Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Out of the Press

Our publications - November

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Peer-reviewed Journal Articles

DCIS

Adaptive sparsity-regularized deep dictionary learning based on lifted proximal operator machine

Z. Li, Y. Xie, K. Zeng, S. Xie, B. T. G. S Kumara

Abstract

Deep dictionary learning (DDL) can mine deeper representations of data more effectively than single-layer dictionary learning. However, existing DDL methods with specific sparse regularizers lead to designated deep sparse representations. Existing DDL optimization methods have limited feature extraction capability because their nonlinear functions must satisfy the condition that the functions are invertible. This paper presents a new DDL model with a learned sparsity constraint and a noninvertible soft-thresholding (ST) function, where the learned sparsity constraint can obtain a data-driven sparse representation and the ST (that produces a sparse output as a nonlinear function) can enhance its the feature extraction capability. To solve the optimization problem efficiently with the noninvertible and learned sparsity constraints, we propose to employ a lifted proximal operator machine to transform the proposed DDL problem into a series of subproblems that include sparsity-regularized and convex minimizations. For the sparsity-regularized minimization, we derive the parameterized proximal operator of the sparse regularizer, which is considered as the activation function used to construct the network. The parameters of the activation function are trained by backpropagation, thus obtaining the proximal operator of the learnable sparse regularizer simultaneously with a sparse solution. The convex minimization for the dictionaries and the coefficients can be obtained via the accelerated proximal gradient and the optimal condition, respectively. In the numerical classification and reconstruction experiments, the proposed algorithm outperformed existing DDL algorithms in terms of classification accuracy, image reconstruction, and noise immunity.

About the Journal

Knowledge-Based Systems

Impact Factor - 8.139

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DFST

Characterization of modified palmyrah tuber starch by pre-gelatinization, acid and dextrinization processes and its applicability

N.Sobini, S.Darsiga, T.C.Kananke, S.Srivijeindran

Abstract

Palmyrah (*Borassus flabellifer* L) tuber is a cheap and rich source of starch. Modifications of native starches are carried out to provide starch products with specific properties. In the present study, three different starch modification techniques (pre-gelatinization, acid modification and dextrinization) were used to produce modified palmyrah tuber starch. The physicochemical and functional properties of the native and modified palmyrah tuber starch were evaluated and the applicability of the palmyrah modified starch as a thickner in instant soup also tested. The recovery yields of modified starches ranged between 75.90-91.96%. The dextrinized palmyrah starch showed significantly ($p<0.05$) the lowest swelling power and the highest average solubility. The gelatinization temperature (76.5-82.27 °C), amylose content (9.2-21.69%), amylopectin content (78.32-90.80%) varied among the native and modified starch. The particle sizes of the starch granules varied from 1.308-7.346 µm. The study revealed that the modification processes can greatly improve the physicochemical and functional characteristics of native starch. According to the sensory analysis of instant soup among trained panelists, high preference was observed for palmyrah pregelatinized starch than commercially available corn starch. Hence this study shows the feasibility of modified palmyrah starch as a thickening agent in instant soup.

About the Journal

Food Chemistry Advances

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Microplastics and plastics-associated contaminants in food and beverages; Global trends, concentrations, and human exposure

Madushika Sewwandi, Hasintha Wijesekara, Anushka Upamali Rajapaksha, Sasimali Soysa, MeththikaVithanage

Abstract

Microplastics has become a global concern due to their ubiquitous presence which poses unavoidable human exposure risks. Geographical distribution and yearly trends of research on microplastics, food, and beverages do not exist. Thus, no overall account is available regarding the presence of microplastics and plastics-associated contaminants in food and beverages. Hence, this attempt is to review the geographical distribution of studies through a brief bibliometric analysis and the plastics-associated contaminants including plasticizers and microplastics in food and beverages. Estimated microplastic consumption has been listed for the pool of publications reviewed here. Further, this review discusses the ingestion potency of micropollutants associated with microplastics, possible health impacts, and existing challenges. Global trend in research exponentially increased after 2018 and China is leading. Studies on microplastics were limited to a few beverages and food; milk, beer, tea, refreshing drinks, salt, sugar, honey, etc., whereas seafood and drinking water have been extensively studied. Publications on plastic-additives were reported in two ways; migration of plastic-additives from packaging by leaching and the presence of plastic-additives in food and beverages. Bisphenol A and Bis(2-Ethylhexyl) phthalate were the most frequently reported both in food and beverages. Exposure of packaging material to high temperatures predominantly involves plastic-additive contamination in food and beverages. Microplastic-bound micropollutants can also be ingested through food and beverages; however, a lack of knowledge exists. The complex matrix of food or beverages and the absence of standard procedures for analysis of microplastics and micropollutants exist as challenges. More investigations on the presence of microplastics and plastic-additives in food and beverage are urgent needs to a better assessment of potential human exposure and human health risk.

About the Journal

Environmental Pollution

Impact Factor – 9.988

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DPST

Materials Design of Organic Lasers Aimed at Low Lasing Threshold

Chihaya Adachi, Atula S. D. Sandanayaka, Sahar Alasvand Yazdani, Masashi Mamada, and Toshinori Matsushima

Abstract

As the next generation optoelectronic devices, i.e., post- organic light emitting diodes (OLEDs), organic semiconductor laser diodes (OSLDs) are supposed to be fascinating devices due to their unique properties such as a wide range of emission wavelength tunability, low- temperature fabrication allowing flexible devices, and the compatibility with present OLED technologies. In this report, by focusing on the most promising laser material of 4,4'-bis[(N- carbazole)styryl]biphenyl (BSBCz), the materials design of organic lasing molecules with their photophysical and current injection device properties are summarized.

About the Journal

Journal of Synthetic Organic Chemistry, Japan

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Conference Proceedings

Systematic Mapping Study on Different Approaches for Detecting the Femoral Fracture Types using X-ray Images

Minuja Kanthasamy, Senthan Prasanth, Kuhaneswaran Banujan and Banage T. G. S Kumara

Abstract

Doctors use X-ray images to diagnose where bone fractures occur. To avoid further injury or causing more harm to the injured area, it is crucial to treat any broken or fractured bones as medical emergencies and seek the necessary treatment right away. In the event that a bone breaks, a fracture is identified. The break will be put back in place as soon as it is treated, allowing for proper healing and preventing any future issues that an improperly healed break may bring about. Instead of wasting time searching for or entering information, machine learning enables healthcare professionals to concentrate on patient care. The improvement of diagnosing accuracy is machine learning's second significant contribution to healthcare. A computer that learns from its errors might be more successful, dependable, and effective than a human physician. Data scientists can use machine learning to find correlations between different characteristics and features of patients with the labeled disease when they have a large amount of data at their disposal. Doctors can develop prevention strategies using these correlations to understand the underlying patterns of disease better. Medical image processing's main advantage is that it enables a thorough, non-invasive investigation of internal anatomy. Medical digital image processing can improve the quality of the image and lessen the impact of noise. Up until 2022, the information will be published in six electronic archives, including IEEE Xplore, Springer Link, Science Direct, Research Gate, and ACM Digital Library. Studies based on the classification of the type of femoral neck fracture have not yet been published. 200 studies were initially chosen, and 12 papers were shortlisted for in-depth analysis. Numerous studies have been done on the identification of bone fractures. There have been attempts to use Artificial Neural Networks (ANN), Support Vector Machine (SVM), and Local Binary Patterns (LBP) approaches. Future studies that are interested in conducting research in the chosen domain will gain a great deal from this study.

About the Conference

International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT 2022)

20-21 Nov 2022 - Bahrain

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Characterization of Polymer Structure and Evaluation of Techno-Functional Properties of Bioplastic films from Red Seaweed (*Kappaphycus alvarezii*)

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Abstract

Bioplastics derived from renewable biomass resources such as seaweed have gained much attention as alternatives to conventional plastics. Polymer characterization is an important aspect to enhance the performance of bioplastics. In this study *Kappaphycus alvarezii* seaweed-based bioplastic films plasticized with 10%, 20%, and 30% V/W glycerol were developed, material characterizations were performed (FTIR-ATR spectroscopy, XRD, TGA, UV-Vis spectrophotometry, colorimetry) and selected techno-functional properties were investigated [tensile properties, water vapor permeability (WVP) and water solubility]. Further, the applicability of the developed bioplastic films and the film-forming solution as a wrapping and coating for selected fruits (fresh-cut watermelons and cavendish bananas) was investigated.

FTIR spectra revealed the presence of characteristic seaweed functional groups chlorophyll a, carotenoids and phaeophytin with C-O and C-C stretching of 3,6-anhydrogalactose and D-galactose-4-sulfate. X-ray diffractograms revealed the amorphous nature of the films. TGA revealed type 04 curves with multiple-stage decomposition. The films showed an acceptable transparency and whiteness index. Both glycerol content and RH impacted the WVP. The tensile strength of the films showed a decreasing pattern when increasing glycerol concentration while water solubility showed an increasing pattern. The film-forming solution plasticized with 20% glycerol was found to be the most effective coating for bananas. The findings of the study suggest that red seaweed would be a potential source for bioplastic production.

About the Conference

21st IUFoST World Congress of Food Science and Technology

31 Oct 2022 - 03 Nov 2022 - Singapore

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DFST

An Internet of Things (IoT)-based real time monitoring and notification system for food safety and traceability applications

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Abstract

Internet of Things (IoT) is an emerging technology advancement that has many potential applications in the food industry. IoT is envisaged to play a key role in food safety management, tracking and traceability, and logistics. The aim of this study was to develop a simple and portable IoT-enabled system for real-time monitoring of temperature and relative humidity (RH) of a storage environment and control them. The system was fabricated using a Node MCU development board (based on the ESP-12E WiFi Module), DHT11 humidity and temperature sensor, an LCD display, a serial board module port for LCD, and a USB power adapter (Raspberry Pi). Arduino Pro Mini IDE and PHP were used for coding the system and hosting the website respectively. Data (temperature and RH) were obtained from three storage environments: under ambient conditions, a controlled storage environment (in a desiccator), and cold storage conditions to generate a big data source. A web hosting platform was used to access the real-time data. The system was capable of automatically detecting temperatures from 14.3^{0}C to 30.8^{0}C, and RH from 19% to 71%. The developed monitoring system can be suggested to detect temperature and RH changes in food through the Internet to ensure food safety throughout the entire food chain from farm to fork.

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Occurrence and *in vitro* bioaccessibility of heavy metals in raw and cooked forms of green leafy vegetables

T.C. Kananke, J. Wansapala, A. Gunaratne

Abstract

This research aimed at investigating the heavy metal contaminations (Ni, Cd, Cr, Pb and Cu) in four popular green leafy vegetables (GLV) [*Ipomoea aquatica, Alternanthera sessilis, Basella alba and Lasia spinosa*] cultivated in Colombo District, Sri Lanka. The study also focused on analysis of heavy metal concentrations (by ICP-OES) in soil and irrigation water, distribution patterns of metals in different plant parts and an *in vitro* gastrointestinal extraction to find the bioaccessibility of heavy metals in raw, cooked and stir-fried GLV. The average concentrations of Cd, Cu, Ni and Cr in tested soils exceeded the acceptable limits. The heavy metal levels in irrigation water samples complied with the recommended guidelines, except for Ni. The mean concentrations of elements tested in all GLV exceeded WHO/FAO safe limits, except Cu. Among the GLV analyzed, *L. spinosa* showed the highest tendency to accumulate metals. All analyzed GLV showed the distribution pattern for heavy metals as: roots>stems>leaves. In almost all cases, cooking and stir-frying of GLV have reduced the bioaccessibility of heavy metals than in raw samples. The average bioaccessibility (%) of trace metals in all the analyzed GLV were significantly higher (at $P<0.05$) in the gastric phase than in the intestinal phase.

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Experimental evaluation of physicochemical characteristics of chili: Sri Lankan variety MI2 (*Capsicum annuum* L.)

L.A.D.S. De Silva, D.M.S.P. Bandara and T.C. Kananke

Abstract

MI2 (*Capsicum annuum* L.) is one of the locally developed chili varieties in Sri Lanka, which is rich in nutrients and phytochemicals. Therefore, the study aimed to evaluate the physicochemical and antioxidant properties of MI2 variety. Both fresh and dry chili samples were evaluated for antioxidant properties using 1,1-diphenyl-2-picrylhydrazyl assay and the total phenolic content by the Folin-Ciocalteu reagent method. The ascorbic acid content was determined using the 2, 6 -dichlorophenol indophenol titration method and the capsaicin content was measured by the High-Performance Liquid Chromatography. The radical scavenging activity of fresh and dry chili were IC 50 - 1361.64 µg/ml and IC 50 - 1142.07 µg/ml, respectively. The total phenolic contents of dried and fresh chili were 416.12 GAE µg/g and 33.25 GAE µg/g. The ascorbic acid contents of fresh and dried chili were recorded as150.51 and 85.53 mg AA/100g. Capsaicin content for the fresh and dried chili varied as 476.7± 38.0 ppm and 1251.0±97.1 ppm, respectively.

About the Conference

21st IUFoST World Congress of Food Science and Technology

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Research Grants

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Name of the grant	Investigator Driven Research Grants 2022 National Research Council, 120/07, Vidya Mawatha, Colombo 07, Sri Lanka Tel: +94 011 2675176 https://www.nrc.gov.lk/
Grant winning project title	Developing ecological tools for monitoring river health using bio-indicators: A case study from Walawe River basin.
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