

Handwritten Devanagari Digit Recognition

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Abstract - Handwritten digit recognition is an advanced area to explore pattern recognition. This report presents the handwritten Devanagari digit recognition method. To obtain these results, we conducted several experiments on the dataset. People possess different handwriting styles to write digits. Hence, handwritten digit recognition is the solution to this problem which uses the image of a digit and recognizes the digit present in the image. In these experiments, we used features ranging from the direct pixel values to gradient features. Using these attributes we were able to measure the recognition accuracies using the deep learning CNN algorithm. In this paper, we have proposed an efficient Handwritten Devanagari numeral digit recognition. CNN architecture is utilized to achieve high accuracy in the classification of the problem.

Key Words: Devanagari font, Pattern recognition, Digit recognition, Deep learning, CNN, Classification.

1. INTRODUCTION

Computer Vision & Pattern Recognition is the fastest developing areas in image processing. Handwritten digit recognition system is one of the pivotal fields in pattern recognition. Using proper techniques the system can recognize the digits from a digitalized or scanned handwritten text. This methodology has been a crucial part of various applications like cheque verification, office report automation, signature confirmation checking, and many different applications in day-to-day life. This system faces complications due to the challenges it faces like different writers providing their handwriting which are indistinguishable in various viewpoints, for example, textual style, size, and shape. The recent ongoing accomplishment of deep learning especially Residual Neural Network is used to recognize manually written digits. This ResNet is based on a deep Convolutional Neural Network (CNN) being one of the best models to date for image classification.

2. BASIC TERMINOLOGIES

Machine Learning: Machine learning is a subfield of artificial intelligence (AI). Machine learning facilitates computers in building models from sample data in order to automate decision-making processes based on data inputs.

Devanagari font: Lets know a little about Devanagari font, it is an ancient Brahmi script used in the Indian subcontinent which is composed of 47 characters, 14 vowels and 33 consonants. It is widely adopted and being used for over 120 languages.

CNN: A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a CNN is much lower as compared to other classification algorithms.

3. System architecture

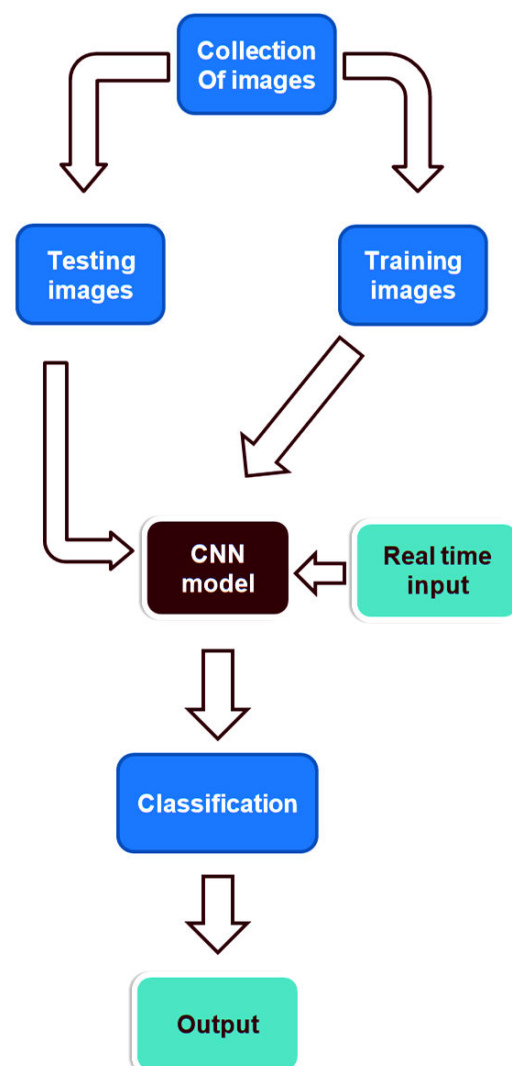


Fig 1: Flowchart

First and foremost, we require some data to train and test our model, thanks to kaggle, we were able to find a dataset of around 40000 images where there were all the possible alphabets and digits of devnagiri font. From this we just require the digits, so, we extracted them from the dataset wherein there were 2000 images for each digit individually. Out of these, we used 1700 images for training purpose and remaining 300 for testing the accuracy of the model.

To use these images we firstly extracted each and every pixel from the image and append it to a csv file so that it becomes more convenient and easy for the network model to process the data. Next we used the created file as input and trained the model and later calculated the accuracy by the process of testing the model. When we feed real time handwritten digit images to the model it classifies the digit and provides the digit as output.

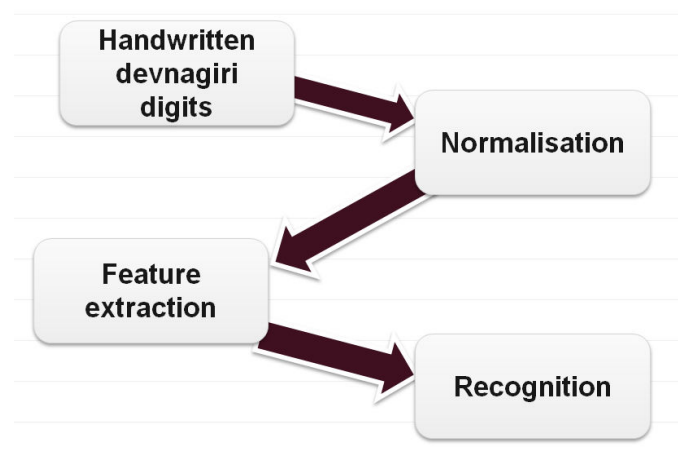


Fig 2: Design

Figure 2 basically shows another level of abstraction for the model of our project, data will be fed to the model followed by normalising the data to a single place with similar input i.e the csv file. Using the neural network we will extract the features leading to recognition of the digits

4. DATASET

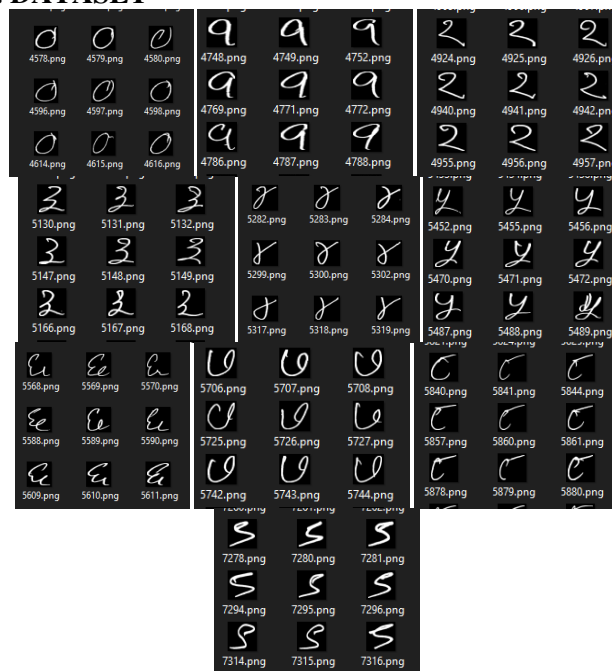


Fig 3: Dataset

In Sec. 2 we used the dataset which was available on kaggle, it covered all the possible alphabets and numeric characters from which we only require the digits as you can see in Fig. 3. Each digit had 2000 images and each image had a resolution of 32x32 pixels. We used python libraries to extract these pixels from their images and append each pixel to the csv file for ease and time saving abilities. Each row of the csv file contains pixel data of only one image where each pixel was separated simultaneously and chronologically in the columns.

5. TECHNOLOGIES USED

Python: Python is a high level computer programming language that is often used to conduct data analysis, create programs and automate tasks.

Libraries used:

Pandas: Pandas is a open source data analysis library for python programming language. It can be used to work with csv files.

NumPy: NumPy i.e Numerical Python is a library based on python for working in domain of linear algebra, Fourier transform, and matrices. It can be used for ease in calculation with a array of data.

SciPy: SciPy is a open source scientific computation library that uses NumPy as its base. SciPy stands for Scientific Python. It provides more utility functions for optimization and signal processing.

OpenCV: OpenCV is a tool for image processing which helps us to perform computer vision tasks in real-time. It can be used for image analysis and detection.

6. HARDWARE AND SOFTWARE REQUIRED

Sr. No	Parameters	Requirements
1	OS	Windows
2	RAM	4 GB
3	IDE used	Jupyter Notebook
4	Storage	2 GB
5	Programming Language	Python 3.0
6	Algorithm	Convolutional Neural Networks
7	Imported Libraries	Pandas, NumPy, SciPy, OpenCV

Table -1: Requirements

9. REFERENCES

1. Ahmend El-Sawy, El-Bakry Hazem, and Mohamed Loey "Cnn for handwritten arabic digits recognition based on lenet-5"
2. V. J. Dongre, V. H. Mankar, "Devanagari offline handwritten numeral and character recognition using multiple features and neural network classifier"
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7. RESULTS & CONCLUSION

Different kinds of techniques were used to detect digits but were not able to classify images at a great accuracy. After we successfully trained 1700 images using the Convolutional neural networks model we did a test for the accuracy of the model using 300 images for each digit, we came up with a result possessing accuracy of 95.6% in the first go. Most importantly, this method requires less computational power and can provide quick results. It can not only be useful for accurate and fast digit recognition but also for solving unreadability in Devanagari font.

8. FUTURE SCOPE

Digit recognition in Devanagari font would be very useful in the field of research in areas with attachment to regional languages. This model can be used to solve real world problems written in Devanagari font. Translation to English can provide immense help to the language barrier and help people to smoothly run businesses.