AGRICULTURE ISSUES AND POLICIES

GENOME EDITING

FOR CROP IMPROVEMENT

Rahul Kumar, PhD
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Chapter 2

Plant Genome Editing Using the CRISPR System

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and Rahul Kumar[2]
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Abstract

There is a need of the great leap in agricultural production by means of innovative breeding methodologies to feed the ever-growing population of this planet. The CRISPR/Cas genome editing tool is very efficient in targeted crop modifications and is accelerating the works on the crop improvement. This book chapter discusses the CRISPR/Cas9 and its variants in detail as well as it provides the applications in plant genome editing and the gene related manipulations. We emphasize base-editing useful for targeted nucleotide substitutions. We also deliberate upon various delivery systems, like DNA-free methods, which is very important in genome editing led crop breeding. The list of trait improvement related genome editing applications is also reviewed in this chapter. The fine-tuning gene regulation and the breeding for virus resistance strategies is also touched upon. The use of high-throughput mutant libraries is also reviewed. This chapter outlines the future perspectives of genome editing in plant synthetic biology, the delivery systems, gene editing specificity, homology-directed repair, and gene drives. In the end, the challenges and the opportunities of precision plant breeding and its role in the future of agriculture have been accommodated.

Keywords: genome editing, CRISPR/Cas, delivery of CRISPR/Cas, stress resistance

Introduction

Plants are the primary source of food and are essential for human life. Anticipated world population will be 9.6 billion by 2050. This will be result in increased global demand for crops [1]. To fulfill the demand of growing population, there is a need of innovative crop breeding technology to increase agricultural productivity. Cross breeding, mutation breeding and

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In: Genome Editing for Crop Improvement
Editors: Rahul Kumar, Ashutosh Sharma, Yogesh Kumar et al.
ISBN: 979-8-88697-740-0
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Studies in Big Data 129

Sanjiban Sekhar Roy
Ching-Hsien Hsu
Venkateshwara Kagita *Editors*

Deep Learning Applications in Image Analysis

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Hyperspectral Images: A Succinet Analytical Deep Learning Study

Ladee Sandeep Kumar, G. K. Panda and B. K. Tripathy

Abstract Hyper spectral image (HI) classification models have been contributing in a wide spectrum of real-world applications ranging from human-need based applications to global safety issues with core concepts of classification, segmentation, anomaly detection and prediction. The use of DL on satellite images and to achieve best performance, the research is swiftly trending from traditional machine learning to deep learning approaches.

In this chapter, first we discuss the narratives of HI, source of satellite images and the role of deep learning based classification on sentinel-2 satellite HI data using 3D-CNN and validated the ground truth. In the latter part, we propose a hybrid multi-scale-spinal-net-DL technique (HybridMSSN) that can address some of key issues. The ensemble model comprises with multi-scale CNN and spinal fully connected network (SFCN) to classify the hyper spectral satellite image. Along with that, we demonstrate how the combination of 3D-CNNs and 2D-CNN play its significance in extracting the characteristics of spectral and spatial features of HI, in addition to the Principal Component Analysis (PCA) based spectral band isolations. The role of SFCN or spinal net in our model to reduce the process of global mapping with an aim for fast response and reduced computing effort in the activation function of NNs. Investigations on three common datasets showed considerable classification accuracy in comparison to four related models, despite the fact that there were few training samples, noise, and class imbalance concerns. Experimental outcomes through Python libraries in Colab platform demonstrate that in comparison with other discussed models, our models consistently achieve better accuracy in all classes with 99.16% in case of 30% training without oversampling and 99.99% in case of with oversampling

Keywords Feature Extraction, Convolutional Neural Networks, Spinal Fully Connceted Networks, Hyperspectral Image, Spectral and Spatial Features

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Studies in Computational Intelligence 1039

B. K. Tripathy
Pawan Lingras
Arpan Kumar Kar
Chiranji Lal Chowdhary *Editors*

Next Generation Healthcare Informatics

Springer

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Effect of Computation and Cognitive Bias in Healthcare Intelligence and Pharmacogenomics

G. K. Panda, I. K. Sahu, and D. Sahu

Abstract Healthcare intelligence is derived from human-centric solutions (predictive and analytical) that deal with diagnosis and treatment based on the patient's information. In an attempt to embed computational accuracy, MYCIN (a rule-based system) was developed in the 1970s, to diagnose the blood-borne bacterial infections. Pharmacogenomics, the study of individualized medicine and life-saving treatments, aims to identify the effect of genes in response to drugs and treatments. It is emerging and offering collaborative solutions of pharmacology (the science of drugs), genomics (study of genes), and machine intelligence (AI technologies). Machine learning and natural language processing are being used by IBM Watson to advance precision medicine, particularly diagnosis and treatment of cancer. But the above systems were not adopted for clinical practices, they demonstrated promise for accurate diagnoses and treatments. In the past, healthcare decisions were almost entirely made by people and integrating smart intelligent devices and models into the process raises questions about accountability, transparency, consent, and privacy. Healthcare decisions are shifting from exclusive human-centric to semi- or fully smart intelligent machines. This entails bias and ethical concerns. In the literal sense, the computation and cognitive processes of such bias effects are manifest in explicit preconceived ideas (consciously) and assumptions or stereotypes (unconsciously) as well as skewed data insights for a particular segment of class (inadvertently). The objective of the rest of discussion is to perform an analytical investigation for future healthcare informatics.

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B. K. Tripathy et al. (eds.), *Next Generation Healthcare Informatics*,
Studies in Computational Intelligence 1039,
https://doi.org/10.1007/978-981-19-2416-3_4

Innovations in Fermentation and Phytopharmaceutical Technologies

Edited by
Hrudayanath Thatoi
Sonali Mohapatra
Swagat Kumar Das

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Innovations in Fermentation and Phytopharmaceutical Technologies
2022, Pages 3-12

Chapter 1 - Photo bioreactors for production of biodiesel from algae: A short review

Bikash Chandra Behera [a], Harisankar Dey [b], Riya Jalan [c], Rashmi Ranjan Mishra [c], Sonali Mohapatra [d]

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https://doi.org/10.1016/B978-0-12-821877-8.00008-7

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Abstract

Due to higher production capability of carbohydrates, lipids, and proteins, microalgae are considered an alternative energy resource for biofuel production. Photo bioreactors that use light as an energy source for algal biomass can be used for the maximum production of metabolites. Hence, now it is very essential to design and develop new aspects of photo bioreactors for maximum biofuel production. Apart from the aforementioned criteria, the production cost of the bioreactor, uncontaminated algal biomass, type of photo bioreactor used, ease of using the reactor, low maintenance, and space convenience measures also play vital roles in the efficiency of the reactor. Thus, this chapter aims for a perceptive understanding of the production of biodiesel from algal biomass along with brief insights into different types of bioreactors used for biofuel production from algae.

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Biotechnological Utilization *of* Mangrove Resources

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Chapter 20

Biotechnological potentials of halotolerant and halophilic bacteria from mangrove ecosystems

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20.1 Introduction

Mangroves are typically tropical and subtropical coastal ecosystems found in the intertidal zones of river deltas and backwater areas. These mangrove ecosystems occupy nearly 60%–75% of the world's tropical and subtropical coastlines. The total mangrove area has been estimated to be 137,760 km^2 distributed in 118 countries and territories of the world. Mangrove ecosystems are ecologically and economically important. They protect coastlines against storm surges, tsunamis, and erosion. Nutrients produced by the mangrove ecosystem supports the communities not only of the ecosystem but also of the adjacent estuarine and coastal ecosystems (Jennerjahn and Ittekkot, 2002; Dittmar et al., 2006). Mangroves are helpful for the stabilization of the shoreline and the prevention of shore erosion and forms a barrier against storms to lessen the damage to coastal land and residents. The mangrove trees and shrubs act as sinks, which concentrate pollutants such as sewage, toxic minerals, pesticides, herbicides, and the like received from mines, industries, and urban settlements through the water channels. Apart from their ecological role, mangroves also contribute substantially to the economy of coastal communities. Mangrove ecosystems serve as nurseries and breeding grounds of several marine fauna like prawns, crabs, fishes, and molluscs, and they enhance the fishery production of nearby coastal waters by storing nutrients and detritus. Some of the important uses of mangroves in terms of ecological, economic, and social uses are presented in Table 20.1

Biotechnological Utilization of Mangrove Resources. DOI: https://doi.org/10.1016/B978-0-12-819532-1.00020-2
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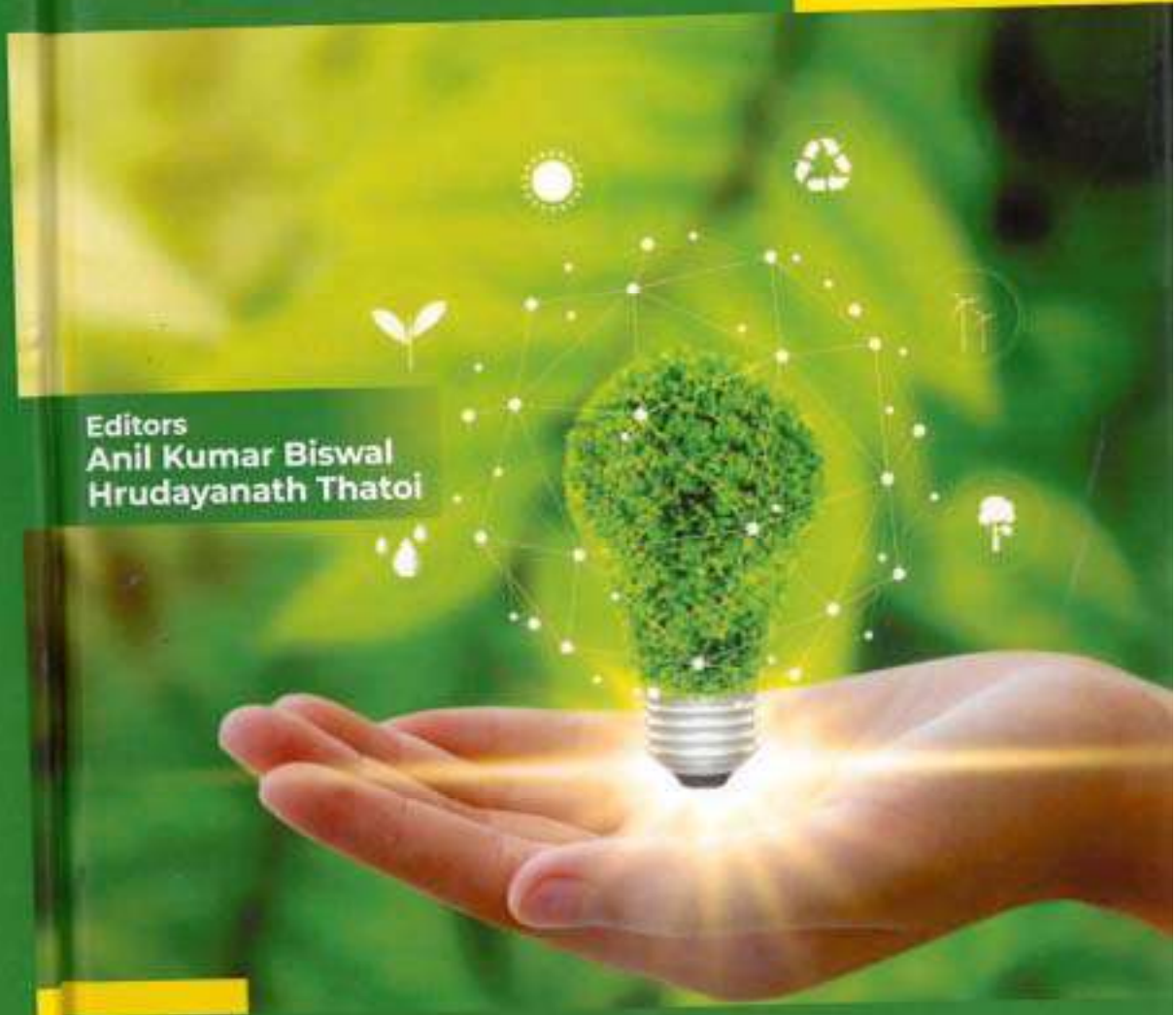
Green Technology for Environment Management

Proceedings of National Seminar on Green Technology for Environment Management (GTEM2020).



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Proceedings of National Seminar on Green Technology for Environment Management (GTEM, 2020), on 4.04.23.

Chapter 16

Bioreduction of Toxic Selenite to Nontoxic Selenium using an Efficient Salt Tolerant *Bacillus* sp. Isolated from Mangrove Soil

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ABSTRACT

In the present study, nine salt tolerant bacteria (BSB1-9) were isolated from mangrove soils collected from outside the National Park area of Bhitarkanika. The isolates were screened for their salt tolerance. Based on the high salt tolerance, five strains were selected for Minimum Inhibitory Concentration (MIC) towards high selenite concentrations. Out of the five bacterial strains, BSB4 could able to tolerate highest concentration of selenite (200 mM) and was further studied for bioremediation of selenite. In an unoptimised condition, at a fixed concentration of selenite (100 mM) the bacterium BSB4 could able to reduce 90 per cent of selenite in 60 h of incubation. Further, the reduction process was optimized in different pH, temperature and NaCl concentrations. It has been observed that at pH 9.0, temperature of 37°C and NaCl concentration of 4 % (w/v) was more effective for selenite reduction. The reduction of selenite

Mangrove Microorganisms

Biodiversity and Biotechnology

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Mangrove Microorganisms

Biodiversity and Biotechnology

The present book highlights diversity, distribution, ecological role and biotechnological potentials of different groups of microorganisms studied by different authors. However, details of biodiversity and biotechnology of mangrove microorganisms have been discussed with reference to mangrove ecosystem of Odisha coast specially Bhitarkanika and Mahanadi delta. This book will be immensely helpful for the students, researchers and academicians pursuing their study and research in the field of microbiology, ecology and biotechnology. Apart from the biodiversity and biotechnological potentials, the book also discusses different methods useful for isolation, characterization and biotechnological application of different groups of microorganisms which will be of great benefit to the researchers.

Dr. Hrudayanath Thatoi obtained his M.Sc; M.Phil and Ph.D. from Utkal University and presently working as Professor in Department of Biotechnology of North Orissa University, Odisha. His area of teaching and research includes microbiology, molecular biology and biotechnology. He has edited a book and published more than 225 research papers in national and international journals, proceedings of conference and book chapters. Besides he has authored 7 books.

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ISBN: 978-93-5124-833-7

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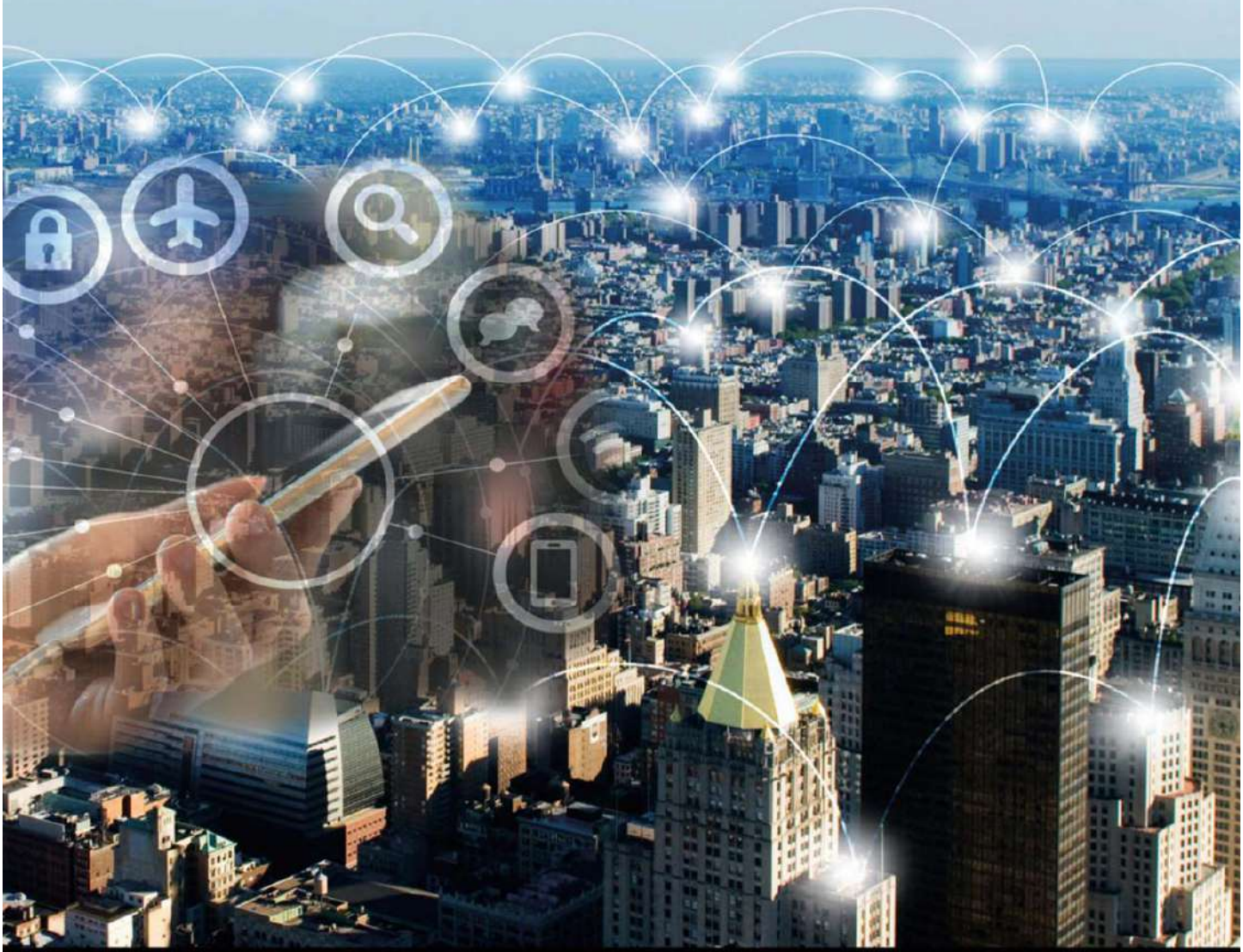

Edited by B.K. Tripathy • J. Anuradha

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Evolution of Social IoT World: Security Issues and Research Challenges

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