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Title of the Thesis: Investigation on Algorithm for Handwritten Gujarati OCR

Abstract

Optical Character Recognition is getting much more attention because of this the computer learns and recognizes the regional languages pretty well and if it gains successes, then it opens a whole new world of endless possibility. The machine printed characters are accurately recognizable which has solved many problems and hence commercialized in routine use, but the recognition of handwritten characters is very difficult. So methods for recognition of handwritten documents are still a subject of active research. There is no common algorithm is possible for all Indian languages, because each Indian language has its own features and restrictions. In Gujarat state, Gujarati is the commercial language and most of the communication in Government office, schools, and private sectors is done in Gujarati. Handwritten Gujarati OCR system used for detecting the handwritten amount on a cheque, automatic reading of marks from the answer sheet, and a learning application for the education system. The research work is mainly focused on the implementation of a robust algorithm for Handwritten Gujarati OCR.

The k-nearest neighbor (KNN) and support vector machine (SVM) classifiers were used on different feature extraction methods like Pixel Count Ratio, Object Gradient, Object Geometry, Character Profile, Local Binary Pattern, Center-Symmetric Local Binary Pattern, And Wavelet Transform methods. Furthermore, hybrid feature extraction methods were used to increase the performance of character recognition. The other novel approach of automated features extracted was implemented using Deep learning and the extracted features were given to SVM for handwritten character classification. For the increasing recognition rate of characters, a pre-trained Deep Neural network (Alexnet) has been used for classification. The three different applications were implemented named “Handwritten Gujarati Character Recognition and Speech Conversion (HGCTS)”, “Handwritten Gujarati Numeral Recognition and Speech Conversion (HGNTS)” and “Automatic Handwritten Marks Recognition (AHMR)”.

KNN, SVM and Deep Neural Networks gives recognition accuracy of 98.46%,98.72% and 99.30% for Numeral, 92.37%, 92.21% and 97.65% for characters and 92.86%, 92.93% and 97.73% for combining Numerals and Characters respectively.

This PhD Thesis would be useful for the development of offline Gujarati characters/numerals recognition based applications.

List of Publications:

1. Mikita Gandhi, V.K.Thakar, H.N.Patel, “Handwritten Gujarati Numeral Recognition using Wavelet Transform”, *Journal of Applied Science and Computation (JASC)*, Vol. VI, Issue IV,2019.
2. Mikita Gandhi, V.K.Thakar, H.N.Patel, “Gujarati Handwritten Character Recognition Using Convolutional Neural Network”, *Journal of Emerging Technologies and Innovative Research (JETIR)*, Vol.VI, Issue V, May 2019.