September 16, Thursday (Japan Time)

8:30 – 10:00    C Room

C4: Neural Networks and Its Application
Chair: Prof. Junhu Ruan (Northwest A&F University, China)

C4-1
ICICIC2021-005
The Application of Artificial Neural Network and Three-Level Factorial Design to Optimize a Photovoltaic System
Karin Kandananond (Thailand)

C4-2
ICICIC2021-009
Keras-Based 3D Convolutional Neural Network Bearing Fault Diagnosis
Xingyu Han*, Zhihua Hu, Miao Huang and Lang Wang (China)

C4-3
ICICIC2021-018
Research and Analysis of Scene Text Detection and Recognition Technology Based on Deep Learning
Yanju Liu*, Xinhai Yi, Yange Li, Huiyu Zhang and Yanzhong Liu (China)

C4-4
ICICIC2021-040
Retrieval of Near-Sea Surface Air Temperature Based on Deep Learning
Feng Gao*, Shinan Zhou, Yuankang Ye and Chang Liu (China)

C4-5
ICICIC2021-068
Real-Time Defect Detection of Metal Surface Based on Improved YOLOv4
Yanju Liu*, Qiuji Wang, Huiyu Zhang, Yanzhong Liu and Kaifeng Zhao (China)

C4-6
ICICIC2021-076
A Study on the Microorganisms Image Detection System Based on Deep Learning
Hiroshi Shiratsuchi*, Misato Furuta, Yuji Wakamori, Kozo Horiuchi and Takanori Matsuzaki (Japan)
The Application of Artificial Neural Network and Three-Level Factorial Design to Optimize a Photovoltaic System

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Abstract. This simulation-based empirical study was conducted to determine the optimal tilt angle, azimuth angle, and longitudinal position which led to the maximization of the power production (kWh/year) of the photovoltaic (PV) system. A designated location of the future installation was selected, and the simulation software was applied to projecting the power production at the different values of tilt angle, azimuth angle, and longitudinal position. For the statistical analysis, the three-level factorial design was applied to determining the statistical relationship between these three inputs (tilt angle, azimuth angle, and longitudinal position) and an output, generated electricity or power production. The analysis of variance (ANOVA) indicates that there were two-factor interactions (tilt angle-azimuth angle and azimuth angle-longitudinal position) as well as the quadratic effects from all three inputs. The second stage of this study was the utilization of artificial neural network (ANN) to predict the power production from the PV system. The training algorithm was the resilient backpropagation with weight backtracking (RPROP+) and globally convergent RPROP (GRPROP). The activation function used was the rectified linear unit (ReLU) and the mean square error (MSE) was utilized as the measurement index for prediction accuracy. The effects of different number of nodes in the hidden layers and training algorithm on the prediction accuracy were studied. The results of this research have presented a guideline for the installation of PV system to maximize the power production.

Keywords: Artificial neural network, Three-level factorial design, Photovoltaic system, Resilient backpropagation

Keras-Based 3D Convolutional Neural Network Bearing Fault Diagnosis

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Abstract. This paper proposes a 3D-convolutional neural network (3D-CNN) fault diagnosis algorithm based on the Keras framework for the diagnosis of rotor bearing output end faults. Feature extraction and diagnostic analysis can be carried out based on 3D data. The model takes the acceleration data collected by the 3D acceleration sensor as the input of the diagnosis model, completes the feature extraction by the 3D-CNN algorithm, and then diagnoses the fault types and classifies the output by the convolutional neural network (CNN). The fault types are classified by CNN Softmax classifier. The experimental results show that the diagnostic accuracy using this fault diagnosis model achieves 99%. Unlike the traditional CNN algorithm, this method can put three data sets directly into the CNN as the input layer for operation, which eases the feature extraction of data sets. Compared with the traditional 1D and 2D CNN-based feature extraction fault diagnosis
algorithms, the Keras-based 3D-CNN diagnostic model has higher accuracy for analyzing and diagnosing. **Keywords:** Machine learning, Deep learning, 3D-convolutional neural network, Fault diagnosis, Data processing

C4-3: ICICIC2021-018

Research and Analysis of Scene Text Detection and Recognition Technology Based on Deep Learning

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Abstract. With the development of deep learning technology in the field of computer vision, there are breakthroughs in scene text detection and text recognition technology. Affected by extreme lighting, occlusion, blur, multi-direction and multi-scale in natural scenes, there are still huge challenges facing unconstrained scene text detection and recognition. In this paper, the basic concept of the problem is introduced, the scene text detection and text recognition technology are deeply studied from the perspective of deep learning, and the method and regression based on segmentation in the text detection technology are summarized. The combination of the advantages of the method can solve the problem of low recall rate of small text areas, while adapting to multi-scale text. Through the combination of the CTC mechanism and the Attention mechanism in the text recognition method, mutual supervision can be achieved, the recognition performance is improved, and the error rate of long text recognition is reduced. **Keywords:** Deep learning, Computer vision, Natural scene, Text detection, Text recognition

C4-4: ICICIC2021-040

Retrieval of Near-Sea Surface Air Temperature Based on Deep Learning

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Abstract. The ocean atmospheric parameters of some regions of South China Sea (110°-130°E, 10°-30°N) from 1960 to 2015 were selected as the experimental objects, research on the inversion algorithm of near sea temperature, based on the deep learning method, three models are established, which are the near surface temperature inversion method based on FCN and BP algorithm, the near surface temperature inversion method based on RNN and BPTT algorithm, and the near surface temperature inversion method based on LSTM and TBPTT algorithm. The results show that the three models are superior to the traditional multiple linear regression method and single hidden layer neural network method, and the LSTM and TBPTT algorithm are the most accurate of the three methods. **Keywords:** Deep learning, Near-sea surface air temperature, Back propagation algorithm, Neural network
C4-5: ICICIC2021-068

Real-Time Defect Detection of Metal Surface Based on Improved YOLOv4

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Abstract. It is important for the surface quality of metal to process final product. Therefore, it is necessary to strictly control the defects on the surface of metal. Aiming at the current YOLOv4 algorithm with low detection accuracy and poor performance on small-scale information, an improved YOLOv4 automatic detection method is proposed. First, in order to enhance detection target feature extraction and reduce gradient vanishing, the feature extraction network CSPDarkNet53 in YOLOv4 is replaced with lightweight deep neural network MobileNetv3 in this paper. Secondly, in order to improve the learning efficiency and accelerate the convergence speed, K-Means clustering is adopted to generate a prior box to suit for this experiment. Finally, the confidence loss is redefined and a loss function is proposed that can adapt to the multi-scale to solve the problem of poor detection effect due to the positive and negative sample imbalance. The experimental results show that the mAP value is improved about 7.94% comparing with the original YOLOv4 model for the surface defect detection of the metal. The accuracy of this model is improved effectively based on ensuring the detection speed.

Keywords: Defect detection, YOLOv4, MobileNetv3, K-Means

C4-6: ICICIC2021-076

A Study on the Microorganisms Image Detection System Based on Deep Learning

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Abstract. This paper aims at a microorganisms image detection system that uses machine learning to estimate the status of aerobic microorganisms in activated sludge, which is necessary for the stable management and operation of a purification facility for factory wastewater. In other words, if the proposed system supports the detection of the type and number of microorganisms in the aeration tank, the condition of the purification facility is easy to estimate. The gooogleLeNet of deep learning models trained by datasets with augmentation such as a padding process is proposed. From the simulation results, the recognition rate for the validation data was a good result in 81.36%.

Keywords: Microorganisms, Wastewater treatment facility, Machine learning, Convolution neural networks