Software Requirements Specification for<Captcha Solver>

Version 0.4 approved

Prepared by

Naveed Hakim(15026393)

Hamza Safdar(1506413)

Khizar Farooq(1506422)

Muhammad Nabeel(14031226)

Module Instructor: Dr.Adil Raja

Mentor: Mr.Faisal Zeshan

Client: Mr.Muhammad Saqib

Namal College, Mianwali

Date: 23/4/2018

Table of Contents

Revision History

Name	Date	Reason For Changes	Version
Captcha Solver	23 Feb, 2018	Change in Interface	0.1
Captcha Solver	15h March,2018	Addition in features	0.2
Captcha Solver	10th april,2018	Data Set enhancement	0.3

1. Introduction

1.1 Purpose

Purpose of writing this document is to give a detailed and clear description of a system named as Captcha Solver. It will give a complete description of scope, use, Graphical User Interface, features, dependencies, assumptions taken, constraints under which system will operate, and all functional and non-functional requirements of the project as well as it will describe conventions, Glossary and abbreviations used in writing this document. This document is to help developers, testers and users of the software so that they may be able to use and improve this system by looking at initials provided in this document**.**

1.2 Document Conventions

This document is written on bases of template provided by IEEE for writing System Requirement Specification Document.

1.3 Intended Audience and Reading Suggestions

1) General Purpose users who want to use this product for their ease to get textual form of any image. This document will act as user-manual for them and will help them using this software.

2) Website owners who want to check Strength of their text based Captchas can use this software to do so.

3) There is always a room for improvement in any product so this document can be used by those coders or developers who want to make further improvements in this product or want to fix bugs. They may take an overview of already done work so that their labor should be minimized.

4) Analyzers who want to do some analysis on output.

5) And finally, those who want to test this product can get description of system from this document.

1.4 Product Scope

The product named as Captcha Solver is a tool designed for those who want to take textual form of an image. Captcha's are of many types. Text Based Captchas are common these days which are sequence of characters written in different fonts and styles and are used effectively to isolate human and robots.

Although Captcha plays an important role in maintenance of security of the system, but it is also necessary to check whether that captcha can be broken down using a program or not. Now a days, it is possible to make computer capable enough to read captcha using domain of Image Processing OCR. So this software can play an important role in checking strength of Captcha.

This software is a MATLAB program which is able to read captcha and give an output in textual form. Current Version of the system takes an image in input and returns its textual form regardless of the fact that images contains driftnet number of characters. This system is basically build upon methodologies of optical character recognition.

This project is actually a building block upon which many other systems can be build. For example, In future, an automatic software can be made which will auto detect the CAPTCHA in the website and will feed the CAPTCHA to the website automatically. In this way, labor for user will be less and he will like using this application which may also be available in form of browsers extension.

Moreover, transferring hand written books in to textual form is also a task in this era because old books are hand written and people need a typewritten version of them. Doing typing manually is a difficult task and acquires human efforts. This project can also be used as a building block for recognizing hand written books. Same goes for important data of users in National databases as that

is also in hand written form in under developed countries. A basic unit for achieving that task is provided in form of this software.

This captcha solver can also give a sound bases for number plate readers .Purpose of number plate reader will be to work in live environment on roads and check if someone breaks traffic rules, his/her number plate will be given to system and system will return a textual form of it. That textual form can be used to search and penalize person in future.

1.5 Abbreviations

Abbreviation	Term
OCR	Optical Character Recognition
GUI	Graphical User Interface
User	The person viewing this document
OS	Operating System
PNG	Portable Network Graphics
JPEG	Joint Photographic Experts Group
BMP	Best Management Practice
NN	Neural Network

1.6 Overview

Document provides requirement specifications for Captcha Solver. Section 1 was mainly for giving an overview of document. It gave description of use, perspective, audience and glossary of this document.

Chapter 2 deals with overall description of this system which explains product perspective, overview of function using flow charts and use case Modals.

2. Overall Description

2.1 Product Perspective

Captcha Solver is not subpart of any other system. It is an independent software which is complete in its functionality. This product is not modified version of any already existing OCR System but some basic functions are having same features as already existing OCR's possess. Software is mainly made for those who want to check capability of their captchas or build interesting software's taking this captcha solver as base.

2.2 Product Functions

2.2.1 Flow Diagram

Captcha Solver mainly performs functions given below. (Figure 1)

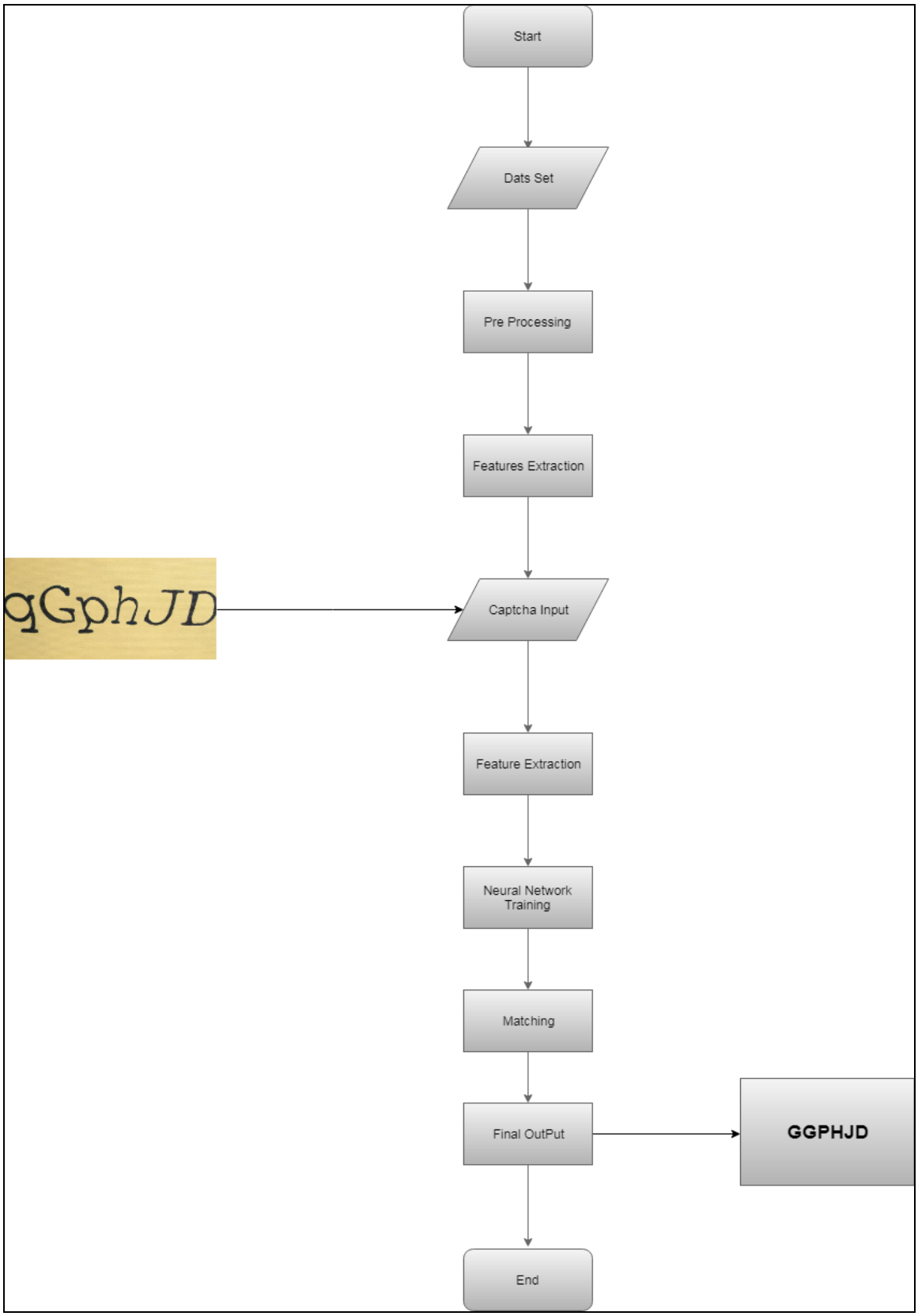

Start
Dats Set
Pre Processing
Features Extraction
qGphJD
Captcha Input
Feature Extraction
Neural Network Training
Matching
Final OutPut
GGPHJD
End

Figure 1

2.2.2 Upload Image

User is able to upload image in graphical user interface of software. This accepts images (with extensions PNG and JPEG). GUI shows image after uploading an image in the system

2.2.3 Pre-Processing

Software performs some preprocessing steps on that image for example converts it into binary image and partitioning on bases of characters.

2.2.4 Feature Extraction

Preprocessed image is given to feature extractor which extracts useful information from that image. If user of system is analyzer or tester, provision of viewing all these steps is provided in this system.

2.2.5 Matching

These features are given to neural network that is rising domain of Artificial intelligence. Neural Network does analysis on these features and checks in its database that which character falls in which category. It matches features of image with already existing data and gives results.

2.2.6 Output

After performing all above given steps, system returns textual form of image which is the ultimate goal. Implementation of all these components is given in Section 3.

2.3 User Characteristic

User is expected to be capable enough of using basic windows command such as “upload file” or drag drop menus. As this software is built using MATLAB , user should be able to build and run a MATLAB program as well as he should know how to use Graphical User Interface that is also made using MATLAB.

If user is a developer who want to take this software as a building block or he an analyzer he is expected to be familiar with terms feature extraction as well as neural networks to get an understanding of Software .These terms are further explained in section 3.

2.4 Assumption and Dependencies

The system is built on taking the assumption that user will give an image by himself to be tested and this program can deal with capital 26 characters only.

2.5 Apportioning of requirements

The current version of system requires to take image as input. Future version may be able to recognize captcha from a website by itself and feed textual form of captcha into text box automatically

This captcha solver deals with texted based captchas only, future version of system may able to recognize other captchas for example captchas containing objects. This will also be done using Image processing.

2.6 Operating Environment

- Windows 7
- Windows 8
- Windows 10
- 64 bits system only as MATLAB does not support 32 bit windows
- Linux

3. External interface Requirements

3.1 User Interfaces

3.1.1 Graphical User Interface

Graphical User Interface of this software is easy to handle, efficient and can handle different kind of inputs. Figure gives overview of starting condition of graphical user interface.

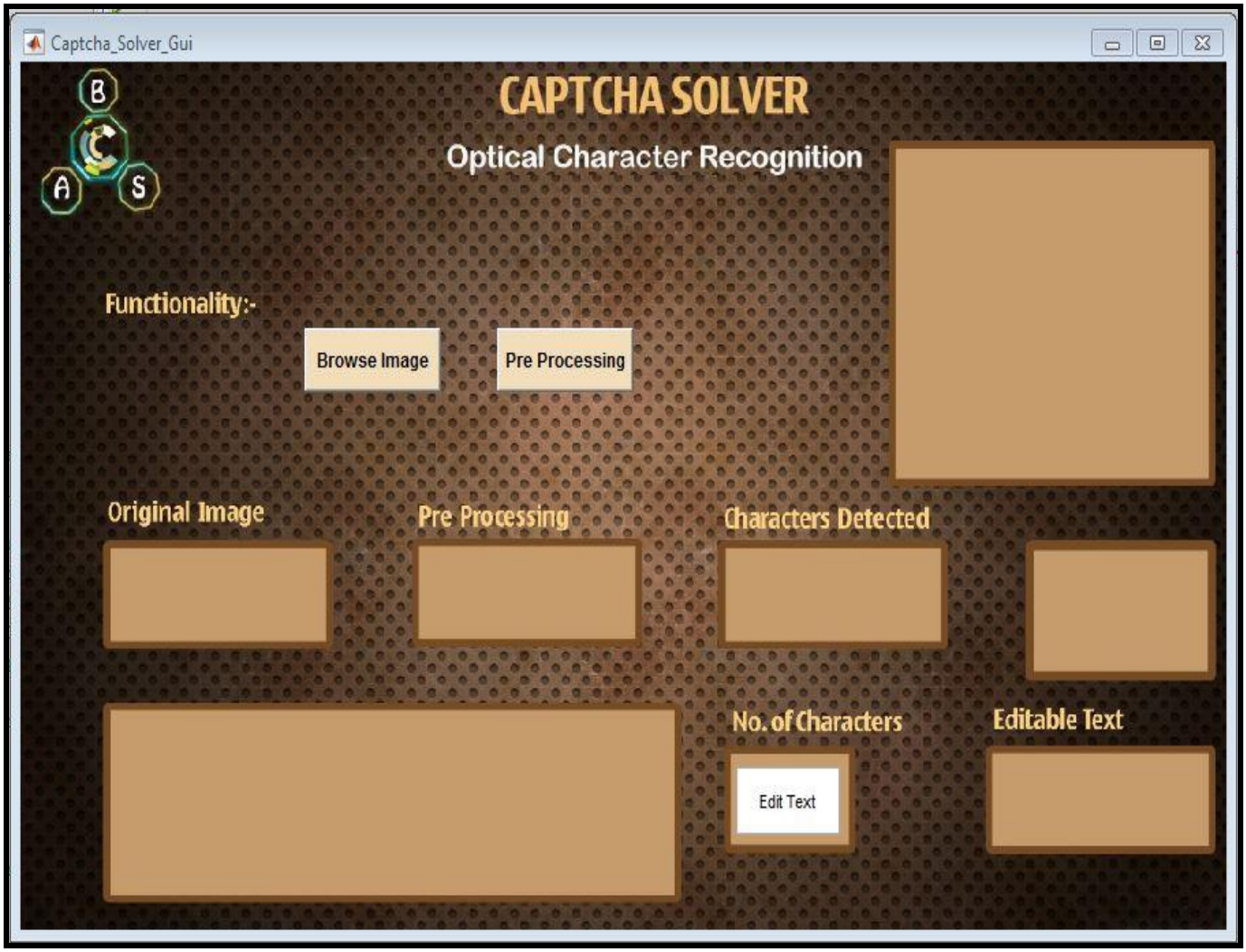


Figure 4.1

3.1.2 Input Image:

Software provides provision of uploading image on graphical user interface for detection of characters so that user can view input, preprocessing and output easily. (Figure 4.2.1)

Here is image for how to upload image in GUI. *User can upload jpg , png, bmp and tiff files by clicking drop down menu.(Figure 4.2.2)*

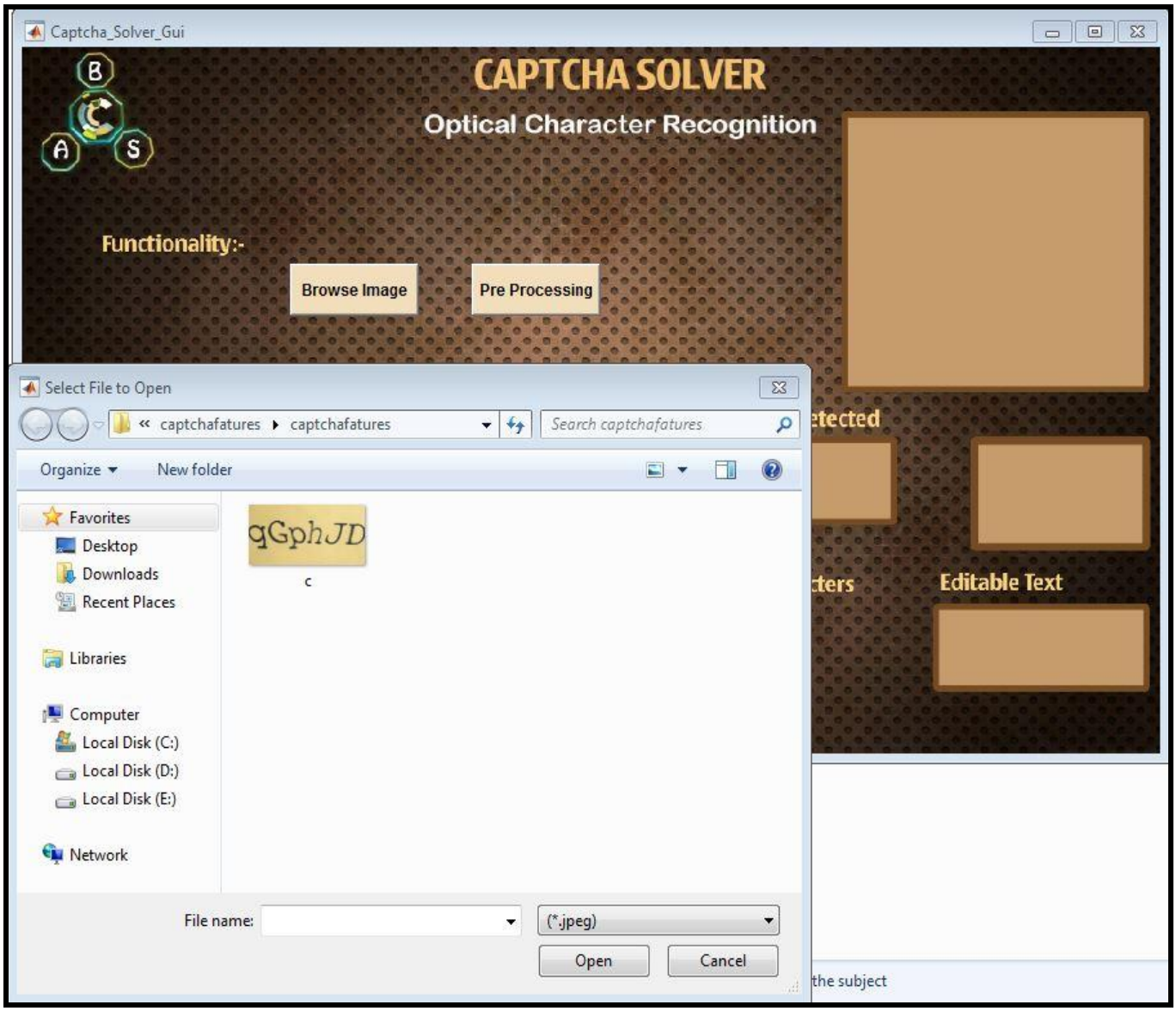


Figure 4.2.1

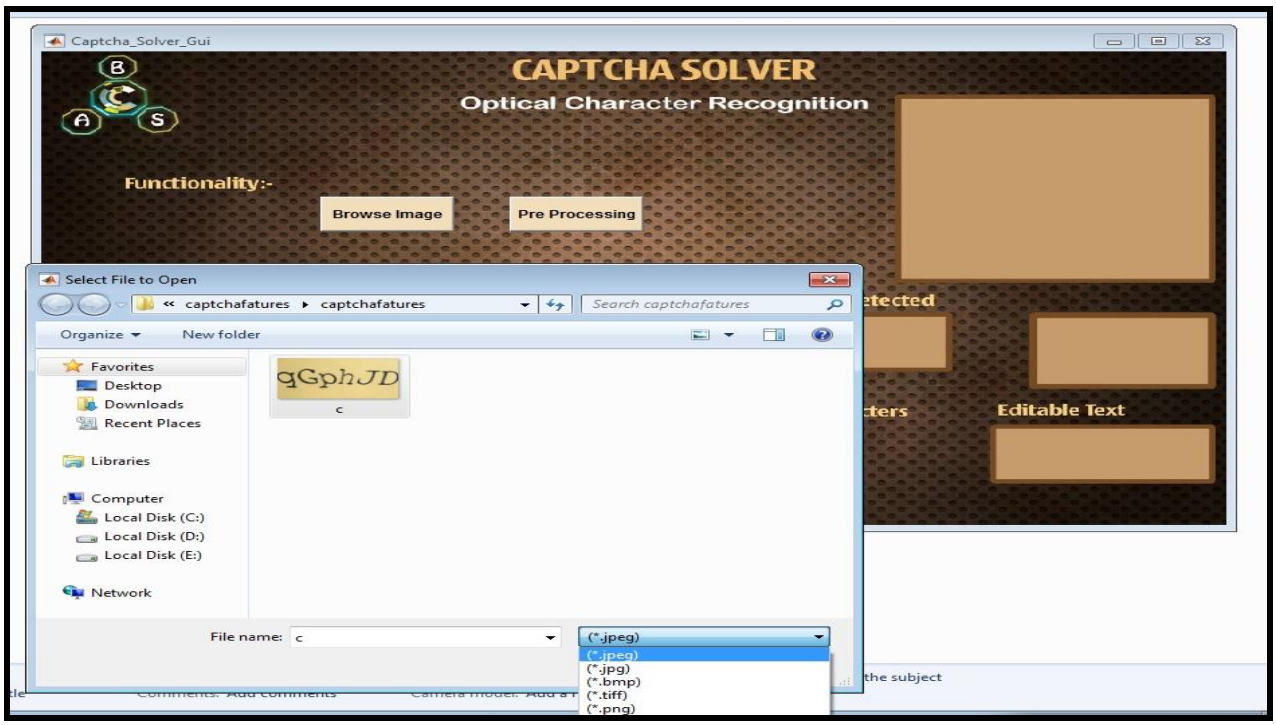


Figure 4.2.2

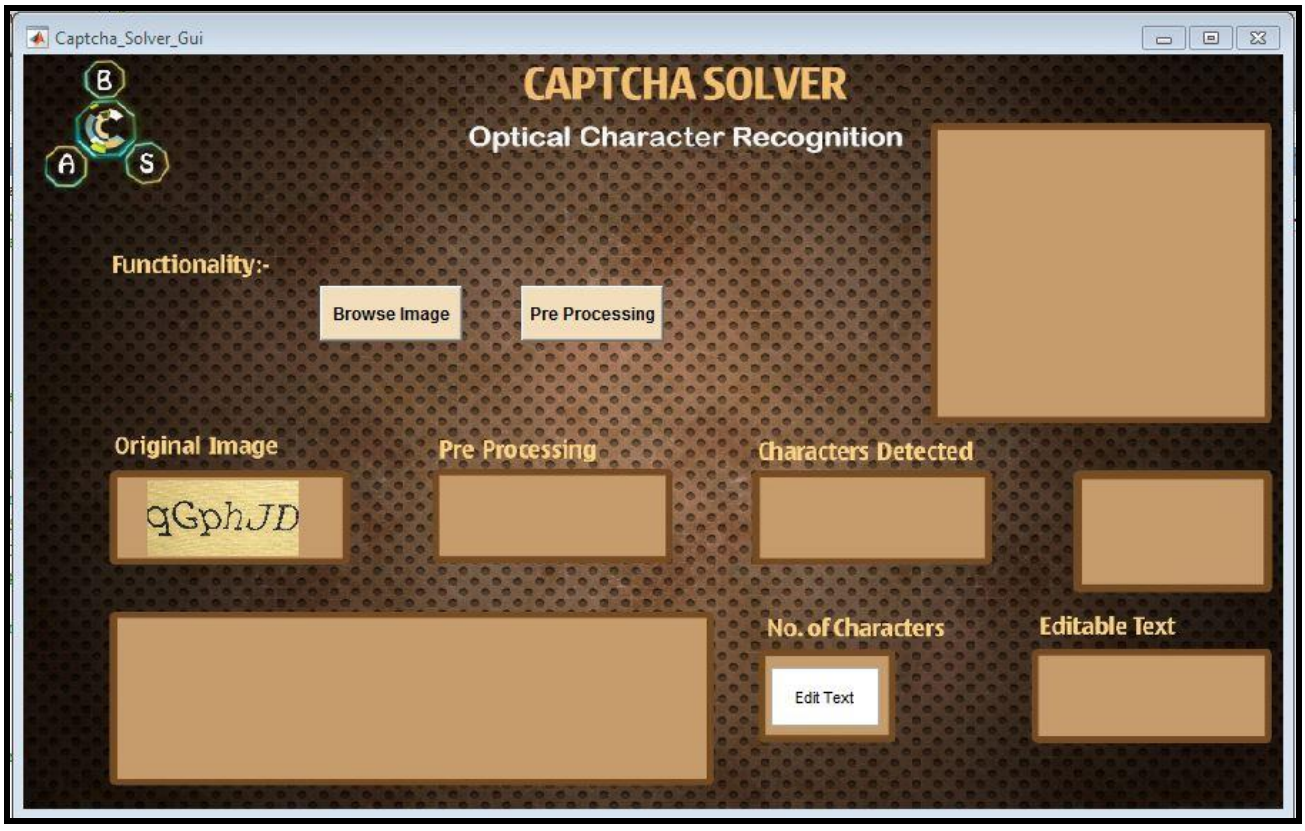


Figure 4.2.3

3.1.3 Pre-processing

Preprocessing button enables user to view some intermediate stages of translating image into text for example partitioning to string, characters identified, number of characters and neural network training. (Fig 4.3)

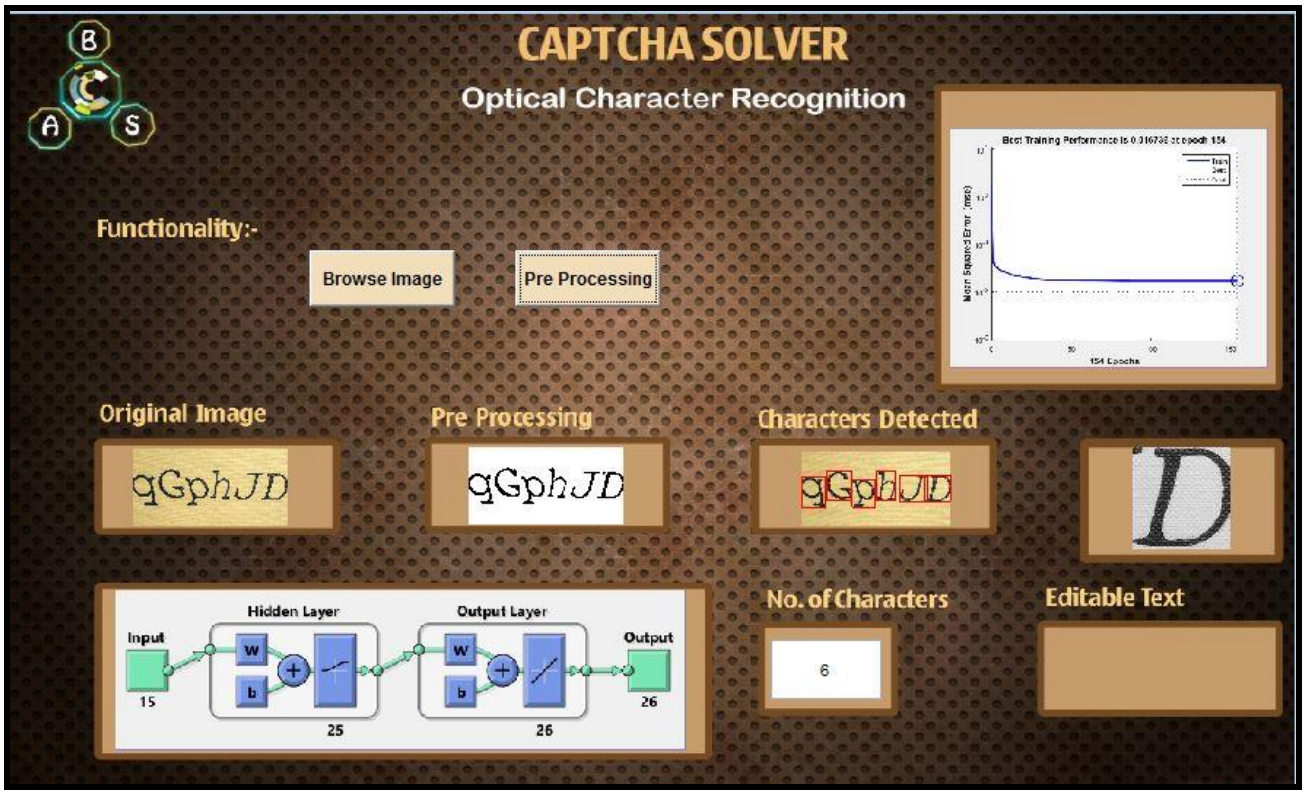


Figure 4.3

3.1.4 Editable text

Final output of Program is as given below:

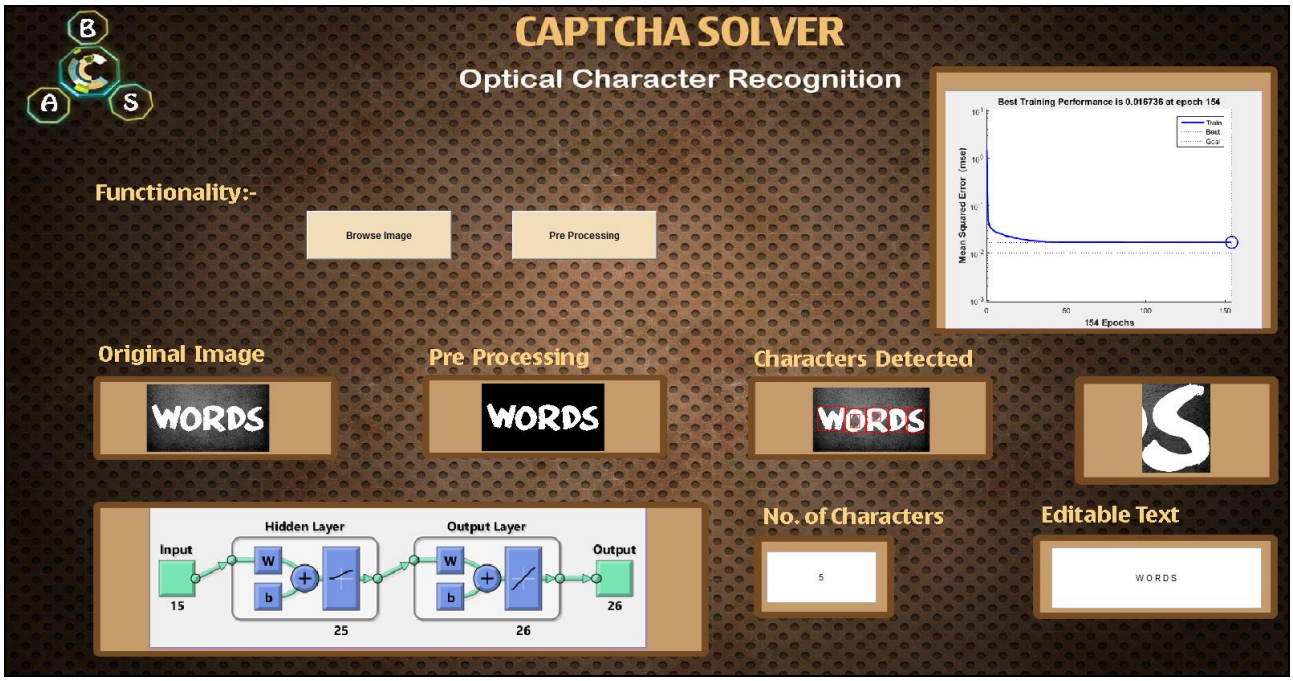


Figure 3.1.4

3.2 Hardware Interfaces

Captcha Solver itself requires 3MB (approx.) but an additional memory of 9GB is required for MATLAB installation.

3.3 Software Interfaces

As it is a Captcha Solver so there does not exist any login constraint on user. Common user have access to all features of the product. It requires MATLAB to run and compile on as it is a MATLAB program. System does not have any other software or hardware requirements rather than OS and a hardware that supports MATLAB R2015a .s

3.4 Communication Interfaces

Captcha Solver needs internet connection only once when user have to install MATLAB. After installation of current version System can work on its own without need of any communication interface.

4. System Features

4.1 Use Case Model

This system has one active user that can be analyzer, tester, common user or developer. All of them can view or access all parts of system as system doesn't require any login credentials.

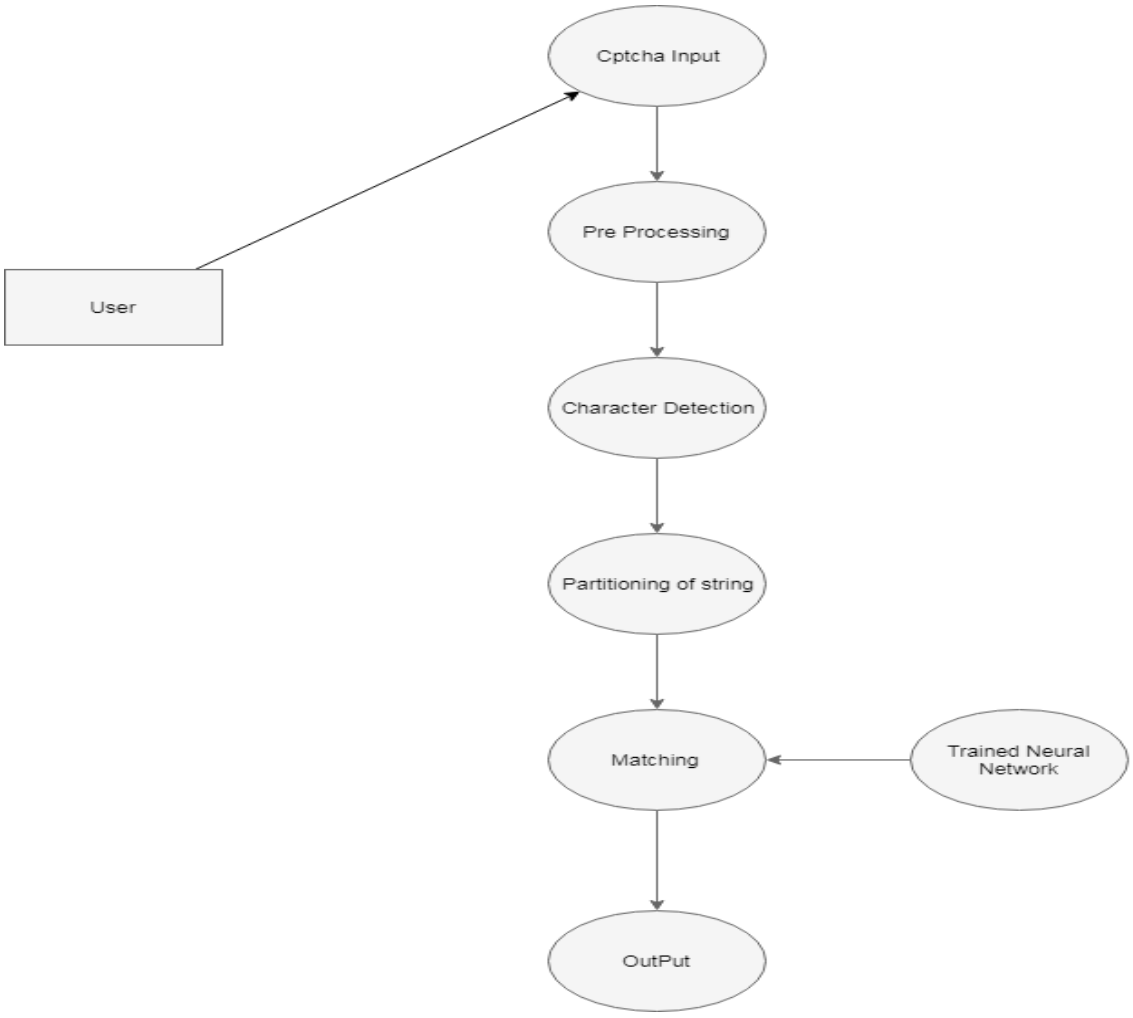
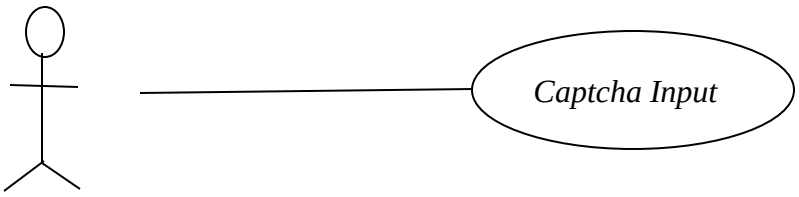


Figure 4

4.1.1 Captcha Input

Use case: Captcha Input

Diagram



User

Brief Description

User runs the code in his/her machine after installation of MATLAB. And gives input to the software.

Description

This use case applies on user who has already run the program in MATLAB

> GUI is appeared in front of user and he selects to upload an image to get its textual form by clicking on given option of "UPLOAD IMAGE".

Use Case	Feed Input
Trigger	User runs Program
Pre-Condition	GUI interface is opened in front of user
Basic Path	{how GUI code is executed step by step}
Post Condition	Image is uploaded and shown on an axis of GUI
Exception Paths	User can drop uploading image any time during Performa of task.

4.1.2 Pre-Processing

This option for the user who is analyzer or developer who want to check each and every step.

Use case: character detection

Diagram

User

Brief Description

User is able to detect characters in an image.

Step by Step Description

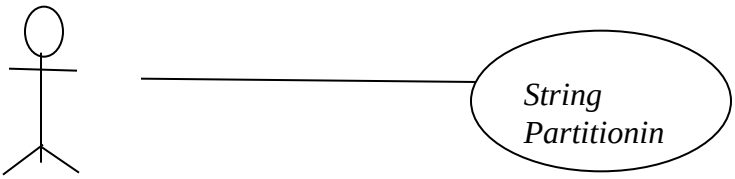
On click of preprocessing button user can see image divided into characters.

This task is done with help of bounding box. Each character is enclosed in an bounding box in this use case so that further processing should be done on this image.

Use Case	Character Detection
Reference	
Trigger	Click on pre-processing button
Pre-Condition	Image must be converted into a binary image before this task
Basic Path	1)User chooses to upload an image for character detection 2) Basic operations like noise removal , edge detection conversion into a binary image and holes filing is done before execution of this task 3) Click on preprocessing button enables software to detect characters from image.
Post Condition	Function returns image which has discrete characters detected in that.

Use case: String Partitioning

Diagram



User

Brief Description

String is divided into parts on basis of characters to get each character's image and identify text from that.

Step by Step Description

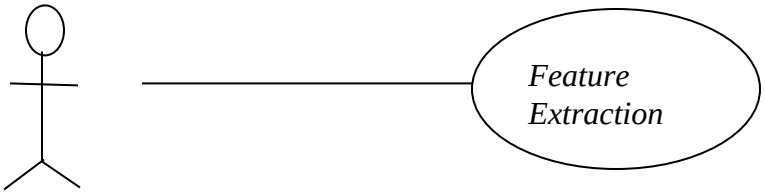
String of input will be passed to program. Program will do preprocessing on it, and will draw bounding box on bases of characters. Furthermore, it will crop image on basis of bounding box

Reference

Use Case	String Partitioning
Trigger	Click on Pre Processing button
Pre-Condition	Image uploaded
Basic Path	Input Pre processing
Post Condition	Partitioned String

Use case: Feature extraction

Diagram



User

Brief Description

Different important features are extracted after getting string inform of characters.

Step by Step Description

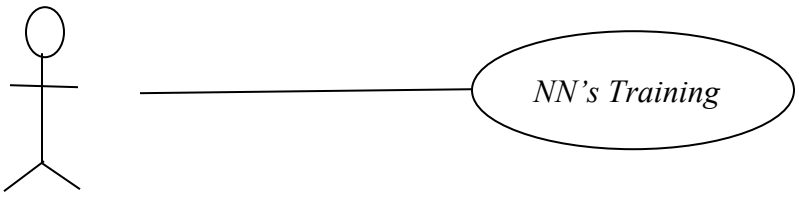
On each character feature extractor is applied which extracts following features

1) Finds black pixels in image
2) width and height of written part of image
3) centroid and area of image
4) Line detection
5) Rho and theta values for lines

Use Case	Feature Extraction
Trigger	Click on Pre Processing button
Pre-Condition	Segmented image
Basic Path	Input image Pre processing Partitioning
Post Condition	Extracted features stored in database

Use case: Neural Network Training

Diagram



User

Brief Description

Neural Network is trained on basis of features extracted of image.

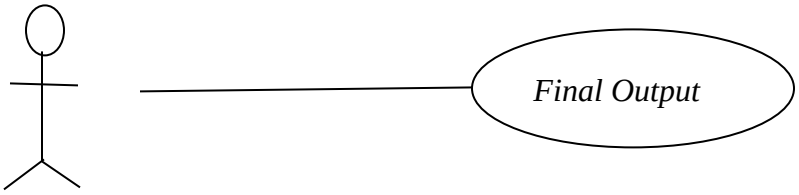
Step by Step Description

Extracted features are passed to neural network.

Use Case	Neural Network Training
Trigger	Features extracted
Pre-Condition	Extracted features stored in variable
Basic Path	Data Set Conversions , filtrations , holes filling Feature extraction Training of NN's
Post Condition	Trained Neural Network which is able to detect characters.

Use case: Matching and final out put

Diagram



User

Description

To get final out put captchas features are sent to neural network and after comparison final output is returned.

Use Case	Matching Final Output
Trigger	Pre Processing button clicked
Pre-Condition	Trained neural network
Basic Path	Data Set Conversions , filtrations , holes filling Feature extraction Training of NN's

	Final Out Put
Post Condition	Final out Put of program

5. Other Non-Functional Requirements

5.1 Security Requirement

Captcha Solver is open software which doesn't need any login credentials as well as interface is easy to understand and error checking and resolving is done so there are no security requirements for this software.

6. References

IEEE. IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications.

IEEE Computer Society, 1998.

Meriem Guerar, Mauro Migliardi, Alessio Merlo, Mohamed Benmohammed, Belhadri Messabih, "A Completely Automatic Public Physical test to tell Computers and Humans Apart: A way to enhance authentication schemes in mobile devices", High Performance Computing & Simulation (HPCS) 2015 International Conference on*, pp. 203-210, 2015.*

Appendix A: Glossary

Captcha: A technique to separate human from machine

Image Processing: Making Computer able to read and analyze images

Feature Extraction: Extracting unique features of an image to identify it uniquely.

Neural Networks: A Try to make computer intelligent artificially using same model as used by

MATLAB: An environment which is allows to work with matrix manipulation and graph plotting, therefore, used for image processing widely

Data Set: Collection of data to train neural network.

<--->