IDEATION ON HANDWRITTEN DIGIT RECOGNITION SYSTEM

DESCRIPTIONS

Writing styles differs in shape and orientation from person to person that makes handwriting digit recognition a challenging task. For the development of reliable handwritten digit recognition, two steps are important. The first step is extraction of discriminating feature from handwritten images and the second method is the classification of new digit images.The handwritten images are taken from MNIST (Mixed National Institute of Standards and Technology) database. The handwritten digits from 0 to 9 are trained and then tested using supervised machine learning model. Histogram of Oriented Gradient (HOG) based features are extracted from handwritten digits. Proximal Support Vector Machine classifier is used . For classification of features of handwritten digits, classifiers like ANN, k-nearest neighbors (k-NN) and Support Vector Machine (SVM) are used. Out of these classifiers SVM is widely applicable. The main advantage of SVM classifier is high accuracy, but the classifier takes long training time.

WORKING PRINCIPLE

Normally handwritten recognition is divided into six phases which are image acquisition, pre-processing, segmentation, feature extraction, classification and post processing.

A. Image Acquisition

Digitized/Digital Image is initially taken as input. The most common of these devices is the electronic tablet or digitizer. These devices use a pen that is digital in nature. Input images for handwritten characters can also be taken by using other methods such as scanners, photographs or by directly writing in the computer by using a stylus.

B. Preprocessing

Pre-processing is the basic phase of character recognition and it's crucial for good recognition rate. The main objective of pre-processing steps is to normalize strokes and remove variations that would otherwise complicate recognition and reduce the recognition rate. The variations or distortions include the irregular size of the text, missing points during pen movement collections, jitter present in text, left or right bend in handwriting and uneven distances of points from neighboring positions. Pre-processing includes five common steps, namely, size normalization and centering, interpolating missing points, smoothing, slant correction and resampling of points.

C. Segmentation

Segmentation is done by separation of the individual characters of an image. Generally document is processed in a hierarchical way. At first level lines are segmented using row histogram. From each row, words are extracted using column histogram and finally characters are extracted from words.

D. Feature Extraction

The main aim of feature extraction phase is to extract that pattern which is most pertinent for classification. Feature extraction techniques like Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), Chain Code (CC), Scale Invariant Feature

Extraction (SIFT), zoning, Gradient based features, Histogram might be applied to extract the features of individual characters. These features are used to train the system .

E. Classification

When input image is presented to HCR system, its features are extracted and given as an input to the trained classifier like artificial neural network or support vector machine . Classifiers compare the input feature with stored pattern and find out the best matching class for input.

F. Post Processing

Post-processing refers to the procedure of correcting misclassified results by applying linguistic knowledge. Post processing is processing of the output from shape recognition. Language information can increase the accuracy obtained by pure shape recognition. For handwriting input, some shape recognizers yield a single string of characters, while others yield a number of alternatives for each character, often with a measure of confidence for each alternative.

Prerequisites

The interesting Python project requires you to have basic knowledge of Python programming, deep learning with Keras library and the Tkinter library for building GUI.

Python

Python is used for the duration of the implementation of assignment the place several traces of code had been brought in order to accomplish the assignment requirements. Python is typically used globally, and is a high-level programming language. It was once implemented in particular for application dominance, and its language shape allows software program engineers to carry thoughts in fewer traces of code. Python is a programming language which gives the chance to work shortly and more correctly organize frameworks.

Keras

Keras is used to build model to arrange the layers in the course of the implementation of this project. Keras is a high-level neural community API written in Python that can run on top of TensorFlow, CNTK, or Theano. It used to be developed with a focal point on allowing for quickly experimentation. The key to doing true lookup is being capable to go from notion to result with the least delay viable.

Keras approves for handy and speedy prototyping (through person friendliness, modularity, and extensibility). Similarly, it supports each convolutional networks

and recurrent networks, as properly as combinations of the two and runs seamlessly on CPU and GPU.

The MNIST dataset

This is probably one of the most popular datasets among machine learning and deep learning enthusiasts. The MNIST dataset contains 60,000 training images of handwritten digits from zero to nine and 10,000 images for testing. So, the MNIST dataset has 10 different classes. The handwritten digits images are represented as a 28×28 matrix where each cell contains grayscale pixel value

Building Python Deep Learning Project on Handwritten Digit Recognition

Below are the steps to implement the handwritten digit recognition project;

1. Import the libraries and load the dataset

2. Preprocess the data

3. Create the model

4. Train the model

5. Evaluate the model

6. Create GUI to predict digits

CONCLUSION

The paper discusses in detail all advances in the area of handwritten character recognition. The most accurate solution provided in this area directly or indirectly depends upon the quality as well as the nature of the material to be read. This thesis HOG-PSVM handwritten digit recognition system is presented.