Decision Support System

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<u>Declaration</u>

We hereby declare that we have taken this thesis under the supervision of Farzana Sadia**, Senior lecturer, Department of Software Engineering, Daffodil International University.** We also declare that neither this thesis nor any part of this has been submitted elsewhere for award of any degree.

_____   _____

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Approval

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Chapter 1: Introduction

1.1 Project Overview

Decision support system is a computer program application that will help you to take decision analyzing business, organizational or other statistical data more efficiently, effective and easily. It serves the administration, tasks, and arranging dimensions of an association and help to decide, which might be quickly changing and not actually determined ahead of time. Using this application any big business organization can gather most important information which is very easily. This application is not appropriate for any kind of normal organization. If any organization want to use this application then here must need to give last few years data. Here is an upload option. After uploading data, it will show the result.

1.2 Project Purpose

You can make decisions about problems that may be rapidly changing and not easily specified in advance, such as unstructured and semi-structured decision problems. Evaluating a DSS project is very important as result of a corporation spends plenty of your time and cash in developing and implementing it. It should fulfill the expectations of users and aid in higher cognitive process. Assessing its measurability is additionally necessary as technology is dynamical terribly oft. It should be climbable and ready to integrate new tools and net technologies whenever would like arises.

1.2.1 Background

Decision support system aids the middle level management to enhance their decision making. The system has its input from the output generated by the operational level of management using the Management Information system.
The input for the choice web is internal data and that they are extremely elaborate. The center level management is that the one that intends to implement the strategic level choices given on the market resources. Call web is especially used for the reportage function (McGraw, 2008). Middle level management create semi-structured choice i.e. management choices created exploitation the choice web isn't structured compared to the operational level. They are won't to create 'on the spot', un-routine improved business choices.

1.2.2 Benefits and Beneficiaries

In business management it helps organizations in taking best decisions and improved efficiency.

Here is some benefits and beneficiaries of Decision support system

a)   Time saving

b)   Enhance effectiveness

c)   Improve interpersonal communication

d)   Cost reduction

e)   Increase decision maker satisfaction

f)   Increase organization control

1.2.3 Goals

General understanding of methods, techniques and systems for supporting complex real-life decision-making tasks.

Make sure the Decision support and data mining.

1.3 Stakeholders

Decision support system has many stakeholders. I am one of the stakeholders in decision support system.

Given below some stakeholder:

a)   Manager

b)   Owners

c)   Government

d)   Shareholders

1.4 Project schedule

Milestone	Planned Computation Week
Statement of Work	1
Software Requirement Specifications	2
Software Project Management Plan	3
Software Development Plan	4
Software Testing Plan	7
Building Prototype	20
Software Testing and Analysis	Along with final submission

Table for Project Schedule

1.6 Release plan/Milestone

The section describes the materials and resources required to start the project. Because most of the information was predefined for the team, the section will not describe the rationale for many of these choices.

Chapter 2: Software Requirement Specifications

2.1 Functional Requirements

Main things a system must be able to perform.

After entering user id and password user will be able to logged in. User will be able to view result after uploading the data.

2.2 Data Requirements

A properly designed DSS is AN interactive software-based system meant to assist call manufacturers compile helpful data from a mixture of information, documents, and private data, or business models to spot and solve issues and create selections.

2.3 Performance Requirements

Performance requirements such as efficiency, reliability, correctness should be considered while developing the system. Proper tests and bug fixes improve the quality of software significantly. The speed and the smoothness with which our application retrieves data and performs operations have a significant impact on users' experience.

2.3.1 Speed and latency requirements

Time is money. That's why every organization focus on time. Decision support system output is very fast, after uploading data it needs only few second to give the output.

2.3.2 Capacity Requirements

We must conduct capacity requirements planning regularly to keep up with changes in supply and demand. Our capacity requirements planning may be happen monthly, quarterly or annually.

2.4 Dependability Requirements

The dependability of Decision support system reflects the extent of user's confidence that it will operate as users expect and that it will not corrupt data or other systems and it will not fail in normal use.

2.4.1 Reliability requirements

It is able to deliver services when specified.

2.4.2 Availability requirements

It is able to deliver services when requested.

2.4.3 Safety critical requirements

It is able to operate without catastrophic failure.

2.5 Maintainability and supportability requirements

Theory explained by some points

2.5.1 Maintenance requirements

Decision support system maintenance process is very smooth. It keeps solutions healthy to deal with changing technical and business environment. It introduces technical advancements almost every day that improve solution efficiency to streamline business operations.

2.5.2 Supportability requirements

In Decision support system supportability is one of the aspects. Technical support is good. It does not need to install and configure. Only need a browser for getting expected result.

2.6 Security requirements

In Decision Support System there is a strong security support. Every user has different user id.

2.6.1 Access requirements

Access requirement is very important for any security system. User can't use same email and same user id Here must need unique email and user id.

2.6.2 Integrity requirements

Our system ensure that data is real, accurate and safeguarded from unauthorized user modification.

2.6.3 Privacy requirements

In Decision support system our privacy policy is very good. No one can see personal information of others person. This privacy policy describes how the decision support system collects, uses, shares and protects the personal information that we collect through this Site. You have to provide us with personal information like your name, contact no, mailing address and email id.

2.7 Look and feel requirements

In Decision support system most basic terms, the "look and feel" of a website is how the site looks to the user and how it feels when he or she is interacting with it.

2.7.1 Appearance requirements

The appearance requirements defined by the following components.

- Color palette
- Layout
- Font choices
- Overall styling

2.7.2 Style requirements

It is extremely important when multiple designers are working on a big website. In development, having defined elements of the website makes it easy for developers to reuse these elements. it easier because they will get what elements they have to code and will see exactly how they need to look from the start.

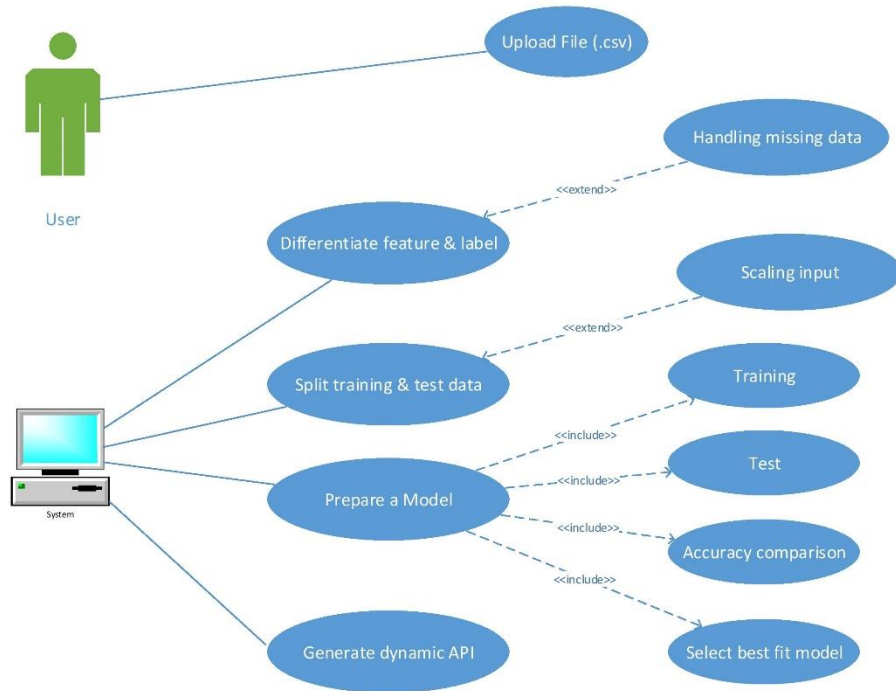# Chapter 3: System Analysis
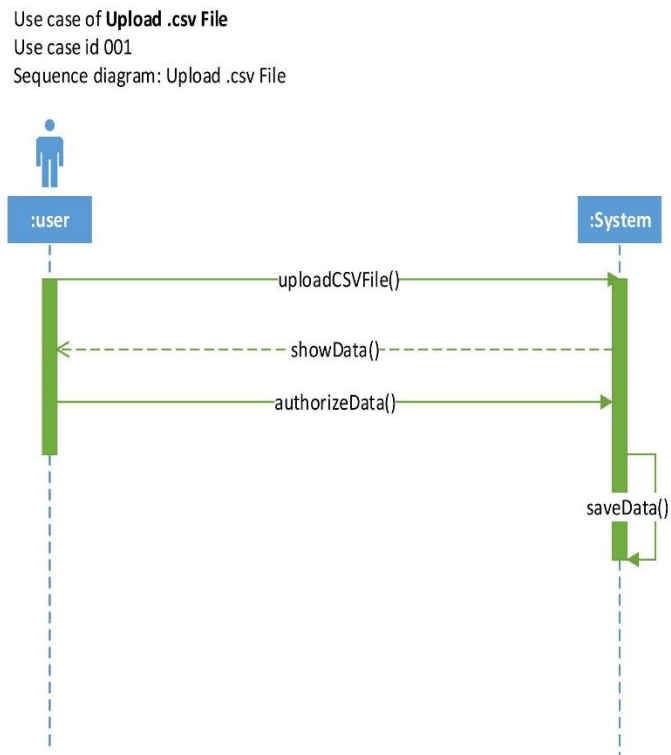
3.1 Use Case Diagram

Figure 1: Use case Diagram

Chapter 4: System Design Specification

4.1 Sequence Diagram

Given complete Sequence Diagram for Decision Support System

Use case of **Upload .csv File**
Use case id 001
Sequence diagram: Upload .csv File

Use case of **Differentiate Feature & Label**
Use case id 002
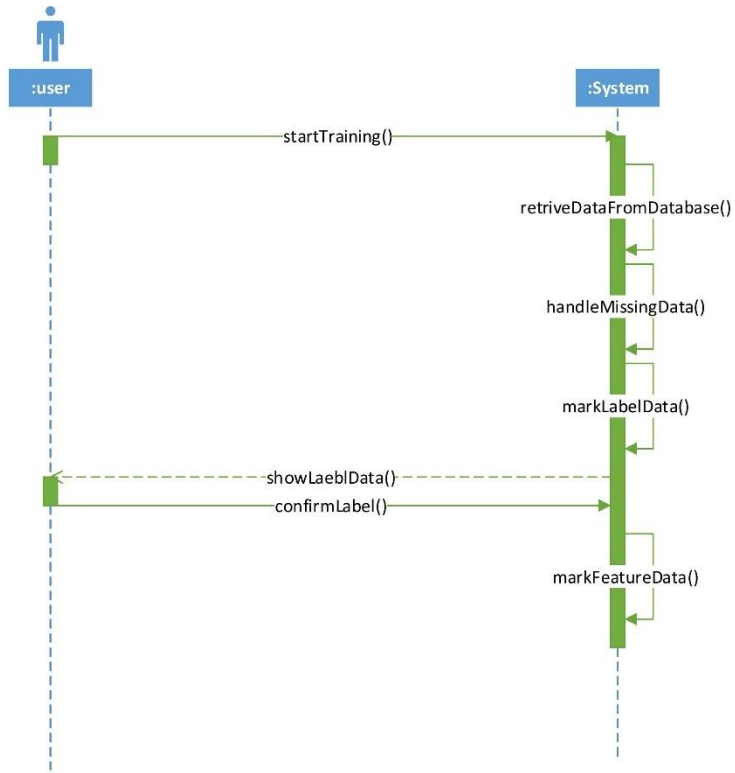Sequence diagram: Differentiate Feature & Label

Figure 2

Use case of **Split Training & Testing Dataset, Data Normalization**
Use case id 003, 004
Sequence diagram: Split Training & Testing Dataset, Data Normalization
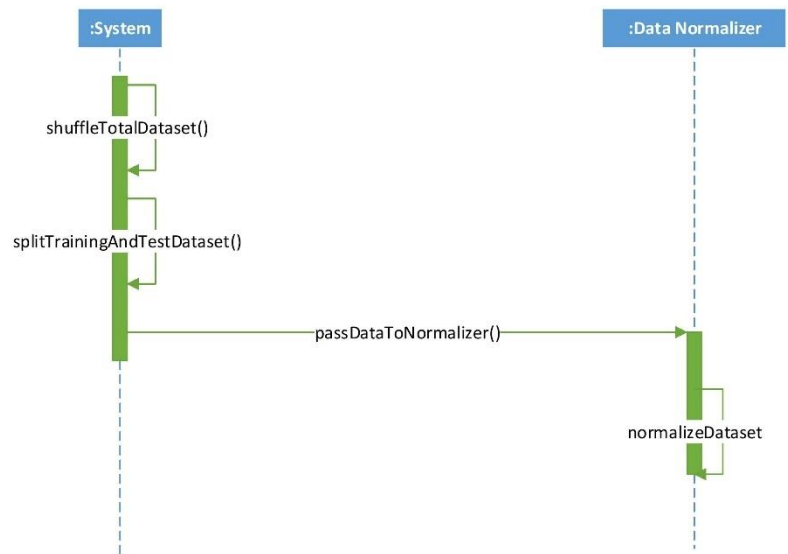

Figure 3

Use case of **Training & Testing, Accuracy Comparison, Generate Dynamic API**
Use case id 005, 006, 007
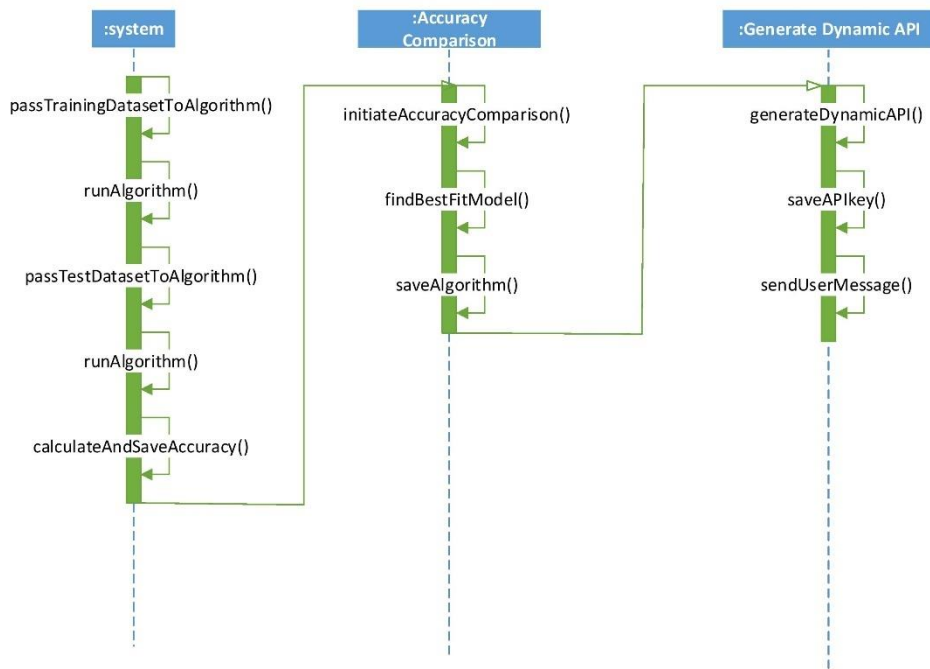Sequence diagram: Training & Testing, Accuracy Comparison, Generate Dynamic API

Figure 4

Figure 5

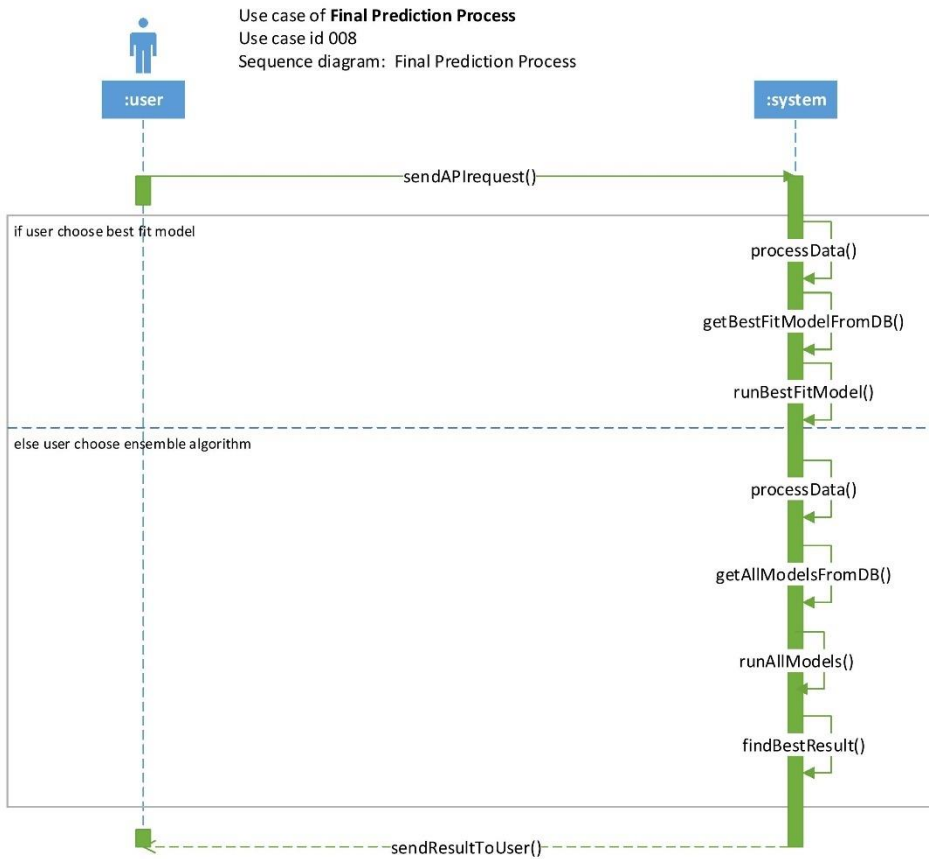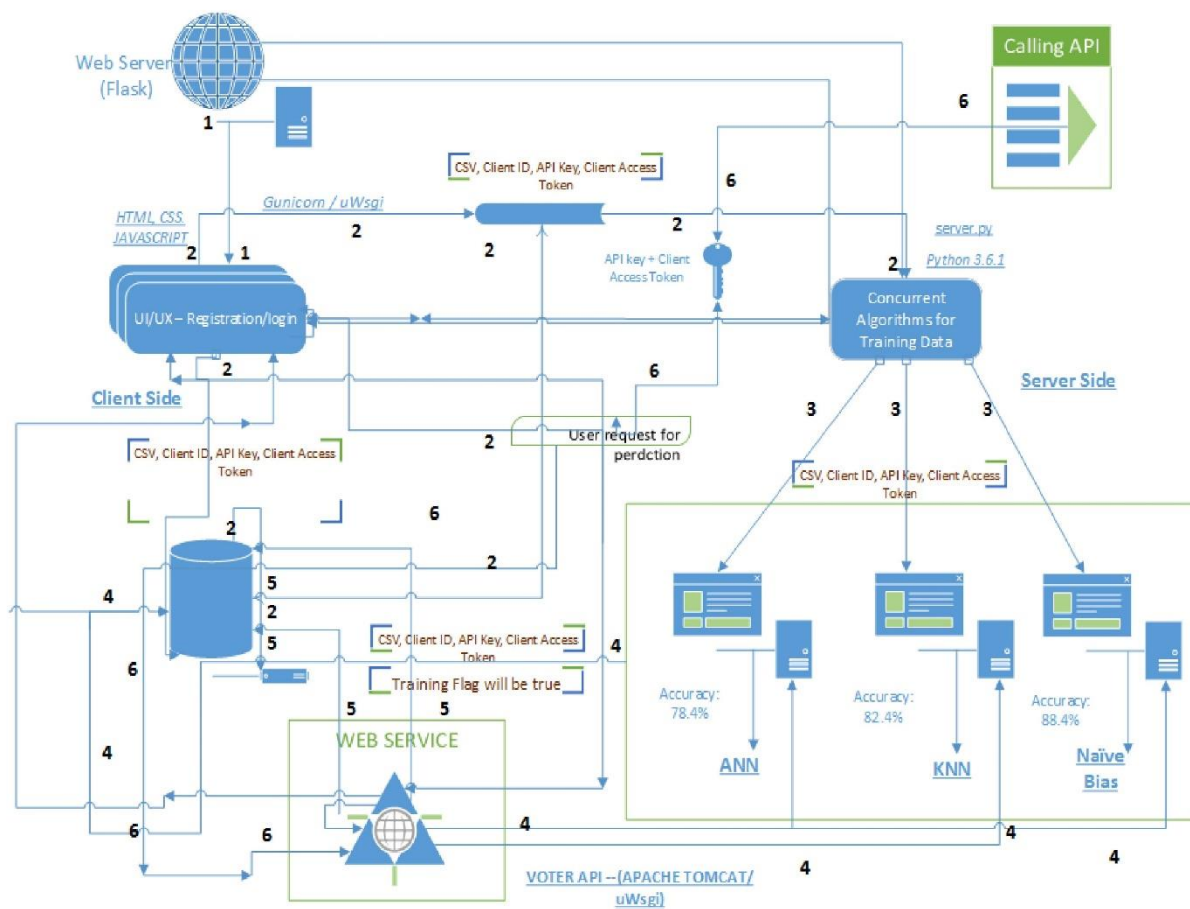## 4.2 Process flow/Architecture

Figure 6

4.3 Development tools and Technology

Given all development tools and technology that used in our project.
- Python
- Scikit-learn
- Numpy
- Pandas

4.3.1 User Interface technology

- Django
- JQuery UI
- Twitter Bootstrap
- Font Awesome

4.3.2 Implementation tools and platforms

- PyCharm 2019
- Windows Operating System
- MongoDB
- Apache HTTP Server

Chapter 5: System testing

5.1 Testing Features

All tested features given below

5.1.1 Tested Features

- Registration
- Login
- Dataset Upload
- Data View
- User profile picture change
- User information change
- Machine learning model creation
- Live dataset upload

5.2 Testing Strategies

- Load Testing
- Concurrency Testing
- Security Testing

5.2.1 Test Approach

- Manual Testing
- Unit Testing

5.2.2 Pass/Fail Criteria

All test passed

5.3 Test case

Test case for Registration page:

Can't be registration without any fill out any field

Test case for Upload file:

If any user Upload any kind of file without CSV then it will give error

Chapter 6: User Manual

Key Points:

- Sign Up
- Login
- Logout
- Forget Password
- Change Password
- Profile
- Profile Setting
- Data Set
- CSV
- Upload Dataset
- List Dataset
- Model
- Start Training
- API
  - API Endpoint
  - API Method
  - API-Variable
  - Retraining
    - Dataset Retraining
    - Model Retraining
  - Delete
    - Delete Dataset
    - Delete Model

Sign Up

If you are a new user you have to sign up first to use the system.
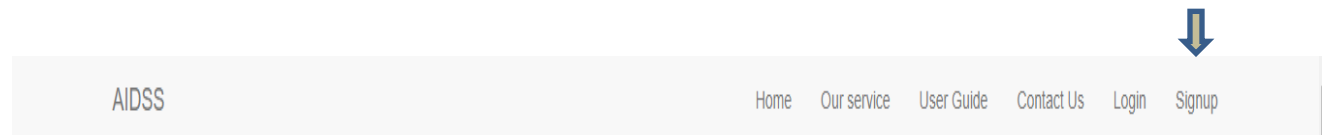

Figure 7: Signup

From the navigation bar of the home page, please click on the Signup option pointed in the following figure.

Provide necessary information.

Fields that are mandatory must be filled.

Provide a valid email which will be used to recover or rest your password.

After providing all valid info press the 'Sign up' button.

Login

An existing user can login to the system. If you are not registered then sign up first. If you are already registered then click on the Login option pointed in the following figure.
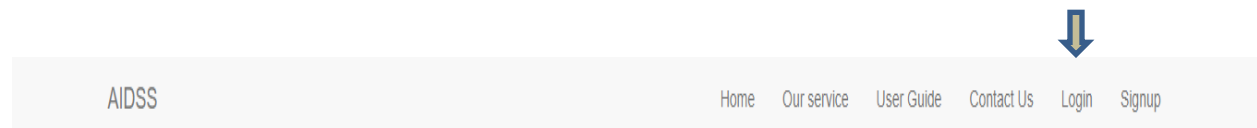

Figure 8: Login

Provide your user name and password. Then click 'Login' button. If you forget your password, click 'Forget password?'

Logout

Always logout from your system when you are done with your job.

You can logout from the dropdown list under 'username' of the navigation bar or from the side menu bar as shown in the following figures.
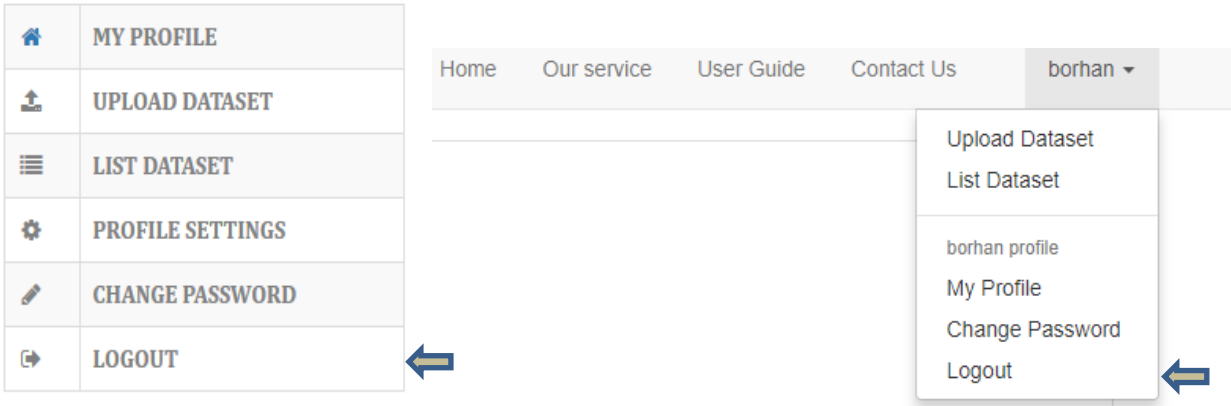
Figure 9: Logout

Forget Password

If you forget your password during login you can set your password using your email id provided by you while registration.

Figure 10: Forgot Password

Figure 11: Email

Click on forget password in the login page, a new page will be shown where you have to provide your email id.

If your email id is valid then a password recovery link will be sent to your mail. You have to set a new password following the link provided in your mail.

Change Password

To change your password, you have to login first then select change password from the dropdown menu under 'username' of the navigation bar or from the side bar shown in the following figures.
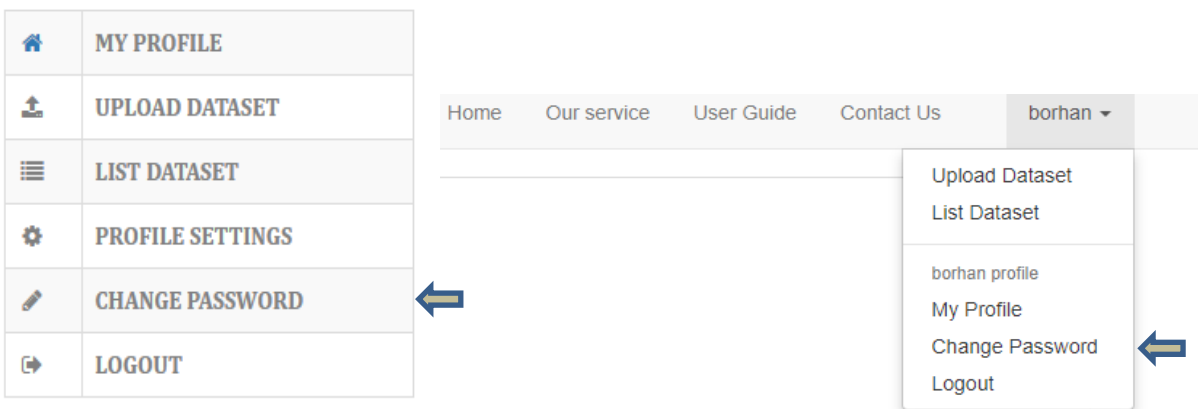
Figure 12: Change Password

Select change password, a new page will appear where you have to provide your current pass and your expected new password twice.

Profile

Your profile shows your information provided by you during registration. You can check your profile information by selection 'My Profile' option from the dropdown menu under 'username' in the navigation bar.

Figure 13: My Profile

Profile Setting

You can change your profile information by selecting edit in 'My Profile' page or selecting Profile setting from the side bar.

Figure 14: Profile Settings

After selectin 'Edit' or 'PROFILE SETTING' a new page will appear where you can edit or update your information except your username and email.

Click the edit sign of each row. A text box will appear. Enter the changed value and press enter. Your information will be updated.

Data Set

A data set (or dataset) is a collection of data. Most commonly a data set corresponds to the contents of a single database table, or a single statistical data matrix, where every column of the table represents a particular variable, and each row corresponds to a given member of the data set in question.

The **DSS** (Decision Support System) work on such datasets that are used to take decisions. You can use any dataset with a variable number of columns. The file format should be .**CSV** (example: data.csv)**.** The thing that you have to consider that the decision class or column should be the last column. The system is designed in such way that it will train itself based upon the feature attributes (columns except the decision column) using the decision attribute (the last column).

The major issues that you have to remember:

- ✓ The training dataset must include the decision attribute.
- ✓ The dataset must be fully featured. Incomplete dataset will be modified by the system. The records with missing data will be removed from the dataset.
- ✓ The test dataset must have similar feature attributes with the similar order as the training dataset.
- ✓ Number of columns in the test dataset will be 1 less than the number of columns in the training dataset (all attributes except the decision attribute)
- ✓ The decision attribute will be automatically generated by the system as an attribute named 'Predicted result' and will be displayed at the first of the dataset.
- ✓ An auto generated file will be created by the system of the predicted data.

CSV

CSV stands for "comma-separated values". CSV is a simple file format used to store tabular data, such as a spreadsheet or database. Files in the CSV format can be imported to and exported from programs that store data in tables, such as Microsoft Excel or OpenOffice Calc.

You have to upload the dataset in .csv format.

Upload Dataset

To upload dataset, you have to login first then select 'Upload Dataset' from the dropdown menu under 'username' of the navigation bar or from the side bar shown in the following figures.
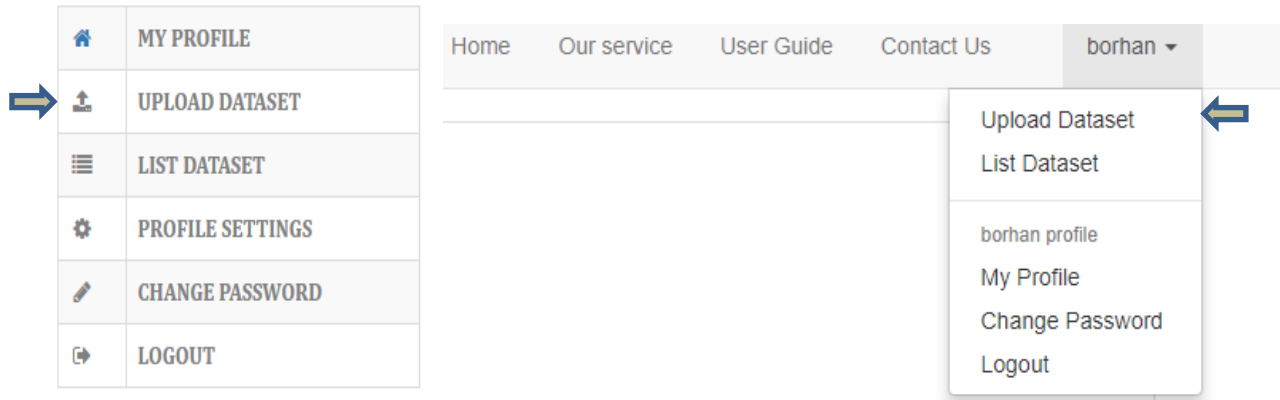
Figure 15: Upload Dataset

A new page will be shown were you have to provide the dataset name and choose a file from your directory and click the 'Upload' button.

List Dataset

To see your uploaded datasets, you have to login first then select 'List Dataset' from the dropdown menu under 'username' of the navigation bar or from the side bar shown in the following figures.
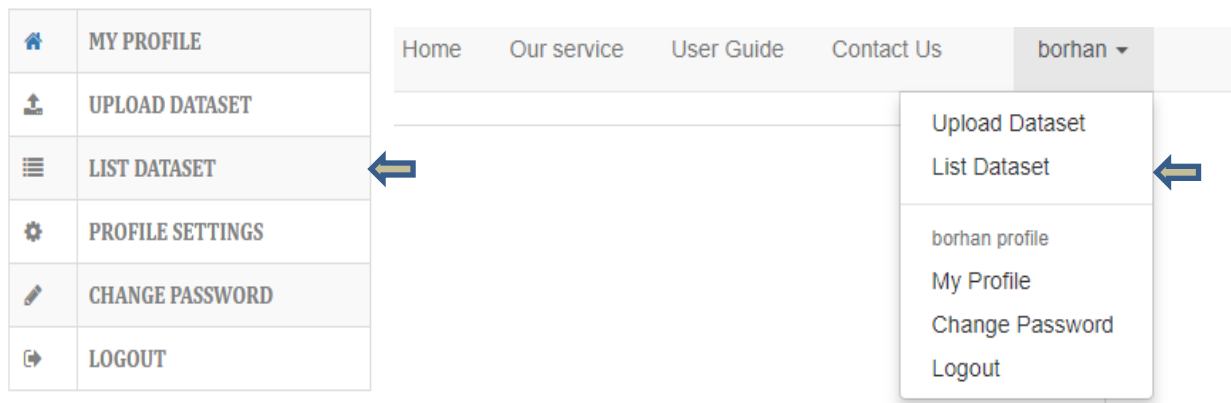

Figure 16: List Dataset

A new page will appear with a list of datasets you uploaded. If no dataset is uploaded yet, you will be given an option to upload your desired dataset.

Model

A model is something to which when you give an input, gives an output. In Machine Learning, any 'object' created after training from an ML algorithm is a model.

An algorithm is a procedure or formula for solving a problem, based on conducting a sequence of specified actions. A computer program can be viewed as an elaborate algorithm.

In DSS, the models are created after the training of the algorithms using the datasets provided by you.

Each model has its own mechanism to predict the output based on the algorithms. You can choose a model analyzing the training and testing scores. You can choose any model of any algorithm for classification or regression problems.

Some related definitions:

Training: While training for machine learning, you pass an algorithm with training data. The learning algorithm finds patterns in the training data such that the input parameters correspond to the target. The output of the training process is a machine learning model which you can then use to make predictions. This process is also called "learning".

Regression: Regression techniques are used when the output is real-valued based on continuous variables. For example, any time series data, predicting the price of a product etc.

Classification: In classification, you will need to categorize data into predefined classes. For example, an email can either be 'spam' or 'not spam', a sample product either can be a 'pen' or 'pencil', a loan can either be 'approved' or 'not'.

Feature: Features are individual independent variables that act as the input in your system. Prediction models use features to make predictions. More simply, you can consider one column of your data set to be one feature. Sometimes these are also called **attributes**. And the number of features is called **dimensions**.

Class/Label: Labels or classes are the final output. You can also consider the output classes to be the labels. When data scientists speak of labeled data, they mean groups of samples that have been tagged to one or more labels.

Start Training

After uploading dataset, you can train the system over your datasets. When you click on 'Start Training' the system will automatically detect the problem either it is classification problem or regression problem and ask you to confirm. When you confirm the system will start feeding the data to the algorithms. Each algorithm will create different models for each algorithm fit to the dataset.

You have to wait for a while to let the system to be trained and create models. The training time will depend on the size of the training dataset provided by you.

After creating the models, analyzing the training score and the testing score you can predict providing the test data to the system using your selected model.

Retraining

You can retrain the system with the existing dataset which is already trained minimum once.

Dataset retraining: If you retrain your dataset then all the models will be newly created with new training parameters and will replace the existing models of that dataset only.

Model retraining: If you retrain individual model, only the selected model will be retrained, create a new model and replace the existing one.

Delete

You can delete the datasets which are already used or irrelevant or nor more to use. You even can delete one or more models of a dataset.

Delete Dataset: If you delete your dataset then all the models of that particular dataset will also be deleted automatically.

Delete Model: If you delete individual model, only the selected model will be deleted. Even you can delete all the models keeping the dataset only.

API

API stands for Application Programming Interface, is a set of routines, protocols, and tools for building software applications.

An API is a software intermediary that allows two applications to talk to each other. In other words, an API is the messenger that delivers your request to the provider that you're requesting it from and then delivers the response back to you.

We have used Django REST framework to develop the API for DSS.

REST describes a set of architectural principles by which data can be transmitted over a standardized interface (such as HTTP). REST does not contain an additional messaging layer and focuses on design rules for creating stateless services. A client can access the resource using the unique URI and a representation of the resource is returned. With each new resource representation, the client is said to transfer state. While accessing RESTful resources with HTTP protocol, the URL of the resource serves as the resource identifier and GET, PUT, DELETE, POST and HEAD are the standard HTTP operations to be performed on that resource.

API Endpoint: In REST, the resource typically refers to some object or set of objects that are exposed at an API endpoint such as /api/users/asif. An endpoint by itself is just a reference to a URI that accepts web requests that may or may not be RESTful.

We will provide an API endpoint for each trained model. You can only POST request through the endpoint and get the predicted result/results.

API variable: The provided API endpoint will receive a single variable

    "live‑data" containing a datafile for prediction.

Chapter 7: Project Summary

7.1 Github link

https://gitlab.com/noyonict/dss

7.2 Limitations

- Only accept CSV file

- Lust column should be decision column

- Only four algorithm used others not included yet

- Machine learning algorithm can be more improved

- Various algorithms accept various kind of dataset but not good for all dataset

7.3 Future Scope

- Make more user friendly

- Collect appropriate requirement

- Make service faster

- Faster processing information as compared to the current system

- Include more function and produce more widgets to the system

- Can enhance the interface so that it looks more attractive and interactive

7.4 Conclusion

Our Decision Support System is such a good for big organization. Our system is a good marketplace for business also. They can easily take a decision. Our system provides a very user-friendly interface which is very easy to use for anyone with qualification.