PROJECT REPORT

A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION

SUBMITTED BY:PNTMID202235141

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CHAPTER 1

INTRODUCTION

HANDWRITTEN DIGIT RECOGNITION is the ability of a computer system to recognize the handwritten inputs like digits, characters etc. from a wide variety of sources like emails, papers, images, letters etc. This has been a topic of research for decades. Some of the research areas include signature verification, bank check processing, postal address interpretation from envelopes etc. Here comes the use of Deep Learning. In the past decade, deep learning has become the hot tool for Image Processing, object detection, handwritten digit and character recognition etc. A lot of machine learning tools have been developed like scikit-learn, scipy-image etc. and pybrains, Keras, Theano, Tensorflow by Google, TFLearn etc. for Deep Learning. These tools make the applications robust and therefore more accurate. The Artificial Neural Networks can almost mimic the human brain and are a key ingredient in image processing field. For example, Convolutional Neural Networks with Back Propagation for Image Processing, Deep Mind by Google for creating Art by learning from existing artist styles

1.1.PROJECT OVERVIEW

Handwriting Recognition has an active community of academics studying it. The biggest conferences for handwriting recognition are the International Conference on Frontiers in Handwriting Recognition (ICFHR), held in even-numbered years, and the International Conference on Document Analysis and Recognition (ICDAR), held in odd-numbered years. Both of these conferences are endorsed by the IEEE. Active areas of research include: Online Recognition, OfflineRecognition, Signature Verification, Postal-Address Interpretation,Bank-Check Processing, Writer Recognition. Classification of images and patterns has been one of the major implementation of Machine Learning and Artificial Intelligence. People are continuously trying to make computers intelligent so that they can do almost all the work done by humans Handwriting recognition system is the most

basic and an important step towards this huge and interesting area of Computer Vision.

1.2.PURPOSE

Handwriting recognition plays a big role in the technology world now. It also plays an important role in the storage and in the recovery of critical handwriting information. This handwriting recognition ensures an accurate medical care and it also reduces storage costs. It ensures that an essential field of research remains available to students in the future. In this era of globalization, technologies continue to improve and improve more in no time.NestorWriter was the first handwriting recognition device found. The one who started the NestorWriter is Dr. Charles Elbaum and he is the one who also developed the NestorWriter. This all happen at the beginning, when many other companies tried to develop these devices and machines all through the years of 1990’s. But most of the companies failed, but the devices didn’t improve that much as they wanted.

CHAPTER 2

LITERATURE SURVEY

Handwriting recognition has gained a lot of attention in the field of pattern recognition and machine learning due to its application in various fields. Optical Character Recognition (OCR) and Handwritten Character Recognition (HCR) has specific domain to apply. Various techniques have been proposed to for character recognition in handwriting recognition system. Even though, sufficient studies and papers describes the techniques for converting textual content from a paper document into machine readable form. In coming days, character recognition system might serve as a key factor to create a paperless environment by digitizing and processing existing paper documents.

2.1 EXISTING PROBLEM

Deep Learning has emerged as a central tool for self-perception problems like understanding images, voice from humans, robots exploring the world. The project aims to implement the concept of Convolution Neural Network which is one of the important architecture of deep learning. Understanding CNN and applying it to the handwritten recognition system, is the major target of the proposed system . There is a reason behind using CNN for handwritten digit recognition. Let us consider a multi-layer feedforward neural network to be applied on MNIST dataset which contains images of size 28×28 pixels (roughly 784 pixels). So if a hidden layer has about 100 units, then the first layer weights comes up to about 78k parameters, which is large but manageable. However, in the natural world the size of the image is much larger . If we consider the size of the typical image which is around 256×256 pixels (roughly about 56,000 pixels), then the first layer weights will have about 560k parameters! So that becomes too many parameters and hence make it unscalable for real images. Hence, it will be so large that it will become very difficult to generalize the new data fed into the network.

Convolution Neural Network extracts the feature maps from the 2D images by applying filters and hence making the task of feature extraction from the images easier. Basically, convolution neural network considers the mapping of image pixels with the neighbourhood space rather than having a fully connected layer of neurons. Convolution Neural Networks has been proved to be a very important and powerful tool in signal and image processing.

2.2 REFERENCES

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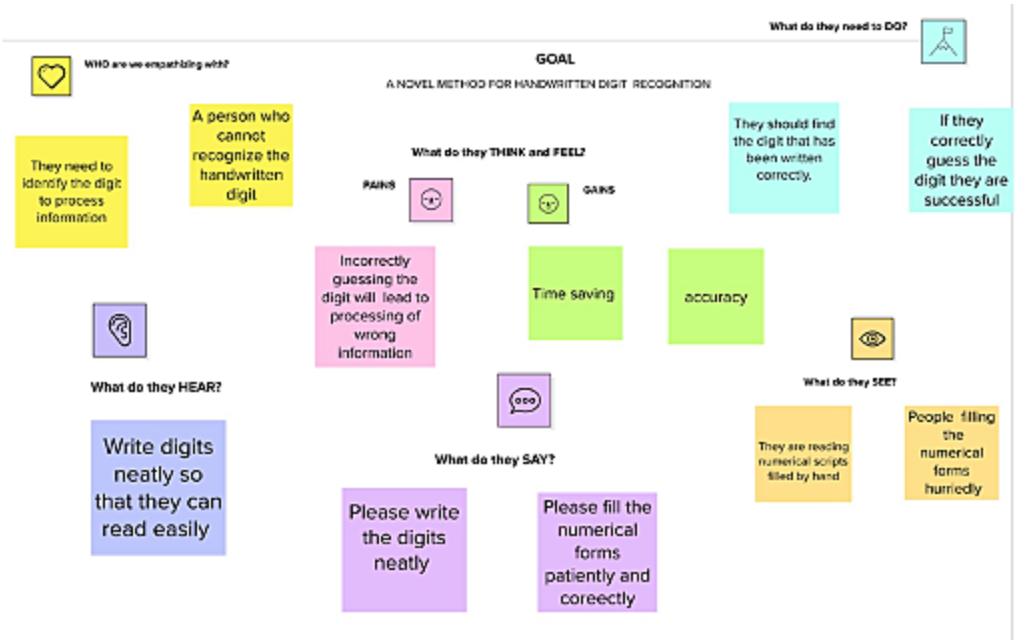
[8] Y. LeCun, L. Bottou, Y. Bengio, and P. Haffner, "Gradientbased learning applied to document recognition," Proceedings of the IEEE, vol. 86, no. 11, pp. 2278-2324, 1998. [9] R. Hecht-Nielsen, "Theory of the backpropagation neural

network," in Neural networks for perception: Elsevier, 1992, pp.

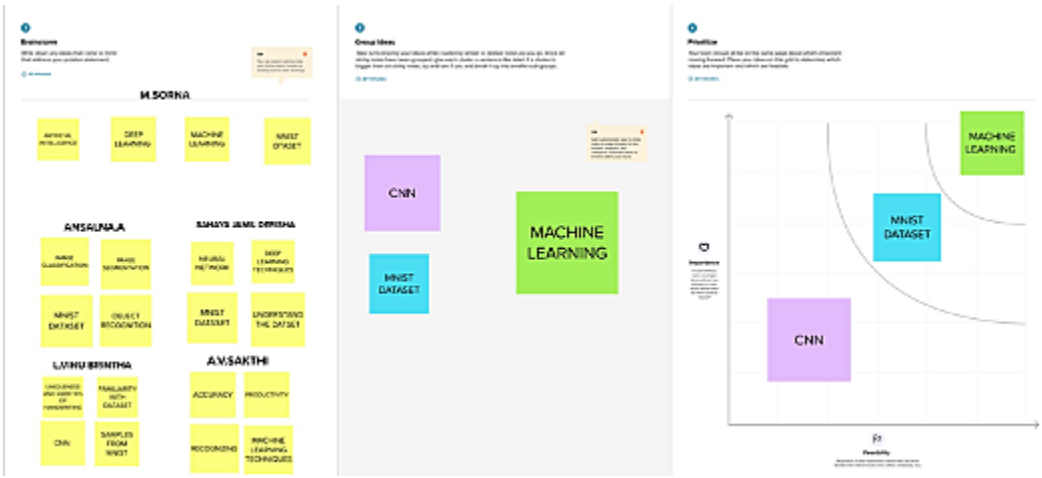
2.3.PROBLEM STATEMENT DEEFINITION

3.IDEATIONS AND PROPOSED SOLUTION

3.1 EMPHATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING



3.3 PROPOSED SOLUTION

Project Title: A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION SYSTEM

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID35141

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS
Bank employee reading cheques

6. CUSTOMER CONSTRAINTS CC
The customers can easily recognise digits by installing this software in their mobile phones

5. AVAILABLE SOLUTIONS AS
Automatic digit recognition system
Often the predictions made by human is not accurate which leads to processing of wrong information

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS J&P
Everyone has a unique handwriting so it is difficult for the computer to guess the digits correctly

9. PROBLEM ROOT CAUSE RC
Every human has their own unique handwriting styles which is difficult to be interpreted by the computer

7. BEHAVIOUR BE
To identify and classify digits accurately which can help us avoid problems and confusions

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS TR
Confidently make transaction or proceed steps without any doubts

4. EMOTIONS: BEFORE / AFTER EM
In case of doubt the user can utilize the digit recognition system to process correct information

10. YOUR SOLUTION SL
CNN model can be used to solve this problem by accurate image recognition techniques without loss of information.By this way the handwritten digits can be converted to machine readable

8. CHANNELS of BEHAVIOUR CH
ONLINE
The customers can download this software in their mobile phones
OFFLINE
They can take a photo process it and recognise the digits

Identify strong TR & EM

3.4.Proposed Solution Fit:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A novel method for handwritten digit recognition system
2.	Idea / Solution description	The proposed system uses CNN based model and trained using MNIST dataset
3.	Novelty / Uniqueness	CNN model provide more accurate analysis alongwith image and voice recognition,which can be especially useful for blind,differently abled and elder people
4.	Social Impact / Customer Satisfaction	Customers will no longer have to depend on any external system as this software can be easily installed in their mobile phones
5.	Business Model (Revenue Model)	Input module, image processing and segmentation module, feature extraction, dataset training module etc
6.	Scalability of the Solution	An accuracy of 99.98% can be obtained by training this model using MNIST dataset. The accuracy can be further increased by training with other types of dataset additionally

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CHAPTER 4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story/ Sub-Task)
FR-1	The product essentially convertshandwritten digits to digital form.	The user is first asked to draw a number on the canvas, and the model that is built is thenutilised to compare the data and provide an output in digitalized form.
FR-2	Recognizing thehandwritten digit and displaying.	Recognizing the handwritten digitand displaying.
FR-3	Import dataset file directly to theprogram from a command that will download the dataset from its website. Savethe dataset file in the same directory as theprogram	Installing packages and applications.
FR-4	Builda Neural Network witha number of nodes in the input layer equal to the number of pixelsin the arrays	Nil
FR-5	Activating the Neural Network	Packages – tensorflow

4.2 NON FUNCTIONAL REQUIREMENTS

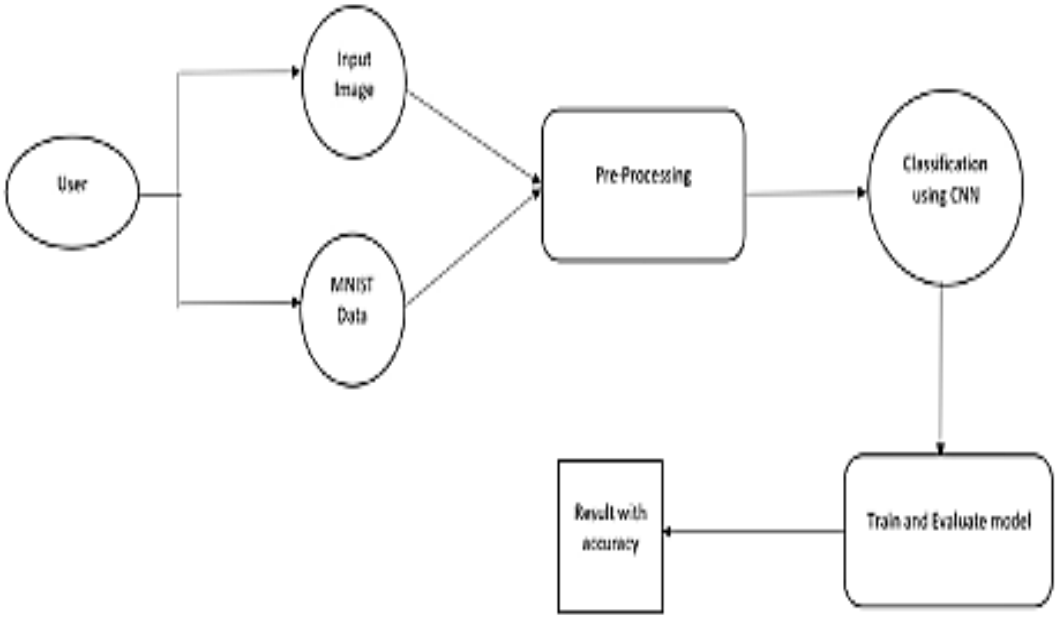
Following are the non-functional requirements of the proposedsolution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	System design should be easily understood and user friendly to users. Furthermore, users of all skill levels of users should be able to navigate it withoutproblems.
NFR-2	**Security**	The system should automatically be able to authenticate all users with their uniqueusername and password
NFR-3	**Performance**	Should reducethe delay in information whenhundreds of requests are given.
NFR-4	**Availability**	Information is restricted to each users limited access
NFR-5	**Scalability**	the system should be able to handle 10000 usersaccessing the site at the same time

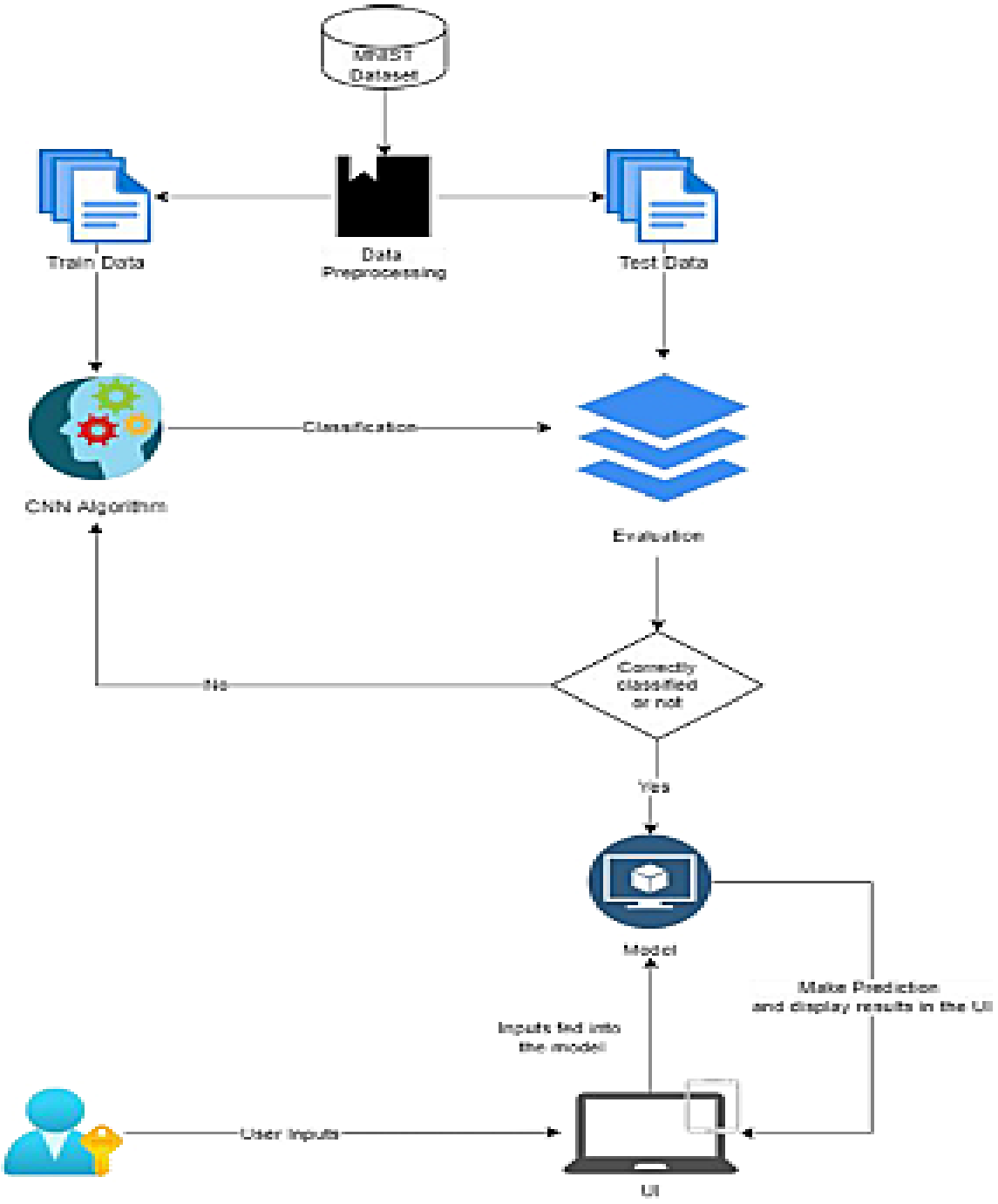
CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

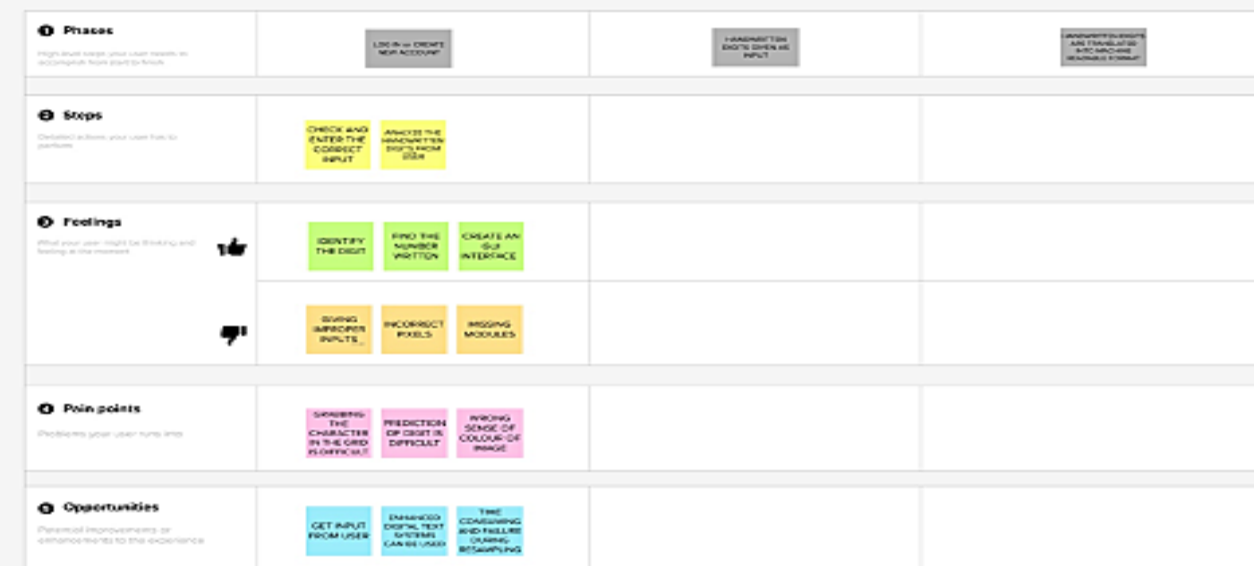


5.2. SOLUTION AND TECHNICAL ARCHITECTURE



5.3 USER STORIES

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.



CHAPTER 6

PROJECT PLANNING AND SCHEDULING

Handwriting recognition is one of the compelling research works going on because every individual in this world has their own style of writing. It is the capability of the computer to identify and understand handwritten digits or characters automatically. Because of the progress in the field of science and technology, everything is being digitalized to reduce human effort. Hence, there comes a need for handwritten digit recognition in many real-time applications. MNIST data set is widely used for this recognition process and it has 70000 handwritten digits. We use Artificial neural networks to train these images and build a deep learning model. Web application is created where the user can upload an image of a handwritten digit. this image is analyzed by the model and the detected result is returned on to UI

6.1 SPRINT PLANNING AND ESTIMATION

-

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

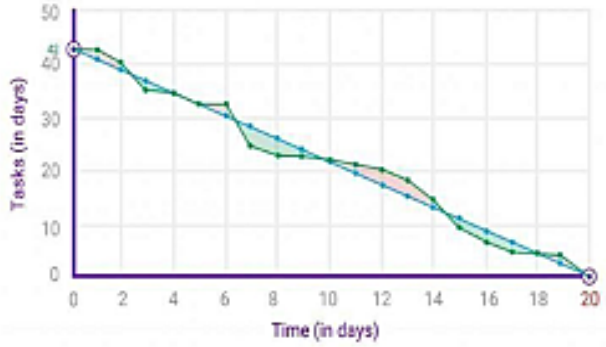
-

Velocity:
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

Average Velocity = 20 / 6 = 3.33

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.2.SPRINT DELIVERY SHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	USN-1	As a user, I can collect the dataset from various resources with different handwritings.	10	Low	ANSALNA, DERISHA, SORNA
Sprint-1	Data Preprocessing	USN-2	As a user, I can load the dataset, handling the missing data, scaling and split data into train and test.	10	Medium	SAKTHI, VINU
Sprint-2	Model Building	USN-3	As a user, I will get an application with ML model which provides high accuracy of recognized handwritten digit.	5	High	VINU, ANSALNA
Sprint-2	Add CNN layers	USN-4	Creating the model and adding the input, hidden, and output layers to it.	5	High	ANSALNA, SAKTHI, SORNA

Sprint-2	Compiling the model	USN-5	With both the training data defined and model defined, it's time to configure the learning process.	2	Medium	SORNA, SAKTHI
Sprint-2	Train & test the model	USN-6	As a user, let us train our model with our image dataset.	6	Medium	SORNA, SAKTHI
Sprint-2	Save the model	USN-7	As a user, the model is saved & integrated with an android application or web application in order to predict something.	2	Low	SORNA
Sprint-3	Building UI Application	USN-8	As a user, I will upload the handwritten digit image to the application by clicking a upload button.	5	High	ANSALNA, DERISHA
Sprint-3		USN-9	As a user, I can know the details of the fundamental usage of the application.	5	Low	SAKTHI
Sprint-3		USN-10	As a user, I can see the predicted / recognized digits in the application.	5	Medium	VINU, SAKTHI
Sprint-4	Train the model on IBM	USN-11	As a user, I train the model on IBM and integrate flask/Django with scoring end point.	10	High	SAKTHI, DERISHA
Sprint-4	Cloud Deployment	USN-12	As a user, I can access the web application and make the use of the product from anywhere.	10	High	SORNA, SAKTHI, VINU, ANSALNA

CHAPTER 7

CODING AND SOLUTION

7.1 FEAUTURE 1

Preprocessing includes steps that are required to shape the input image into a form suitable for segmentation. Colour image is converted into grayscale image transform into binary image that means in the form of black in white image.
As each colour pixel is described by a triplet (R,G,B) of intensities for red, green and blue colour. we can map that to a single number giving a grayscale value. There are many approaches to convert colour image into grayscale. Here average method is used for colour to grayscale conversion.

7.2 .FEATURE 2

Once image pre-processing is done itis necessary to segment document into lines, lines into words and words into characters. When characters has been extracted from document we can extract features from it for recognition. Segmentation of image is performed to separate the characters from the image. Characters separation from the input image involves three steps as:

- Line Segmentation
- Word Segmentation
- Character Segmentation

CHAPTER 8

TESTING

The testing part comes with some latest real time update in the machine learning part .The image processing work like webcam access and the other techniques has been discussed before that is why it has not been discussed here. So this part comes with some ransom upgrade of the technique which is very small to say but not that much easy to design.

8.1 TEST CASES

1. To make things shorter what has been done in this model- 1) Loaded self created data and MNIST dataset into the model
2. Set the numpy array system to take input the kernel along with the data.
3. Create the neural network model setting the input layer and the number of hidden layers and the output layers along with the activation functions used in different layers.
4. Set the probabilistic statistical value into the biased dataset into unbiased. 22
5. Check the target and the output predicted value every time while training the dataset and set the number of epochs corresponding to the error.
6. Model check with checksum value removal and biased value removal after setting the weight value by the neural network on its set and set the dataset into the unbiased.
7. Access the webcam and capture the image using python javascript and

google colab display.

8. Check the parameter of probability of the figure after normalisation and noise removal and scaling.
9. Got highest predicted value? match the figure with the detected from the neural

8.2 USER ACCEPTANCE TESTING

This is a type of system or software testing where a system has been tested for availability. The purpose of this test is to check the business requirements and assess whether it will be accepted for delivery. In this part ADRIAN of pyrimagsearch has been referred to, who worked with the same platform and to check this project accepted by the delivery partner or not

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	5	2	3	20
Duplicate	1	0	3	0	4
External	2	5	0	1	8
Fixed	10	3	2	18	33
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	23	18	11	24	76

Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	62	0	0	58
Security	4	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	7	0	0	7
Final Report Output	3	0	0	3
Version Control	6	0	0	5

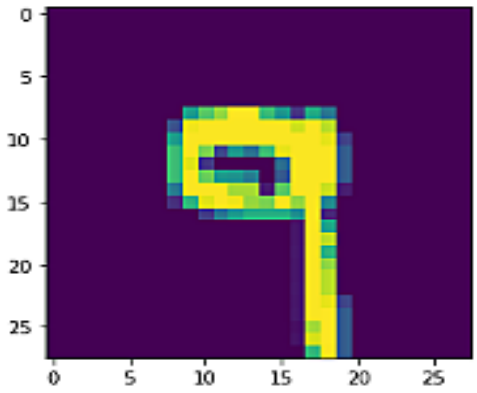
CHAPTER 9

RESULTS

We do not considerour results to be flawless,as with any study or project undertaken in the field ofmachine learning and image processing.

There is always opportunity for improvement in your methodsbecause machine learningis a topicthat is continually developing; there will always be a fresh new idea that solves the same problembetter. Three models were used to test the application: Multi-Layer Perceptron (MLP), Convolution Neural Network, and (CNN). We obtain a different classifier accuracy with each model, indicating which is superior.

```
In [64]: plt.imshow(x_test[6000])
Out[64]: <matplotlib.image.AxesImage at 0x1cc49df97c0>
```




```
In [65]: print(np.argmax(prediction, axis=1))
         [9]
```

The network's training resultsare saved in npz formatso that the programme won't have to repeat the training processeach time a user triesto recognise a digit. We employed a logistic classifier, theSoftMax function, one hot encoding, cross entropy, and loss minimization with mini batch gradientdescent for classification. These are some of the fundamentals of neural networks that must be understood in order to process output from the network and present it to the user in an

understandable manner.

9.1 PERFORMANCE METRICES

DATASET USED:

TheMNIST collection of handwritten digitsserved as the dataset. It has a test set of 10. Thedigits have been centred in a fixed-size image and size-normalized. The photos are 28*28 pixelsin size. It is a useful database for those who want to practise new skills and pattern recognition algorithms on actual data with the least amount of pre-processing and formatting work. The databasecomes in from http://yann.lecun.com/exdb/mnist/

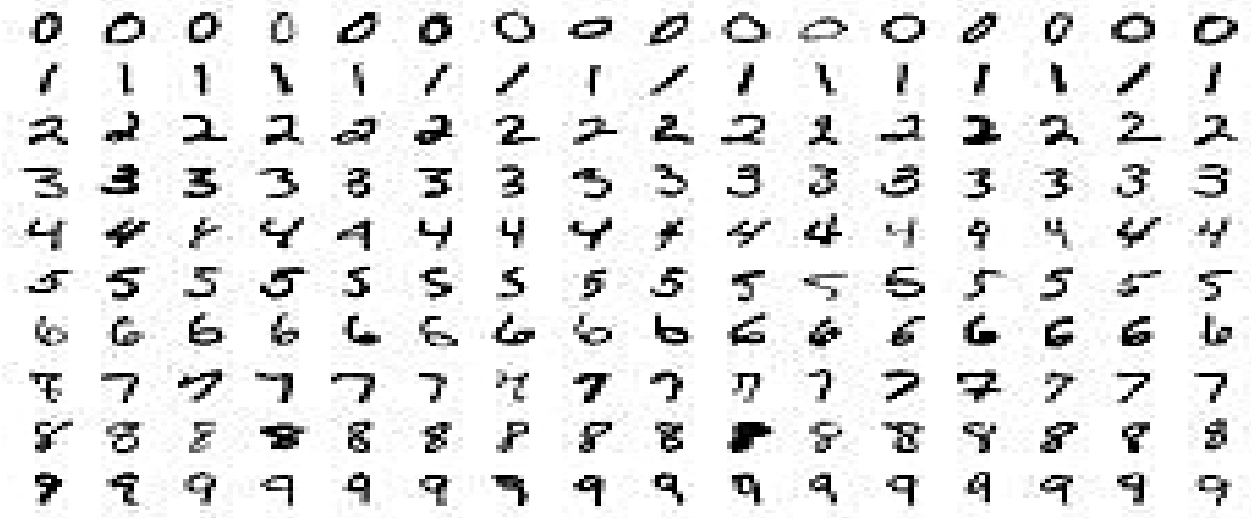


FIG 6: MNIST DATASET

ANALYSIS OF THE RESULTS:

System Analysis and Design is the term used in businessto describe the process of analysing abusiness issue with the goal of improving it through improvedpractises and methodologies.
Designing organisations, enhancing performance, and attaining goalsfor profitability and expansionare all relatedto system analysisand design. The focus

is on systemsin action, the connections
between subsystems, and their role in achievinga common objective.

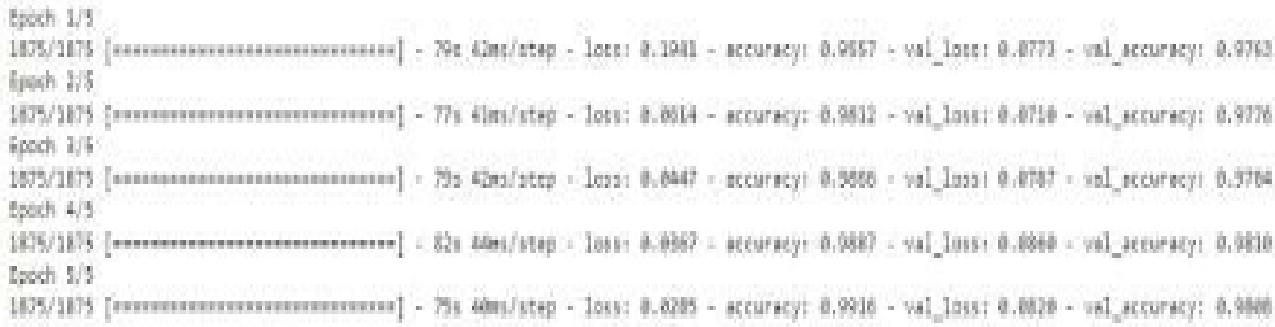


FIG.7.DATA TRAINING AND ACCURACY

System analysis includesexamining a systemto determine its effectiveness, the necessary adjustments, and the output's quality.Organizations are intricate systems made up of connected andinterdependent subsystems.

CHAPTER 10

ADVANTAGES AND DISADVANTAGES

ADVANATGES

- The system not only produces a classification of the digit but also a rich description of the instantiation parameters which can yield information such as the writing style
- The generative models can perform recognition driven segmentation
- The method involves a relatively small number of parameters and hence training is relatively easy and fast;
- Unlike many other recognition schemes, it does not rely on some form of pre-normalization of input images, but can handle arbitrary scalings, translations and a limited degree of image rotation.

DISADVANTAGES

- IT REQUIRES MORE COMPUTATION THAN THE OCR TECHNIQUES

CHAPTER 11

CONCLUSION

In business, System Analysis and Design refers to the process of examining a business situation with the intent of improving it through better procedures and methods. System analysis and design relates to shaping organizations, improving performance and achieving objectives for profitability and growth. The emphasis is on systems in action, the relationships among subsystems and their contribution to meeting a common goal. Looking at a system and determining how adequately it functions, the changes to be made and the quality of the output are parts of system analysis. Organizations are complex systems that consist of interrelated and interlocking subsystems. Changes in one part of the system have both anticipated and unanticipated consequences in other parts of the system. The systems approval is a way of thinking about the analysis and design of computer based applications. It provides a framework for visualizing the organizational and environmental factors that operate on a system. Proposed Application Module: The proposed application has been implemented using Python on terminal. The user is given two options in the home image: Simple Upload, Model Form Upload. Simple Upload will allow the user to upload the image and predict it then and there. After navigating away from that page, the link to the uploaded image is lost. The Model Form Upload will allow the user to upload the image with description. With this link, the user will be able to store the image and see its link on the home page itself. By clicking on the link, the user will be able to get the result from the CNN classifier.

CHAPTER 12

FUTURE SCOPE

This project has endless potentialand can always be enhancedto become better.Implementing this concept in the real world will benefit several industries and reducethe workload on many workers,enhancing overall work efficiency.

CHAPTER 13

APPENDIX

SOURCE

MODEL BUILDING

```
# Load the necessary packages
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from keras.utils import np_utils
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, Dense, Flatten
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.models import load_model
from PIL import Image, ImageOps

# Load the data
(X_train, y_train), (X_test, y_test) = mnist.load_data()

# Data pre-processing
X_train = X_train.reshape(60000, 28, 28, 1).astype('float32')
X_test = X_test.reshape(10000, 28, 28, 1).astype('float32')

number_of_classes = 10
Y_train = np_utils.to_categorical(y_train, number_of_classes)
Y_test = np_utils.to_categorical(y_test, number_of_classes)
```

```
# Create the model
model = Sequential()
model.add(Conv2D(64, (3, 3), input_shape=(28, 28, 1), activation="relu"))
model.add(Conv2D(32, (3, 3), activation="relu"))
model.add(Flatten())
model.add(Dense(number_of_classes, activation="softmax"))

model.compile(loss='categorical_crossentropy', optimizer="Adam", metrics=["accuracy"])

# Train the model
model.fit(X_train, Y_train, batch_size=32, epochs=5, validation_data=(X_test,Y_test))

# Evaluate the model
metrics = model.evaluate(X_test, Y_test, verbose=0)
print("Metrics (Test Loss & Test Accuracy): ")
print(metrics)

# Save the model
model.save("model.h5")
```

```
# Test the saved model
model=load_model("model.h5")

img = Image.open("sample.png").convert("L")
img = img.resize((28, 28))
img2arr = np.array(img)
img2arr = img2arr.reshape(1, 28, 28, 1)
results  = model.predict(img2arr)
results = np.argmax(results,axis = 1)
results = pd.Series(results,name="Label")
print(results)
```

FLASK APP

```
from flask import Flask,render_template,request
from recognizer import recognize

app=Flask(__name__)

@app.route('/')
def main():
    return render_template("home.html")


@app.route('/predict',methods=['POST'])
def predict():
    if request.method=='POST':
      image = request.files.get('photo', '')
      best, others, img_name = recognize(image)
      return render_template("predict.html", best=best, others=others, img_name=img_name)


if __name__=="__main__":
    app.run()
```

RECOGNIZER APP

```python
# Import necessary packages
import os
import random
import string
from pathlib import Path
import numpy as np
from tensorflow.keras.models import load_model
from PIL import Image, ImageOps
```

```python
def random_name_generator(n: int) -> str:
    """
    Generates a random file name.

    Args:
        n (int): Length the of the file name.

    Returns:
        str: The file name.
    """
    return ''.join(random.choices(string.ascii_uppercase + string.digits, k=n))
```

```python
def recognize(image: bytes) -> tuple:
    """
    Predicts the digit in the image.

    Args:
        image (bytes): The image data.

    Returns:
        tuple: The best prediction, other predictions and file name
    """

    model=load_model(Path("./model/model.h5"))

    img = Image.open(image).convert("L")

    # Generate a random name to save the image file.
    img_name = random_name_generator(10) + '.jpg'
    if not os.path.exists(f"./static/data/"):
        os.mkdir(os.path.join('./static/', 'data'))
    img.save(Path(f"./static/data/{img_name}"))

    # Convert the Image to Grayscale, Invert it and Resize to get better prediction.
    img = ImageOps.grayscale(img)
    img = ImageOps.invert(img)
    img = img.resize((28, 28))

    # Convert the image to an array and reshape the data to make prediction.
    img2arr = np.array(img)
    img2arr = img2arr / 255.0
    img2arr = img2arr.reshape(1, 28, 28, 1)

    results  = model.predict(img2arr)
    best = np.argmax(results,axis = 1)[0]

    # Get all the predictions and it's respective accuracy.
    pred = list(map(lambda x: round(x*100, 2), results[0]))

    values = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
    others = list(zip(values, pred))

    # Get the value with the highest accuracy
    best = others.pop(best)

    return best, others, img_name
```

HOME PAGE

```
<html>
    <head>
        <meta name="viewport" content="width=device-width, initial-scale=1.0" />
        <title>Handwritten Digit Recognition</title>
        <link rel="icon" type="image/svg" sizes="32x32" href="{{url_for('static',filename='images/icon.svg')}}"
 />
        <link rel="stylesheet" href="{{url_for('static',filename='css/main.css')}}" />
        <script src="https://unpkg.com/feather-icons"></script>
        <script defer src="{{url_for('static',filename='js/script.js')}}"></script>
    </head>
    <body>
        <div class="container">
            <div class="heading">
                <h1 class="heading__main">Handwritten Digit Recognizer</h1>
                <h2 class="heading__sub">Easily analyze and detect handwritten digits</h2>
            </div>
            <div class="upload-container">
                <div class="form-wrapper">
                    <form class="upload" action="/predict" method="post" enctype="multipart/form-data">
                        <label id="label" for="upload-image"><i data-feather="file-plus"></i>Select File</label>
                        <input type="file" name="photo" id="upload-image" hidden />
                        <button type="submit" id="up_btn"></button>
                    </form>
                    <img id="loading" src="{{url_for('static',filename='images/loading.gif')}}">
                </div>
            </div>
        </div>
    </body>
</html>
```

HOME PAGE(CSS)

```css
@import url("https://fonts.googleapis.com/css2?family=Overpass:wght@200;300;400;500;600;700;900&display=swap");

* {
    padding: 0;
    margin: 0;
}

body {
    color: black;
    font-family: "Overpass", sans-serif;
}
```

```css
.container {
    width: 100%;
    height: 100%;
    display: flex;
    flex-direction: column;
    justify-content: center;
    align-items: center;
    background-color: white;
}

.heading {
    margin-top: -2rem;
    padding-bottom: 2rem;
    width: fit-content;
    text-align: center;
}

.heading .heading__main {
    font-size: 3rem;
    font-weight: 550;
}

.heading .heading__sub {
    font-size: 1rem;
    color: rgb(90, 88, 88);
}

.upload-container {
    box-shadow: 0 0 20px rgb(172, 170, 170);
    width: 40rem;
    height: 25rem;
    padding: 1.5rem;
}

.form-wrapper {
    background-color: rgba(190, 190, 190, 0.5);
    width: 100%;
    height: 100%;
    display: flex;
    border: 1px dashed black;
    justify-content: center;
    align-items: center;
}

.form-wrapper #loading {
    display: none;
    position: absolute;
}
```

```css
.form-wrapper .upload {
    display: flex;
    justify-content: center;
    align-items: center;
    width: 8rem;
    height: -webkit-fit-content;
    height: -moz-fit-content;
    height: fit-content;
    border-radius: 6px;
    color: white;
    background-color: rgb(114, 96, 182);
    box-shadow: 0 5px 10px rgb(146, 135, 247);
}

.form-wrapper .upload #up_btn {
    display: none;
}

.form-wrapper .upload label {
    font-size: 1rem;
    font-weight: 600;
    color: white;
    height: 100%;
    width: 100%;
    padding: 10px;
    display: block;
}

.form-wrapper .upload svg {
    height: 15px;
    width: auto;
    padding-right: 8px;
    margin-bottom: -2px;
}

@media screen and (max-width: 700px) {
    .upload-container {
        height: 20rem;
        width: 18rem;
        margin-top: 3.5rem;
        margin-bottom: -8rem;
    }

    .heading .heading__main {
        margin-top: -6rem;
        font-size: 2rem;
        padding-bottom: 1rem;
    }
}
```

```css
.result-wrapper .input-image-container img {
    width: 60%;
    height: 60%;
    background-color: aqua;
    background-size: contain;
}

.result-wrapper .result-container .value {
    font-size: 6rem;
}

.result-wrapper .result-container .accuracy {
    margin-top: -3rem;
}

.other_predictions {
    display: flex;
    justify-content: center;
    align-items: center;
    flex-wrap: wrap;
    column-gap: 1rem;
    row-gap: 1rem;
    font-weight: 700;
}

.other_predictions .value {
    display: flex;
    justify-content: center;
    align-items: center;
    flex-direction: column;
    width: 5rem;
    height: 5rem;
    box-shadow: 0 0 7px rgb(158, 157, 157);
}

.other_predictions .value div {
    margin-top: -1.2rem;
}

@media screen and (max-width: 700px) {
    h1 {
        font-size: 2.3rem;
    }

    .result-wrapper .input-image-container,
    .result-wrapper .result-container {
        width: 7rem;
        height: 7rem;
    }

    .result-wrapper .result-container .value {
        font-size: 4rem;
    }
}
```

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-44979-1660727685

PROJECT DEMO LINK

https://drive.google.com/file/d/1jG2RfA5brJ4C_1RjJSDQ8NcTj_T9O7S3/view?usp=share_link