A Novel Strategy for Classifying Spectral-spatial Shallow and Deep Hyperspectral Image Features Using 1D-EWT and 3D-CNN

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Research Article

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A Novel Grey Wolf Optimisation based CNN Classifier for Hyperspectral Image classification

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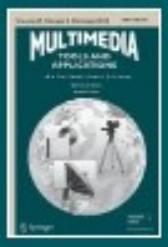

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Sandeep Kumar Ladi ✉, G. K. Panda, Ratnakar Dash, Pradeep Kumar Ladi & Rohan Dhupar

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This article has been updated

Abstract

Hyperspectral image (HI) analysis is becoming popular in remote sensing applications due to its high spectral resolution along with high spatial resolution compared to a Multispectral image. Classification of pixel vectors in a hyperspectral image (HI) to their respective classes is challenging. HI classification is an elementary task for land cover mapping, mineral exploitation, precision agriculture, etc. Optimal parameters are required to reduce the losses in the Convolutional Neural Networks (CNNs) and provide the most accurate results possible. Studies in this regard, so far have been made with manual selection of optimal parameters using traditional trial-and-error methods like the selection of loss function, a number of convolution filters, optimizer function, etc., and found to be strenuous and time-consuming. To alleviate these challenges of selecting the hyperparameters and observing the accuracy until a competitive value is reached, this paper uses a novel mechanism to classify Hyperspectral Images using Convolutional Neural Network (CNN) where the 6-hyperparameters of CNN are optimized with Grey Wolf Optimizer (GWO). The proposed GWO-based-CNN-HI model exhibits better classification accuracy (99.95%, 99.96%, and 99.99%) on three benchmark HI datasets in comparison to traditional models. Thus the novel GWO-based-CNN-HI model finds its suitability in applications of land cover classification, crop stage detection, specially in remote applications with limited computing power.

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Bio-production of alkaline protease by *Trichoderma longibrachiatum* and *Penicillium rubidurum* using different agro-industrial products

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Abstract

Alkaline protease being active in neutral to alkaline pH has huge demands in food, detergent, leather and pharmaceutical industries. Its production from agro-industrial wastes not only lowers the production costs but also reduces the environmental problems. Hence, the present study aimed to search for new potential microbes, which can produce alkaline protease enzyme, to meet the industrial demands. In this study, 13 fungal spp. were isolated on potato dextrose agar medium (PDA) from mangrove soil through serial dilution, and then were streaked on the skim milk agar medium for qualitative screening of protease production. Out of 13 fungal spp.; only 7 spp. were able to produce proteolytic zones through the proteolytic assay. The Relative enzymatic index (REI) value (Zone diameter/Colony diameter) of all the fungal isolates that produced proteolytic zones on skim milk agar medium was evaluated. Only 2 fungal isolates which showed maximum REI value were selected, and then identified morphologically and molecularly as *Trichoderma longibrachiatum* (Accession no. MF144551) and by *Penicillium rubidurum* (Accession no. MF144561). Submerged fermentation was carried out using different agro industrial substrates to quantify for protease production, where the supernatants obtained were used for alkaline protease estimation. Among the different tested substrates, soybean powder and wheat bran were the most suitable substrates for maximum protease production by *T. longibrachiatum* (233.78±7.12 U/ mg) and *P. rubidurum* (228.61±11.13 U/ mg), respectively. The partial purified enzyme from these fungi showed maximum proteolytic potentials at pH 8.0 (*P. rubidurum*) and pH 9.0 (*T. longibrachiatum*), with optima temperature of 40 °C. Among the tested heavy metals, only Mn^{2+} expressed marginal enhancement of the protease enzyme activity.

Keywords: Alkaline protease, Agro-industrial waste, Fermentation, Fungi

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Development of co-culture yeast fermentation for efficient production of biobutanol from rice straw: A useful insight in valorization of agro industrial residues

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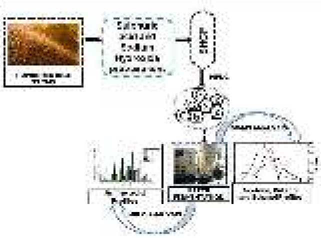
GRAPHICAL ABSTRACT



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Keywords:
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ABSTRACT

Escalating environmental concerns and petroleum demands leads into the present study. In this investigation delignification of rice straw was optimized by NaOH and H2SO4 pretreatment using L16 Taguchi orthogonal array. NaOH pretreatment revealed higher delignification as compared to H_2SO_4 and; further subjected to separate enzymatic hydrolysis and co-fermentation (SHCF) using RSM as the SHCF demonstrated a maximum glucose and xylose yield of 575 and 205 mg/g. Further, butanol concentration of 4.32 g/L was achieved from 20 g/L of sugar loadings by co-culture of *Saccharomyces cerevisiae* and *Pichia* sp. at 72 h of incubation time which was 73.25% higher as compared to monocultures of *Pichia* sp. Scale-up experiments with higher sugar loadings (50 g/L) demonstrated a butanol concentration of 12.3 g/L. The release of amino acids in co-culture and monoculture systems demonstrated that the addition of *S. cerevisiae* promoted the butanol synthesis pathway which led to higher butanol concentration.

1. Introduction

The rising gasoline prices due to the continuous depletion of fossil fuels along with the environmental concerns have led to a growing interest in sustainable and environmental friendly renewable energy carriers, such as biobutanol. Biobutanol is considered a superior

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Process optimization for conversion of Waste Banana peels to biobutanol by A yeast Co-Culture fermentation system

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ABSTRACT

In the present investigation, sodium hydroxide (NaOH) and sulfuric acid (H_2SO_4) pretreatment were conducted using response surface methodology (RSM) technique for maximum cellulose exposure and delignification of banana peel (BP) biomass. H_2SO_4 pretreatment revealed higher cellulose exposure (288.2 mg/g of biomass) as compared to NaOH pretreatment. H_2SO_4 pre-treated banana peel (PBP) was further subjected to separate enzymatic hydrolysis and co-fermentation (SHCF) using L16 Taguchi orthogonal array design. SHCF demonstrated a maximum glucose and xylose yield of 677.3 and 168.1 mg/g of PBP respectively. Further, higher butanol titers of 7.4 g/L were achieved from 28 g/L of sugar loadings by co-culture of *Saccharomyces cerevisiae* and *Pichia sp.* at 72 h of incubation time which was 89.1% and 75.57% higher as compared to monocultures of *S cerevisiae* and *Pichia sp.* respectively. Scale-up experiments with higher sugar loadings (90 g/L) demonstrated lower butanol concentrations of 19.7 g/L with total butanol productivity of 0.2 g/L/h. The overall energy consumption for 1 g of fuel-grade butanol from 20 g/L (shake flask) and 90 g/L (fermenter) of reducing sugar loadings was 13.81 KJ and 69.7 KJ respectively.

1. Introduction

Banana (*Musa sapientum*) is an important and widely consumed fruit crop that belongs to the Musaceae family and adopted well in tropical and sub-tropical regions [1,2]. The Asia-pacific region dominates the world banana market accounting for 61% share of global consumption [3]. Among the different countries in the Asia-Pacific region, India leads as the largest producer of the fruit crop, with a production of 29.7 million metric tons from an area of 0.84 million hectares [3]. However, most of the banana produced in India is used for the domestic market and only 0.3% of the produced fruit crop is exported to other countries [3]. Followed by India are countries like China, Indonesia, Brazil, and Equador which represent the list of top producers of the fruit crop worldwide [3].

The ripe banana fruit consists of a soft edible pulp and an outer skin (often known as the peel) that constitutes about 30–40% of the total weight of the fruit [4]. The banana peel (BP) is an important lignocellulosic biomass that consists of important cell wall components such as cellulose (30–35%), hemicellulose (15–21%) and lignin (7–16%) with minor quantities of pectin and other proteins [5]. However, after utilization of the inner fleshy fruit by the food processing industries and juice processing plants a significant amount of BP is discarded in the form of solid waste, that remains exposed in the environment [6]. The BP generally ends up either in the drainage systems where they threaten both surface and groundwater quality or are burned in the open air emitting a considerable amount of hazardous gas emissions that promote environmental pollution levels [6]. Thus, the conversion of these solid wastes to useful metabolites or products can serve as an attractive approach for the utilization of this otherwise unusable biomass.

Conversion of BP to renewable fuel like ethanol has been well documented in the literature [6,7]. However, n-butanol or butanol is a promising biofuel alternative as compared to the more

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Recent Biotechnological Tools for Diagnosis of COVID-19 Disease: A review

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Abstract

Recently, a corona virus disease (COVID-19) caused by a novel corona virus (Sevier Acute Respiratory Syndrome Corona Virus 2; SARS-CoV-2), rapidly spread throughout the world. It has been resulted an unprecedented public health crisis and has become a global threat. WHO declared it as a pandemic due to rapid transmission and severity of the disease. According to WHO, as of 22nd of August 2020, the disease spread over 213 countries of the world having 22, 812, 491 confirmed cases and 795, 132 deaths recorded worldwide. In the absence of suitable antiviral drugs and vaccines the current pandemic has created an urgent need for accurate diagnostic tools that would be helpful for early detection of the patients. Many tests including classical and high throughput techniques have developed and obtained U.S. Food and drug administration (FDA) approval. However, efforts are being made to develop new diagnostic tools for detection of the disease. Several molecular diagnostic tests such as Real Time-PCR, Real time Isothermal loop mediated amplification (RT-LAMP), full genome analysis by next-generation sequencing (NGS), clustered regularly interspaced short palindromic repeats (CRISPR) technique and microarray-based assays along with other techniques such as Computed Tomography (CT) scan, biomarkers, biosensor, nanotechnology, serological test, enzyme-linked immunosorbent assay (ELISA), isolation of viral strain in cell culture are currently available for diagnosis of COVID-19 infection. This review provides a brief overview of promising high throughput techniques currently used for detection of SARS-CoV-2, along with their scope and limitations that may be used for effective control of the disease.

Key words: SARS-CoV-2, NAAT, biosensor, CRISPR, ELISA

Conflict of Interest

The authors declare no potential conflict of interest

1. Introduction

Emergence of viral diseases represents a serious threat to global public health. The past few decades have witnessed several viral epidemics that have emerged with increasing frequency, including the severe acute respiratory syndrome corona virus (SARS-CoV identified in 2002/2003), Swine flu (H1N1 influenza identified

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APPLICATION OF ROUGH SET THEORY IN MEDICAL HEALTH CARE DATA ANALYTICS

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Abstract—**Rough Set theory (RST) is a mathematical tool and used to deal with vagueness, impreciseness, inconsistence and uncertain type knowledge. RST-based research has been applied in machine learning, inductive reasoning, decision support systems and knowledge discovery applications. Popular methods like finding of reducts, core, feature selection and reduction through the concepts of approximations have attracted researchers to use RST further in the field of high dimensional data like social networks, IoT applications and Big data analytics. In this article we make an attempt to summarize the basic concepts, characteristics of RST, some evolutionary extensions of RST and applications limited to Medical data analysis. In keeping the view of learners, a survey on RST based software tools and packages outlined with their exhaustive functionalities. It also identifies the importance of RST in the domain of medical or clinical data analytics, and also exhibits the strengths and limitations of the respective underlying approaches.**

Keywords— **Rough Set, Reduct, Core, Medical Data Analytics, Clinical Dataset**

1. INTRODUCTION

Smart Healthcare system is a new healthcare paradigm and evolving with high expectations where physicians, professionals, integrators, stake holders and researchers across the globe are looking for cost-effective, innovative and technology-driven collaborative solutions to the patient community. The complement of high configured, lightweight and low-cost intelligent bio-sensors has also given a best choice for mobile medical diagnosis systems and mobile health monitoring systems. IoT based such sensors are capable of sensing, processing and communicating vital observatory signs of patients during diagnosis, examinations and alert processes into a network of IoT based computer system.

Today's medical system facilitate one layer solution to both caregivers and consumers in adopting applications like, doctor-on-demand, video calls with doctors, Wi-Fi-enabled blood pressure monitors etc. The back-end of such system is powered with a strong base of cloud infrastructure with real time computing techniques that integrates the right operational and clinical decision makers at the right time. These processes produce large quantities of data, in real time. The recent adoption of electronic health records (EHR) **and electronic medical records (EMR) systems also taking driver's** role in making sense of huge collected data from prescriptions, diagnostic tests, patient care records and insurance claims.

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A comparative study of citric acid production from different agro-industrial wastes by *Aspergillus niger* isolated from mangrove forest soil

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Abstract

Citric acid is an important organic acid having worldwide demand due to its huge application in the food and pharmaceutical industries. To overcome this increasing demand attempt has been made to use cheap agro-industrial waste products as sources of carbohydrate feedstock for citric acid production by fermentation with the fungus *Aspergillus niger*. In the present study, 12 fungal isolates were isolated from soil samples collected from the Bhitarkanika mangrove swamps and named as Bhitarkanika Mangrove Fungi BMF-1 to BMF-12. Out of the 12 fungal isolates, three fungal isolates were identified as *A. niger*. These three fungal isolates were screened for their citric acid production ability and found that the fungal isolate BMF-1 showed the widest yellow zone in Czapek-Dox agar medium, and hence was selected for further citric acid production studies. Fruit peels such as banana peel, rice straw, orange peel and sugarcane bagasse were used for the production of citric acid and compared with the control (sucrose) carbohydrate source of the medium. Maximum citric acid production (0.51%) was obtained with banana peel as a substrate after 6 days of incubation followed by sugarcane bagasse (0.46%), orange peel (0.44%) and rice straw (0.18%) with gradual reduction in pH of the fermentation medium. Maximum reduction in pH (3.3) of the fermentation medium (from initial pH 6.8) was observed after 144 h of incubation with maximum citric acid production by the isolate BMF-1 when banana peel was used as a substrate. To obtain higher citric acid production the fungal growth culture was optimized under different concentrations of banana peel, pH, temperature, nitrogen source, inoculum size and methanol concentration. It has been observed that under optimized condition the production of citric acid was increased from 0.51% to 0.62% which is considered suitable for citric acid production.

Key words: *Aspergillus niger*, citric acid, fermentation, fungi, mangrove, optimization.
Abbreviations: BMF, Bhitarkanika Mangrove Fungi; PDA, Potato Dextrose Agar.

Introduction

Mangrove forests occurring at the interface between land and sea are a highly productive and biologically diverse ecosystem. This ecosystem is rich in nutrients and harbours diverse groups of microorganisms. (Holguin et al. 2001; Behera et al. 2013). Mangrove vegetation has morphologically and physiologically adapted to harsh conditions such as high salinity, tidal extremes, high wind velocity and anaerobic clayey soils (Thatoi et al. 2013). Mangrove forests are biodiversity "hotspots" for marine fungi (Shearer et al. 2007). Since mangrove vegetation is exposed to various stress conditions, the associated fungi have high stress tolerance capacity (Thatoi et al. 2013). Stress-tolerant fungi inhabiting mangrove habitat are sources for many natural products, which have immense industrial, agricultural and pharmaceutical importance (Thatoi et al. 2013). The microorganisms occur as saprophytes on decomposing organic matter in mangrove ecosystems and play a major role in recycling of various organic waste.

Due to extensive application of citric acid at present time, its demand is very high in the food industry for preserving food, and a demand in the beverage industry, particularly for soft drinks due to its pleasant taste, low toxicity and high solubility in water (Soccol et al. 2006). Various microorganisms have the ability to synthesize citric acid but most of them, however, are not able to produce commercially acceptable yields due to the fact that citric acid is a metabolite of energy metabolism and its accumulation rises in appreciable amounts only under conditions of drastic imbalances (Soccol et al. 2006).

Among all microorganism, the fungus *Aspergillus niger* has remained the organism of choice for commercial citric