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INTRODUCTION

1.1 Machine Learning

Machine Learning is a system of computer algorithms that can learn from example through self-improvement without being explicitly coded by a programmer. Machine learning is a part of artificial Intelligence which combines data with statistical tools to predict an output which can be used to make actionable insights. The breakthrough comes with the idea that a machine can singularly learn from the data (i.e., example) to produce accurate results.

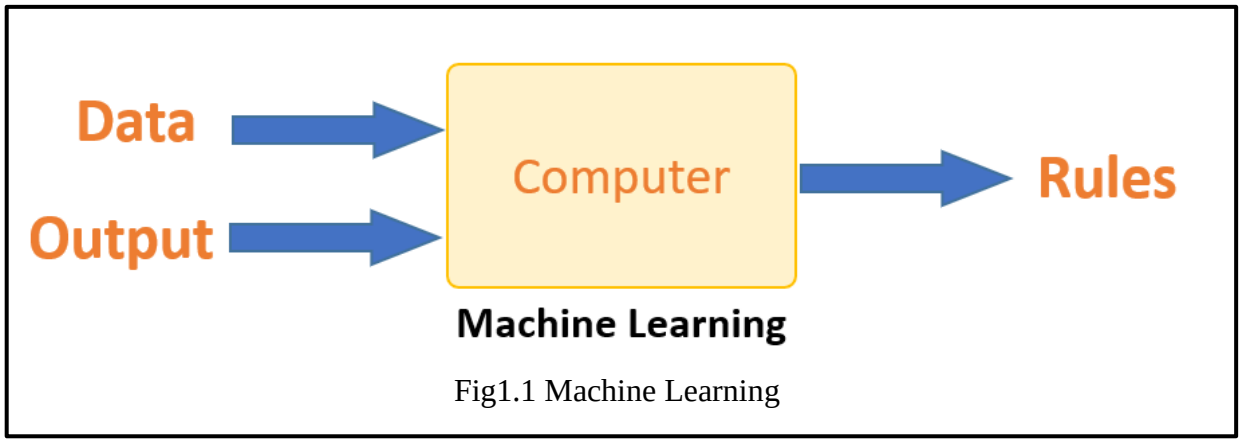
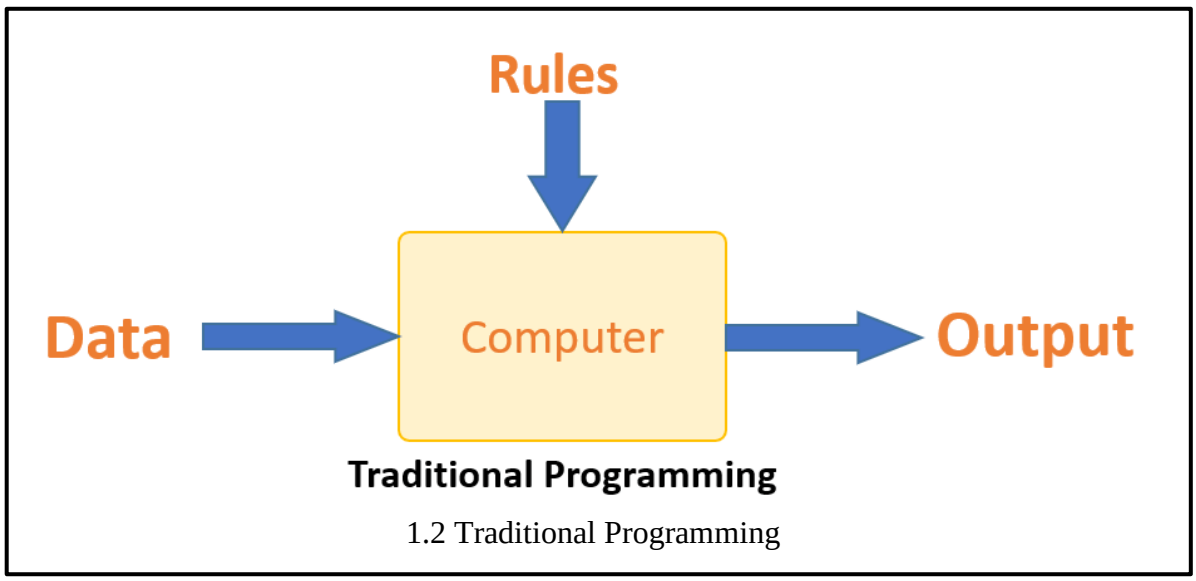


Fig1.1 Machine Learning

Machine Learning vs. Traditional Programming

Traditional programming differs significantly from machine learning. In traditional programming, a programmer code all the rules in consultation with an expert in the industry for which software is being developed. Each rule is based on a logical foundation; the machine will execute an output following the logical statement.



1.2 Traditional Programming

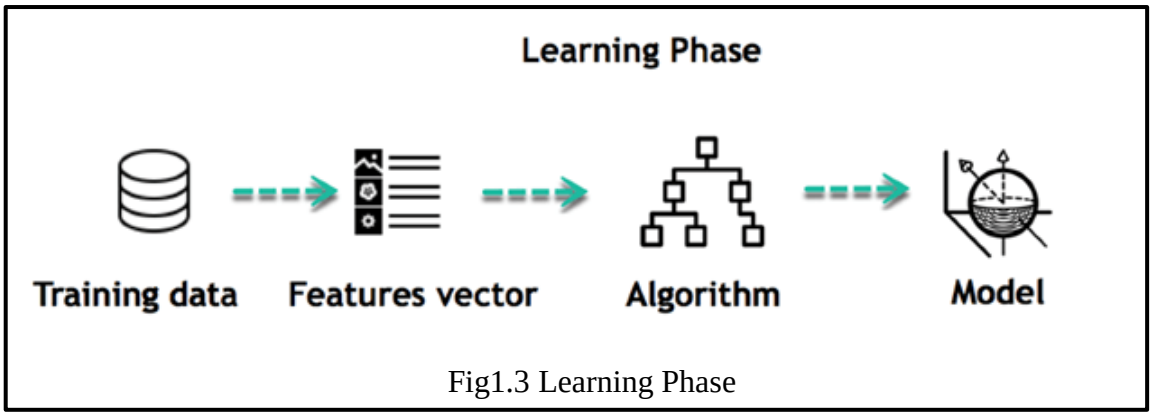


Fig1.3 Learning Phase

1. Define a question
2. Collect data
3. Visualize data
4. Train algorithm
5. Test the Algorithm
6. Collect feedback
7. Refine the algorithm
8. Loop 4-7 until the results are satisfying
9. Use the model to make a prediction

Machine Learning Algorithms and where they are used?

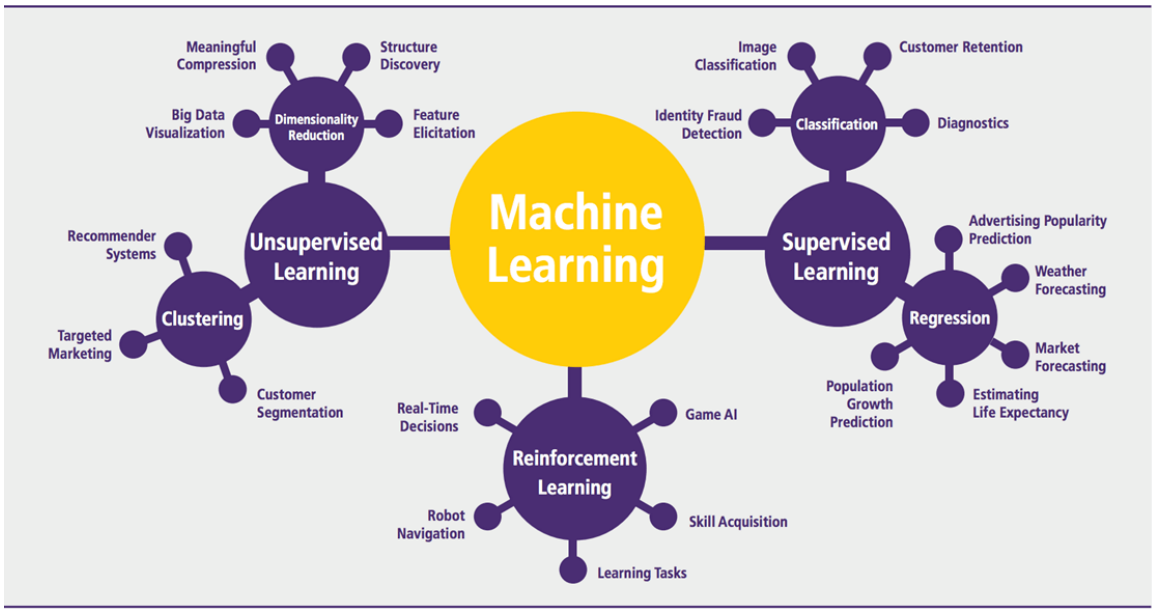


Fig1.4 Machine learning Algorithms

1.2. Supervised learning

An algorithm uses training data and feedback from humans to learn the relationship of given inputs to a given output. For instance, a practitioner can use marketing expense and weather forecast as input data to predict the sales of cans. You can use supervised learning when the output data is known. There are two categories of supervised learning:

- Classification
- Regression

1.3 Unsupervised learning

In unsupervised learning, an algorithm explores input data without being given an explicit output variable (e.g., explores customer demographic data to identify patterns). You can use it when you do not know how to classify the data, and you want the algorithm to find patterns and classify the data for you. There are two categories of un-supervised learning:

- Clustering
- Association rules

1.4 Reinforcement learning

Reinforcement learning is an area of machine learning concerned with how software agents thought to take actions in an environment so as to maximize some notion of cumulative reward. Due to its generality, the field is studied in many other disciplines, such as game theory, control theory, operations research, information theory, simulation-based optimization, multi-agent systems, swarm intelligence, statistics and genetic algorithms. There are two categories of Reinforcement learning:

- Positive reinforcement learning
- Negative reinforcement learning

1.5 Application of Machine Learning

- Automation
- Finance Industry
- Government organization
- Healthcare industry
- Marketing

1.6 How does Machine Learning Work?

Machine learning is the brain where all the learning takes place. The way the machine learns is similar to the human being. Humans learn from experience. The more we know, the more easily we can predict. By analogy, when we face an unknown situation, the likelihood of success is lower than the known situation. Machines are trained the same. To make an accurate prediction, the machine sees an example. When we give the machine a similar example, it can figure out the outcome. However, like a human, if it's feed a previously unseen example, the machine has difficulties to predict.

Data mining

Machine learning and data mining often employ the same methods and overlap significantly, but while machine learning focuses on prediction, based on known properties learned from the training data, data mining focuses on the discovery of (previously) unknown properties in the data (this is the analysis step of knowledge discovery in databases).

Statistics

Machine learning and statistics are closely related fields in terms of methods, but distinct in their principal goal: statistics draws population inferences from a sample, while machine learning finds generalizable predictive patterns.

Feature learning

Several learning algorithms aim at discovering better representations of the inputs provided during training. Classic examples include principal components analysis and cluster analysis. Feature learning algorithms, also called representation learning algorithms, often attempt to preserve the information in their input but also transform it in a way that makes it useful, often as a pre-processing step before performing classification or predictions.

LITERATURE SURVEY

1) Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges

AUTHORS: K. F. Hew and W. S. Cheung

Massive open online courses (MOOCs) are among the latest e-learning initiative to attain widespread popularity among many universities. In this paper, a review of the current published literature focusing on the use of MOOCs by instructors or students was conducted. Our primary goal in doing this is to summarize the accumulated state of knowledge concerning the main motivations and challenges of using MOOCs, as well as to identify issues that have yet to be fully addressed or resolved. Our findings suggest four reasons why students sign up for MOOCs: the desire to learn about a new topic or to extend current knowledge, they were curious about MOOCs, for personal challenge, and the desire to collect as many completion certificates as possible. Up to 90% drop out due to reasons including a lack of incentive, failure to understand the content material and having no one to turn to for help, and having other priorities to fulfill.

2) Understanding the massive open online course (MOOC) student experience: An examination of attitudes, motivations, and barriers

AUTHORS: H. B. Shapiro, C. H. Lee, N. E. Wyman Roth, K. Li, M. Çetinkaya-Rundel, and D. A. Canelas

During the widespread development of open access online course materials in the last two decades, advances have been made in understanding the impact of instructional design on quantitative outcomes. Much less is known about the experiences of learners that affect their engagement with the course content. Through a case study employing text analysis of interview transcripts, we revealed the authentic voices of participants and gained a deeper understanding of motivations for and barriers to course engagements experienced by students participating in Massive Open Online Courses (MOOCs). We sought to understand why learners take the courses, specifically Introduction to Chemistry or Data Analysis and

Statistical Inference, and to identify factors both inside and outside of the course setting that impacted engagement and learning.

3) openSAP: Evaluating xMOOC Usage and Challenges for Scalable and Open Enterprise Education

AUTHORS: J. Renz, F. Schwerer, and C. Meinel

The openSAP University is a co-innovative initiative founded in 2013 by SAP SE in partnership with the Hasso-Plattner-Institute (HPI) located in Potsdam, Germany. With its new course offering, SAP responds to a rising demand for scalable knowledge transfer due to the digital transformation by making use of the Massive Open Online Courses (MOOC) format. This paper provides a brief introduction to the first Enterprise MOOC platform openSAP, including details about the learning environment and the underlying platform, different team roles and usage statistics. In addition, the topic of dropouts in enterprise MOOCs will be addressed and discussed. A standardized calculation model for enterprise MOOCs to measure completion and consumption rates is proposed. The paper closes with an outlook about the future work on enterprise MOOCs

4) Experiences in MOOCs: The Perspective of Students

AUTHORS: S. Zutshi, S. O'Hare, and A. Rodafinos

The aim of this article was to examine the experiences of students who have participated in massive open online courses (MOOCs). The results of an initial Google blog search were narrowed down to a sample of twenty-one blog posts, each of which was written by a MOOC participant. Content analysis was applied to identify and classify blog comments into emergent themes (e.g., the relevance of type and length of course, student demographics, instruction/instructor interactive styles, and factors that impacted on the learning process) to develop a picture of their experiences. Overall, mixed feelings were expressed. Results provided a glimpse of the student experiences, including why students take such courses, what elements of their experience are positive, and what can be improved from the student point of view.

5) Interaction pattern analysis in cMOOCs based on the connectivist interaction and engagement framework

AUTHORS: Z. Wang, T. Anderson, L. Chen, and E. Barbera

Connectivist learning is interaction-centered learning. A framework describing interaction and cognitive engagement in connectivist learning was constructed using logical reasoning techniques. The framework and analysis was designed to help researchers and learning designers understand and adapt the characteristics and principles of interaction in connectivist learning contexts. In this study empirical evidence to support and further develop this framework is presented. This study analyzed 6 weeks of data harvested from the daily newsletter, Twitter, and a Facebook group in a well-known cMOOC led by George Siemens and Stephen Downes. These text transcripts were analyzed using a deductive approach of qualitative content analysis. This study revealed the main activity patterns of participants as they engage in four levels of interaction (operation interaction, wayfinding interaction, sensemaking interaction, and innovation interaction) during the MOOC. Generally the framework serves as a conceptual model to understand and to analyze the interaction in this cMOOC, although some implied interaction is hard to recognize and categorize. The relationship of the four levels of interaction and the role of each element in the framework were explored with the intent of offering the framework as a conceptual and analytic tool to guide both researchers and practitioners in designing and studying connectivist learning.

SYSTEM ARCHITECTURE

3.1 SYSTEM REQUIRMENTS

HARDWARE REQUIREMENTS:

- System : Intel core i5 Processor.
- Hard Disk : 256 GB.
- Monitor : 15.6'' LED
- Input Devices : Keyboard, Mouse
- RAM : 8 GB

SOFTWARE REQUIREMENTS:

- Operating system : Windows 11.
- Coding Language : Python, HTML, CSS, JavaScript
- Web Framework : Flask

3.2 SYSTEM ANALYSIS

EXISTING SYSTEM:

- The Factor Analysis Model (FAM) was proposed to predict the student's performance in Intelligent Tutoring System (ITS) taking into consideration the difficulty level of assessments based on Item Response Theory concept. The difficulty level of tasks can infer measurement of the correlation between the student's performances and assessment questions. To compute the probability of a student solving a task correctly, a set of predictor variables are defined in the FAM including the number of opportunities presented to the student at each task, the duration spent on each step and the difficulty level of each question or latent variable. The results reveal that incorporating the latent variables into the estimates of student performance can significantly enhance the model.

- S. Jiang et. al. proposed Students' marks in the first assessment and quiz scores in conjunction with social factors are used to predict students' final performance in online course. Two predictive models were introduced. In the first model, logistic regression was used to predict whether students gained a normal or distinction certificate. In the second predictive model, logistic regression was also used to predict if students achieved certification or not. The results indicated that the number of peer assessment is the most effective feature for acquiring a distinction. The average quiz scores were considered the most reliable predictor for earning a certificate.

DISADVANTAGES OF EXISTING SYSTEM:

- The student performance has been evaluated in online course using only two targets: "success" and "fail".
- Lower Accuracy
- Average Performance.
- No Accurate results

PROPOSED SYSTEM:

- In this paper, a model is proposed to predict the performance of students in an academic organization. The algorithm employed is a machine learning technique called Random Forest Classification. Further, the importance of several different attributes, or "features" is considered, in order to determine which of these are correlated with student performance. Finally, the results of an experiment follow, showcasing the power of machine learning in such an application.
- The first step is collecting the data from the data sources. In our case, the data has been collected. The second step is preprocessing the data in order to get a normalized dataset and then labeling the data rows. In the third step, the result of the second step, the training and testing dataset, is fed to the Machine Learning algorithm. The Machine Learning Algorithm builds a model using the training data and tests the model using the test data. Finally, the Machine Learning Algorithm produces a trained model or a trained classifier that can take as an input a new data row and predicts its label.

ADVANTAGES OF PROPOSED SYSTEM:

- Our model predicts the performance with three-class labels "success", "fail" and "withdrew".
- The proposed models offer new insight into determining the most critical learning activity and assist the educators in keeping tracking of timely student performance.
- The primary reason the machine learning models obtain higher performance in classification than regression is the relevant to the type of features sets. As such, in classification analysis, the static behavioral features in conjunction with the temporal features and demographic features are used as input variables in the prediction of final student performance model while only dynamic behavioral features employed to estimate students' assessments grades

3.3 SYSTEM STUDY

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are

- ECONOMICAL FEASIBILITY
- TECHNICAL FEASIBILITY
- SOCIAL FEASIBILITY

ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

3.4 SYSTEM DESIGN

SYSTEM ARCHITECTURE

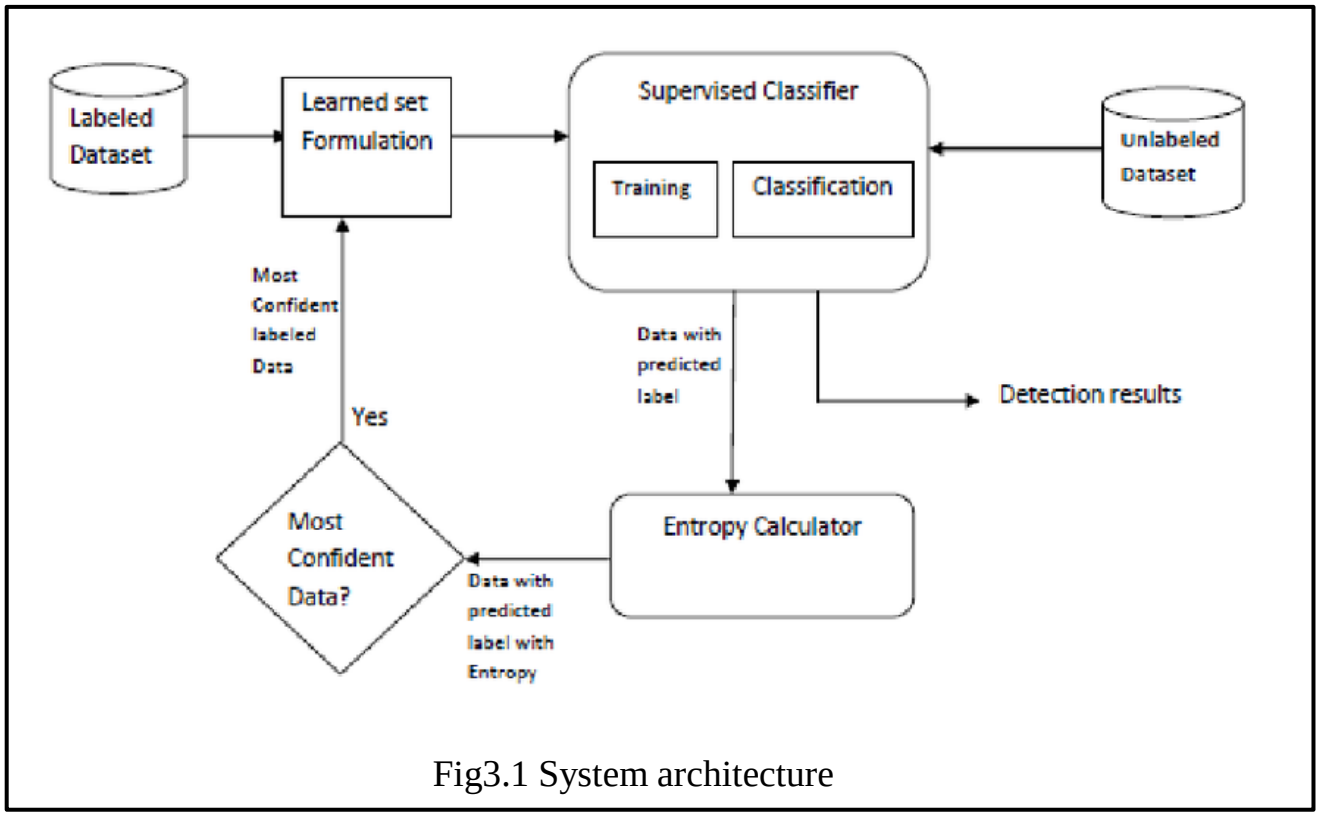


Fig3.1 System architecture

DATA FLOW DIAGRAM: The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.

1. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
2. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.

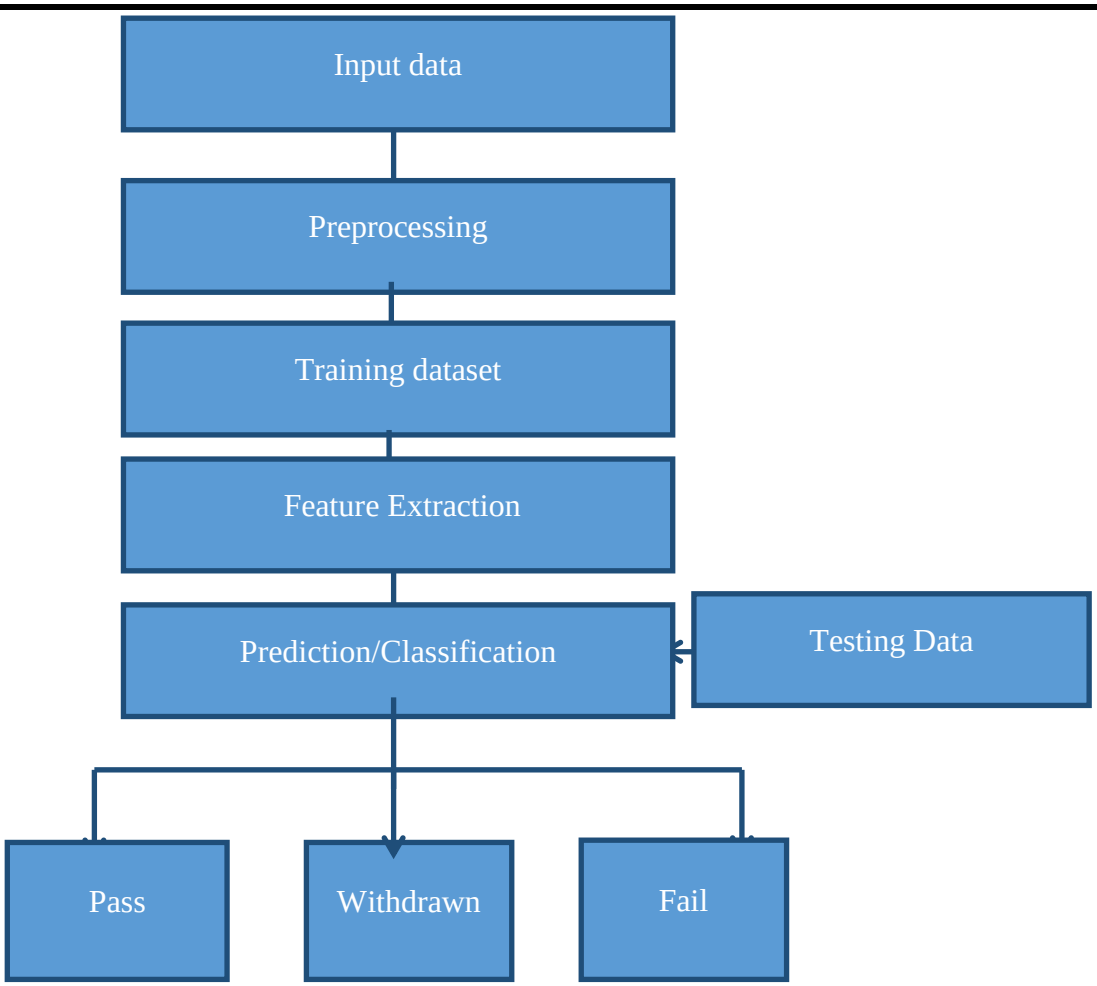


Fig3.2 Data flow diagram

USE CASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

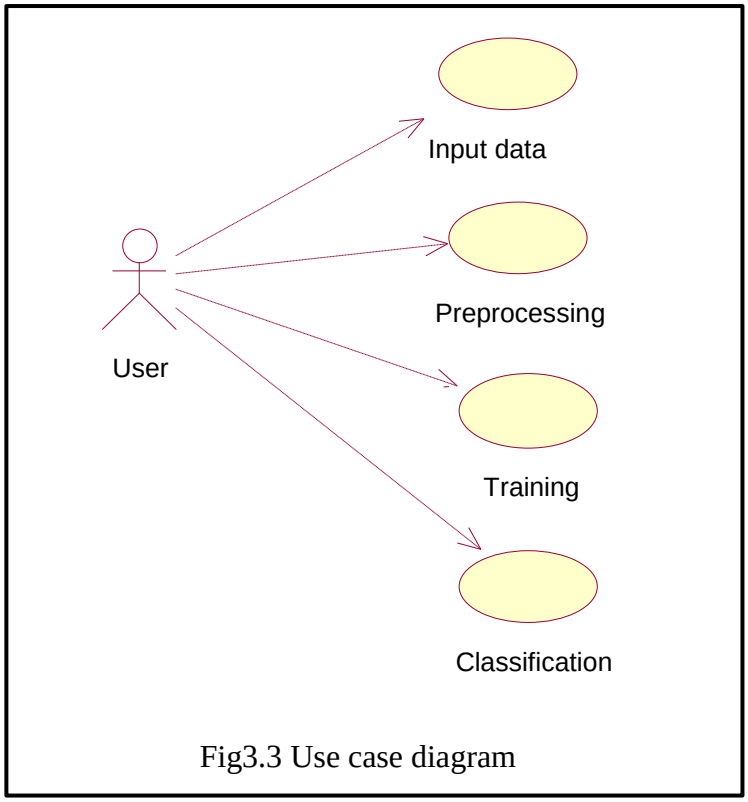


Fig3.3 Use case diagram

CLASS DIAGRAM:

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

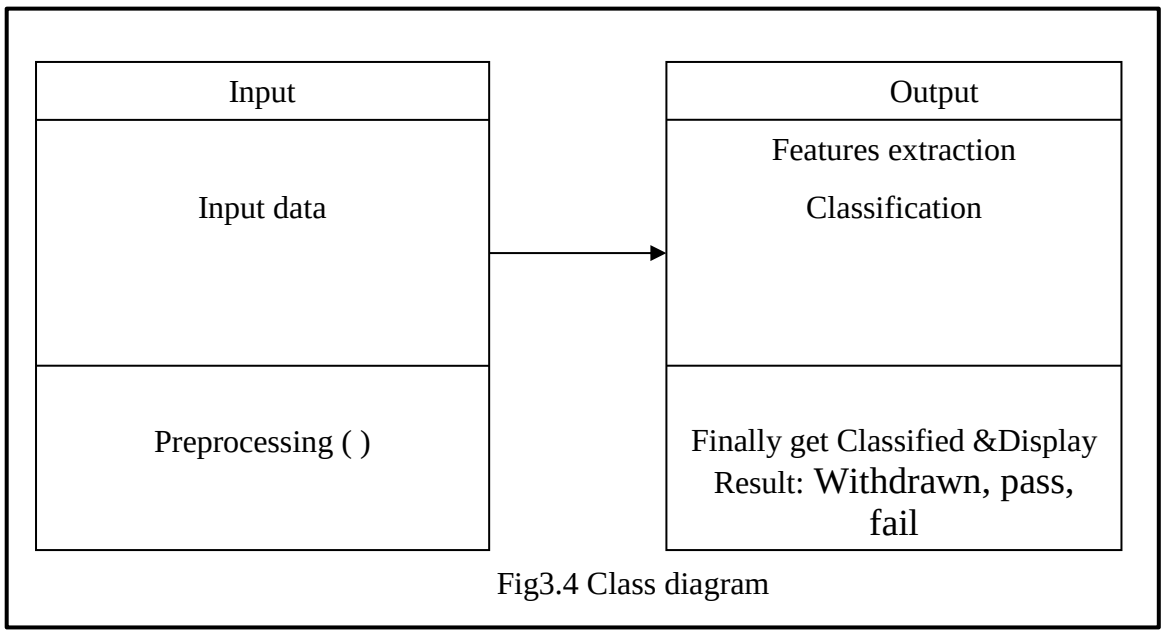


Fig3.4 Class diagram

SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

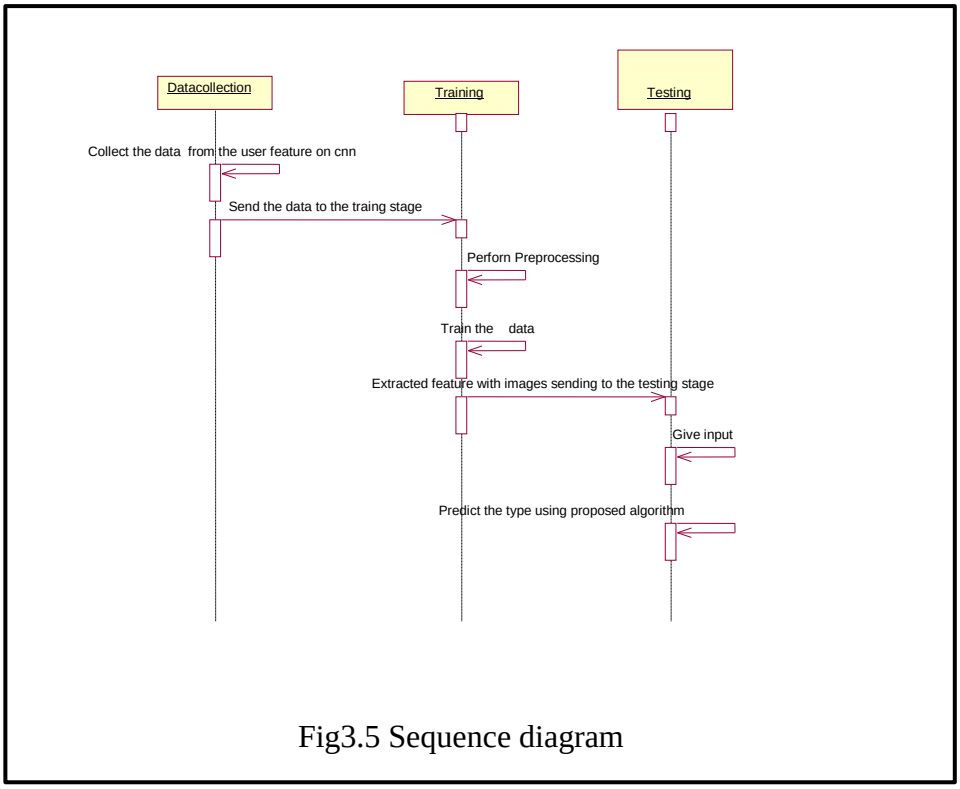


Fig3.5 Sequence diagram

ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

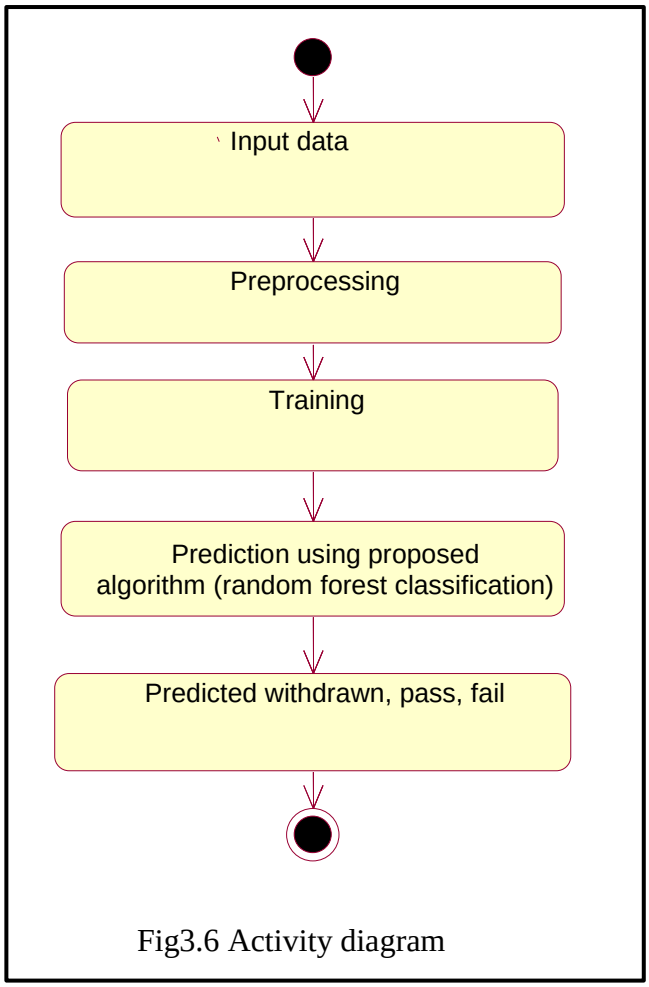


Fig3.6 Activity diagram

3.5 SOFTWARE ENVIRONMENT

Python

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages.

- **Python is Interpreted** − Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.
- **Python is Interactive** − you can actually sit at a Python prompt and interact with the interpreter directly to write your programs.
- **Python is Object-Oriented** − Python supports Object-Oriented style or technique of programming that encapsulates code within objects.

- **Python is a Beginner's Language** − Python is a great language for the beginner-level programmers and supports the development of a wide range of applications from simple text processing to WWW browsers to games.

History of Python

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands. Python is derived from many other languages, including ABC, Modula-3, C, C++, Algol-68, Smalltalk, and UNIX shell and other scripting languages. Python is copyrighted. Like Perl, Python source code is now available under the GNU General Public License (GPL). Python is now maintained by a core development team at the institute, although Guido van Rossum still holds a vital role in directing its progress.

Python Features

Python's features include −

- **Easy-to-learn** − Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.
- **Easy-to-read** − Python code is more clearly defined and visible to the eyes.
- **Easy-to-maintain** − Python's source code is fairly easy-to-maintain.
- **A broad standard library** − Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.
- **Interactive Mode** − Python has support for an interactive mode which allows interactive testing and debugging of snippets of code.
- **Portable** − Python can run on a wide variety of hardware platforms and has the same interface on all platforms.
- **Extendable** − you can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.
- **Databases** − Python provides interfaces to all major commercial databases.

- **GUI Programming** − Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.
- **Scalable** − Python provides a better structure and support for large programs than shell scripting.

Getting Python

The most up-to-date and current source code, binaries, documentation, news, etc., is available on the official website of Python https://www.python.org.

Windows Installation

Here are the steps to install Python on Windows machine.

- Open a Web browser and go to https://www.python.org/downloads/.
- Follow the link for the Windows installer python-XYZ.msifile where XYZ is the version you need to install.
- To use this installer python-XYZ.msi, the Windows system must support Microsoft Installer 2.0. Save the installer file to your local machine and then run it to find out if your machine supports MSI.
- Run the downloaded file. This brings up the Python install wizard, which is really easy to use. Just accept the default settings, wait until the install is finished, and you are done.

Flask Framework Flask is a web application framework written in Python. Armin Ronacher, who leads an international group of Python enthusiasts named Pocco, develops it. Flask is based on Werkzeug WSGI toolkit and Jinja2 template engine. Both are Pocco projects.

Http protocol is the foundation of data communication in World Wide Web. Different methods of data retrieval from specified URL are defined in this protocol.

The following table summarizes different http methods –

Sr.No	Methods & Description
1	**GET** Sends data in unencrypted form to the server. Most common method.
2	**HEAD** Same as GET, but without response body
3	**POST** Used to send HTML form data to server. Data received by POST method is not cached by server.

3.6 INPUT DESIGN AND OUTPUT DESIGN

INPUT DESIGN

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

OBJECTIVES

1. Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2. Select methods for presenting information.

3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.

- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

3.7 SYSTEM TESTING

SYSTEM TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of

components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

Test Results:

All the test cases mentioned above passed successfully. No defects encountered.

Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

Test Results:

All the test cases mentioned above passed successfully. No defects encountered.

Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results:

All the test cases mentioned above passed successfully. No defects encountered.

METHODOLOGY

4.1 MODULES

- Data Collection
- Dataset
- Data Preparation
- Model Selection
- Analyze and Prediction
- Accuracy on test set
- Saving the Trained Model

4.2 MODULES DESCSRIPTION

Data Collection:

This is the first real step towards the real development of a machine learning model, collecting data. This is a critical step that will cascade in how good the model will be, the more and better data that we get, the better our model will perform.

There are several techniques to collect the data, like web scraping, manual interventions and etc.

Open University Learning Analytics dataset taken from kaggle and some other source.

Dataset:

Multivariate dataset

There are 46,412 number of records

The dataset consists of data about courses, students and their interactions with Virtual Learning Environment (VLE) for seven selected courses (called modules)

Presentations of the course start in February and October

All tables are stored in the csv format

1. students assessments : assessments.csv
2. students courses: courses.csv
3. student Info: studentInfo.csv
4. student Registration: studentRegistration.csv

In this data set we are taken 13 columns in the dataset, which are described below.

Gender: The student's gender

Region: Identifies the geographic region, where the student lived while taking the module-presentation

Highest Education: Highest student education level on entry to the module presentation

Imd Band: Specifies the Index of Multiple Depravation band of the place where the student lived during the module-presentation

Age Group: Band of the student's age

Number Of Previous Attempts: The number times the student has attempted this module

Semester: A status flag indicating that the Semester

First Module: Code name of the module, which serves as the identifier

Semester (First Module): Code name of the presentation. It consists of the year and "B" for the presentation starting in February and "J" for the presentation starting in October

Second Module: Code name of the module, which serves as the identifier

Semester (Second Module): Code name of the presentation. It consists of the year and "B" for the presentation starting in February and "J" for the presentation starting in October

Score: total score in module exam

Students credits: total credits

Final Result: Student's final result in the module-presentation

Data Preparation:

we will transform the data. By getting rid of missing data and removing some columns. First we will create a list of column names that we want to keep or retain.

Next we drop or remove all columns except for the columns that we want to retain.

Finally we drop or remove the rows that have missing values from the data set.

Model Selection:

While creating a machine learning model, we need two dataset, one for training and other for testing. But now we have only one. So lets split this in two with a ratio of 80:20. We will also divide the dataframe into feature column and label column.

Here we imported train_test_split function of sklearn. Then use it to split the dataset. Also, test_size = 0.2, it makes the split with 80% as train dataset and 20% as test dataset.

The random_state parameter seeds random number generator that helps to split the dataset.

The function returns four datasets. Labelled them as train_x, train_y, test_x, test_y. If we see shape of this datasets we can see the split of dataset.

We will use Random Forest Classifier, which fits multiple decision tree to the data. Finally I train the model by passing train_x, train_*y* to the *fit* method.

Once the model is trained, we need to Test the model. For that we will pass test_x to the predict method.

Random Forest is one of the most powerful methods that is used in machine learning for classification problems. The random forest comes in the category of the supervised classification algorithm. This algorithm is carried out in two different stages the first one deals with the creation of the forest of the given dataset, and the other one deals with the prediction from the classification.

Analyze and Prediction:

In the actual dataset, we chose only 12 features

Gender: The student's gender

Region: Identifies the geographic region, where the student lived while taking the module-presentation

Highest Education: Highest student education level on entry to the module presentation

Imd Band: Specifies the Index of Multiple Depravation band of the place where the student lived during the module-presentation

Age Group: Band of the student's age

Number Of Previous Attempts: The number times the student has attempted this module

Semester: A status flag indicating that the Semester

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Second Module: Code name of the module, which serves as the identifier

Semester (Second Module): Code name of the presentation. It consists of the year and "B" for the presentation starting in February and "J" for the presentation starting in October

Score: total score in module exam

Students credits: total credits

Accuracy on test set:

We got an accuracy of 99.1% on test set.

Saving the Trained Model:

Once you're confident enough to take your trained and tested model into the production-ready environment, the first step is to save it into a .h5 or . pkl file using a library like `pickle` .
Make sure you have `pickle` installed in your environment.
Next, let's import the module and dump the model into `. pkl` file

4.3 Algorithm used

The RandomForestClassifier is a robust machine learning algorithm widely used for classification tasks. It is an ensemble learning method that constructs multiple decision trees during training and outputs the class that is the mode of the classes of the individual trees. This algorithm is particularly effective in handling various types of data and is less prone to overfitting compared to individual decision trees.

Working Principle

1. **Bootstrap Sampling**: RandomForest uses bootstrapping to create multiple subsets of the original dataset. Each subset is used to grow an individual decision tree.
2. **Feature Randomness**: During the construction of each tree, a random subset of features is selected for splitting nodes. This introduces further diversity among the trees.
3. **Voting Mechanism**: For classification, each tree in the forest votes for a class, and the class with the majority vote is chosen as the final prediction.

Advantages

- **Accuracy**: By aggregating the results of multiple trees, the RandomForestClassifier often provides higher accuracy than individual decision trees.
- **Robustness**: It is less likely to overfit the training data due to the ensemble of multiple trees.

- **Feature Importance**: The algorithm provides insights into feature importance, helping identify which variables are most influential in making predictions.
- **Scalability**: RandomForest can handle large datasets efficiently and is scalable across various problem domains.

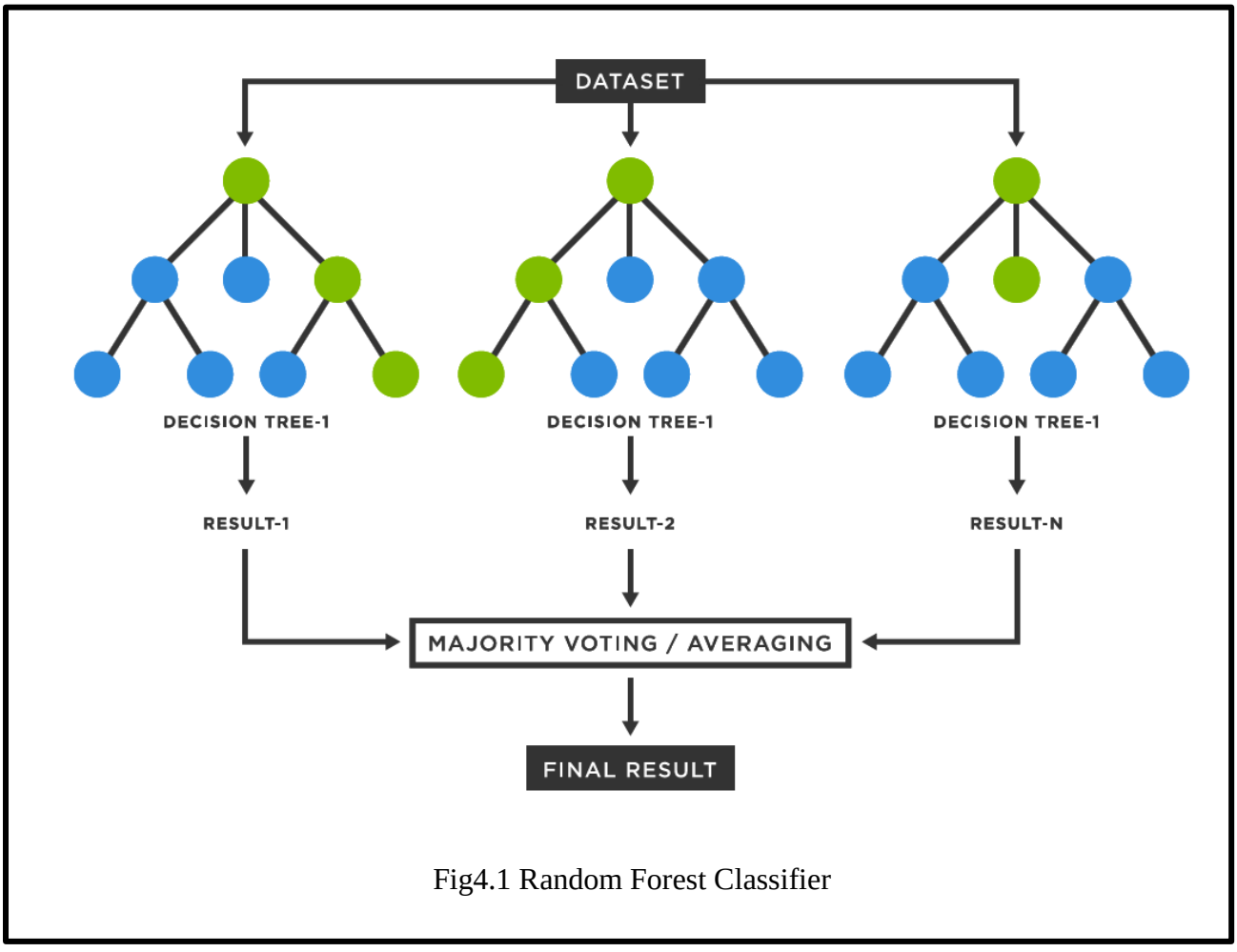


Fig4.1 Random Forest Classifier

CODING

Login.html

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Sedan+SC&display=swap"
rel="stylesheet">
<link href='https://unpkg.com/boxicons@2.1.4/css/boxicons.min.css'
rel='stylesheet'>
<title>Login</title>
</head>
<style>
*{
margin: 0;
padding: 0;
box-sizing: border-box;
}
body{
min-height: 100vh;
background: url("../static/background.png") no-repeat;
background-size: cover;
background-position: center;
font-family: "Sedan SC", serif;
background-attachment: fixed;
}
.login-container{
width: 400px;
background: transparent;
border: 2px solid rgba(255, 255, 255, .2);
backdrop-filter: blur(9px);
color: #fff;
border-radius: 12px;
padding: 30px 40px;
margin-top: 100px;
}
.login-container h1{
font-size: 32px;
text-align: center;
margin: 50px;
}
.login-container .input-box{
position: relative;
width: 100%;
```

```
height: 50px;
display: flex;
margin: 30px 0;
}
.input-box input{
width: 100%;
height: 100%;
background: transparent;
border: none;
outline: none;
border: 2px solid rgba(255, 255, 255, .2);
border-radius: 40px;
font-size: 16px;
color: #fff;
padding: 20px 45px 20px 20px;
}
.input-box input::placeholder{
color: #fff;
}
.input-box i{
position: absolute;
right: 20px;
top: 30%;
transform: translate(-50%);
font-size: 20px;
}
.login-container .btn{
width: 100%;
height: 45px;
background: #fff;
border: none;
outline: none;
border-radius: 40px;
box-shadow: 0 0 10px rgba(0, 0, 0, .1);
cursor: pointer;
font-size: 16px;
color: black;
font-weight: 600;
}
.login-container .btn:hover{
color: black;
background-color: greenyellow;
}
.header {
display: flex;
justify-content: space-between;
align-items: center;
background-color: darkcyan;
padding: 8px;
```

```
}
.menu {
text-decoration:none;
font-size: 18px;
color: whitesmoke;
margin-right: 30px;
}
.menu:hover {
color: black;
}
</style>
<body>
<div class="header">
<h1>Student's Performance Prediction</h1>
<nav>
<a class ="menu" href="/">Home</a>
<a class ="menu" href="/abstract">Abstract</a>
</nav>
</div>
<center>
<div class="login-container">
<h1>Login</h1>
<div class="input-box">
<input type="text" placeholder="Username" id = "username" required>
<i class='bx bxs-user'></i>
</div>
<div class="input-box">
<input type="password" placeholder="Password" id = "password" required>
<i class='bx bxs-lock-alt'></i>
</div>
<button type="submit" class="btn" onclick = validate()> Login </button>
</br ></br >
</div>
</center>
</body>
<script>
function validate() {
var username = document.getElementById("username").value;
var password = document.getElementById("password").value;
if(username == "admin" && password == "admin") {
alert("login success");
window.open('/upload',"_self");
} else {
alert("Invalid credentials")
}
}
</script>
</html>
```

Upload.html

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Sedan+SC&display=swap"
rel="stylesheet">
<title>Upload</title>

</head>
<body>
<div class="header">
<h1>Student's Performance Prediction</h1>
<nav>
<a class ="menu" href="/">Home</a>
<a class ="menu" href="/abstract">Abstract</a>
</nav>
</div>
<center>
<form action = "/read_data" method="post" enctype="multipart/form-data">
<div class = "login-container">
<h2>Upload Form</h2>
</br ></br >
<label>Choose the file:  </label>
<input type="file" name="file" id="file" required/>
<br /></br ></br >
<input type = "submit" value="Upload" />
</form>
</div>
</center>
</body>
</html>
```

Prediction.html

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
<link href="https://fonts.googleapis.com/css2?family=Sedan+SC&display=swap"
rel="stylesheet">
```

```
<title>Prediction</title>
</head>
<body>
<div class="header">
<h1>Student's Performance Prediction</h1>
<nav>
<a class ="menu" href="/">Home</a>
<a class ="menu" href="/abstract">Abstract</a>
<a class ="menu" href="/upload">Upload</a>
<a class ="menu" href="/charts">Charts</a>
<a class ="menu" href="/future">Future</a>
</nav>
</div>
<center>
<form action="/predict" method="POST">
<div class="login-container">
<h1>prediction</h1>
<table>
<tbody>
<td>First Module:</td>
<td>
<select type="text" name="code_module_x" method="post" required="required"
placeholder="Gender" width="300" style="width: 300px">
<option value="0">AAA</option>
<option value="1">BBB</option>
<option value="2">FFF</option>
<option value="3">CCC</option>
<option value="4">EEE</option>
<option value="5">DDD</option>
<option value="6">GGG</option>
</select>
</td>
<td>Semester (First Module):</td>
<td>
<select type="text" name="code_presentation_x" method="post"
required="required" placeholder="Gender" width="300" style="width: 300px">
<option value="0">2013J</option>
<option value="1">2014J</option>
<option value="2">2014B</option>
<option value="3">2013B</option>
</select>
</td>
</tbody>
<!-- Row 1 -->
<tbody>
<td>Gender:</td>
<td>
<select type="text" name="gender" method="post" required="required"
placeholder="Gender" width="300" style="width: 300px">
```

```
<option value="0">Female</option>
<option value="1">Male</option>
</select>
</td>
<td>Region:</td>
<td>
<select type="text" name="region" method="post" required="required"
placeholder="Region" width="300" style="width: 300px">
<option value="0">East Anglian Region</option>
<option value="1">South Region</option>
<option value="2">West Midlands Region</option>
<option value="3">South East Region</option>
<option value="4">South West Region</option>
<option value="5">North Region</option>
<option value="6">North Western Region</option>
<option value="7">East Midlands Region</option>
<option value="8">Yorkshire Region</option>
<option value="9">Wales</option>
<option value="10">London Region</option>
<option value="11">Scotland</option>
<option value="12">Ireland</option>
</select>
</td>
</tbody>
</br>
<!-- Row 2 -->
<tbody>
<td>Highest Education:</td>
<td>
<select type="text" name="highest_education" method="post"
required="required" placeholder="Gender" width="300" style="width: 300px">
<option value="0">A Level or Equivalent</option>
<option value="1">Lower Than A Level</option>
<option value="2">HE Qualification</option>
<option value="3">No Formal quals</option>
<option value="4">Post Graduate Qualification</option>
</select>
</td>
<td>IMD Band:</td>
<td>
<select type="text" name="imd_band" method="post" required="required"
placeholder="Gender" width="300" style="width: 300px">
<option value="0">70-80%</option>
<option value="1">80-90%</option>
<option value="2">50-60%</option>
<option value="3">90-100%</option>
<option value="4">30-40%</option>
<option value="5">40-50%</option>
<option value="6">60-70%</option>
```

```
<option value="7">0-10%</option>
<option value="8">20-30%</option>
<option value="9">10-20</option>
</select>
</td>
</tbody>
</br>
<!-- Row 3 -->
<tbody>
<td>Age Group:</td>
<td>
<select type="text" name="age_band" method="post" required="required"
placeholder="Age" width="300" style="width: 300px">
<option value="0">0-35</option>
<option value="1">35-55</option>
<option value="2">55<=</option>
</select>
</td>
<td>Number Of Previous Attempts:</td>
<td>
<select type="text" name="num_of_prev_attempts" method="post"
required="required" placeholder="Gender" width="300" style="width: 300px">
<option value="0">0</option>
<option value="1">1</option>
<option value="2">2</option>
<option value="3">3</option>
<option value="4">4</option>
<option value="5">5</option>
<option value="6">6</option>
</select>
</td>
</tbody>
<!-- Row 4 --></br>
<tbody>
<td>studied_credits:</td>
<td>
<input type="text" type="text" name="studied_credits"
placeholder="studied_credits" required="required" width="300" style="width:
290px"/ >
</td>
<td>assessment_score:</td>
<td>
<input type="text" name="assessment_score" placeholder="assessment_score"
required="required" width="300" style="width: 290px"/ >
</td>
</tbody>
<!-- Row 5 --></br>
<tbody>
<td>Second Module:</td>
```

```
<td>
<select type="text" name="code_module_y" method="post" required="required"
placeholder="Gender" width="300" style="width: 300px">
<option value="0">AAA</option>
<option value="1">BBB</option>
<option value="2">FFF</option>
<option value="3">CCC</option>
<option value="4">EEE</option>
<option value="5">DDD</option>
<option value="6">GGG</option>
</select>
</td>
<td>Semester (Second Module):</td>
<td>
<select type="text" name="code_presentation_y" method="post"
required="required" placeholder="Gender" width="300" style="width: 300px">
<option value="0">2013J</option>
<option value="1">2014J</option>
<option value="2">2014B</option>
<option value="3">2013B</option>
</select>
</td>
</tbody>
</table>
</br>
</br>
<div class="center">
<center>  <button type="submit" class="btn btn-primary btn-block btn-
large">Predict</button> </center>
<br /><br />
</div>
</form>
</form>
<h2>Prediction is :{{ prediction_text }}</h2>
</center>
</body>
</html>
```

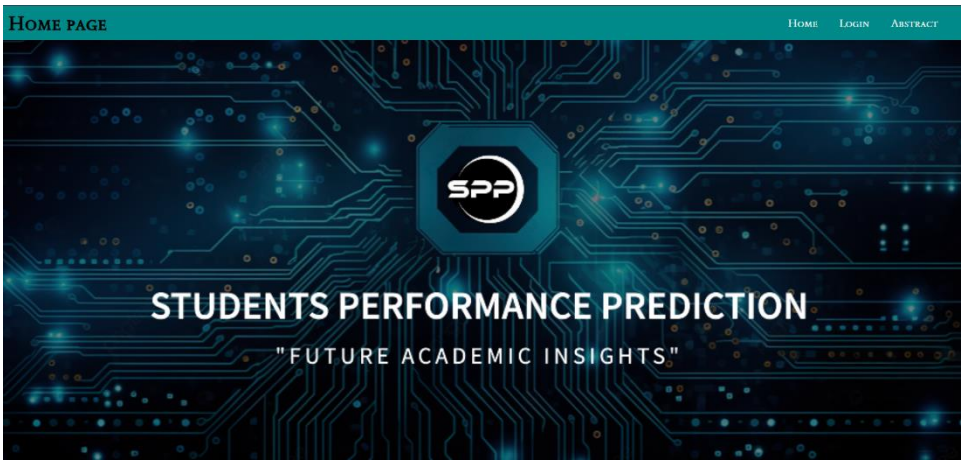
Chart.html

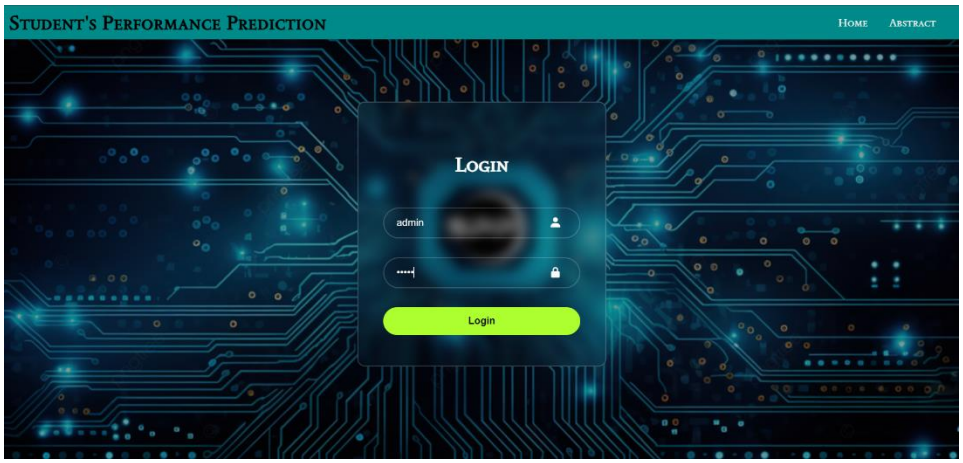
```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="preconnect" href="https://fonts.googleapis.com">
<link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
```

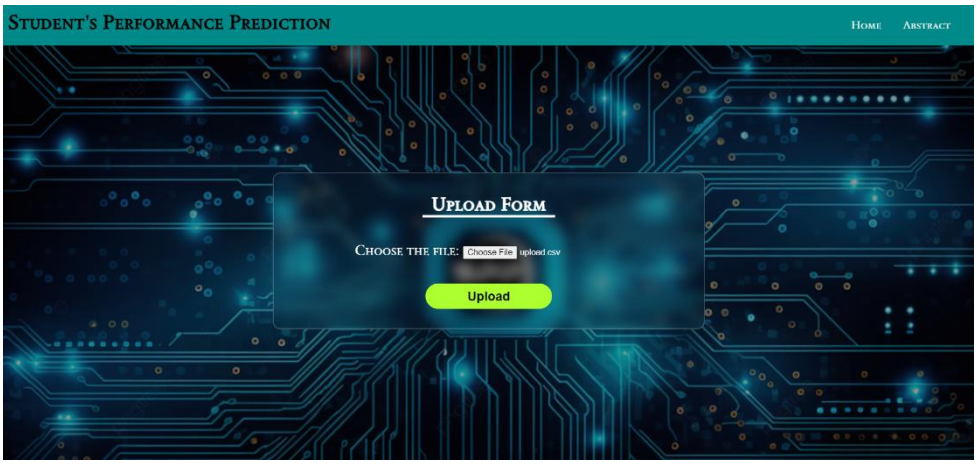
```
<link href="https://fonts.googleapis.com/css2?family=Sedan+SC&display=swap"
rel="stylesheet">
<title>Future</title>
</head>
<body><div class="header" >
<h1>Student's Performance Prediction</h1>
<nav>
<a class ="menu" href="/">Home</a>
<a class ="menu" href="/abstract">Abstract</a>
<a class ="menu" href="/upload">Upload</a>
<a class ="menu" href="/preview">Preivew</a>
<a class ="menu" href="/prediction">Prediction</a>
<a class ="menu" href="/future">Future</a>
</nav>
</div>
<h2>Total gender</h2>
</br></br>
<script type="text/javascript"
src="https://www.gstatic.com/charts/loader.js"></script>
<script type="text/javascript">
google.charts.load("current", {packages:["corechart"]});
google.charts.setOnLoadCallback(drawChart);
function drawChart() {
var data = google.visualization.arrayToDataTable([
['gender', 'precentage'],
['Female',     60],
['Male',      50]
]);
var options = {
title: ' ',
colors: ['blue', 'red'],
pieHole: 0.4,
};
var chart = new
google.visualization.PieChart(document.getElementById('donutchart'));
chart.draw(data, options);
}
</script>
</head>
<body>
<center><div id="donutchart" style="width: 900px; height:
500px;"></div></center>
</body>
</html>
</br>
</br>
<html>
<head>
<h2>students performance</h2>
```

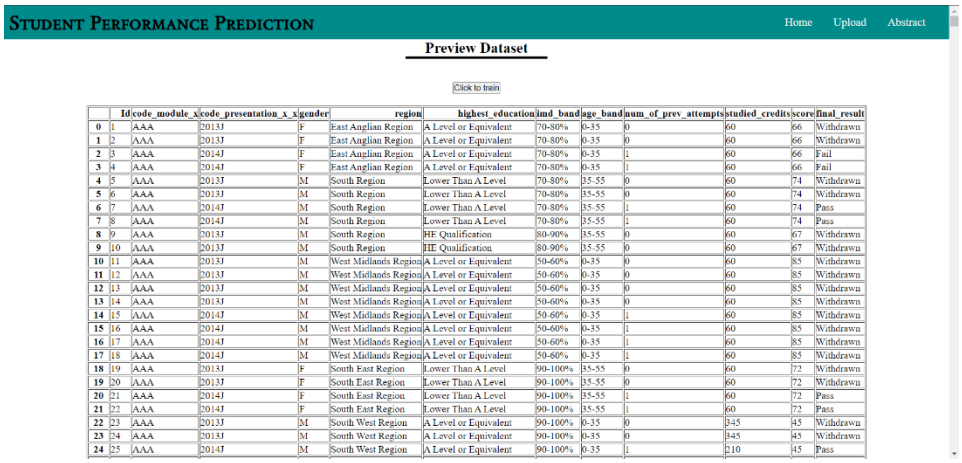
```
</br></br>
<script type="text/javascript"
src="https://www.gstatic.com/charts/loader.js"></script>
<script type="text/javascript">
google.charts.load('current', {'packages':['bar']});
google.charts.setOnLoadCallback(drawStuff);
function drawStuff() {
var data = new google.visualization.arrayToDataTable([
['result', 'Female', 'Male'],
['Withdrawn', 21000, 23.3],
['Fail', 24000, 4.5],
['Pass', 30000, 14.3]
]);
var options = {
width: 800,
chart: {
title: ' ',
subtitle: ''
},
bars: 'vertical', // Required for Material Bar Charts.
series: {
0: { axis: 'Female' }, // Bind series 0 to an axis named 'distance'.
1: { axis: 'Male' } // Bind series 1 to an axis named 'brightness'.
},
axes: {
x: {
Female: {label: 'parsecs'}, // Bottom x-axis.
Male: {side: 'top', label: 'Gender'} // Top x-axis.
}
}
};
var chart = new google.charts.Bar(document.getElementById('dual_x_div'));
chart.draw(data, options);
};
</script>
</head>
<body>
<center>
<div id="dual_x_div" style="width: 900px; height: 500px;"></div>
</center>
</body>
</body>
</html>
```

SNAPSHOTS

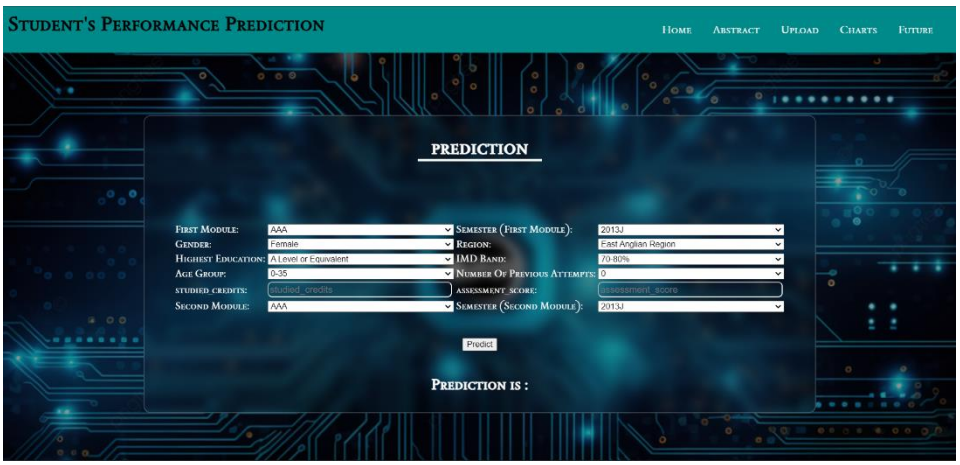

HOME PAGE
HOME
LOGIN
ABSTRACT
SPP
STUDENTS PERFORMANCE PREDICTION
"FUTURE ACADEMIC INSIGHTS"

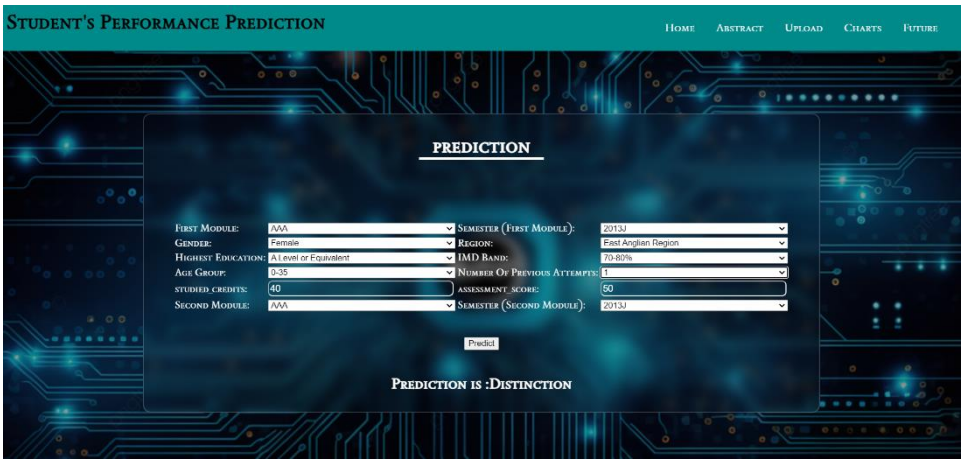

STUDENT'S PERFORMANCE PREDICTION
HOME
ABSTRACT
LOGIN
admin
Login

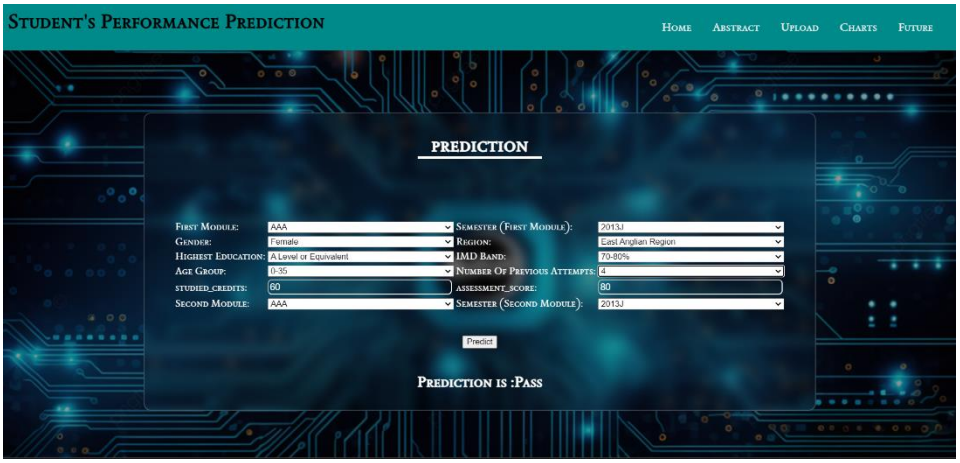

STUDENT'S PERFORMANCE PREDICTION
HOME
ABSTRACT
UPLOAD FORM
CHOOSE THE FILE:
Choose File
upload.csv
Upload

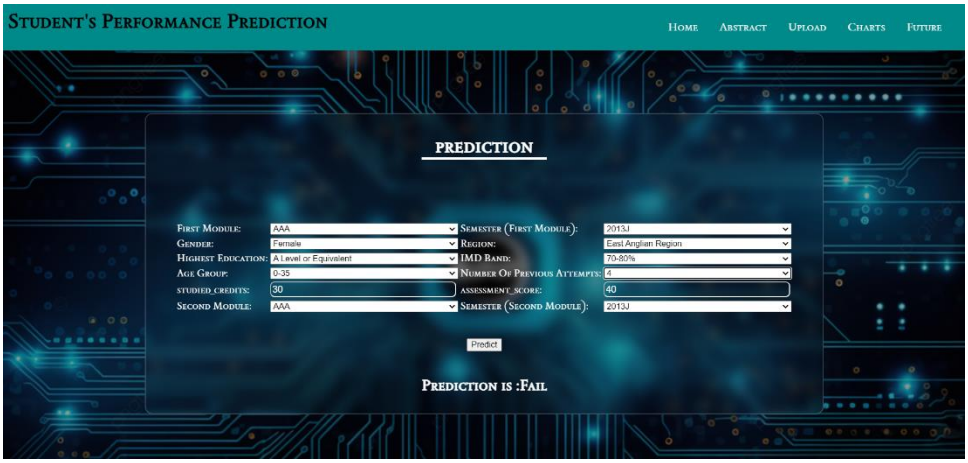


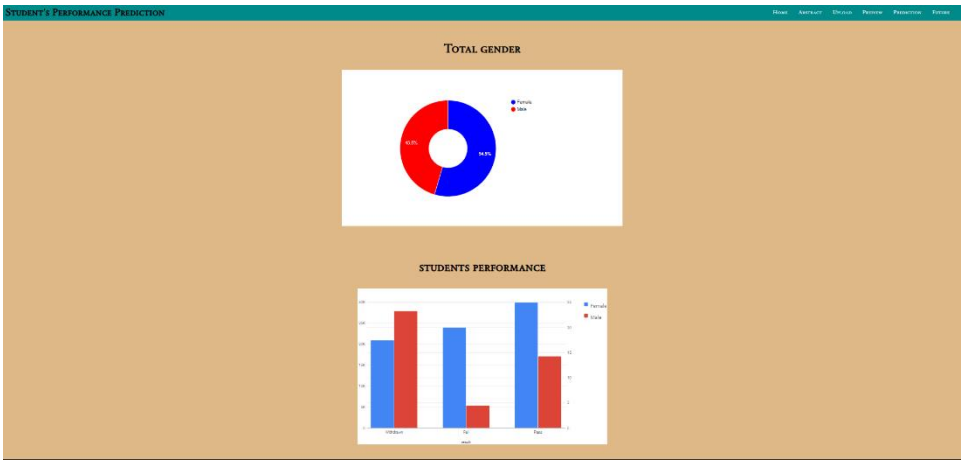
	Id	code_module_x	code_presentation_x_x	gender	region	highest_education	imd_band	age_band	num_of_prev_attempts	studied_credits	score	final_result
0	1	AAA	2013J	F	East Anglian Region	A Level or Equivalent	70-80%	0-35	0	60	66	Withdrawn
1	2	AAA	2013J	F	East Anglian Region	A Level or Equivalent	70-80%	0-35	0	60	66	Withdrawn
2	3	AAA	2014J	F	East Anglian Region	A Level or Equivalent	70-80%	0-35	1	60	66	Fail
3	4	AAA	2014J	F	East Anglian Region	A Level or Equivalent	70-80%	0-35	1	60	66	Fail
4	5	AAA	2013J	M	South Region	Lower Than A Level	70-80%	35-55	0	60	74	Withdrawn
5	6	AAA	2013J	M	South Region	Lower Than A Level	70-80%	35-55	0	60	74	Withdrawn
6	7	AAA	2014J	M	South Region	Lower Than A Level	70-80%	35-55	1	60	74	Pass
7	8	AAA	2014J	M	South Region	Lower Than A Level	70-80%	35-55	1	60	74	Pass
8	9	AAA	2013J	M	South Region	HE Qualification	80-90%	35-55	0	60	67	Withdrawn
9	10	AAA	2013J	M	South Region	HE Qualification	80-90%	35-55	0	60	67	Withdrawn
10	11	AAA	2013J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	0	60	85	Withdrawn
11	12	AAA	2013J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	0	60	85	Withdrawn
12	13	AAA	2013J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	0	60	85	Withdrawn
13	14	AAA	2013J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	0	60	85	Withdrawn
14	15	AAA	2014J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	1	60	85	Withdrawn
15	16	AAA	2014J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	1	60	85	Withdrawn
16	17	AAA	2014J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	1	60	85	Withdrawn
17	18	AAA	2014J	M	West Midlands Region	A Level or Equivalent	50-60%	0-35	1	60	85	Withdrawn
18	19	AAA	2013J	F	South East Region	Lower Than A Level	90-100%	35-55	0	60	72	Withdrawn
19	20	AAA	2013J	F	South East Region	Lower Than A Level	90-100%	35-55	0	60	72	Withdrawn
20	21	AAA	2014J	F	South East Region	Lower Than A Level	90-100%	35-55	1	60	72	Pass
21	22	AAA	2014J	F	South East Region	Lower Than A Level	90-100%	35-55	1	60	72	Pass
22	23	AAA	2013J	M	South West Region	A Level or Equivalent	90-100%	0-35	0	345	45	Withdrawn
23	24	AAA	2013J	M	South West Region	A Level or Equivalent	90-100%	0-35	0	345	45	Withdrawn
24	25	AAA	2014J	M	South West Region	A Level or Equivalent	90-100%	0-35	1	210	45	Pass






STUDENT'S PERFORMANCE PREDICTION
HOME ABSTRACT UPLOAD CHARTS FUTURE
PREDICTION
FIRST MODULE: AAA
SEMESTER (FIRST MODULE): 2013J
GENDER: Female
REGION: East Anglian Region
HIGHEST EDUCATION: A Level or Equivalent
IMD BAND: 70-80%
AGE GROUP: 0-35
NUMBER OF PREVIOUS ATTEMPTS: 4
STUDIED_CREDITS: 60
ASSESSMENT_SCORE: 80
SECOND MODULE: AAA
SEMESTER (SECOND MODULE): 2013J
Predict
PREDICTION IS :PASS


STUDENT'S PERFORMANCE PREDICTION
HOME ABSTRACT UPLOAD CHARTS FUTURE
PREDICTION
FIRST MODULE: AAA
SEMESTER (FIRST MODULE): 2013J
GENDER: Female
REGION: East Anglian Region
HIGHEST EDUCATION: A Level or Equivalent
IMD BAND: 70-80%
AGE GROUP: 0-35
NUMBER OF PREVIOUS ATTEMPTS: 4
STUDIED_CREDITS: 30
ASSESSMENT_SCORE: 40
SECOND MODULE: AAA
SEMESTER (SECOND MODULE): 2013J
Predict
PREDICTION IS :FAIL


STUDENT'S PERFORMANCE PREDICTION
TOTAL GENDER
STUDENTS PERFORMANCE

CONCLUSION

Two sets of exterminates have been carried out in this study using regression and classification analysis. The results of predicting students' assessments grades model show that the students' performance in a particular assignment relies on students' mark in the previous assignment within single Courses. The researchers conclude that students' prior grade point average (GPA) with a low mark is considered as a significant factor of withdrawal from the next course in the traditional classroom setting, Both conventional classroom setting and virtual class share similar characteristic in term of the effective of pervious performance into student learning achievement in the future. The final student performance predictive model revealed that student engagement with digital material has a significant impact on their success in the entire course. The findings' results also demonstrate that long-term students' performance achieves better accuracy than students' assessments grades prediction model, due to the exclusion of temporal features in regression analysis. The date of student deregistration from the course is a valuable predictor that is significantly correlated with student performance. With the regression analysis, the data does not provide the last date of students' activity prior to undertaken assessments. The findings' results have been recommended to take into account the temporal features on predicting of subsequent assessments grades. Future research direction involves the use of temporal features for predicting students' assessments grades model. With temporal feature time series analysis will be untaken, might be more advanced machine leering will be utilized

FUTURE ENHANCEMENT

The prediction of student performance using machine learning (ML) has significant attention in recent years, driven by the need to identify at-risk students early and tailor educational interventions accordingly. However, the field is ripe for further enhancements that could significantly improve accuracy, reliability, and applicability.

1. Advanced Feature Engineering
2. Improved Algorithms and Techniques
3. Data Privacy and Ethics
4. Continuous Learning and Adaptation

BIBLIOGRAPHY

TEXTBOOK REFERENCES

[1]. R. Alshabandar, A. Hussain, R. Keight, A. Laws, and T. Baker, "The Application of Gaussian Mixture Models for the Identification of At-Risk Learners in Massive Open Online Courses," in 2018 IEEE Congress on Evolutionary Computation, CEC 2018 - Proceedings, 2018.

[2]. P. and K. Al-Shabandar, R., Hussain, A.J., Liatsis, "Detecting At-Risk Students With Early Interventions Using Machine Learning Techniques," IEEE Access, vol. 7, pp. 149464–149478, 2019.

[3]. Z. Wang, T. Anderson, L. Chen, and E. Barbera, "Interaction pattern analysis in cMOOCs based on the connectivist interaction and engagement framework," Br. J. Educ. Technol., vol. 48, no. 2, pp. 683–699, 2017.

WEB LINKS:

[1] .https://www.ibm.com/topics/machine-learning

[2] .https://www.geeksforgeeks.org/machine-learning/

[3] .https://www.w3schools.com/python/python_intro.asp

[4] .https://flask.palletsprojects.com/en/3.0.x/