Convolutional Neural Network Training with Artificial Pattern for Bangla Handwritten Numeral Recognition

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Abstract

Recognition of handwritten numerals has gained much interest in recent years due to its various application potentials. The progress of handwritten Bangla numeral is well behind Roman, Chinese and Arabic scripts although it is a major language in Indian subcontinent and is the first language of Bangladesh. Handwritten numeral classification is a high-dimensional complex task and existing methods use distinct feature extraction techniques and various classification tools in their recognition schemes. Recently, convolutional neural network (CNN) is found efficient for image classification with its distinct features. In this study, a CNN based method has been investigated for Bangla handwritten numeral recognition. A moderated pre-processing has been adopted to produce patterns from handwritten scan images. On the other hand, CNN has been trained with the patterns plus a number of artificial patterns. A simple rotation based approach is employed to generate artificial patterns. The proposed CNN with artificial pattern is shown to outperform other existing methods while tested on a popular Bangla benchmark handwritten dataset.

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Sharif, S. M. A.; Mahhooh, Mandin. A Comparison between Hybrid Models for Classifying Bangla Isolated Basic Characters. 2017 4TH INTERNATIONAL CONFERENCE ON ADVANCES IN ELECTRICAL ENGINEERING (ICAEE) (2017)

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   International Journal of Machine Learning and Computing Volume: 3 Issue: 4 Pages: 322-31 Published: Aug. 2013

2. **ENSEMBLES OF NEURAL NETWORKS BASED ON THE ALTERATION OF INPUT FEATURE VALUES** — Times Cited: 23
   By: Akhand, M. A. H.; Murase, K.
   INTERNATIONAL JOURNAL OF NEURAL SYSTEMS Volume: 22 Issue: 1 Pages: 77-87 Published: FEB 2012

3. **Bangla handwritten numeral recognition using convolutional neural network** — Times Cited: 5
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   P INT C EL ENG INF C Pages: 1-5 Published: 2015
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4. **Handwritten Bangia Numerical Digit Recognition using Histogram Technique** — Times Cited: 9
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   Asian Journal of Information Technology Volume: 3 Pages: 611-615 Published: 2004
   [Show additional data]

5. **Handwritten Bangla digit recognition using classifier combination through DS technique** — Times Cited: 25
   By: Basu, S; Sarkar, R; Das, N; et al.
   PATTERN RECOGNITION AND MACHINE INTELLIGENCE, PROCEEDINGS Book Series: Lecture Notes in Computer Science Volume: 3776 Pages: 236-241 Published: 2005

6. **Handwritten Numeral Databases of Indian Scripts and Multistage Recognition of Mixed Numerals** — Times Cited: 114
   By: Bhattacharya, Ujjwal; Chaudhuri, B. B.
   IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE Volume: 31 Issue: 3 Pages: 444-457 Published: MAR 2009

7. **A genetic algorithm based region sampling for selection of local features in handwritten digit recognition application** — Times Cited: 55
   By: Das, Nibaran; Sarkar, Ram; Basu, Subhadip; et al.
   APPLIED SOFT COMPUTING Volume: 12 Issue: 5 Pages: 1592-1606 Published: MAY 2012

8. **Handwritten Bangla numeral recognition using Local Binary Pattern** — Times Cited: 14
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   EL ENG INF COMM TECH Pages: 1-4 Published: 2015

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   2014 4TH INTERNATIONAL CONFERENCE ON ENGINEERING TECHNOLOGY AND TECHNOPRENEURSHIP (ICE2T) Pages: 1-5 Published: 2014

10. **Bangla handwritten digits recognition using evolutionary artificial neural networks** — Times Cited: 4
    By: Khan, M. M. R.; Rahman, S. M. A.; Alam, M. M.
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