Recognition of Odia Handwritten Digits using Gradient based Feature Extraction Method and Clonal Selection Algorithm

Puspalata Pujari, Guru Ghasidas Vishwavidyalaya, Bilaspur, India
Babita Majhi, Guru Ghasidas Vishwavidyalaya, Bilaspur, India

ABSTRACT

This article aims to recognize Odia handwritten digits using gradient-based feature extraction techniques and Clonal Selection Algorithm-based (CSA) multilayer artificial neural network (MANN) classifier. For the extraction of features which contribute the most towards recognition from images, are extracted using gradient-based feature extraction techniques. Principal component analysis (PCA) is used for dimensionality reduction of extracted features. A MANN is used as a classifier for classification purposes. The weights of the MANN are adjusted using the CSA to get optimized set of weights. The proposed model is applied on Odia handwritten digits taken from the Indian Statistical Institution (ISI), Calcutta, which consists of four thousand samples. The results obtained from the experiment are compared with a genetic-based multi-layer artificial neural network (GA-MANN) model. The recognition accuracy of the CSA-MANN model is found to be 90.75%.

KEYWORDS
Artificial Neural Network, Classification, Clonal Selection Algorithm, Feature Extraction, Odia Digit Recognition, Preprocessing

INTRODUCTION

Hybrid approach is one of the main characteristics of the contribution of soft computing. Hybrid approach is the integration of already existing techniques. There are several population-based optimization algorithms inspired by biological evolution. These optimization algorithms can be integrated with other techniques to increase the performance of a model. CSA-MANN is an approach which incorporates clonal selection algorithm and artificial neural network (Majhi et al., 2011; Xuefeng et al., 2017). A Neural network is designed to adopt in a similar way the human nervous system works. It learns from a set of past data or pre-defined data with class label and develops a model that can be applied to unseen data without class label. They have the ability to adapt to circumstances and learn from past experience. Neural Network can model complex non-linear relationships and are appropriately suited for classification phenomenon into predetermined class. It is difficult to get optimized set of weight by using MANN. On the other hand, a CSA is an evolutionary algorithm which mimics the behavior of living organism to adapt to the environment. In CSA initially a number of solutions are generated. Out of the possible solutions best possible solutions are chosen. Then some of the accepted solutions are generated using the factors of best choices and the process is repeated again and again. The above process is repeated until a desired solution is found. CSA is useful for finding the optimal solutions from a number of alternative solutions for a problem. CSA

DOI: 10.4018/IJRSDA.2019040102

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.
can be effectively used to optimize the weights of a neural network which is very difficult task. In this proposed work CSA-MANN integrated model is used to determine the weights of a multilayer feed forward neural network using back propagation concept. The backpropagation algorithms are based on gradient descent-based learning method for the update of weights of the multi-layer artificial neural network. The network architecture of the proposed MANN is based on back propagation learning method and real coded chromosomes are used for implementing CSA as compared to binary coded methods. Optimization technique is used for the selection of best solution among a number of alternatives. A large number of optimization techniques have been applied by the authors for the identification of handwritten characters. In most of the cases the recognition accuracy of the system depends on the combination of feature extraction techniques and classifiers used for recognition. In Nawwaf et al. (2001) developed a system for recognition of online Arabic characters regardless of the orientation, position and size of the input pattern. Modified quadratic discriminant function (MQDF) for the classification of handwritten Chinese character (Xiao et al., 2017). Sparse coding is used to compact the parameters of MQDF. They have adopted maximum likelihood-based and the K-SVD methods to build two compact MQDF classifiers. In Rina et al. (2017) the authors integrated hidden Markov model and harmony search algorithm for recognition of writer independent online Kurdish character recognition. The system is applied on a dataset of 4500 words and a recognition rate of 93.52% is achieved with this model. Xuefeng Xiao et al. (2017) proposed convolutional neural network (CNN) model for recognition of handwritten Chinese character and adaptive drop-weight technique for pruning CNN parameter. In Ritesh et al. (2016) the authors have proposed region sampling methodologies based on a non-dominated sorting harmony search algorithm and a non-dominated sorting genetic algorithm for recognition of Bangla character. An axiomatic fuzzy set (AFS) based fuzzy logic is used for integrating the pareto-optimal solution from the multi-objective heuristics algorithm. Recognition accuracy of 86.64% and 98.23% is an obtained for handwritten Bangla character and digits respectively. A deep learning technique is presented in Roy et al., (2017) for recognition of compound character of Bangla script. The authors employed layer wise training to deep convolutional neural network augmented with RMSPROP algorithm for faster convergence. A new benchmark of recognition accuracy is highlighted on the CMATERdb 3.1.3.3 dataset. In Boufenar et al. (2018) the authors proposed deep convolutional neural network (DCNN) using transfer learning strategies on OIHCADDB and AHCD of-line isolated handwritten Arabic character.

Recently clonal selection algorithm has been used in many applications like wind power forecasting, Brain MR image segmentation, short-term hydro thermal scheduling, power generators maintenance scheduling, automatic clustering, virus detection, for urban bus scheduling, construction site utilization planning and development of digital channel equalizer. In (Chitsaz et al., 2015) the authors have proposed Clonal selection algorithm-based wavelet neural network for optimization of free parameters of wavelet neural network for wind power forecasting. Tong Zhang et al. (2012) have incorporated CSA into hidden Markov random field (HMRF) model for brain image segmentation and produced more accurate result. R. K. Swain et al. (2011) proposed CSA based evolutionary approach for obtaining a solution to short-term hydro thermal scheduling problem. The proposed algorithm is compared with other evolutionary techniques and produced better result. In El-Sharkh (2013) the authors have introduced a novel method for power generators maintenance scheduling where CSA is used for obtaining optimum solution. A gene transposon-based clone selection algorithm (GTCSA) has been proposed in Liu et al. (2012) to find satisfied number of clusters automatically. The authors compared the results of the proposed model with other models and obtained good performance. A novel approach has been presented by the authors in Afaneh et al. (2013) for detection of computer virus using Clonal selection algorithm and achieved 94.4% accuracy in detection of virus. Xinguo Shui et al. (2015) has proposed a Clonal selection algorithm-based bus vehicle scheduling approach for finding an optimum solution to real world problem within a few seconds. In Wang et al. (2016) the authors have introduced Clonal selection algorithm for construction site utilization planning to support construction process and produced efficient results with the proposed system. In Nanda et al.,

www.igi-global.com/e-resources/library-recommendation/?id=2

Related Content

Bring Your Own Device (BYOD) and Work/Life Balance
www.igi-global.com/chapter/bring-your-own-device-byod-and-worklife-balance/112808?camid=4v1a

Discovering Patterns using Process Mining
Ishak Meddah and Belkadi Khaled (2016). International Journal of Rough Sets and Data Analysis (pp. 21-31).
www.igi-global.com/article/discovering-patterns-using-process-mining/163101?camid=4v1a
A Roughset Based Ensemble Framework for Network Intrusion Detection System
www.igi-global.com/article/a-roughset-based-ensemble-framework-for-network-intrusion-detection-system/206878?camid=4v1a

A Particle Swarm Optimization Approach to Fuzzy Case-based Reasoning in the Framework of Collaborative Filtering
www.igi-global.com/article/a-particle-swarm-optimization-approach-to-fuzzy-case-based-reasoning-in-the-framework-of-collaborative-filtering/111312?camid=4v1a