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# **Mini Project Report**

on

## **(Hindi) Hand Written Character Recognition**

### **Using Deep Learning**

**(CSE VI Semester Mini project)**

**2021-2022**



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**GRAPHIC ERA HILL UNIVERSITY, DEHRADUN**

## **CERTIFICATE**

Certified that Mr. Pawan Singh Chaudhary (University ID-1918533) has developed a mini project on “**(Hindi) Hand Written Character Recognition**” Using Deep Learning, for the CSE VI Semester Mini Project in Graphic Era Hill University, Dehradun. The project carried out by the student is his own work as best of my knowledge.

Date: 29-06-2022

Mr. Aniruddha Prabhu B.P.

(Class Coordinator-CSE-F-VI-Sem)

GEHU, Dehradun

## **ACKNOWLEDGEMENT**

Firstly, I would like to thank my parents for their endless support and encouragement. I also wish to thank them for providing me with the opportunity to reach this far in my studies.

Secondly, I would like to thank particularly our project Co-ordinator Mr. Aniruddha Prabhu B.P. sir, for his patience, support and encouragement throughout the completion of this project and having faith in me.

At last, but not the least I greatly indebted to all other persons who directly or indirectly helped me during this work.

**Mr. Pawan Sing Chaudhary**

**University ID- 1918533**

**CSE-F-VI-Sem**

**Session: 2021-2022**

**GEHU, Dehradun**

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# INTRODUCTION

Automatic character recognition is a process that converts scanned document images into electronically understandable format. Thus, enabling computers to recognize text present in images. The latest advancements in technology have highlighted the need for robust methods of automatic character recognition. There are techniques which have been implemented for Hindi character recognition as discussed in next section but there was a need of more complete and modern architecture for recognition. Thus, this article uses deep learning concepts for character recognition.

Many artificial intelligence tasks can be solved by identifying the right set of features, and then providing these features to classifier. For example, estimating the size of speaker's vocal tract is a useful feature for speaker identification, estimating pressure points and pen up and down movements are useful feature for online handwriting recognition. However, for many tasks, it is difficult to identify the right set of features. The solution to this problem is deep learning, also called end-to end learning. It is called end-to-end learning because feature extraction and classification phase is automatically done, unlike traditional machine learning, where features are to be explicitly specified. Deep architectures have provided to solutions to some well-known problems of pattern recognition which are mental load classification, speech recognition, document recognition, object detection, scene classification, pedestrian detection etc.

Devanagari is an Indic script and forms a basis for over 100 languages spoken in India and Nepal including Hindi, Marathi, Sanskrit, and Maithili. It comprises of 47 primary alphabets, 14 vowels, and 33 consonants, and 10 digits. In addition, the alphabets are modified when a vowel is added to a consonant. There is no capitalization of alphabets, unlike Latin languages.

## 1.1 ABOUT PROJECT

we present a **handwritten Hindi character recognition system** based on different Deep learning technique. Handwritten character recognition plays an important role and possible applications in assisting technology for blind and visually impaired users, human–robot interaction, automatic data entry for business documents, etc. In this work, we propose a technique to recognize handwritten Hindi characters using deep learning approaches like **Convolutional Neural Network (CNN)**. This is a Character Recognition System which I developed for Devanagari Script.

## 1.2 ABOUT PYTHON

Python is a general-purpose programming language, so it can be used for many things. Python is used for web development, AI, machine learning, operating systems, mobile application development, and video games.



Python Logo: [python.org](https://python.org)

A successor to the ABC programming language, Python is a high level, dynamically typed language developed by Guido Van Rossum in the early 1980s. In the intervening years, Python has become a favourite of the tech industry, and it has been used in a wide variety of domains

Python is used to develop:

- Web applications
- Calculators
- Operating Systems
- Desktop applications
- Mobile applications
- Fintech

Python is a relatively easy programming language to learn and follows an organized structure. This, combined with its versatility and simple syntax, makes it a fantastic programming language for all sorts of projects.

Why Use Python?

- Readable and Maintainable Code
- Multiple Programming Paradigms
- Compatible with Major Platforms and Systems
- Robust Standard Library
- Many Open-Source Frameworks and Tools
- Simplify Complex Software Development
- Adopt Test Driven Development

## 1.3 About Anaconda IDE



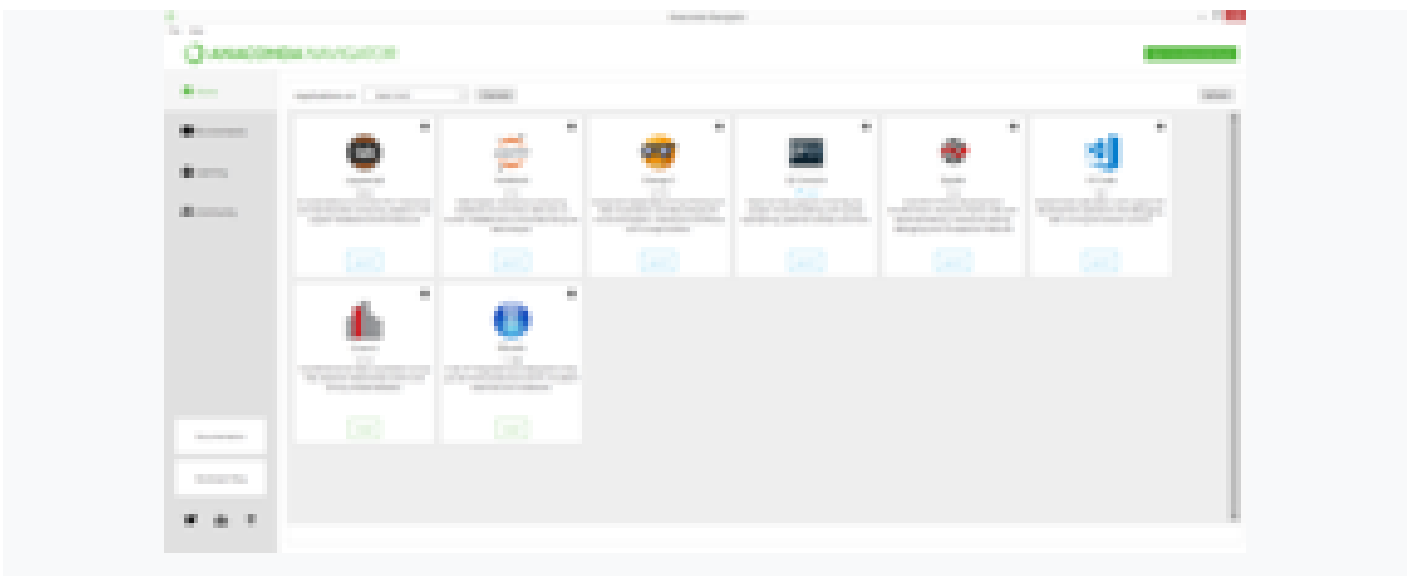
Anaconda is a distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), that aims to simplify package management and deployment.

Package versions in Anaconda are managed by the package management system conda. This package manager was spun out as a separate open-source package as it ended up being useful on its own and for things other than Python. There is also a small, bootstrap version of Anaconda called Miniconda, which includes only conda, Python, the packages they depend on, and a small number of other packages.

**Anaconda distribution** comes with over 250 packages automatically installed, and over 7,500 additional open-source packages can be installed from PyPI as well as the conda package and virtual environment manager. It also includes a GUI, **Anaconda Navigator**, as a graphical alternative to the command-line interface (CLI).

The big difference between conda and the pip package manager is in how package dependencies are managed, which is a significant challenge for Python data science and the reason conda exists.

### Anaconda Navigator





## Anaconda Navigator

Anaconda Navigator is a desktop graphical user interface (GUI) included in Anaconda distribution that allows users to launch applications and manage conda packages, environments and channels without using command-line commands. Navigator can search for packages on Anaconda Cloud or in a local Anaconda Repository, install them in an environment, run the packages and update them. It is available for Windows, macOS and Linux.

The following applications are available by default in Navigator:

- JupyterLab
- Jupyter Notebook
- QtConsole
- Spyder
- Glue
- Orange
- RStudio
- Visual Studio Code

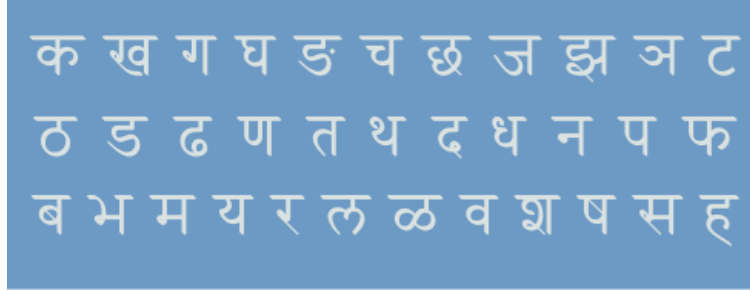
## Conda

Conda is an open source cross-platform, language-agnostic package manager and environment management system that installs, runs, and updates packages and their dependencies. It was created for Python programs, but it can package and distribute software for any language (e.g., R), including multi-language projects. The conda package and environment manager is included in all versions of Anaconda, Miniconda, and Anaconda Repository.

# PROJECT

## What is Devanagari?

An alphabet usually employed for Sanskrit and used as a literary hand for various modern languages of India

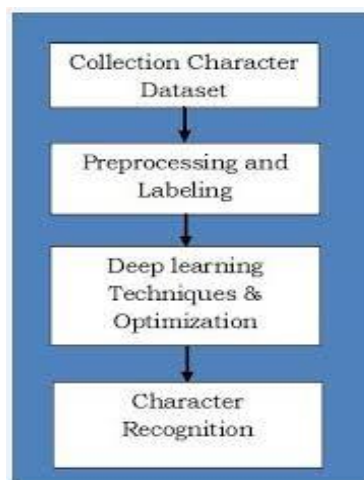


## Goals

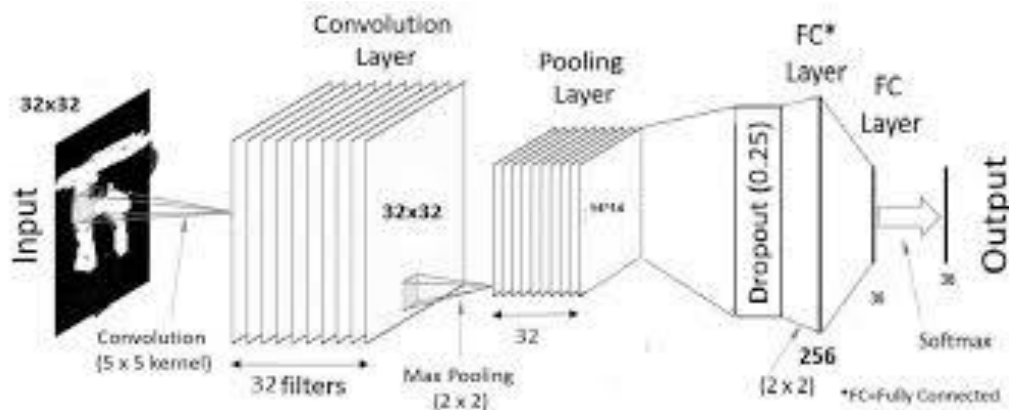
1. Get a proper insight into the target product/element.
2. Proper classify for a better understanding of the situation about the general public.
3. Getting real-time classification of images

## Convolutional neural network

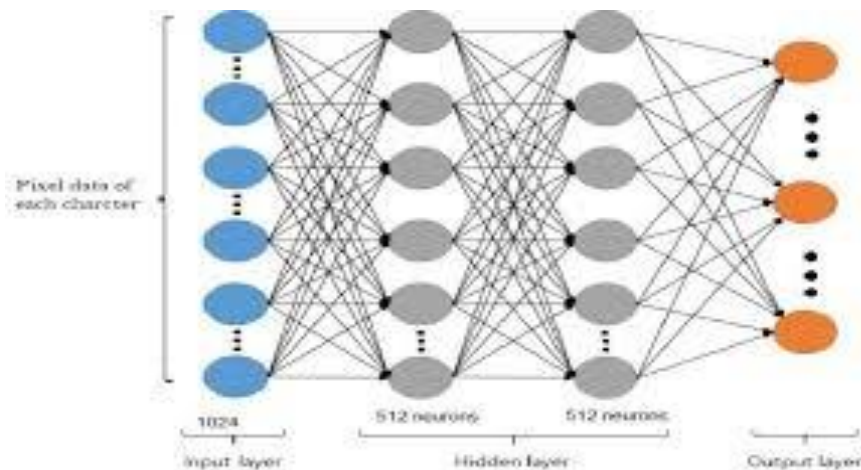
Computer Vision and pattern recognition is a major growing field in area of image processing. In that Convolutional Neural Network (CNNs) plays major role in computer vision. CNN is working on many applications in Image Classification and it is the core of most Computer Vision and pattern recognition systems today, from automatic tagging of photo in Face books to self-driving cars, recognizes digits, alpha-numerals, traffic signal boards, and the other object class. We used five layered Convolutional Neural Networks (CNN) model. On them one layers for convolutional, one layers for max pooling or sub sampling, one Flatten layer which converts 2D array into 1D array and finally two fully connected layers for classification. The initial layer is convolutional (Conv2D) layer has 32 output mapping and the next max pooling layer has 14 output mapping.



**Block diagram of proposed handwritten character recognition system.**



The overall structural design of the CNN Model of our proposed system with different layer.



The overall structural design of the DFFNN Model of our proposed system with different layer.

**Deep feedforward networks, also often called feedforward neural networks, or multilayer perceptrons (MLPs), are the quintessential deep learning models.**

## 2.1 Code Requirements

1. you can install Conda for python which resolves all the dependencies for machine learning.
2. install tensorflow , in conda -> \$ conda install tensorflow
3. install keras , in conda -> \$ conda install keras
4. install opencv , in conda -> \$ conda install opencv
5. handWritingRecognition.py require data set data.csv for training and test
6. application.py require devanagari\_model.h5 model for classify the characters.

```
Anaconda Powershell Prompt (anaconda3)
(base) PS C:\Users\hp> conda env list
# conda environments:
#
base                * C:\Users\hp\anaconda3
test                C:\Users\hp\anaconda3\envs\test

(base) PS C:\Users\hp> conda activate test
(test) PS C:\Users\hp> conda list
# packages in environment at C:\Users\hp\anaconda3\envs\test:
#
# Name                   Version            Build    Channel
blas                     1.0                mkl
certifi                  2021.5.30          py36haa95532_0
intel-openmp             2022.0.0           haa95532_3663
keras                    2.6.0              pyhd3eb1b0_0
mkl                      2020.2             256
mkl-service              2.3.0              py36h196d8e1_0
mkl_fft                  1.3.0              py36h46781fe_0
mkl_random               1.1.1              py36h47e9c7a_0
numpy                    1.19.2             py36hdc3359_0
numpy-base               1.19.2             py36ha3acd2a_0
opencv-python            3.4.17.63          pypi_0    pypi
pip                      21.2.2             py36haa95532_0
python                   3.6.13             h3758d61_0
setuptools               58.0.4             py36haa95532_0
six                      1.16.0             pyhd3eb1b0_1
sqlite                   3.38.5             h2bbff1b_0
vc                        14.2               h21ff451_1
vs2015_runtime           14.27.29016        h5e58377_2
wheel                    0.37.1             pyhd3eb1b0_0
winertstore              0.2                py36h7fe50ca_0
(test) PS C:\Users\hp>
```

## 2.2 Architecture

CONV2D --> MAXPOOL --> CONV2D --> MAXPOOL --> FC --> Softmax --> Classification

### Technique Used

I have used convolutional neural networks. I am using Tensorflow as the framework and Keras API for providing a high level of abstraction.

### Python Implementation

- 1.Dataset- DHCD (Devanagari Character Dataset)
- 2.Images of size 32 X 32
- 3.Convolutional Network Support added.

## Experimental Outcomes

### Experimental Values:

- Training Size: 70000 with 8 Epochs
- Accuracy: 95%
- Test Set Size: 2001
- Accuracy: 92%

# CONCLUSION

## 3.1 SUMMARY

- Handwritten character recognition plays an important role and possible applications in assisting technology for blind and visually impaired users, human–robot interaction, automatic data entry for business documents, etc.
- Convolutional Neural Network (CNNs) plays major role in computer vision
- OpenCV is the most popular library for computer vision. Originally written in C/C++, it now provides bindings for Python. OpenCV uses machine learning algorithms to search for faces within a picture. Because faces are so complicated, there isn't one simple test that will tell you if it found a face or not.

## 3.2 FUTUREWORKS

Keeping in view the current project, I would like to ensure that with a little bit of study and more of practical evaluation, this project can be developed to a greater extent and can be made more user friendly and not only that it can be made interesting by improving GUI but also new feature like “**Character precision**” using various libraries & functions to the **handwritten Hindi character recognition system**.

# REFERENCE

1. Python from: <https://www.python.org/> (version 3.6)
2. Anaconda IDE: <https://www.anaconda.com/products/distribution>
3. Books:
  - Learn Python the Hard Way: 3rd Edition.
  - Python Programming: An Introduction to Computer Science (3rd Edition)
  - Deep learning with Python Written by Mark Graph

-----Thank You-----