Title: An experimental approach to design a system that recognize handwritten digit using python

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1 SUMMARY

Handwritten digit recognition refers to the process of providing the capability to all types of machines regarding the recognition of digital written by human. It is considered as a complex task for machine a handwritten digit are not completely perfect and easy to analyze as it varies from person to person. In this concern, the given research will focus on designing an automated system for automatically recognizing handwritten digitals using python platform (Vaidya, Trivedi, Satra, and Pimpale, 2018). This system will be designed in a manner to add ability in machines to easily recognize the digit written by a person by creating a GUI for the prediction of digits. This proposed system can be used in different areas such as recognition of ID of an individual, recognition of number plate on vehicle or bank automation also.

2 PROJECT DESCRIPTION

2.1 Main goals and objectives

2.1.1 Goals of the project

The primary goal of this project is to design a handwritten digit recognition system in order to allow machines to recognize handwritten digits in an easy manner. This project will include the development of GUI in which digits can be drawn and recognized easily (Siddique, Sakib, and Siddique, 2019). The whole study will focus on observing the handwritten digits in real time using CNN and python in order to classify them into 10 predefined classes (0-9) (Vaidya, Trivedi, Satra, and Pimpale, 2018). Main objectives of this research include:

- Designing a deep learning-based model for automatically recognizing digits 0 to 9
- Create an attractive GUI to allow users to write digit, which will be recognized by the system and display on the screen

2.1.2 What is your proposed project trying to achieve

The project will generate significant outcomes as the system will be introduced to allow machines to train or recognize the handwritten digits. These digits are not of same size, orientation, width and justified to margins because handwritten digits differ from writing one individual to another. So, it has become a major problem to classify the digits due to similarity between several digits such as 5, 2 and 5; 1 and 7 and others (Baldominos, Saez, and Isasi, 2019). This type of problem is mainly faced when many people write only single digit with different handwritings. So, the system to be proposed in this project will help in eliminating this problem by automatically recognizing the digits written by different people.

2.1.3 Significance or need of the project

The given project will focus on improving the capabilities of current systems or machines by adding the feature of automatically recognizing the digits handwritten by a person. It will also help in making machines smarter and intelligent than humans. GUI (Graphical user interface) will be designed in this project with the help of which an individual can easily draw or recognize the digit (Siddique, Sakib, and Siddique, 2019).

2.2 Main functionality and characteristics

2.2.1 High level requirements and characteristics

a. Designing architecture using deep neural network models based on the chosen dataset.
b. Use GPU for improving the overall speed of the training.
c. Pre-trained neural networks such as VGG and Res-Net

2.2.2 Mid- level of more details requirements

The mid-level details requirements include:

a. Python modules and packages
b. Tensor flow and keras framework
c. Anaconda and jupyter notebooks

d. Tkinter for GUI implementation

2.3 INTENDED AUDIENCE

Intended audience for the given project is as follows:

Companies designing mobile devices with hand recognition system: Organizations dealing in the development of mobile devices with handwritten recognition feature can be an intended audience for this project. It will provide them efficient solution, which can be integrated in their mobile devices to enable users to write digits with the use of their finders or attached pen, which will easily be recognized as a proper digit from 0-9 (Siddique, Sakib, and Siddique, 2019).

Banking: The proposed system can also be used by banks to understand the amount filled by customers in their cheques for further process, which can be sometimes difficult to read or enter manually. The system will automatically scan the digit from the cheque through scanning and automatically update it into the database.

2.4 CHALLENGES AND OBSTACLES

A number of challenges and obstacles could be encountered during the development of this project as discussed below:

- **Development of GUI frame**: During the development of the project, there might be a possibility that the GUI frame may not be developed in proper manner, which can reduce the chances of recognizing digits by system in the end or impact the overall quality of the project (Siddique, Sakib, and Siddique, 2019).
- **Lack of communication between team**: Due to lack of communication between all the team members, it can be hard to make effective decisions for the completion of project as per the requirements such as features, functionalities, time, cost, quality etc.
- **Less familiar with Tensorflow**: We would like to enhance our skills in Tensor flow technology, to maintain the quality throughout the development.

2.5 TECHNOLOGY DESCRIPTION

Hardware : Configured Laptop having minimum 4gb RAM and 20 GB Memory.

Software : Anaconda, Jupyter notebook, Python 3

Technology Used : Tensorflow, Keras, Dlib

2.6 TEAM OVERVIEW

Team members	Biography Information	Specific skills	Expected involvement
Jeshwanth Reddy Katta	Electronics and communication engineer, worked on IOT based monitoring and controlling based industrial parameters using Raspberry PI and CORDIC algorithm.	C, Python, Numpy , Java	To collect the required dataset and other tools and software required for the project
Saikrishna Reddy Kotha	BTech in Computer science, Previously worked projects are time series forecasting , sentiment analysis and chatbot	Python, Tkinter, JavaScript, NumPy, TeaensorFlow,	Prepare proposal and coding of the proposed system
Abhishek Raj Sampath	Bachelors in Computer science, Academic Projects are US Airlines Tweets Sentiment Analysis and Analyzing Financial Time Series with Big Query and Cloud Data lab	Python, java , JavaScript , C++ , R	Perform system testing and evaluation to demonstrate the findings

3 PAPER DIFFERENTIATORS

3.1 COMPETITIVE ANALYSIS

A number of papers have been seen related to the chosen project from which a huge amount of information has been gathered. In the similar concern, (Pashine, Dixit, and Kushwah, 2021) proposed a system capable to deal with inheriting different aspects associated with the deep

learning technique where network is developed for the purpose of identifying and extracting digits from images consisting of distinct characteristics. The proposed system also has capability to detect digits with 83% of accuracy and characters of 97% accuracy. The findings of this paper shows that the proposed system can be deployed in processing bank statement where handwriting of each individual is ambiguous. In addition to this, (Alwzwazy, et al., 2016) also aimed at constructing an appropriate machine to deal with complex handwritings and digits personally. In order to develop this system or machine, the author used machine learning and neural networks by defining that these techniques can provide high accuracy in terms of recognizing digits.

After reading these papers, this research project is proposed to introduce an efficient system using deep neural network models able to provide better accuracy than the machines or systems proposed in published papers. In addition, the project will also focus on creating simple and attractive GUI, which can be easy to deploy or understand by every user as per the requirement.

3.2 COMPETITIVE ADVANTAGES

The system to be proposed in this project using deep neural network models will be developed by considering simplicity and attractiveness. In addition to this, it will provide high accuracy to recognize the handwritten digits as compared to other systems used for handwriting recognition system. In this project, GUI will be designed where the user will input the digit by hand and the model will recognize the digit by displaying the similar digit (Vaidya, Trivedi, Satra, and Pimpale, 2018). This model can also be integrated into mobile devices to enable the users to draw the digit, which will automatically be recognized by the machine itself.

4 TIME WORKED

Jeshwanth Reddy Katta :- Gathered the required background information , main functionality and characteristics , collecting the technical requirements like software , tools , then creating the GUI for the project (future implementation) ,preparation of the proposal. Worked around 20 hours of the project.

Saikrishna Reddy Kotha :- Identify the problems then defining the main goals and objectives , project scope , selection of required dataset for the project then using libraries and dataset for training and testing the data and creating a deep learning model(future implementation) and preparation of the proposal whereas worked around 25 hours

Abhishek Raj Sampath : Gathering the data for the intended audience , evaluating the proposed papers results and making a conclusion from the papers , Testing, and evaluating the model then demonstrating the results from the model(future implementation) that we created for this project and preparing the final report moreover worked around 22 hours.

5 REFERENCES

Alwzwazy, H.A., Albehadili, H.M., Alwan, Y.S. and Islam, N.E., 2016. Handwritten digit recognition using convolutional neural networks. International Journal of Innovative Research in Computer and Communication Engineering, 4(2), pp.1101-1106.

Pashine, S., Dixit, R. and Kushwah, R., 2021. Handwritten Digit Recognition using Machine and Deep Learning Algorithms. arXiv preprint arXiv:2106.12614.

Vaidya, R., Trivedi, D., Satra, S. and Pimpale, M., 2018, April. Handwritten character recognition using deep-learning. In 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT) (pp. 772-775). IEEE.

Siddique, F., Sakib, S. and Siddique, M.A.B., 2019, September. Recognition of handwritten digit using convolutional neural network in python with tensorflow and comparison of performance for various hidden layers. In 2019 5th International Conference on Advances in Electrical Engineering (ICAEE) (pp. 541-546). IEEE.

Baldominos, A., Saez, Y. and Isasi, P., 2019. Hybridizing evolutionary computation and deep neural networks: an approach to handwriting recognition using committees and transfer learning. Complexity, 2019.