A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

LITERATURE SURVEY

PAPER - 1TITLE:

Deep Convolutional Self-Organizing Map Network for Robust Handwritten Digit Recognition AUTHOR:

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YEAR OF PUBLICATION: 2020

JOURNAL NAME: IEEE Access DESCRIPTION:

Deep Convolutional Neural Networks (DCNN) are currently the predominant technique commonly used to learn visual features from images. However, the complex structure of most recent DCNNs impose two major requirements namely, huge labeled dataset and high computational resources. In this paper, we develop a new efficient deep unsupervised network to learn invariant image representation from unlabeled visual data. The proposed Deep Convolutional Self-organizing Maps (DCSOM) network comprises a cascade of convolutional SOM layers trained sequentially to represent multiple levels of features. The 2D SOM grid is commonly used for either data visualization or feature extraction. However, this work employs high dimensional map size to create a new deep network. The N-Dimensional SOM (ND-SOM) grid is trained to extract abstract visual features using its classical competitive learning algorithm. The topological order of the features learned from ND-SOM helps to absorb local transformation and deformation variations exhibited in the visual data. The input image is divided into an overlapped local patches where each local patch is represented by the Ncoordinates of the winner neuron in the ND-SOM grid. Each dimension of the NDSOM can be considered as a non-linear principal component and hence it can be exploited to represent the input image using N-Feature Index Image (FII) bank. Multiple convolutional SOM layers can be cascaded to create a deep network structure. The output layer of the DCSOM network computes local histograms of each FII bank in the final convolutional SOM layer. A set of experiments using MNIST handwritten digit database and all its variants are conducted to evaluate the robust representation of the proposed DCSOM network. Experimental results reveal that the performance of DCSOM outperforms state-of-the-art methods for noisy digits and achieve a comparable performance with other complex deep learning architecture for other image variations. Deblur GAN-CNN: Effective Image Denoising and Recognition for Noisy Handwritten Characters AUTHOR.

PAPER - 2 TITLE:

HDSR-Flor: A Robust End-to-End System to Solve the Handwritten Digit String Recognition Problem in Real Complex Scenarios.

AUTHOR:

Arthur Flor De Sousa Neto, Byron Leite Dantas Bezerra (Member, IEEE),Estanislau Baptista Lima And Alejandro Héctor Toselli

YEAR OF PUBLICATION: 2020

JOURNAL NAME: IEEE Access DESCRIPTION:

Automatic handwriting recognition systems are of interest for academic research fields and for commercial applications. Recent advances in deep learning techniques have shown dramatic improvement in relation to classic computer vision problems, especially in Handwritten Text Recognition (HTR). However several approaches try to solve the problem of deep learning applied to Handwritten Digit String Recognition(HDSR), where it has to deal with the low number of trainable data, while learning to ignore any writing symbol around the digits (noise). In this context, we present a new optical model architecture (Gated-CNN-BGRU), based on HTR workflow, applied to HDSR. The International
Conference on Frontiers of Handwriting Recognition (ICFHR) 2014 competition on HDSR were used as baselines to evaluate the effectiveness of our proposal, whose metrics, datasets and recognition methods were adopted for fair comparison. Furthermore, we also use a private dataset (Brazilian Bank Check - Courtesy
Amount Recognition), and 11 different approaches from the state-of-the-art in HDSR, as well as 2 optical models from the state-of-the-art in HTR. Finally, the proposed optical model demonstrated robustness even with low data volume (126 trainable data, for example), surpassing the results of existing methods with an average precision of 96.50%, which is equivalent to an average percentage of improvement of 3.74 points compared to the state-of-the-art in HDSR. In addition, the result stands out in the competition's CVL HDS set, where the proposed optical model achieved a precision of 93.54%, while the best result so far had been from Beijing group (from the competition itself), with 85.29%

PAPER 3Title:

SARAYUT GONWIRAT , AND OLARIK SURINTA

YEAR OF PUBLICATION: 2022 JOURNAL

NAME: IEEE ACCESS DESCRIPTION:

Many problems can reduce handwritten character recognition performance, such as image degradation, light conditions, low-resolution images, and even the quality of the capture devices. However,in this research, we have focused on the noise in the character images that could decrease the accuracy of handwritten character recognition. Many types of noise penalties influence the recognition performance, for example, low resolution, Gaussian noise, low contrast, and blur. First, this research proposes a method that learns from the noisy handwritten character images and synthesizes clean character images using the robust deblur generative adversarial network (Deblur GAN). Second, we combine the Deblur GAN architecture with a convolutional neural network (CNN), called Deblur GAN-
CNN. Subsequently, two state-of-the-art CNN architectures are combined with Deblur GAN, namely DeblurGAN-DenseNet121 and DeblurGAN-MobileNetV2, to address many noise problems and enhance the recognition performance of the handwritten character images. Finally, the Deblur GAN-CNN could transform the noisy characters to the new clean characters and recognize clean characters simultaneously. We have evaluated and compared the experimental results of the proposed Deblur GAN-CNN architectures with the existing methods on four handwritten character datasets: n-THI-C68, n-MNIST, THI-C68, and THCC-67. For the n-THI-C68 dataset, the Deblur GAN-CNN achieved above 98% and
outperformed the other existing methods. For the n-MNIST, the proposed Deblur GAN-CNN achieved an accuracy of 97.59% when the AWGN+Contrast noise method was applied to the handwritten digits. We have evaluated theDeblur GAN-CNN on the THCC-67 dataset. The result showed that the proposed Deblur GAN-CNN achieved an accuracy of 80.68%, which is significantly higher than the existing method, approximately 10%

PAPER - 4 Title:

A Novel Learning Algorithm to Optimize Deep Neural Networks: Evolved Gradient Direction Optimizer (EVGO).

AUTHOR:

Ibrahim Karabayir , Oguz Akbilgic , and Nihat Tas

YEAR OF PUBLICATION: 2020

JOURNAL NAME: IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS

DESCRIPTION:

Gradient-based algorithms have been widely used in optimizing parameters of deep neural networks' (DNNs) architectures. However, the vanishing gradient remains as one of the common issues in the parameter optimization of such networks. To cope with the vanishing gradient problem, in this article, we propose a novel algorithm, evolved gradient direction optimizer (EVGO), updating the weights of DNNs based on the first-order gradient and a novel hyperplane we introduce. We compare the EVGO algorithm with other gradient-based algorithms, such as gradient descent, RMSProp, Adagrad, momentum, and Adam on the well-known Modified National Institute of Standards and Technology (MNIST) data set for handwritten digit recognition by implementing deep convolutional neural networks. Furthermore, we present empirical evaluations of EVGO on the CIFAR-10 and CIFAR-100 datasets by using the well-known AlexNet and ResNet architectures. Finally, we implement an empirical analysis for EVGO and other algorithms to investigate the behavior of the loss functions. The results show that EVGO outperforms all the algorithms in comparison for all experiments. We conclude that EVGO can be used effectively in the optimization of DNNs, and also, the pro-posed hyperplane may provide a basis for future optimization algorithms.