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OFFLINE KANNADA HANDWRITTEN WORDS RECOGNITION USING DEEP LEARNING

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ABSTRACT

This paper proposes an efficient method for Offline Kannada handwritten word recognition system which uses image preprocessing techniques. Chars 51K dataset was used for experimentation of the work. Experiments were performed on handwritten Kannada Varanamala, Ottakshara, and Kaagunitha consisting of 25 handwritten characters in 637 classes. Kannada characters are used in our dataset. i.e Varanamala, Kaagunitha and Ottakshara. In this report we used CNN for training our model where it consists of different layers.

Keywords: *A4 sheets, Black marker pen, Deep Learning, CNN.*

1. INTRODUCTION

Kannada is one of the most important languages spoken by the people of Karnataka, known as the official and administrative language. Amongst the most difficult as well as interesting parts of object detection as well as algorithmic is hand recognition. Character recognition is often defined as a mechanical simulation of human reading. This is also known as optical character recognition. It has become a challenging research environment due to its diverse functional environment. Handwriting has always been and always will be a means of communication. There is a need to convert these writing or script into a compact format that can be developed by an Offline Kannada handwriting recognition system. It makes a substantial contribution to the continuance of the machine process, which enhances the human-machine interaction at a cost.

Many experiments in this area are closely related to the recognition of handwritten letters of textual texts such as kannada, Devanagari and Bangla. In the literature it can be considered that there is a great need for character recognition programs to prove about there presence. A great need for Indian letter recognition systems and excellent reviews have been made on Optical Character Recognition (OCR) for Indian languages.

Handwriting recognition is a process that requires preparation. Learning could be done in the presence of authors' handwritten datasets (author learning) or with a personal author's handwritten datasets (author-dependent learning). From the different experiments conducted by the experimenters, it can be concluded that the accuracy of identification of writing style is advanced when it comes to author training because textbook samples from an individual writer are used to train the recognizer.

In addition, the pre-processed image will be used to extract the feature with the help of CNN, an in-depth learning method. During the removal of the feature various techniques will be used to extract the desired features from the image which include convolution functionality, high integration, flattening and a fully integrated layer.

2. LITERATURE SURVEY

1] Exploring Deep Learning Techniques for Kannada Handwritten Character Recognition: A Boon for Digitization proposed by Abhishek S. Rao, Sandhya S, Anusha K, Arpitha, Chandana Nayak, Meghana, Sneha Nayak, they have successfully implemented a Kannada handwriting recognition system that uses image processing techniques to improve image quality and evaluation. an in-depth learning method to remove the feature.

2] Handwriting recognition on form document using convolutional neural network and support vector machines(CNN-SVM) proposed by Darmatasia and

Mohammad Ivan Fanany in the year 2017. This approach is more effective than adding complex structures to CNN. The proposed strategy achieves a recognition level of 98.85% for alphabets, 93.05% for capital letters, 86.21% for enemy letters, and 91.37% for combining alphanumeric characters. Ten-fold verification method was also used to validate this method, and the results showed that the accuracy level could be increased using support vector machine (SVM), and CNN.

3] Automatic Handwritten Digit Recognition on Document Images Using Machine Learning Methods developed by Akkireddy Challa in January 2019. First, the digits are divided into individual digits to perform the recognition function. Then divide each digit into sections by completing the handwriting unit recognition task, using the digital recognition module. Digital unit images are trained by the SVM, ANN and CNN model with Vector HOG features.

4] Efficient Offline Hand Written Character Recognition using CNN and Xgboost model was developed by Joseph JamesS, C.Lakshmi, UdayKiran P, and Parthiban in the year 2019. The XGBoost gradient magnification model selects the appropriate goal work, loss function, and familiarity. When CNN and XGBoost are combined, the accuracy level and calculation time as a whole are expected to increase.

5] A CNN Model Based Approach For Offline Handwritten Tamil Text Recognition System proposed by R.C. Suganthe, Pavithra K, N. Shanthi and R.S. Latha in 2021. Feature releases are performed on CNN architecture automatically. There have been very few studies done in the Tamil language. Instead of predicting words, the first step is to separate the individual letters in the text, and then the separated character is given a trained CNN model to predict handwritten Tamil characters.

6] Recognition of Automated Hand-written Digits on Document Images Making Use of Machine Learning Techniques proposed by Aarti Gupta, Rohit Miri, and Hiral Raja in May 2021 focused on developing an effective system for automatically detecting handwritten digits. Test results have undoubtedly shown that the CNN method is more effective than the ANN and SVM method, ranked 71%.

3. METHODOLOGY

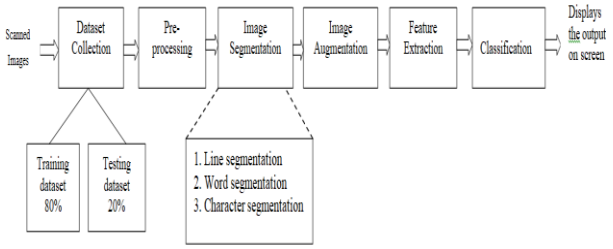

Fig1: Block Diagram of our proposed method.

The block diagram of our proposed method steps includes,

3.1 Dataset collection

The data set contains a collection of images from various sources. The characters in the database are 637 classes consisting of 25 to 50 handwritten letters in each class. In the offline section we start by taking an A4 sheet and collecting different characters from different people. After collecting the datasets take a photo of that A4 sheet and scan with the Collecting the user handwriting in terms of images for training the model.

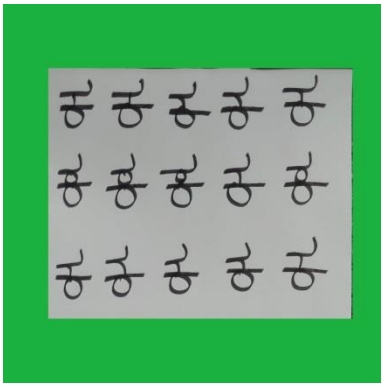

Fig2: Collection of handwriting Alphabet on Paper.

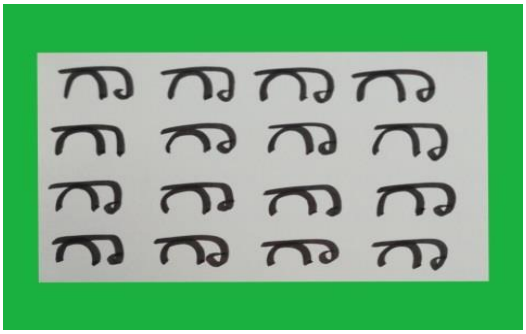

Fig3: Collection of handwriting Kaagunitha on Paper.

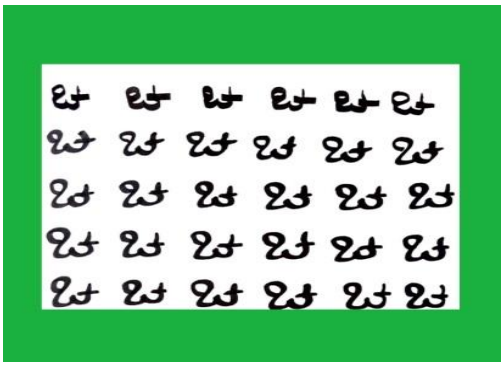

Fig4: Collection of handwriting Ottakshara on Paper.

3.2 Pre-processing

Pre-image processing is essential for improving image quality in order to create computer-generated visual algorithms. Here the collected data is subjected to the resizing. Whatever the size of input, the data will be resized to 52 X 52. Data collection is through offline, so there is need to remove noise so the image is performed with Grayscale convershion, Denoising, Contrast normalization, Binarization.

3.3 Segmentation

- The color image is converted to gray scale image.
- The threshold value is set, which helps to convert the pixel values in zeros and ones. i.e, pixel value > threshold value = 255(white)
- pixel value < threshold value = 0(black).
- Dilation is carried out with kernel comparing and padding ones to the actual image. hence, increases the white region in the image. It is used to cover the broken regions of the image.
- Next step is to find contour, it is a closed path used in object detection, analyzing the shapeetc.

It helps in cropping the objects in an image.

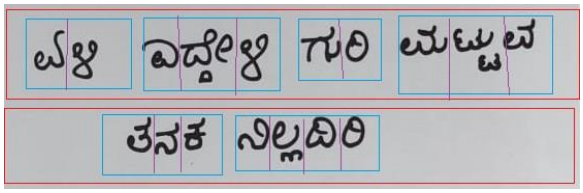

Fig5: Segmentation of character, word and Line.

In the above depicted figure 3, the character segmentation is shown in thin red line, word segmentation is stored in the thick red rectangular box. The sentence segmentation is shown in blue color rectangular box.

In the output window when the user gives the input, the segmented characters, words and sentences are saved in a folder. Lets take an example. If the image is saved as 01-02-01-0.png, it means that the segmentation is done for first sentence, second word and first character. 0 at the end tells that the is no ottakshara. If 1 is present at the end it means that there is a presence of ottakshara.

Each character extends pixel to 5 pixels towards right. So that one word is recognized. If 50 pixels are extended then it considers it as sentence. Rectangular shape is used to recognize the different words. To recognize the characters 5 pixels are extended. Image processing is the main technique that is employed here to do segmentation. Cropping is done in this process. The pixels are extended mainly to get the content of data, so that no information is lost.

After character segmentation, if the segmented characters that are stored in the folders are not properly segmented, it leads to wrong recognition of characters. Such data need to be discarded.

The data collection contains 25 characters in each folder. There will be 15,675 characters need to be segmented and saved in the respective folders. The dataset includes these characters which are shown below.

Data segmentation plays a very important role. If segmentation is done properly then the remaining next processes are easily carried out. After data collection the characters need to be segmented. The data collection contains 25 characters in each folder. There will be 15,675 characters need to be segmented and saved in the respective folders. The dataset includes these characters which are shown below.

3.4 Augmentation

Adding an image is a way for the user to improve the variety of images, which may be required in model training. Care should be taken during image enlargement to prevent excessive data overload. It is difficult to collect reliable machine data. This can be achieved by using a number of transforming techniques, such as image enhancement which includes rotation, rotation, and rotation.

Fig6: Example of Image Augmentation.

3.5 CNN

Using the CNN model, 80% of the data is used for training and 20% of the data for testing. Among the available neural network algorithms CNN is considered as the best. It consists of three layers, namely

1. Input Layer
2. Hidden Layers
3. Output Layer.

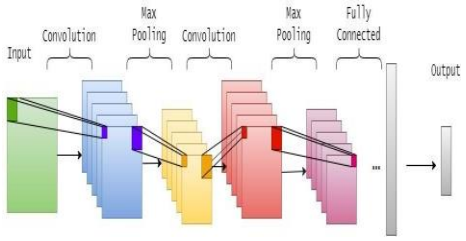

Fig7: CNN Architecture

Feature extraction and classification are done using CNN. Hidden layers in CNN are:
1.Convolution Layer
2.PoolingLayer
3.ReLU Correction Layer
4.Fully connected layer
5. Softmax layer.

3.6 Training and Testing

In the training phase 80% of the collected data is used and 20% of the data for testing. The accuracy of training and validation increases and the training and validation loss decreases.

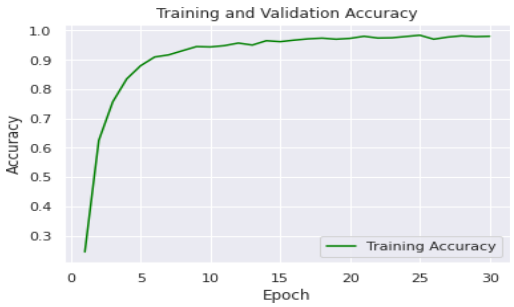

Fig8: Training and validation Accuracy.

Fig9: Training and validation loss.

4. IMPLEMENTATION AND RESULTS

The accuracy graph is constructed by placing the number of epochs on the x axis and precision on the y axis to compare the accuracy of the test and training with training and test losses.
Tkinter is integrated with Python. The steps involved from creating the window and displaying the output is discussed below:
STEP 1: Install anaconda prompt with latest version available for windows operating system.

STEP 2: copy the path where the program is kept under one folder .
STEP 3: open anaconda Prompt type- activate Kannada-enter ; cd <paste the path which is copied in previous

step>-enter ; python <file_name>.py-enter. The code starts to run, the window displays and initializes the thread counting 0(zero) until the user.

STEP 4: As said in we already collected datasets through offline mode, and upload the photo to see the output left side shows each predicted words data with thread count. The output of recognized characters is converted back to string and is shown in red color with standard Kannada text format.

STEP 5: If new input has to be written click on clear button, the thread counts 0, then user can continue writing and the steps repeat.

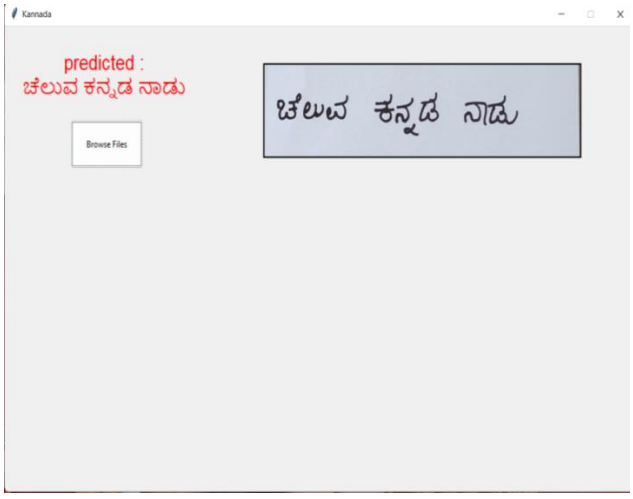

Fig10: Example of Offline handwriting recognition.

Fig11: Output displayed in notepad.

5. CONCLUSION

In our paper we introduced Offline handwriting recognition, where we collected dataset existensly and trained using CNN for classification and hence we accomplished the results having highest confidence value. Through the tkinter toolkit we developed programming on front-end for user friendly. Pre-processing and segmentation also plays important role in image analysis. This comprehensive discussion will provide a brief idea about the concepts involved in Offline Kannada handwriting recognition with latest technologies. Python being one of emerging programming language which is easy to learn and understand we have used it in our present project.

6. FUTURE SCOPE

To improve partition performance, multiple split models can be used simultaneously. It is best to reduce the number of ideas in the algorithm to make it easier and faster to work. Improved filters should be used to extract subdivision ideas in order to shorten calculation times. Use a large number of data sets to obtain good accuracy in model training.

7. ACKNOWLEDGMENT

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BIOGRAPHIES

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