals and neutron stars[18].

MATERIALS

Janus channel of membranes enables concurrent oil and water recovery from emulsions

Xin-Yu Guo, Lei Zhao, et al.

Abstract

Existing separation technologies struggle to recover oil and water concurrently from surfactant-stabilized emulsions to achieve the goal of near-zero liquid discharge. We present a Janus channel of membranes (JCM) that features a confined architecture constructed of a pair of hydrophilic and hydrophobic membranes, which allows for concurrent, highly efficient recovery of oil and water from surfactant-stabilized emulsions. The confined Janus channel can amplify the interplay of the membrane pair through a feedback loop that involves enrichment and demulsification. Our JCM achieves exceptional oil and water recoveries of up to 97 and 75%, respectively, with near 99.9% purities. Moreover, its versatility in handling diverse emulsions may enable near-zero liquid discharge for a range of separations.

Ultrahigh–surface area covalent organic frameworks for methane adsorption

Ying Yin, Ya Zhang, et al.

Abstract

Developing porous materials with ultrahigh surface areas for gas storage (for example, methane) is attractive but challenging. Here, we report two isostructural three-dimensional covalent organic frameworks (COFs) with a rare self-catenated alb-3,6-Ccc2 topology and a pore size of 1.1 nanometer. Notably, these imine-linked microporous COFs show both high gravimetric Brunauer–Emmett–Teller (BET) surface areas (~4400 square meters per gram) and volumetric BET surface areas (~1900 square meters per cubic centimeter). Moreover, their volumetric methane uptake reaches up to 264 cubic centimeter (standard temperature and pressure) per cubic centimeter [cm3 (STP) cm−3] at 100 bar and 298 kelvin, and they exhibit the highest volumetric working capacity of 237 cm3 (STP) cm−3 at 5 to 100 bar and 298 kelvin among all reported porous crystalline materials.

Impurity-healing interface engineering for efficient perovskite submodules

Wang, Haifei, Su, et al.

Abstract

An issue that affects the scaling-up development of perovskite photovoltaics is the marked efficiency drop when enlarging the device area, caused by the inhomogeneous distribution of defected sites1,2,3. In the narrow band gap formamidinium lead iodide (FAPbI3), the native impurities of PbI2 and δ-FAPbI3 non-perovskite could induce unfavoured non-radiative recombination, as well as inferior charge transport and extraction4,5. Here we develop an impurity-healing interface engineering strategy to address the issue in small-area solar cells and large-scale submodules. With the introduction of a functional cation, 2-(1-cyclohexenyl)ethyl ammonium, two-dimensional perovskite with high mobility is rationally constructed on FAPbI3 to horizontally cover the film surface and to vertically penetrate the grain boundaries of three-dimensional perovskites. This unique configuration not only comprehensively transforms the PbI2 and δ-FAPbI3 impurities into stable two-dimensional perovskite and realizes uniform defect passivation but also provides interconnecting channels for efficient carrier transport. As a result, the FAPbI3-based small-area (0.085 cm2) solar cells achieve a champion efficiency of more than 25.86% with a notably high fill factor of 86.16%. The fabricated submodules with an aperture area of 715.1 cm2 obtain a certified record efficiency of 22.46% with a good fill factor of 81.21%, showcasing the feasibility and effectualness of the impurity-healing interface engineering for scaling-up promotion with well-preserved photovoltaic performance.

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CHEMISTRY

Synchronous recognition of amines in oxidative carbonylation toward unsymmetrical ureas

Jinhui Wang, Shengchun Wang, et. al

Abstract

Unsymmetrical ureas are commonly found in pharmaceuticals and bioactive compounds. However, devising strategies to introduce two distinct amines selectively in the construction of unsymmetrical ureas remains a challenge. In this work, we use a synchronous recognition strategy that takes advantage of radical and nucleophilic activation to discriminate between secondary and primary amines. Specifically, a copper catalyst preferentially oxidizes secondary amines to radical species, whereas a cobalt catalyst carbonylates primary amines to produce cobalt amides. Coupling these fragments by cooperative catalysis produces unsymmetrical ureas with high selectivity, as showcased by the modification of 41 biologically active compounds and six drugs.

Detection of interstellar 1-cyanopyrene: A four-ring polycyclic aromatic hydrocarbon

Gabi Wenzel, Ilsa R. Cooke, et. al

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are organic molecules containing adjacent aromatic rings. Infrared emission bands show that PAHs are abundant in space, but only a few specific PAHs have been detected in the interstellar medium. We detected 1-cyanopyrene, a cyano-substituted derivative of the related four-ring PAH pyrene, in radio observations of the dense cloud TMC-1, using the Green Bank Telescope. The measured column density of 1-cyanopyrene is $\sim 1.52 \times 1012$ cm^{-2}, from which we estimate that pyrene contains up to 0.1% of the carbon in TMC-1. This abundance indicates that interstellar PAH chemistry favors the production of pyrene. We suggest that some of the carbon supplied to young planetary systems is carried by PAHs that originate in cold molecular clouds.

Fluorspar to fluorochemicals upon low-temperature activation in water

Klose, Immo, Patel, et. al

Abstract

The dangerous chemical hydrogen fluoride sits at the apex of the fluorochemical

industry, but the substantial hazards linked to its production under harsh conditions (above 300 degrees Celsius) and transport are typically contracted to specialists. All fluorochemicals for applications, including refrigeration, electric transportation, agrochemicals and pharmaceuticals, are prepared from fluorspar (CaF_2) through a procedure that generates highly dangerous hydrogen fluoride[1,2,3,4,5]. Here we report a mild method to obtain fluorochemicals directly from fluorspar, bypassing the necessity to manufacture hydrogen fluoride. Acid-grade fluorspar (more than 97 per cent CaF_2) is treated with the fluorophilic Lewis acid boric acid ($B(OH)_3$) or silicon dioxide (SiO_2), in the presence of oxalic acid, a Brønsted acid that is highly effective for Ca^{2+} sequestration. This scalable process carried out in water at low temperature (below 50 degrees Celsius) enables access to widely used fluorochemicals, including tetrafluoroboric acid, alkali metal fluorides, tetraalkylammonium fluorides and fluoro(hetero)arenes. The replacement of oxalic acid with sulfuric acid gave comparable results for $B(OH)_3$, but was not as effective when the fluorophilic Lewis acid was SiO_2. A similar process also works with the lower-purity metspar. The production of fluorochemicals directly from fluorspar offers the possibility of decentralized manufacturing—an attractive model for the fluorochemical industry. With the renewed interest in innovative methods to synthesize oxalic acid via carbon dioxide capture and biomass[6,7], and the challenges posed by our dependence on fossil fuels for sulfur and therefore sulfuric acid supply[8,9], our technology may represent a departure towards a sustainable fluorochemical industry.

BIOLOGY

A glutamine metabolic switch supports erythropoiesis

Junhua Lyu, Zhimin Gu, et al.

Abstract

Metabolic requirements vary during development, and our understanding of how metabolic activity influences cell specialization is incomplete. Here, we describe a switch from glutamine catabolism to synthesis required for erythroid cell maturation. Glutamine synthetase (GS), one of the oldest functioning genes in evolution, is activated during erythroid maturation to detoxify ammonium generated from heme biosynthesis, which is up-regulated to support hemoglobin production. Loss of GS in mouse erythroid precursors caused ammonium accumulation and oxidative stress, impairing erythroid maturation and recovery from anemia. In β-thalassemia, GS activity is inhibited by protein oxidation, leading to glutamate and ammonium accumulation, whereas enhancing GS activity alleviates the metabolic and pathological defects. Our findings identify an evolutionarily conserved metabolic adaptation that

could potentially be leveraged to treat common red blood cell disorders.

SPL13 controls a root apical meristem phase change by triggering oriented cell divisions

Baojun Yang, Yanbiao Sun, et. al

Abstract

Oriented cell divisions are crucial for determining the overall morphology and size of plants, but what controls the onset and duration of this process remains largely unknown. Here, we identified a small molecule that activates root apical meristem (RAM) expression of SQUAMOSA PROMOTER BINDING PROTEIN-LIKE13 (SPL13) a known player in the shoot's juvenile-to-adult transition. This expression leads to oriented cell divisions in the RAM through SHORT ROOT (SHR) and cell cycle regulators. We further show that the RAM has distinct juvenile and adult phases typed by morphological and molecular characteristics and that SPL factors are crucially required for this transition in Arabidopsis and rice (Oryza sativa). In summary, we provide molecular insights into the age-dependent morphological changes occurring in the RAM during phase change.

Sequence modeling and design from molecular to genome scale with Evo

Eric Nguyen, Michael Poli, et. al

Abstract

The genome is a sequence that encodes the DNA, RNA, and proteins that orchestrate an organism's function. We present Evo, a long-context genomic foundation model with a frontier architecture trained on millions of prokaryotic and phage genomes, and report scaling laws on DNA to complement observations in language and vision. Evo generalizes across DNA, RNA, and proteins, enabling zero-shot function prediction competitive with domain-specific language models and the generation of functional CRISPR-Cas and transposon systems, representing the first examples of protein-RNA and protein-DNA codesign with a language model. Evo also learns how small mutations affect whole-organism fitness and generates megabase-scale sequences with plausible genomic architecture. These prediction and generation capabilities span molecular to genomic scales of complexity, advancing our understanding and control of biology.

Ⅲ Calling for papers

ICAESEE 2024 (EI/SCOPUS)

Submission deadline: **Dec 4, 2024**
Conference date: **Dec 20, 2024 - Dec 22, 2024**
Full name: **International Conference on Advances in Energy Resources and Environment Engineering**
Location: **Changsha, China**

2024 10th International Conference on Advances in Energy Resources and Environment Engineering (ICAESEE 2024), will be held on December 20-22, 2024 in Changsha, China. ICAESEE 2024 is to bring together innovative academics and industrial experts in the field of energy resources and environment engineering to a common forum. The primary goal of the conference is to promote research and developmental activities in energy resources and environment engineering and another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working all around the world. The conference will be held every year to make it an ideal platform for people to share views and experiences in energy resources and environment engineering and related areas.

Call for papers:

The topics of interest for submission include, but are not limited to:
- Environmental Science and Environmental Engineering
- Environmental chemistry and Biology
- Environmental protection materials
- Environmental safety and health
- Environmental planning and assessment
- Environmental analysis and monitoring

- Exploration and Utilization of Resources and Sustainable Development
- Mineral Resources and Mining Engineering
- Oil and Gas Resources Engineering
- Metallurgical Engineering
- Machines and Equipments for Resource Processing
- Hydrology and Water Resources Engineering

- Energy Economy and Management
- Energy Development and Environmental Protection
- Energy Industry Economy
- Energy Strategy Management
- Energy Industry and Urban Development
- Energy Enterprise Management

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ICCCS 2025 (IEEE)

Submission deadline: **Dec 5, 2024**
Conference date: **Apr 18, 2025 - Apr 21, 2025**
Full name: **The 10th International Conference on Computer and Communication Systems**
Location: **Chengdu, China**

he continuous development of information communication has provided advanced and reliable technical support for the progress and development of computer networks. With the in-depth development of computer network and communication technology, computer communication technology and database technology are widely used in the field of information services. Computer technology plays a vital role in the information era, and is conducive to the integration of information collection, information processing, information storage and the transmission and utilization of information and other aspects of natural information functions, and then form an information technology revolution that has a far-reaching impact on society. The computer network communication system is a remarkable symbol of the progress of the information society, and occupies an extremely important position in the information processing and transmission.
2025 The 10th International Conference on Computer and Communication Systems will be held in Chengdu, China on April 18-21, 2025, which is sponsored by University of Electronic Science and Technology of China, UESTC, China, and hosted by National Key Laboratory of Wireless Communications as well as School of Information and Communication Engineering.

Topics of Interest :
* Algorithms
* Big Data
* Computer Architecture
* Data Compression
* Image Processing
* Mobile Computing
* High-Performance Computing
* Autonomic and Trusted Computing
* Parallel and Distributing Computing
* Biomedical Informatics and Computation
* Software Engineering and Knowledge Engineering
* Artificial Intelligence and Machine Learning
* RF, Microwave and millimeter circuit
* Techniques of Laser
* Antenna and Propagation
* RF and Microwave devices
* Electromagnetic and Photonics
* Microwave Theory and Techniques
* Virtual Reality and Visualization
* Modulation, Coding, and Channel Analysis

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ICCAI 2025 (ACM)

Submission deadline: **Dec 5, 2024**
Conference date: **Mar 28, 2025 - Mar 31, 2025**
Full name: **11th International Conference on Computing and Artificial Intelligence**
Location: **Kyoto, Japan**

2025 11th International Conference on Computing and Artificial Intelligence (ICCAI 2025) will be held in Kyoto, Japan during March 28-31, 2025. It is hosted by Ritsumeikan University, supported by Tiangong University, Shanghai Jiao Tong University, Tianjin University, Nankai University, Tianjin Normal University, Beijing University of Technology, Udayana University, and Gifu University.
ICCAI 2025 is an international conference devoted specifically to facilitate synergies in research and development in the areas of Computing and Artificial Intelligence. It provides the communication platform for those who are leading experts and scholars in Computing and Artificial Intelligence from around the world.

Call for Papers:
Topics of interest include, but are not limited to:

Intelligent Computing
Genetic algorithm
Simulated annealing algorithm
Taboo search algorithm
Evolutionary algorithm
Heuristic algorithm
Ant colony algorithm
Artificial fish swarm algorithm
Particle swarm algorithm
Hybrid intelligent algorithm

Artificial Intelligence and its Applications
Biometrics
Pattern Recognition
Computer vision
Machine vision
Fingerprint recognition
Face recognition
Retina recognition
Iris recognition
Palmprint recognition

Computer and Information Technology
Coding, cryptography, and information protection
Compilers and operating systems
Computer networks, mobile computing, and distributed systems
Computer systems: architecture, parallel processing, and dependability
Embedded systems
Signal, image and speech processing
Software engineering
Human computer interaction
Vision and graphics
Programming languages
Theory of computing
Information systems

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ICCCV 2025 (ACM)

Submission deadline: **Dec 10, 2024**
Conference date: **Mar 28, 2025 - Mar 30, 2025**
Full name: **The 7th International Conference on Control and Computer Vision**
Location: **Wuhan, China**

On behalf of the organizing committee, we cordially invite you to attend The 7th International Conference on Control and Computer Vision (ICCCV 2025) which will be held in Wuhan, China during March 28-30, 2025. ICCCV 2025 is organized by Hubei University of Technology, China.

Founded in 2018, ICCCV has successfully held six editions. The conference focuses on the new theories and applications of control and computer vision, and is committed to providing a wide-ranging communication platform for experts and scholars in related research fields to exchange the latest research results and discuss the direction of academic development.

***Call for papers:**

Control and Automation

- Adaptive Control
- Identification and Estimation
- Complex Systems
- Intelligent Systems
- Control Applications
- Networked Control Systems
- Control Engineering Education
- Neural Networks
- Control of Biological Systems
- Precision Motion Control
- Delay Systems
- Process Control
- Discrete Event Systems
- Robust Control
- Fuzzy Systems
- Sensor Networks

Computer Vision

- Activity/Behavior Recognition
- Learning and Statistical Methods
- Medical Image Analysis
- Object Recognition
- Feature Extraction
- Scene Analysis
- Human-computer Interaction
- Stereo and Structure from Motion
- Image/Video Analysis
- Tracking and Surveillance
- Image-based Modeling
- Vision for Robots

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IC2ECS 2024 (IEEE-EI/SCOPUS)

Submission deadline: **Dec 15, 2024**
Conference date: **Dec 27, 2024 - Dec 29, 2024**
Full name: **4th International Conference on Electrical Engineering and Control Science**
Location: **Nanjing, China**

As a leading role in the global megatrend of scientific innovation, China has been creating a more and more open environment for scientific innovation, increasing the depth and breadth of academic cooperation, and building a community of innovation that benefits all. These endeavors have made new contribution to globalization and creating a community of shared future.
To adapt to this changing world and China's fast development in this new era, the 2024 4th International Conference on Electrical Engineering and Control Science（IC2ECS 2024）is to be held in Nanjing, China during December 27-29, 2024.
The conference aims to provide a platform for research scholars, technicians and related personnel engaged in mechanical systems and electrical engineering to share research results and cutting-edge technologies, understand academic trends, broaden research ideas, strengthen academic research and discussion, and promote industrial cooperation of academic results. Experts, scholars, business people and other related personnel from universities and research institutions at home and abroad are cordially invited to participate in the exchange.

Topics of interest

The topics of interest for submission include, but are not limited to:
1.Electrical Engineering
· Stable Operation and Control of Power Systems
· Electrical Machines and their Intelligent Control Systems
· Power Transmission and Control Technology
· Control Theory and Applications in Power Electronics and Transmission
· Operation and control of new energy devices
· Intelligent control and information processing technology
· New technology of power electronics and motion control
· Computer measurement and control and network technology
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2.Control Science
· Power systems and their automationElectricity market research and analysis
· Artificial Intelligence Technology in Power Systems
· Power system optimization
· Power distribution automation systems
· Large-scale generator design and new cooling technologies
· Theory, operation, monitoring and diagnosis of large motors
· Theoretical analysis of the internal physical field of motors
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