

IBM PROJECT DOCUMENTATION

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1.INTRODUCTION

1.1 Project Overview

The handwritten digit recognition is the ability of computers to recognize human handwritten digits. It is a hard task for the machine because handwritten digits are not perfect and can be made with many different flavors. The handwritten digit recognition is the solution to this problem which uses the image of a digit and recognizes the digit present in the image.

All the Python codes are first written in Jupyter notebook supplied along with Anaconda Python and then the codes are tested in IBM cloud. Finally a web based framework is designed with help Flask a Python library. There are 2 html files and CSS are created in templates folder along with their associated files in static folder. The Python program 'app.py' used to interface with these two webpages is written in Spy-der-Anaconda python and tested.

1.2 Purpose

Handwritten character recognition is one of the practically important issues in pattern recognition applications. The applications of digit recognition includes in postal mail sorting, bank check processing, form data entry.

2.LITERATURE SURVEY

2.1 Existing problem

The handwritten digit recognition is the capability of computer applications to recognize the human handwritten digits. It is a hard task for the machine because handwritten digits are not perfect and can be made with many different shapes and sizes. The handwritten digit recognition system is a way to tackle this problem which uses the image of a digit and recognizes the digit present in the image. Convolutional Neural Network model created using PyTorch library over the MNIST dataset to recognize handwritten digits .

Handwritten Digit Recognition is the capability of a computer to fete the mortal handwritten integers from different sources like images, papers, touch defenses, etc, and classify. them into 10 predefined classes (0-9). This has been a Content of bottomless- exploration in the field of deep literacy. Number recognition has numerous operations like number plate recognition, postal correspondence sorting, bank check processing, etc . (2). In Handwritten number recognition, we face numerous challenges . because of different styles of jotting of different peoples as it . is not an Optic character recognition. This exploration provides a comprehensive comparison between different machine literacy and deep literacy algorithms for the purpose of handwritten number recognition. For this, we've used Support . Vector Machine, Multilayer Perceptron, and Convolutional . Neural Network. The comparison between these algorithms is carried out on the base of their delicacy, crimes, and .testing- training time corroborated by plots and maps that have been constructed using matplotlib for visualization.

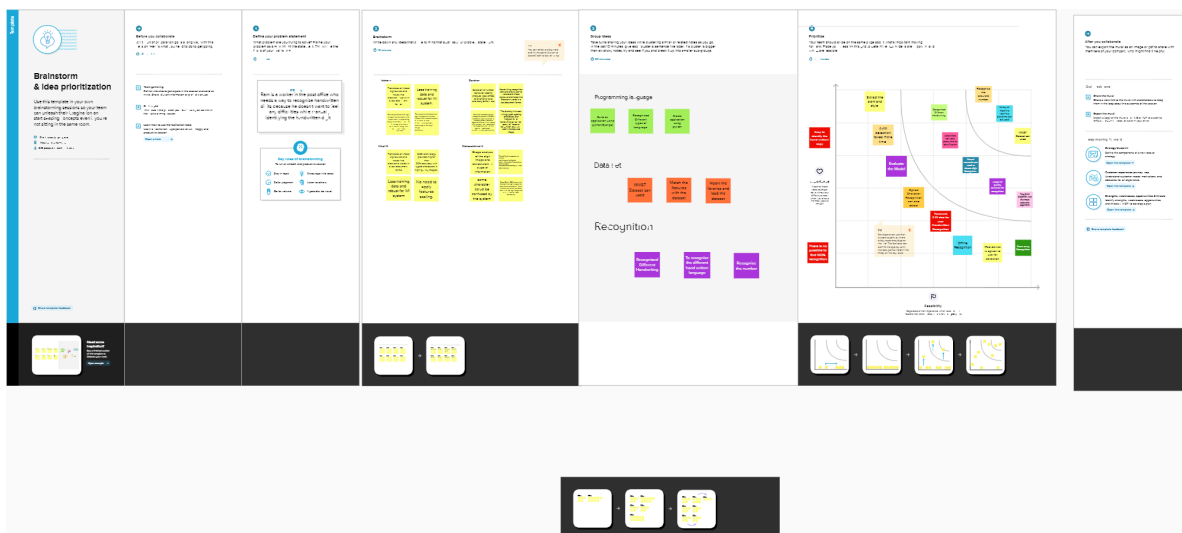
2.2 References

- [1] R. Jayadevan, S. R. Kolhe, P. M. Patil, and U. Pal, "Automatic processing of handwritten bank cheque images: a survey," *Int. J. Doc. Anal. Recognit. IJDAR*, vol. 15, no. 4, pp. 267–296, 2012.
- [2] N. M. Nasrabadi, "Pattern recognition and machine learning," *J. Electron. Imaging*, vol. 16, no. 4, p. 049901, 2007.

2.3 Problem Statement Definitions

The problem statement is to classify handwritten digits. The goal is to take an image of a handwritten digit and determine what that digit is The digits range from zero (0) through nine (9).

3.1 Empathy Map Canvas



3.3 Proposed Solution

| S.No. | Parameter | Description |
|-------|--|---|
| 1. | Problem Statement (Probleto be solved) | <p>Statement-The handwritten digit recognition is the capability of computer applications to recognize the human handwritten digits.</p> <p>Description: To make the machine to get recognize the available digits written in any form of descriptions by giving many sample images with various constraints.</p> |
| 2. | Idea/Solution description | <p>It is the capability of a computer to feed the mortal handwritten integers from various input devices.</p> <p>It allows users to define the available solutions to find the answers on the search engine to improve knowledge of the students.</p> |
| 3. | Novelty/Uniqueness | Accurately recognize the digits like OCR, specifically for numbers. |
| 4. | Social Impact/ Customer Satisfaction | <p>Difficulties for the people during the recognition of digits is reduced.</p> <p>Rather than identifying the characters, it identifies specifically numbers before defining the recognition.</p> |
| 5. | Business Model (Revenue Model) | <p>It is used to recognize the register number of the candidates while writing the exams.</p> <p>It can be integrated with banking systems to identify and recognize the account numbers and amount details easily.</p> |

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 | User Registration | No Registration needed. |
| FR-2 | Image | Image of the paper and any documents to check for the right digits. |
| FR-3 | PC / Desktop or Mobile | Device needed to run the application |

4.2 Non-Functional Requirement

Following are the non-functional requirements of the proposed solution.

| FR No. | Non-Functional Requirement | Description |
|--------|----------------------------|---|
| NFR-1 | Usability | Used to find the exact digit. |
| NFR -2 | Security | No security needed while using this application |
| NFR -3 | Reliability | Reliable on anytime anywhere with the usage |
| NFR -4 | Performance | High performance to find the digit as very clear and exactly |
| NFR -5 | Availability | Available for customers on both web and mobile |
| NFR -6 | Scalability | Scalable with finding the digit as earlier as possible and detect all digits. |

5.PROJECT DESIGN

5.1 Data Flow Diagram

User Stories :

Use the below template to list all the user stories for the product.

| Customer usage types | Functional Requirement | User Story Numbers | User Story / Task | Acceptance criteria | Priority | Release |
|------------------------|------------------------|--------------------|---|--|----------|----------|
| Customer (Mobile View) | Home | USN-1 | As a user, I can view the guide and awareness to use this application. | I can view the awareness to use this application and its limitations. | Low | Sprint-1 |
| | | USN-2 | As a user, I'm allowed to view the guided video to use the interface of this application. | I can gain knowledge to use this application by a practical method. | Low | Sprint-1 |
| | | USN-3 | As a user, I can read the instructions to use this application. | I can read instructions also to use it in a user-friendly method. | Medium | Sprint-2 |
| | Recognize | USN-4 | As a user, In this prediction page I get to choose the image. | I can choose the image from our local system and predict the output. | High | Sprint-2 |
| | Predict | USN-6 | As a user, I'm Allowed to upload and choose the image to be uploaded | I can upload and choose the image from the system storage and also in any virtual storage. | High | Sprint-3 |
| | | USN-7 | As a user, I will train and test the input to get the maximum accuracy of output. | I can able to train and test the application until it gets maximum accuracy of the result. | High | Sprint-4 |
| | | USN-8 | As a user, I can access the MNIST data set | I can access the MNIST data set to produce the accurate result. | Medium | Sprint-3 |

| Customer (Web View) | Home | USN-9 | As a user, I can view the guide to use the web app. | I can view the awareness of this application and its limitations. | Low | Sprint-1 |
|------------------------|------------------------|-------------------|---|--|----------|----------|
| Customer usage types | Functional Requirement | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
| Customer (Mobile View) | House | USN-1 | As a user, I can view the guide and awareness to use this application. | I can view the awareness to use this application and its limitations. | Low | Sprint-1 |
| | | USN-2 | As a user, I'm allowed to view the guided video to use the interface of this application. | I can gain knowledge to use this application by a practical method. | Low | Sprint-1 |
| | | USN-3 | As a user, I can read the instructions to use this application. | I can read instructions also to use it in a user-friendly method. | Low | Sprint-2 |
| | Recognize | USN-10 | As a user, I can use the web application virtually anywhere. | I can use the application portably anywhere. | High | Sprint-1 |
| | | USN-11 | As it is an open source, can use it cost freely. | I can use it without any payment to be paid for it to access. | Medium | Sprint-2 |
| | | USN-12 | As it is a web application, it is installation free | I can use it without the installation of the application or any software. | Medium | Sprint-4 |
| | Predict | USN-13 | As a user, I'm Allowed to upload and choose the image to be uploaded | I can upload and choose the image from the system storage and also in any virtual storage. | Medium | Sprint-3 |

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning

1. Planning is a crucial role in project management because it allows team members to schedule their time on the project.
 2. This activity demonstrates how the team members assigned and completed various tasks!
 3. In Project we can Split into the Four Step of Phrases are
- Phrase 1: Information Collection and Requirement Analysis
 - Phrase 2: Project Planning and Developing Modules
 - Phrase 3: Implementing the High Accuracy Machine Learning Algorithm to Perform
 - Phrase 4: Deploying the Model on Cloud and Testing the Model and UI Performance

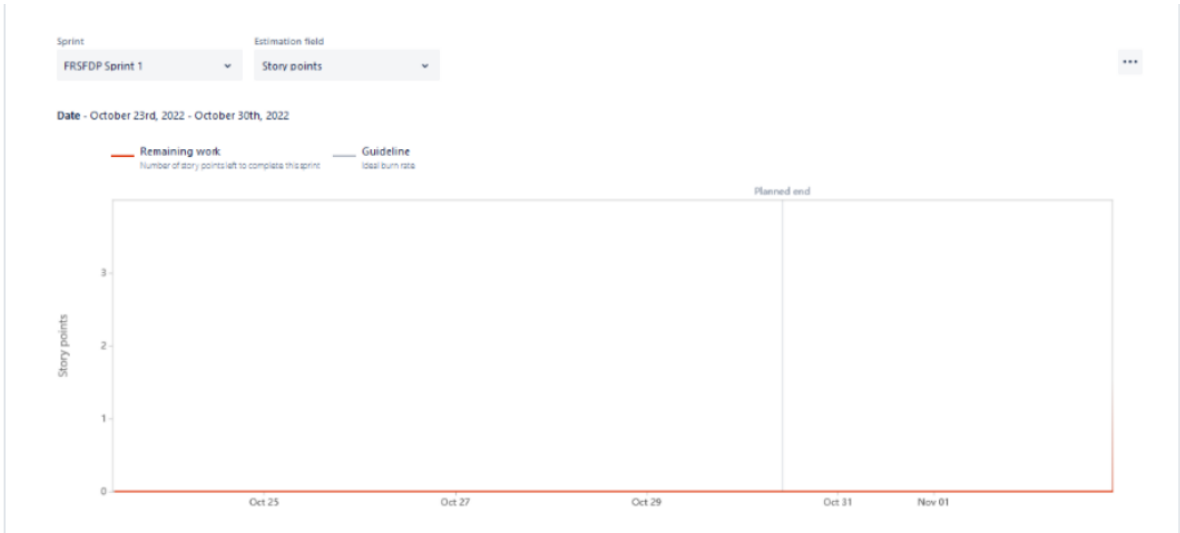
6.1 Estimation

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Team Members |
|----------|---------------------------------------|-------------------|--|--------------|
| Sprint-1 | Registration | USN-1 | Each user should have the phone number to use this service and verified using otp and passwords should be created. | 4 |
| Sprint-2 | Login | USN-2 | User can Login by using their respective user id and password. | 4 |
| Sprint-3 | Upload Image of hand written document | USN-3 | The input from the user to find the digits should be uploaded. | 4 |
| Sprint-4 | Recognition and Results. | USN-4 | The userinput got processed and the result outcome will be the clear digits. | 4 |

6.2 Sprint Delivery Schedule

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

6.3 Reports From JIRA



Velocity report

[How to read this report](#)



7.CODING & SOLUTIONING

HOME

IBM

IBM-12295-1662558326

Inbox (1,734) - kishorkity278@gmail.com

Digit Recognition WebApp

+

127.0.0.1:5000

IBM PROJECT

Handwritten Digit Recognition Website

The website is designed to predict the handwritten digit.


Handwriting recognition is one of the fascinating research projects currently underway because everyone in the world has their own writing style. It is the computer's ability to automatically recognise handwritten digits or characters. Because of advances in science and technology, everything is being digitalized to reduce human effort.

As a result, handwritten digit recognition is required in many real-time applications. The MNIST data set, which contains 70000 handwritten digits, is widely used in this recognition process. To train these images and create a deep learning model, we use artificial neural networks. A web application is developed that allows the user to upload an image of a handwritten digit. The model analyses this image and returns the detected result to the user interface.

Select a image:

Choose File

 No file chosen



Predict

Clear

INSERTION

IBM

IBM-12295-1662558326

Inbox (1,734) - kishorkity278@gmail.com

Digit Recognition WebApp

+

127.0.0.1:5000

IBM PROJECT

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Select a image:

Choose File

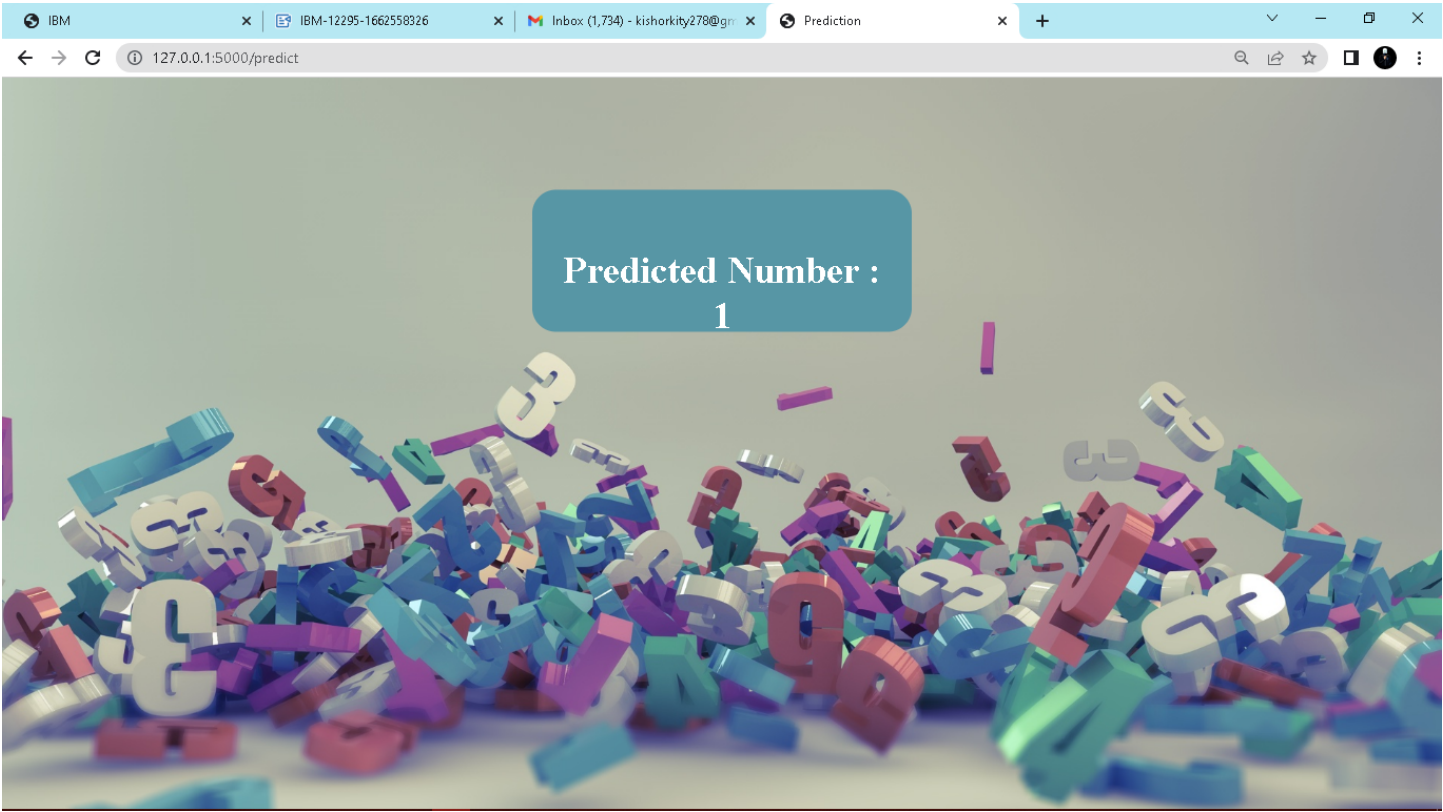
 mnist-dataset-1.png



Predict

Clear

PREDICT



8. TESTING

8.1 Test Cases

| Test case ID | Feature Type | Component | Test Scenario | Pre-Requisite | Steps To Execute | Test Data | Expected Result | Actual Result | Status | Comments | TC for Automation(Y/N) | BUG ID | Executed By |
|----------------|--------------|--------------|--|---------------|---|-------------------------|---|---------------------|--------|----------|------------------------|--------|----------------------------|
| Test Case - Q1 | Functional | web Page | Verify user is able to see the page popup when user they enter to web page | | 1.Enter URL and click go | | webpage should display | Working as expected | Pass | | | | Darshan, B. Nihal M |
| Test Case - Q2 | UI | Home Page | Verify the UI elements in Homepage | | 1.Enter URL and click go 2.webpage displayed | | Application should show below UI elements: a.Homepage b.Introduction c.Launch | Working as expected | Pass | | | | Mahasakthivel, A Kishor, V |
| Test Case - Q3 | Functional | Home page | Verify user is able to See the details about the webpage | | 1.Enter URL and click go 2.Webpage Displayed 3.Displays necessary details | | User should navigate to homepage | Working as expected | Pass | | | | Nihal M, Mahasakthivel, A |
| Test Case - Q4 | Functional | Introduction | Verify user is able to details about uses of the gesture based tool and its importance | | 1.Enter URL and click go 2.Webpage Displayed 3.Displays necessary details 4.click introduction to go Displays about the uses of the gesture based tool | | user should navigate to introduction | Working as expected | Pass | | | | Kishor, V. Nihal M |
| Test Case - Q5 | Functional | Launch | Verify user is able to navigate to launch | | 1.Enter URL and click go 2.Webpage Displayed 3.Displays necessary details 4.click introduction to go Displays about the uses of the gesture based tool 5.Click Launch to navigates to launch page | | user should navigate to Launch | Working as expected | Pass | | | | Kishor, V, Darshan, B |
| Test Case - Q6 | Functional | Launch | Verify user is able to upload image and predicts the Handwritten Digit. | | 1.Enter URL and click go 2.Webpage Displayed 3.Displays necessary details 4.click introduction to go Displays about the uses of the gesture based tool 5.Click Launch to navigates to launch page 6.uploads the image and predicts using the hand gesture | Upload image : img1.jpg | Application should Display the images in different types of images like blurred , rotated image | Working as expected | Pass | | | | Darshan, B, Nihal M |

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. 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 | 6 | 2 | 0 | 1 | 9 |
| Duplicate | 2 | 0 | 3 | 0 | 5 |
| External | 3 | 2 | 0 | 0 | 5 |
| Fixed | 10 | 3 | 2 | 16 | 31 |
| Not Reproduced | 0 | 0 | 0 | 0 | 0 |
| Skipped | 0 | 0 | 1 | 1 | 2 |
| Won't Fix | 0 | 2 | 1 | 2 | 5 |
| Totals | 21 | 9 | 7 | 20 | 57 |

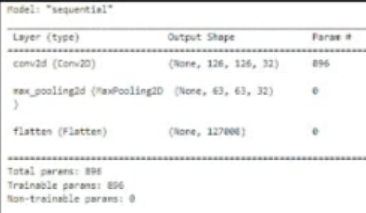
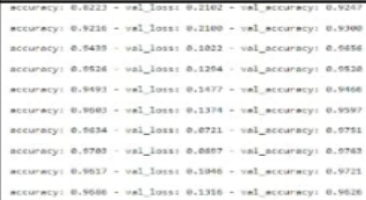
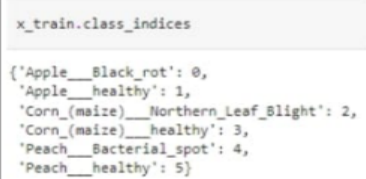
3. Test Case Analysis

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

| Section | Total Cases | Not Tested | Fail | Pass |
|---------------------|-------------|------------|------|------|
| Print Engine | 7 | 0 | 0 | 7 |
| Client Application | 10 | 2 | 0 | 10 |
| Security | 0 | 0 | 0 | 0 |
| Outsource Shipping | 6 | 0 | 0 | 6 |
| Exception Reporting | 6 | 0 | 0 | 6 |
| Final Report Output | 5 | 0 | 0 | 5 |
| Version Control | 1 | 0 | 0 | 1 |

9.RESULTS

9.1Performance Metrics

| S.No. | Parameter | Values | Screenshot |
|-------|---------------------------------------|--|---|
| 1. | Model Summary | Model value - 896 |  |
| 2. | Accuracy | Training Accuracy – 0.9686 Validation Accuracy – 0.9626 |  |
| 3. | Confidence Score (Only Yolo Projects) | Class Detected Confidence Score - 96 |  |

10.ADVANTAGES & DISADVANTAGES

Advantages:

- ✓ The main purpose is to recognize corrupted handwritten digits using recognition method. Image of connected digits, disjoint digits and overlapped digits was divided into sub-images.
- ✓ Our study serves as a reference for aspiring researchers in automatic handwritten digits or hand recognition and classification.
- ✓ The experimental results of this study showed that conventional neural network is the best suitable algorithm or classifier for automatic handwritten digits on documented images accuracy rate is also high when compared with other algorithms like SVM and ANN .

Disadvantages:

- ✓ Computation cost of the proposed system
- ✓ It could be indeployed in connected digit , overlapped digit and spaced digits.
- ✓ Some of the threats need to be solve within the given validity.

11.CONCLUSION

In this paper an extensive review of recent advancement in the field of handwritten numeric digit classification and recognition has been presented. The review presented covers all the aspects for handwritten as well as printed digit recognition like off-line and on-line recognition, different features used, and finally various types of classifiers recently used for digit classification. Moreover, all the important and recent works have been discussed with their advantages and limitations. It has been also discussed, most of the available systems were developed for particular database and yet to analyze over real time handwritten digits.

12.FUTURE SCOPE

The proposed model in this project work can be extended to image recognition. The entire model can be converted to application software using python to exe software. The real time image classification, image recognition and video processing are possible with help OpenCV python library. This project work can be extended for security applications such as fingerprint recognition, iris recognition and face recognition.

13.APPENDIX

13.1 SOURCE CODE

INDEX.HTML

```
<html>
```

```
<head>
```

```
<title>Digit Recognition WebApp</title>
```

```
<meta name="viewport" content="width=device-width">
```

```
<!-- GoogleFont -->
```

```
<link href="https://fonts.googleapis.com/css2?family=Prompt:wght@600&display=swap" rel="stylesheet">
```

```
<link href="https://fonts.googleapis.com/css2?family=Varela+Round&display=swap" rel="stylesheet">
```

```
<link href="https://fonts.googleapis.com/css2?family=Source+Code+Pro:wght@500&display=swap" rel="stylesheet">
```

```
<link href="https://fonts.googleapis.com/css?family=Calistoga|Josefin+Sans:400,700|Pacifico&display=swap" rel="stylesheet">
```

```
<!-- bootstrap -->
```

```
<link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css" integrity="sha384-ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T" crossorigin="anonymous">
```

```
<link rel="stylesheet" type="text/css" href="{{ url_for('static',filename='css/style.css') }}">
```

```
<!-- fontawesome -->
```

```
<script src="https://kit.fontawesome.com/b3aed9cb07.js" crossorigin="anonymous"></script>
```

```
<script src="https://code.jquery.com/jquery-3.3.1.slim.min.js" integrity="sha384-q8i/X+965DzO0rT7abK41JStQIAqVgRVzpbzo5smXKp4YfRvH+8abtTE1Pi6jizo" crossorigin="anonymous"></script>
```

```
<script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.14.7/umd/popper.min.js" integrity="sha384-
```

```
U02eT0CpHqdSJQ6hJty5KVphtPhzWj9WO1clHTMGa3JDZwrnQq4sF86dIHNDz0W1"
crossorigin="anonymous"></script>
    <script    src="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/js/bootstrap.min.js"
integrity="sha384-JjSmVgyd0p3pXB1rRibZUAYoIlly6OrQ6VrjIEaFf/nJGzIxFDsf4x0xIM+B07jRM"
crossorigin="anonymous"></script>
    <script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@latest"></script>
```

```
</head>
```

```
<script>
function preview() {
    frame.src=URL.createObjectURL(event.target.files[0]);
}
```

```
$(document).ready(function() {
    $('#clear_button').on('click', function() {
        $('#image').val("");
        $('#frame').attr('src','');
    });
});
```

```
</script>
```

```
<body>
```

```
<h1 class="welcome">IBM PROJECT
</h1>
```

```
<section id="title">
```

```
<h4 class="heading">Handwritten Digit Recognition Website</h4>
```

```
<br><br>
```

```
<p>
```

The website is designed to predict the handwritten digit.

```
</p>
```

Handwriting recognition is one of the fascinating research projects currently underway because everyone

in the world has their own writing style. It is the computer's ability to automatically recognise handwritten

digits or characters. Because of advances in science and technology, everything is being digitalized to reduce human effort.

</p>

<p> As a result, handwritten digit recognition is required in many real-time applications. The MNIST data set,

which contains 70000 handwritten digits, is widely used in this recognition process. To train these images

and create a deep learning model, we use artificial neural networks. A web application is developed that allows

the user to upload an image of a handwritten digit. The model analyses this image and returns the detected result

to the user interface.</p>

</section>

<section id="content">

<div class="leftside">

<form action="/predict" method="POST" enctype="multipart/form-data">

<label>Select a image:</label>

<input id="image" type="file" name="image" accept="image/png, image/jpeg" onchange="preview()">

<div class="buttons_div">

<button type="submit" class="btn btn-dark" id="predict_button">Predict</button>

<button type="button" class="btn btn-dark" id="clear_button"> Clear </button>

</div>

</form>

</div>

</section>

</body>

</html>

PREDICT.HTML

<html>

<head>

<title>Digit Recognition WebApp</title>

<meta name="viewport" content="width=device-width">

<!-- GoogleFont -->

<link href="https://fonts.googleapis.com/css2?family=Prompt:wght@600&display=swap" rel="stylesheet">

<link href="https://fonts.googleapis.com/css2?family=Varela+Round&display=swap" rel="stylesheet">

<link href="https://fonts.googleapis.com/css2?family=Source+Code+Pro:wght@500&display=swap" rel="stylesheet">

<link href="https://fonts.googleapis.com/css?family=Calistoga|Josefin+Sans:400,700|Pacifico&display=swap" rel="stylesheet">

<!-- bootstrap -->

<link href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.css" integrity="sha384-ggOyR0iXCbMQv3Xipma34MD+dH/1fQ784/j6cY/iJTQUOhcWr7x9JvoRxT2MZw1T" crossorigin="anonymous">

<link rel="stylesheet" type="text/css" href="{{ url_for('static',filename='css/style.css') }}">

<!-- fontawesome -->

<script src="https://kit.fontawesome.com/b3aed9cb07.js" crossorigin="anonymous"></script>

<script src="https://code.jquery.com/jquery-3.3.1.slim.min.js" integrity="sha384-q8i/X+965DzO0rT7abK41JStQIAqVgRVzpbzo5smXKp4YfRvH+8abtTE1Pi6jizo" crossorigin="anonymous"></script>

<script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.14.7/umd/popper.min.js" integrity="sha384-UO2eT0CpHqdSJQ6hJty5KVphtPhzWj9WO1clHTMGa3JDZwrnQq4sF86dIHNDz0W1" crossorigin="anonymous"></script>

<script src="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/js/bootstrap.min.js" integrity="sha384-JjSmVgyd0p3pXB1rRibZUAYoIlly6OrQ6VrjIEaFf/nJGzlxFDsf4x0xIM+B07jRM" crossorigin="anonymous"></script>

```
<script src="https://cdn.jsdelivr.net/npm/@tensorflow/tfjs@latest"></script>
```

```
</head>
```

```
<script>
```

```
function preview() {  
    frame.src=URL.createObjectURL(event.target.files[0]);  
}
```

```
$(document).ready(function() {  
    $('#clear_button').on('click', function() {  
        $('#image').val("");  
        $('#frame').attr('src','');  
    });  
});
```

```
</script>
```

```
<body>
```

```
<h1 class="welcome">IBM PROJECT
```

```
</h1>
```

```
<section id="title">
```

```
<h4 class="heading">Handwritten Digit Recognition Website</h4>
```

```
<br><br>
```

```
<p>
```

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```
</p>
```

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```
</p>
```


<p> As a result, handwritten digit recognition is required in many real-time applications. The MNIST data set,

which contains 70000 handwritten digits, is widely used in this recognition process. To train these images

and create a deep learning model, we use artificial neural networks. A web application is developed that allows

the user to upload an image of a handwritten digit. The model analyses this image and returns the detected result

to the user interface.</p>

</section>

<section id="content">

<div class="leftside">

<form action="/predict" method="POST" enctype="multipart/form-data">

<label>Select a image:</label>

<input id="image" type="file" name="image" accept="image/png, image/jpeg" onchange="preview()">

<div class="buttons_div">

<button type="submit" class="btn btn-dark" id="predict_button">Predict</button>

<button type="button" class="btn btn-dark" id="clear_button"> Clear </button>

</div>

</form>

</div>

</section>

</body>

</html>

STYLE.CSS

```
#clear_button{  
    margin-left: 15px;  
    font-weight: bold;  
    color: blue;  
}
```

```
#confidence{  
    font-family: 'Josefin Sans', sans-serif;  
    margin-top: 7.5%;  
}
```

```
#content{  
    margin: 0 auto;  
    padding: 2% 15%;  
    padding-bottom: 0;  
}
```

```
.welcome{  
    text-align: center;  
    position: relative;  
    color: honeydew;  
    background-color: greenyellow;  
    padding-top: 1%;  
    padding-bottom: 1%;  
    font-weight: bold;  
    font-family: 'Prompt', sans-serif;  
}
```

```
#team_id{  
    text-align: right;  
    font-size: 25px;  
    padding-right: 3%;  
}
```

```
#predict_button{
```

```
margin-right: 15px;  
color: blue;  
font-weight: bold;  
}
```

```
#prediction_heading{  
font-family: 'Josefin Sans', sans-serif;  
margin-top: 7.5%;  
}
```

```
#result{  
font-size: 5rem;  
}
```

```
#title{  
padding: 1.5% 15%;  
margin: 0 auto;  
text-align: center;  
}
```

```
.btn {  
font-size: 15px;  
padding: 10px;  
-webkit-appearance: none;  
background: #eee;  
border: 1px solid #888;  
margin-top: 20px;  
margin-bottom: 20px;  
}
```

```
.buttons_div{  
margin-bottom: 30px;  
margin-right: 80px;  
}
```

```
.heading{  
font-family: 'Varela Round', sans-serif;
```



```
font-weight: 700;
font-size: 2rem;
display: inline;
}
```

```
.leftside{
  text-align: center;
  margin: 0 auto;
  margin-top: 2%;
  /* padding-left: 10%; */
}
```

```
#frame{
  margin-right: 10%;
}
```

```
.predicted_answer{
  text-align: center;
  margin: 0 auto;
  padding: 3% 5%;
  padding-top: 0;
  /* padding-left: 10%; */
}
```

```
p{
  font-family: 'Source Code Pro', monospace,sans-serif;
  margin-top: 1%;
}
```

```
@media (min-width: 720px) {
  .leftside{
    padding-left: 10%;
  }
}
```

APP.PY

```
import os

import numpy as np
from PIL import Image
from flask import Flask, request, render_template
from keras.models import load_model
from werkzeug.utils import secure_filename

UPLOAD_FOLDER = './uploads'

app = Flask(__name__)
app.config['UPLOAD_FOLDER'] = UPLOAD_FOLDER

model = load_model("digit-recognition.h5")

@app.route('/')
def index():
    return render_template('index.html')

@app.route('/predict', methods=['GET', 'POST'])
def upload():
    if request.method == "POST":
        f = request.files["image"]
        filepath = secure_filename(f.filename)
        f.save(os.path.join(app.config['UPLOAD_FOLDER'], filepath))

        upload_img = os.path.join(UPLOAD_FOLDER, filepath)
        img = Image.open(upload_img).convert("L") # convert image to monochrome
        img = img.resize((28, 28)) # resizing of input image

        im2arr = np.array(img) # converting to image
        im2arr = im2arr.reshape(1, 28, 28, 1) # reshaping according to our requirement
```

```
pred = model.predict(im2arr)

num = np.argmax(pred, axis=1) # printing our Labels

return render_template('predict.html', num=str(num[0]))

if __name__ == '__main__':
    app.run(debug=True, threaded=False)
```

Github Link : <https://github.com/IBM-EPBL/IBM-Project-12295-1659446816>