

USAGE OF MACHINE LEARNING FOR STRATEGIC DECISION MAKING AT HIGHER EDUCATIONAL INSTITUTIONS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in Computer Science and Engineering

By

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(DEEMED TO BE UNIVERSITY)

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BONAFIDE CERTIFICATE

This is to certify that this Professional Training Report is the bonafide work of **Vadlapati Krithika Catherin (Reg No. 38110610)**, **Vallabhaneni Haasavi (Reg No. 38110611)** who have done the project work as a team who carried out the project entitled "**USAGE OF MACHINE LEARNING FOR STRATEGIC DECISION MAKING AT HIGHER EDUCATIONAL INSTITUTIONS**" under my supervision from nov 2021 to MAR 2022.

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ABSTARCT

In many organizations, machine learning techniques are used for analyzing large amount of available data and information for decision making process. In educational sector, Machine learning is used for wide variety of applications such as suggestion to the students based on 10th mark and interest. One of the most important milestones in an individual's life involves self-analysis, critical thinking and finally decision making. This paper represent survey results on which academic decisions they concern and the variables involved in them. Using machine learning algorithms, it predicted courses/institutions in a real case study to support decision making. The choice of the career is influenced by views of your parents, friends, relatives, teachers and the media. Today with a wider choice and an ever increasing competition, you need to plan your career wisely and at the earliest. While choosing a stream after 10th, a training course or a career and 12th groups you should know your abilities, interests, and personality. Besides these you should gather information regarding different career options, the eligibility criteria, the premier institutions/Schools, and other criteria of selection and the market demands. The present system undertaken by Education Department, on different educational and vocational courses available and the institutions through competitive examination after 10th and 12th aims at giving you the much needed information.

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LIST OF ABBREVIATIONS

BL	Blended Learning
GUI	Graphical User Interface
KNN	K-Nearest Neighbour
ML	Machine Learning
MTBF	Mean Time Between Failures
OS	Operating system
RDBMS	Relational Database Management System
SQL	Structured Query Language
UML	Unified Modelling Language

CHAPTER 1

INTRODUCTION

1.1 OUTLINE OF THE PROJECT

Two imperatives for better use of data confront higher education. The first is driven by external factors while the second is driven internally by continuous quality improvement. Steep declines in financial and public support have driven efforts by governments to collect data that support the proposition that institutions are accountable for the revenue they receive. Working from a defensive posture, many colleges and universities have been able to waylay undesirable changes by satisfying external requests for data. At a higher level, however, those institutions that deliberately use data to improve overall performance meet compliance-based requirements while enacting a future that is informed by data. The proposition that higher education's approach to data use has changed very little may be disputed. At the same time, it also is clear that technology has made new conversations possible. New techniques including analytics or predictive analytics provide institutions new opportunities to use data to improve their efficiency while better serving students (see, for example, Bichsel, 2012 and WCET, n.d.). Colleges and universities are entering an era in which strategic information about student learning and success, budgeting, and efficiency can be united under the umbrella of big data. Higher education is now collecting more data than ever before. However, these efforts are most often directed at the first imperative, compliance reporting, rather than the second imperative, improving institutional strategy. Forward thinking institutions will quickly resolve this seeming dichotomy. They will seek opportunities to build capacity, remove constraints to span existing boundaries that determine data use and find ways to bring data and strategy together. The result can advance institutional mission, meeting external policy demands and improving student success. Strategic thinking and the data that serve those strategies come at a price. In this chapter, we review both opportunities and barriers associated with creating and using actionable strategic and operational

data. We also identify successful steps for data use based on our experiences in working with higher education institutions to facilitate strategic planning and to create cultures of inquiry and evidence. We also survey emerging technologies and their promise to help institutions help their students. This chapter is intended to provide practical advice and not to provide a theoretical overview of the tenets of strategic planning. Institutions sufficiently courageous to engage in a data journey require support. Toward that end, this chapter also provides advice drawn from personal experience and new developments in management science to help navigate these new pathways.

1.2 OBJECTIVES OF THE PROJECT

- One of the main objective of the recently developed policy for higher education regards the creation of a more diversified higher education system with flexible and adaptive institutions.
- In educational sector, machine learning is used for wide variety of applications such as suggestion to the students based on 10th mark and interest.
- Hoping that it would help you in understanding what each course for career entails and help you introspect and analyze the required abilities to be successful, happy and content in the course/career you choose.
- While choosing a stream after 10th, a training course or a career and 12th groups you should know your abilities, interests, and personality.
- Besides these you should gather information regarding different career options, the eligibility criteria, the premier institutions/Schools, and other criteria of selection and the market demands.

1.3 EXISTING SYSTEM

In existing system, three supervised classification algorithms are deployed to predict graduation rates from real data about undergraduate engineering students in South America. The analysis of receiver operating characteristic curve and accuracy are executed as measures of effectiveness to compare and

evaluate decision tree, logistic regression, and random forest, where this last one demonstrates the best outcomes.

DISADVANTAGE OF THE EXISTING SYSTEM

- Existing system miss the undesirable data for the students.
- And it may not check the social data for the student.

1.4 DOMAIN INTRODUCTION

Java is one of the world's most important and widely used computer languages, and it has held this distinction for many years. Unlike some other computer languages whose influence has weared with passage of time, while Java's has grown.

1.4.1 APPLICATION OF JAVA

Java is widely used in every corner of world and of human life. Java is not only used in software but is also widely used in designing hardware controlling software components. There are more than 930 million JRE downloads each year and 3 billion mobile phones run java.

Following are some other usage of Java:

1. Developing Desktop Applications
2. Web Applications like Linkedin.com, Snapdeal.com etc
3. Mobile Operating System like Android
4. Embedded Systems
5. Robotics and games etc.

1.4.2 FEATURES OF JAVA

The prime reason behind creation of Java was to bring portability and security feature into a computer language. Beside these two major features, there were many other features that played an important role in moulding out the final form of this outstanding language. Those features are;

1)Simple

Java is easy to learn and its syntax is quite simple, clean and easy to understand. The confusing and ambiguous concepts of C++ are either left out in Java or they have been re-implemented in a cleaner way.

Eg: Pointers and Operator Overloading are not there in java but were an important part of C++.

2) Object Oriented

In java everything is Object which has some data and behaviour. Java can be easily extended as it is based on Object Model.

3) Robust

Java makes an effort to eliminate error prone codes by emphasizing mainly on compile time error checking and runtime checking. But the main areas which Java improved were Memory Management and mishandled Exceptions by introducing automatic Garbage Collector and Exception Handling.

4) Platform Independent

Unlike other programming languages such as C, C++ etc. which are compiled into platform specific machines. Java is guaranteed to be write-once, run-anywhere language.

5) Secure

When it comes to security, Java is always the first choice. With java secure features it enable us to develop virus free, temper free system. Java program always runs in Java runtime environment with almost null interaction with system OS, hence it is more secure.

6) Multi-Threading

Java multithreading feature makes it possible to write program that can do many tasks simultaneously. Benefit of multithreading is that it utilizes same memory and other resources to execute multiple threads at the same time, like While typing, grammatical errors are checked along.

7) Architectural Neutral

Compiler generates byte codes, which have nothing to do with a particular computer architecture, hence a Java program is easy to interpret on any machine.

8) High Performance

Java is an interpreted language, so it will never be as fast as a compiled language like C or C++. But, Java enables high performance with the use of just-in-time compiler.

1.4.3 COLLECTION FRAMEWORK

Collection framework was not part of original Java release. Collections was added to J2SE 1.2. Prior to Java 2, Java provide classes such as Dictionary, Vector, Stack and Properties to store and manipulate groups of objects. Collection framework provides many important classes and interfaces to collect and organize group of alike objects.

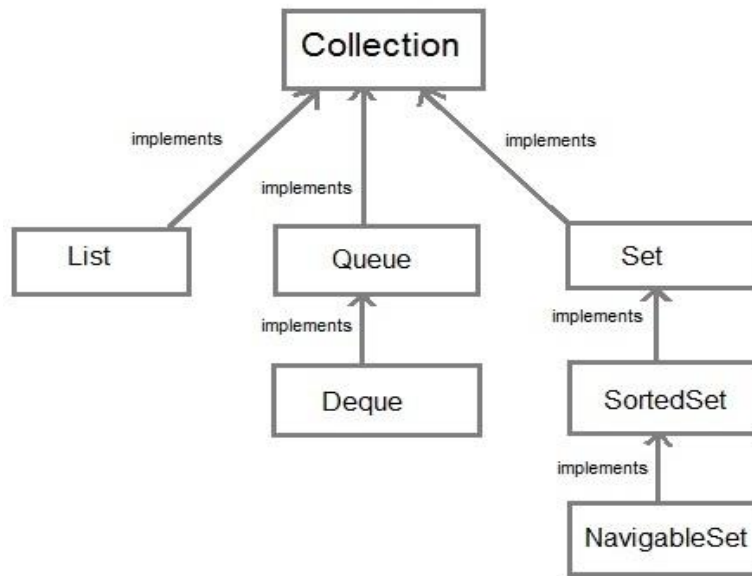


FIG 1.1 COLLECTION FRAMEWORK

CHAPTER 2

AIM AND SCOPE

2.1 AIM OF THE PROJECT

The main objective is to create a developed policy for higher education regards the creation of a more diversified higher education system with flexible and adaptive institutions.

2.2 SCOPE OF THE PROJECT

- We present survey results on which academic decisions they concern and the variables involved in them.
- Using machine learning algorithms, we predicted courses/institutions in a real case study to support decision making.

2.3 SOFTWARE REQUIREMENTS

- Operating System - Windows XP
- Coding language - Java
- IDE - Net beans
- Database -Mysql

2.4 HARDWARE REQUIREMENTS

- System - Pentium-IV
- Speed - 2.4GHZ
- Hard disk - 40GB
- Monitor - 15VGA color
- RAM - 512MB

CHAPTER 3

LITERATURE SURVEY

Literature survey is the most important step in software development process. Before developing the tool it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, then the next step is to determine which operating system and language can be used for developing the tool. Once the programmers start building the tool the programmers need lot of external support. This support can be obtained from senior programmers, from book or from websites. Before building the system the above consideration are taken into account for developing the proposed system. The major part of the project development sector considers and fully survey all the required needs for developing the project. For every project Literature survey is the most important sector in software development process. Before developing the tools and the associated designing it is necessary to determine and survey the time factor, resource requirement, man power, economy, and company strength. Once these things are satisfied and fully surveyed, then the next step is to determine about the software specifications in the respective system such as what type of operating system the project would require, and what are all the necessary software are needed to proceed with the next step such as developing the tools, and the associated operations.

1.Barriers and drivers of innovation in higher education: Case study-based evidence across ten European Universities

The paper advances current knowledge on factors affecting higher education institutions in their quest for innovation in education. Based on an analysis of ten institutional cases from five European countries, a comprehensive description and classification of barriers and drivers of innovation are provided. Results indicate certain “disengagement” in relation of higher education institutions and education policy makers, business, and students as well as

between higher education institutions' managers and their subordinates. Based on the findings, major innovation-related challenges in the higher education are discussed and related practical recommendations are presented.

2.Supporting academic decision making at higher educational institutions using machine learning-based algorithms

Decisions made by deans and university managers greatly impact the entire academic community as well as society as a whole. In this paper, we present survey results on which academic decisions they concern and the variables involved in them. Using machine learning algorithms, we predicted graduation rates in a real case study to support decision making. Real data from five undergraduate engineering programs at District University Francisco Jose de Caldas in Colombia illustrate our results. The comparison between support vector machine and artificial neural network is held using the confusion matrix and the receiver operating characteristic curve. The algorithm methods and architecture are presented.

3.The effect of blended learning on student performance at course-level in higher education: A meta-analysis

The present paper analyzes the impact of blended learning (BL) on the academic achievement of higher education students. A meta-analysis ($k = 51$ effect sizes) was conducted to perform a statistical synthesis of studies contrasting student performance in BL conditions with traditional classroom instruction. We include disciplines and instructors' end-of-course evaluation method as moderating variables. The results show that BL demonstrates a small summary effect ($g^+ = 0.385$, $p < 0.001$) compared to traditional teaching methods. A significantly higher mean effect size was found in STEM disciplines ($g^+ = 0.496$) compared to that of non-STEM disciplines ($g^+ = 0.210$). Nevertheless, the weighted mean effect sizes reveal no significant differences regarding of end-of-course assessment methods, namely one-moment and multiple-component assessment. The finding confirms that BL is significantly associated with greater learning performance of STEM-disciplined students

than with traditional classroom practice. Accordingly, discussion concerning the findings and implications for future research are elaborated.

4.Using system dynamics to develop education for sustainable development in higher education with the emphasis on the sustainability competencies of students

In response to growing concerns of the community about sustainability challenges and the intensification of the international calls to move towards a sustainable future, higher education should be involved in implementing the programs of education for sustainable development; because of this fact that University graduates are part of this solution as future leaders and inheritors of technology. In this study, the underlying research question is: What mechanisms are needed to develop education for sustainable development in higher education with the emphasis on the sustainability competencies of students? The research method was system dynamics. Therefore, we used a mix method research design. Tools of research included the literature review, questionnaire, interview, and observation. We developed a dynamic model to develop the education for sustainable development in higher education with the emphasis on the sustainability competencies of students. This model describes the research problem and predicts the behavior of model variables by simulating in the next 20 years. Finally, we evaluated these mechanisms for finding the impacts on improving the problem.

5.Strategic alignment between sustainability and information systems: A case analysis in Malaysian public higher education Institutions

Higher Education Institutions have embedded sustainability initiatives into their core activities of curriculum, research, community, and operational to respond the global transformation towards a sustainable future. Numerous studies have been conducted concerning an integrated sustainability into the missions and strategies of the Higher Education Institutions. However, there is a lack of works that highlight the important role of information systems to support the sustainability practices in Higher Education Institutions. This problem motivates the study to underscore the important role of information systems during the

sustainability implementation. A preliminary case analysis is performed to observe how the Higher Education Institutions implement the sustainability initiatives and to proof the knowledge gap in real practice. The analysis was conducted during visits via a semi-structured interview with a number of persons from Higher Education Institutions in Malaysia that have been implementing sustainable campus. According to the preliminary case analysis, the Higher Education Institutions do not contemplate the information system strategy at the beginning of their sustainability implementation. There is a lack of information system application to support their sustainability practices. They still use manual methods to collect the sustainability metrics and assess their sustainability performance. As a result, the sustainability decision-making is isolated and they cannot evaluate their sustainable performance. The problems of managing the sustainability data and processes arise. Therefore, a concept of the strategic alignment between sustainability and information system is underscored in the present study. The introduction of this concept through this study would enhance our understanding in term of the significant role of the information systems to support the sustainability practices and to achieve a successfully sustainable campus.

CHAPTER 4

MEATHODS AND ALGORITHMS USED

4.1 DATA COLLECTION

- Data is a collection global dataset. IN this system use Pima Indian data set is used for training a model.
- The training data is an initial set of data which is used to understand the program.
- This is the one in which we have to train the model first because to set the feature and this data is available on system.
- This data is used to teach the machine for do different actions. It is the data in which model can learn with algorithm to teach the model and doing work automatic.
- Testing data is the input given to a software. It shows the data affects when the execution of the module that specifying and this is basically used for testing.

4.2 DATA CLEANING

- Data cleaning is a critically important step in any machine learning project.
- In this module data cleaning is done to prepare the data for analysis by removing or modifying the data that may be incorrect, incomplete, duplicated or improperly formatted.
- In tabular data, there are many different statistical analysis and data visualization techniques you can use to explore your data in order to identify data cleaning operations you may want to perform.

4.3 DATA PREPROCESSING

- Data preprocessing is a process in which that is actual use for converting the basic data into the clean data set.
- It is the step in which the data transform or encode to the state that the machine can be easily parse.
- The major task of data preprocessing in learning process is to remove the unwanted data and filling the missed value. So that it help to machine can be trained easily.

4.3.1 SYSTEM ARCHITECHTURE

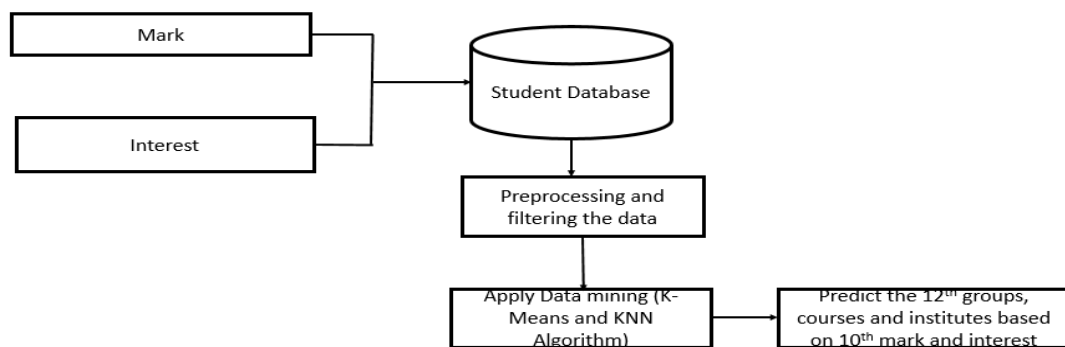


FIG. 4.1 SYSTEM ARCHITECHTURE

4.4 FEATURE EXTRACTION

- This is done to reduce the number of attributes in the dataset hence providing advantages like speeding up the training and accuracy improvements.
- When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it

can be transformed into a reduced set of features (also named a feature vector).

- Feature Extraction is the method in which it used for alter the key data for features of outcomes. This, trait square is used to compute the characteristics of designs given that facilitate in different amid the class of key pattern details.
- This is done to reduce the number of attributes in the dataset hence providing advantages like speeding up the training and accuracy improvements.
- This method involving to decrease the counts of resource required to describe the huge set of data. Feature
- Extraction is an attribute reduction process. This is also used to increasing the speed and effectiveness of supervised learning.

4.5 Testing model

- In this module we test the trained machine learning model using the test dataset
- Quality assurance is required to make sure that the software system works according to the requirements. Were all the features implemented as agreed? Does the program behave as expected? All the parameters that you test the program against should be stated in the technical specification document.
- Moreover, software testing has the power to point out all the defects and flaws during development. You don't want your clients to encounter bugs after the software is released and come to you waving their fists. Different kinds of testing allow us to catch bugs that are visible only during runtime.

4.5.1 Types of testing

There are many types of testing like

- Unit Testing
- Integration Testing
- Functional Testing
- System Testing
- Stress Testing
- Performance Testing
- Usability Testing
- Acceptance Testing
- Regression Testing
- Beta testing

Unit Testing

Unit testing is the testing of an individual unit or group of related units. It falls under the class of white box testing. It is often done by the programmer to test that the unit he/she has implemented is producing expected output against given input.

Integration Testing

Integration testing is testing in which a group of components are combined to produce output. Also, the interaction between software and hardware is tested in integration testing if software and hardware components have any relation. It may fall under both white box testing and black box testing.

Functional Testing

Functional testing is the testing to ensure that the specified functionality required in the system requirements works. It falls under the class of black box testing.

System Testing

System testing is the testing to ensure that by putting the software in different environments (e.g., Operating Systems) it still works. System testing is done with full system implementation and environment. It falls under the class of black box testing.

Stress Testing

Stress testing is the testing to evaluate how system behaves under unfavorable conditions. Testing is conducted at beyond limits of the specifications. It falls under the class of black box testing.

Performance Testing

Performance testing is the testing to assess the speed and effectiveness of the system and to make sure it is generating results within a specified time as in performance requirements. It falls under the class of black box testing.

Usability Testing

Usability testing is performed to the perspective of the client, to evaluate how the GUI is user-friendly? How easily can the client learn? After learning how to use, how proficiently can the client perform? How pleasing is it to use its design? This falls under the class of black box testing.

Acceptance Testing

Acceptance testing is often done by the customer to ensure that the delivered product meets the requirements and works as the customer expected. It falls under the class of black box testing.

Regression Testing

Regression testing is the testing after modification of a system, component, or a group of related units to ensure that the modification is working correctly and is not damaging or imposing other modules to produce unexpected results. It falls under the class of black box testing.

4.6 Performance Evaluation

- In this module, we evaluate the performance of trained machine learning model using performance evaluation criteria such as F1 score, accuracy and classification error.
- In case the model performs poorly, we optimize the machine learning algorithms to improve the performance.
- performance Evaluation is defined as a formal and productive procedure to measure an employee's work and results based on their job responsibilities. It is used to gauge the amount of value added by an employee in terms of increased business revenue, in comparison to industry standards and overall employee return on investment (ROI).
- All organizations that have learned the art of “winning from within” by focusing inward towards their employees, rely on a systematic performance evaluation process to measure and evaluate employee performance regularly.
- Ideally, employees are graded annually on their work anniversaries based on which they are either promoted or are given suitable distribution of salary raises
- . Performance evaluation also plays a direct role in providing periodic feedback to employees, such that they are more self-aware in terms of their performance metrics.

4.7 Prediction

- In this module, machine learning is used for wide variety of applications such as suggestion to the students based on 10th mark and interest.
- One of the most important milestones in an individual's life involves self-analysis, critical thinking and finally decision making. While choosing a stream after 10th, a training course or a career and 12th groups you should know your abilities, interests, and personality.
- Besides these you should gather information regarding different career options, the eligibility criteria, the premier institutions/Schools, and other criteria of selection and the market demands.

4.8 K-MEANS CLUSTERING ALGORITHM:

What is K-means?

1. Partitional clustering approach
2. Each cluster is associated with a centroid (center point)
3. Each point is assigned to the cluster with the closest centroid
- 4 Number of clusters K must be specified

Input: k (the number of clusters),
 D (a set of lift ratios)
Output: a set of k clusters
Method:
 Arbitrarily choose k objects from D as the initial cluster centers;
Repeat:
 1. (re)assign each object to the cluster to which the object is the most similar, based on the mean value of the objects in the cluster;
 2. Update the cluster means, i.e., calculate the mean value of the objects for each cluster
Until no change;

Details of K-means

1. Initial centroids are often chosen randomly. - Clusters produced vary from one run to another
2. The centroid is (typically) the mean of the points in the cluster.
3. 'Closeness' is measured by Euclidean distance, cosine similarity, correlation, etc.
4. K-means will converge for common similarity measures mentioned above.
5. Most of the convergence happens in the first few iterations. - Often the stopping condition is changed to 'Until relatively few points change clusters'

4.9 KNN CLASSIFICATION METHOD

KNN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The k -NN algorithm is among the simplest of all machine learning algorithms. The neighbors are taken from a set of objects for which the class (for k -NN classification) or the object property value (for k -NN regression) is known.

STEP 1: BEGIN

STEP 2: Input: $D = \{(x_1, c_1), \dots, (x_N, c_N)\}$

STEP 3: $x = (x_1, \dots, x_n)$ new instance to be classified

STEP 4: FOR each labelled instance (x_i, c_i) calculate $d(x_i, x)$

STEP 5: Order $d(x_i, x)$ from lowest to highest, ($i = 1. \dots N$)

STEP 6: Select the K nearest instances to x : D_x^K

STEP 7: Assign to x the most frequent class in D_x^K

STEP 8: END

4.10 MYSQL

MySQL, officially, but also called "My Sequel" is the world's most widely used open-source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases, though SQLite probably has more total embedded deployments. The SQL phrase stands for Structured Query Language.

The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation. MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (and other 'AMP' stacks).

LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Freesoftware-open source projects that require a full-featured database management system often use MySQL.

For commercial use, several paid editions are available, and offer additional functionality. Applications which use MySQL databases include: TYPO3, MODx, Joomla, WordPress, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-profile, large-scale websites, including Wikipedia, Google (though not for searches), Facebook, Twitter, Flickr and YouTube. Microsoft is the vendor of SQL Server. We have different editions of SQL Server, where SQL Server Express is free to download and use. SQL Server uses T-SQL (Transact-SQL). T-SQL is Microsoft's proprietary extension to SQL. TSQL is very similar to standard SQL, but in addition it supports some extra functionality, built in functions, etc.

T-SQL expands on the SQL standard to include procedural programming, local variables, and various support functions for string processing, date processing, mathematics, etc. SQL Server consists of a Database Engine and a Management Studio (and lots of other stuff which we will not mention here). The Database engine has no graphical interface - it is just a service running in the background of your computer (preferable on the server). The Management Studio is graphical tool for configuring and viewing the information in the database. It can be installed on the server or on the client (or both).

SQL Server Management Studio can also be used to create a new database, alter any existing database schema by adding or modifying tables and indexes, or analyze performance. It includes the query windows which provide a GUI based interface to write and execute queries.

4.10.1 SQL SERVER MANAGEMENT STUDIO

SQL Server Management Studio is a GUI tool included with SQL Server for configuring, managing, and administering all components within Microsoft SQL Server. The tool includes both script editors and graphical tools that work with objects and features of the server. As mentioned earlier, version of SQL Server Management Studio is also available for SQL Server Express Edition, for which it is known as SQL Server Management Studio Express.

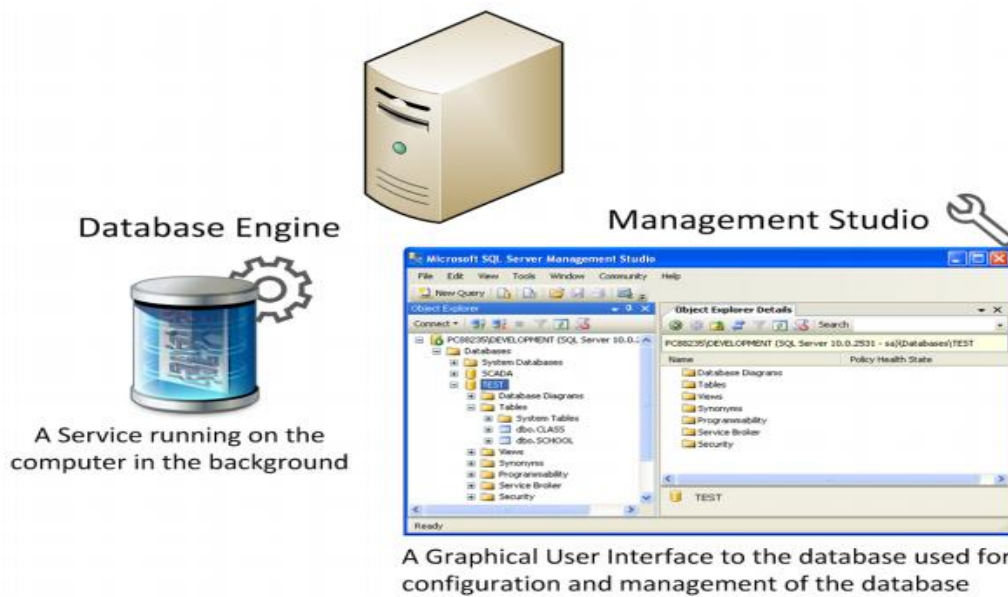


FIG 4.2 SERVER MANAGEMENT STUDIO

A central feature of SQL Server Management Studio is the Object Explorer, which allows the user to browse, select, and act upon any of the objects within the server. It can be used to visually observe and analyze query plans and optimize the database performance, among others. SQL Server Management Studio can also be used to create a new database, alter any existing database schema by adding or modifying tables and indexes, or analyze performance. It includes the query windows which provide a GUI based interface to write and execute queries.

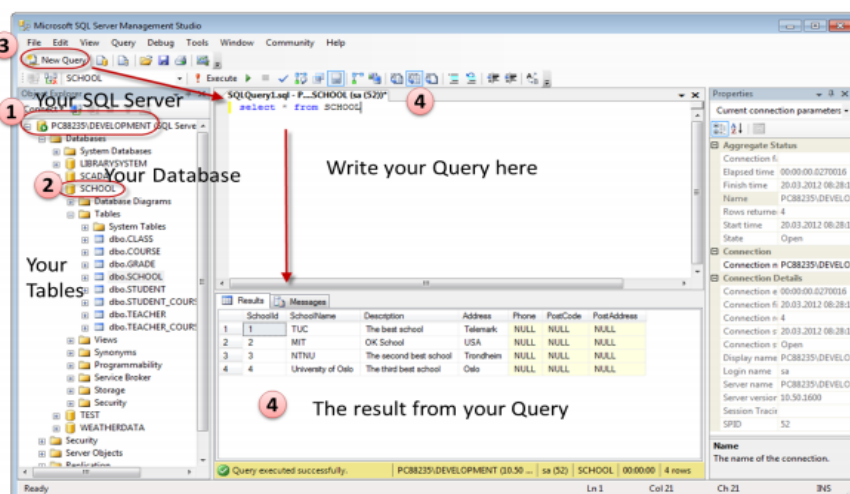


FIG 4.3 QUERY EDITOR

4.10.2 Create a new Database

It is quite simple to create a new database in Microsoft SQL Server. Just right-click on the “Databases” node and select “New Database...”

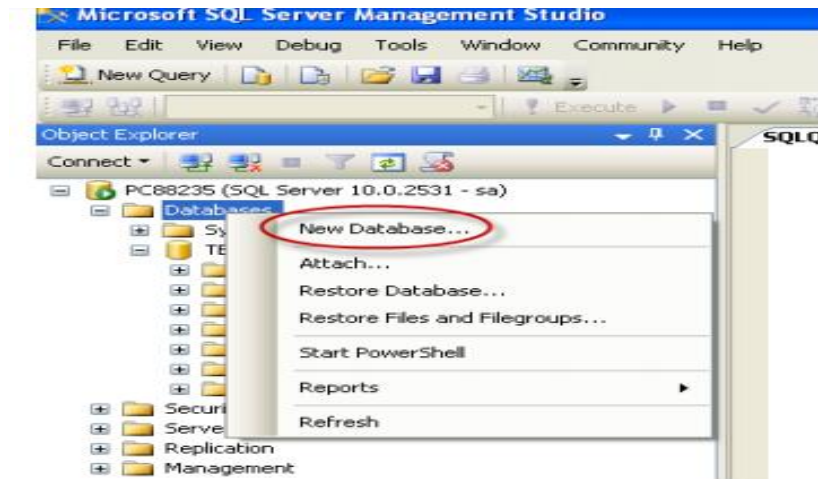


FIG 4.4 NEW DATABASE CREATION

The OLAP Services feature available in SQL Server version 7.0 is now called SQL Server 2000 Analysis Services. The term OLAP Services has been replaced with the term Analysis Services. Analysis Services also includes a new data mining component. The Repository component available in SQL Server version 7.0 is now called Microsoft SQL Server 2000 Meta Data Services. References to the component now use the term Meta Data Services. The term repository is used only in reference to the repository engine within Meta Data Services

4.11 SYSTEM 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.

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.

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.

4.12 REQUIREMENT ANALYSIS

Requirement analysis, also called requirement engineering, is the process of determining user expectations for a new modified product. It encompasses the tasks that determine the need for analysing, documenting, validating and managing software or system requirements. The requirements should be documentable, actionable, measurable, testable and traceable related to identified business needs or opportunities and define to a level of detail, sufficient for system design.

4.12.1 FUNCTIONAL REQUIREMENTS

It is a technical specification requirement for the software products. It is the first step in the requirement analysis process which lists the requirements of particular software systems including functional, performance and security requirements. The function of the system depends mainly on the quality hardware used to run the software with given functionality.

Usability

It specifies how easy the system must be use. It is easy to ask queries in any format which is short or long, porter stemming algorithm stimulates the desired response for user.

Robustness

It refers to a program that performs well not only under ordinary conditions but also under unusual conditions. It is the ability of the user to cope with errors for irrelevant queries during execution.

Security

The state of providing protected access to resource is security. The system provides good security and unauthorized users cannot access the system there by providing high security.

Reliability

It is the probability of how often the software fails. The measurement is often expressed in MTBF (Mean Time between Failures). The requirement is needed in order to ensure that the processes work correctly and completely without being aborted. It can handle any load and survive and survive and even capable of working around any failure.

Compatibility

It is supported by version above all web browsers. Using any web servers like local host makes the system real-time experience.

Flexibility

The flexibility of the project is provided in such a way that is has the ability to run on different environments being executed by different users.

Safety

Safety is a measure taken to prevent trouble. Every query is processed in a secured manner without letting others to know one's personal information.

4.12.2 NON- FUNCTIONAL REQUIREMENTS

Portability

It is the usability of the same software in different environments. The project can be run in any operating system.

Performance

These requirements determine the resources required, time interval, throughput and everything that deals with the performance of the system.

Accuracy

The result of the requesting query is very accurate and high speed of retrieving information. The degree of security provided by the system is high and effective.

Maintainability

Project is simple as further updates can be easily done without affecting its stability. Maintainability basically defines that how easy it is to maintain the system. It means that how easy it is to maintain the system, analyse, change and test the application. Maintainability of this project is simple as further updates can be easily done without affecting its stability.

4.13 UML DIAGRAMS

UML is simply another graphical representation of a common semantic model. UML provides a comprehensive notation for the full lifecycle of object-oriented development.

ADVANTAGES

- To represent complete systems (instead of only the software portion) using object oriented concepts
- To establish an explicit coupling between concepts and executable code
- To take into account the scaling factors that are inherent to complex and critical systems
- To creating a modeling language usable by both humans and machines
- UML defines several models for representing systems
- The class model captures the static structure
- The state model expresses the dynamic behavior of objects
- The use case model describes the requirements of the user

- The implementation model shows the work units
- The deployment model provides details that pertain to process allocation

4.13.1 Use Case Daigram

Use case diagrams overview the usage requirement for system. They are useful for presentations to management and/or project stakeholders, but for actual development you will find that use cases provide significantly more value because they describe “the meant” of the actual requirements. A use case describes a sequence of action that provides something of measurable value to an action and is drawn as a horizontal ellipse.

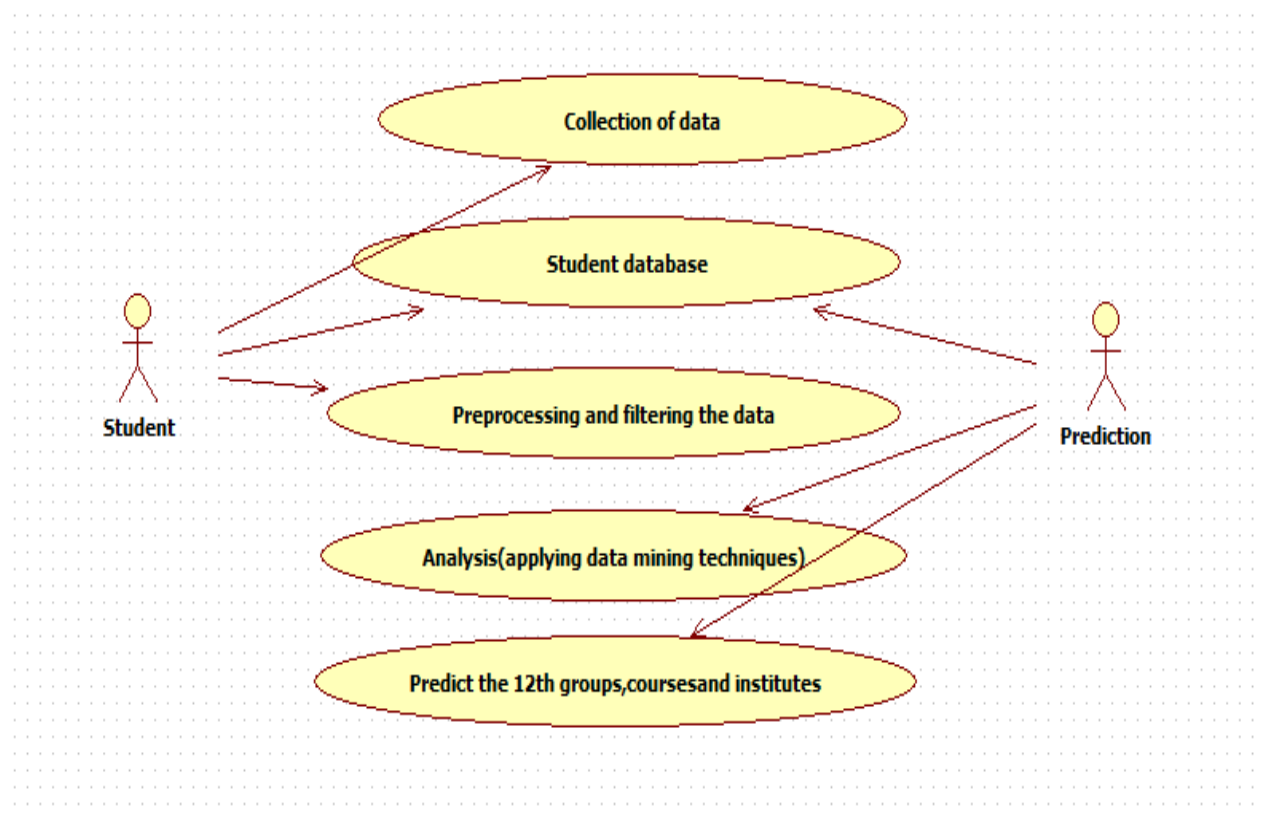


FIG 4.5 USE CASE DAIGRAM

4.13.2 SEQUENCE DIAGRAM

Sequence diagram model the flow of logic within your system in a visual manner, enabling you both to document and validate your logic, and commonly used for both analysis and design purpose. Sequence diagram are the most popular UML artifact for dynamic modeling, which focuses on identifying the behavior within your system.

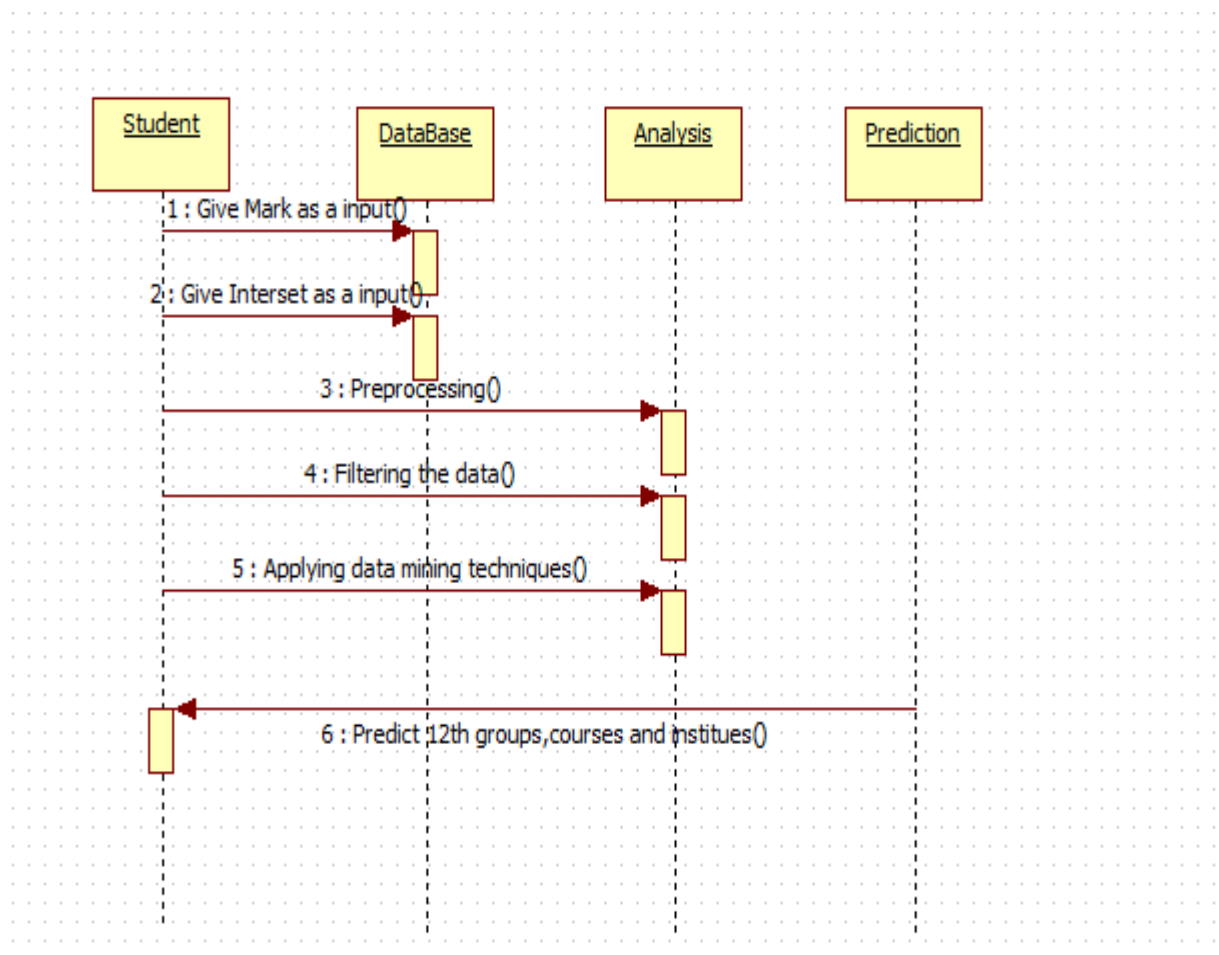


FIG 4.6 SEQUENCE DAIGRAM

4.13.3 COLLABORATION DIAGRAM

Another type of interaction diagram is the collaboration diagram. A collaboration diagram represents a collaboration, which is a set of objects related in a particular context, and interaction, which is a set of messages exchange among the objects within the collaboration to achieve a desired outcome.

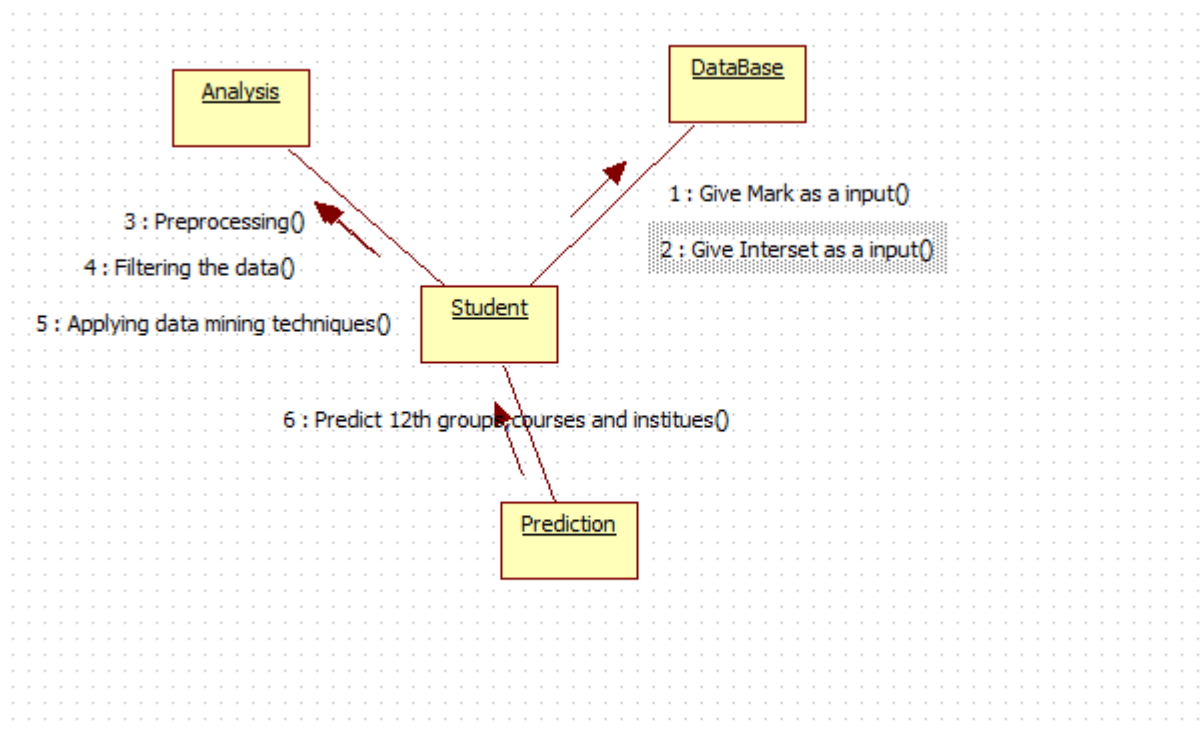


FIG 4.7 COLLABORATION DAIGRAM

CHAPTER 5

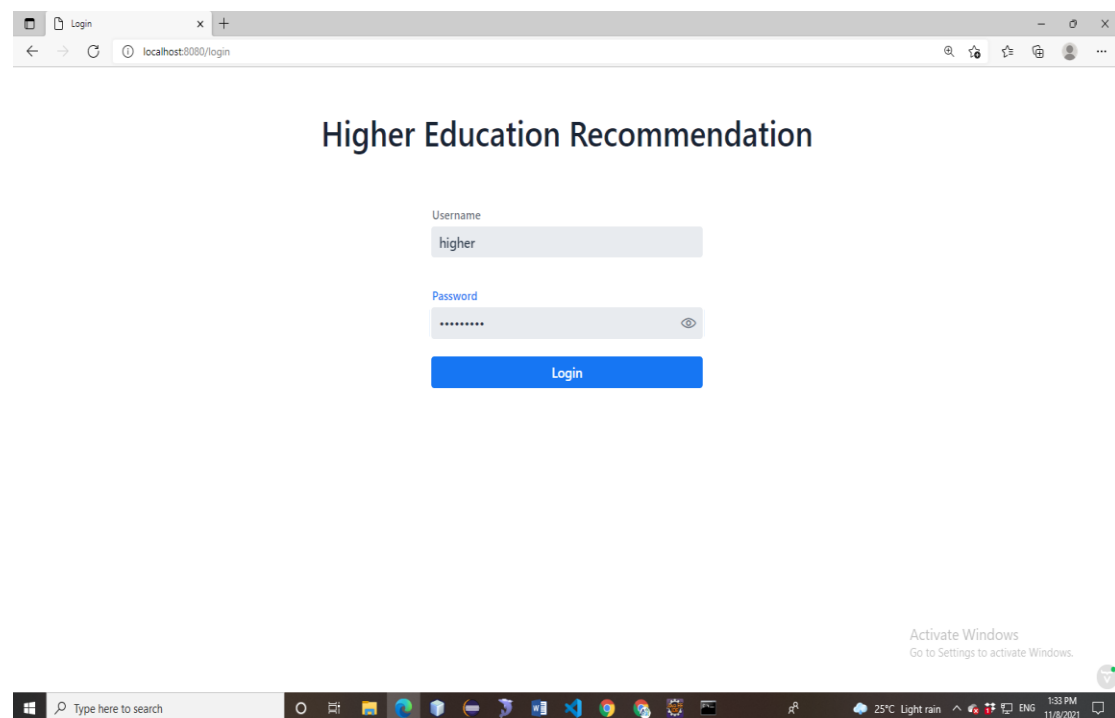
RESULTS AND DISCUSSION

5.1 RESULT

The classification task is used on student database to predict the student's decision on the basis of previous database. As there are many approaches that are used for data classification, the k-means clustering Classifier and KNN Classifier are used here. Information's like marks, interest were collected from the student's previous database, to predict the training course or a career and 12th groups at the end. This study will help to the students to improve the decision of the student. This can help the students improve in their academics, which eventually leads to a good decision in their career.

5.2 SCREENSHOTS

Login Page



School to +2 Recommendation Page

School to Intermediate (+2)

Intermediate (+2) to College

Career Development

School to Intermediate (+2) suggestion

Mathamatics	79	Physics	23
Biology	23	Chemistry	45
Social	78		

Suggest

Reset

MPC is recommended

Suggested colleges are

1. Sree chaitanya Junior college
2. Narayana Junior college

Intermediate to Graduation Page

School to Intermediate (+2)

Intermediate (+2) to College

Intermediate (+2) to College suggestion

Mathamatics	56	Physics	78
Electronics	54	Chemistry	78
Programming	97		

Suggest

Reset

CSE / IT are recommended

Suggested colleges are

1. SRM Institute of technology and sciences
2. Hindustan Institute of technology and sciences

Based on Interest



School to Intermediate (+2)

Intermediate (+2) to College

Career Development

Machine learning 

SuggestReset

1. Green tree software solutions

2. Green tree technologies

3. Omega solutions

CHAPTER 6

SUMMARY AND CONCLUSION

As there are many approaches that are used for data classification, the k-means clustering Classifier and KNN Classifier are used here. Information's like marks, interest were collected from the student's previous database, to predict the training course or a career and 12th groups at the end. This study will help to the students to improve the decision of the student. This can help the students improve in their academics, which eventually leads to a good decision in their career.

REFERENCES

- [1] A. Lašáková, L. Bajžíková, and I. Dedze, "Barriers and drivers of innovation in higher education: Case study-based evidence across ten European Universities," *Int. J. Educ. Develop.*, vol. 55, pp. 69–79, May 2017.
- [2] Y. V. N. Acevedo and C. E. M. Marín, "System architecture based on learning analytics to educational decision makers toolkit," *Adv. Comput. Sci. Eng.*, vol. 13, no. 2, pp. 89–105, 2014.
- [3] A. R. T. Góes, M. T. A. Steiner, and P. J. S. Neto, "Education quality measured by the classification of school performance using quality labels," *Appl. Mech. Mater.*, vols. 670–671, pp. 1675–1683, Oct. 2014.
- [4] H. Lounis and T. Fares, "Using efficient machine-learning models to assess two important quality factors: Maintainability and reusability," in *Proc. Joint Conf. 21st Int. Workshop Softw. Meas. 6th Int. Conf. Softw. Process Product Meas.*, Nov. 2011, pp. 170–177.
- [5] Y. Nieto, V. García-Díaz, C. Montenegro, and R. G. Crespo, "Supporting academic decision making at higher educational institutions using machine learning-based algorithms," *Soft Comput.*, vol. 23, no. 12, pp. 4145–4153, 2018.

- [6] K. V. Pincus, D. E. Stout, J. E. Sorensen, K. D. Stocks, and R. A. Lawson, "Forces for change in higher education and implications for the accounting academy," *J. Accounting Educ.*, vol. 40, pp. 1–18, Sep. 2016.
- [7] A.-P. Pavel, A. Fruth, and M.-N. Neacsu, "ICT and e-learning—Catalysts for innovation and quality in higher education," *Procedia Econ. Finance*, vol. 23, pp. 704–711, Jan. 2015.
- [8] F. V. Elena, A. M. Manuel, and G. G. S. Carina, "Which use give teachers at La Laguna University to ICTs?" *Procedia-Social Behav. Sci.*, vol. 93, pp. 1646–1651, Oct. 2013.
- [9] H. M. Vo, C. Zhu, and N. A. Diep, "The effect of blended learning on student performance at course-level in higher education: A meta-analysis," *Stud. Educ. Eval.*, vol. 53, pp. 17–28, Jun. 2017.
- [10] I. M. Taucean and M. Tamasila, "Research challenges for eLearning support in engineering and management training," *Procedia-Social Behav. Sci.*, vol. 124, pp. 210–218, Mar. 2014.

APPENDIX

A. SOURCE CODE

```
package com.suggest.next.step;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class SuggestNextStepApplication {

    public static void main(String[] args) {
        SpringApplication.run(SuggestNextStepApplication.class, args);
    }

}
```

```

package com.suggest.next.step.models;

public class IntermediateSubject {

    private Integer maths;

    private Integer physics;

    private Integer chemistry;

    private Integer electronics;

    private Integer programming;

    public Integer getMaths() {
        return maths;
    }

    public void setMaths(Integer maths) {
        this.maths = maths;
    }

    public Integer getPhysics() {
        return physics;
    }

    public void setPhysics(Integer physics) {
        this.physics = physics;
    }

    public Integer getChemistry() {
        return chemistry;
    }

    public void setChemistry(Integer chemistry) {
        this.chemistry = chemistry;
    }

    public Integer getElectronics() {
        return electronics;
    }

    public void setElectronics(Integer electronics) {
        this.electronics = electronics;
    }

    public Integer getProgramming() {
        return programming;
    }
}

```

```

public void setProgramming(Integer programming) {
    this.programming = programming;
}

}
package com.suggest.next.step.models;

public class SchoolSubject {

    private Integer maths;

    private Integer physics;

    private Integer chemistry;

    private Integer social;

    private Integer biology;

    public Integer getMaths() {
        return maths;
    }

    public void setMaths(Integer maths) {
        this.maths = maths;
    }

    public Integer getPhysics() {
        return physics;
    }

    public void setPhysics(Integer physics) {
        this.physics = physics;
    }

    public Integer getChemistry() {
        return chemistry;
    }

    public void setChemistry(Integer chemistry) {
        this.chemistry = chemistry;
    }

    public Integer getSocial() {
        return social;
    }

    public void setSocial(Integer social) {
        this.social = social;
    }
}

```

```

public Integer getBiology() {
return biology;
}

public void setBiology(Integer biology) {
this.biology = biology;
}

}
package com.suggest.next.step.views;

import com.vaadin.flow.component.button.Button;
import com.vaadin.flow.component.combobox.ComboBox;
import com.vaadin.flow.component.html.Div;
import com.vaadin.flow.component.html.Label;
import com.vaadin.flow.component.orderedlayout.HorizontalLayout;
import com.vaadin.flow.component.orderedlayout.VerticalLayout;
import com.vaadin.flow.router.Route;

@SuppressWarnings("serial")
@Route(value = "career-development", layout = MainView.class)
public class CareerDevelopmentView extends Div {
public CareerDevelopmentView() {
    VerticalLayout layout = new VerticalLayout();

    ComboBox<String> comboBox = new ComboBox<>();
    comboBox.setItems("Python",
        "Java",
        "C",
        "C++",
        "C#",
        "Machine learning",
        "Automation");

    HorizontalLayout actions = new HorizontalLayout();
    Button save = new Button("Suggest");
    Button reset = new Button("Reset");
    actions.add(save, reset);

    VerticalLayout verticalLayout = new VerticalLayout();
    save.addClickListener(event -> {
        String language = comboBox.getValue();
        if("Python".equals(language)) {
            verticalLayout.removeAll();
            verticalLayout.add(
                new Label("1. Green tree software solutions"),
                new Label("2. Green tree technologies"));
        }
        if("Java".equals(language)) {

```

```

verticalLayout.removeAll();
verticalLayout.add(
    new Label("1. Green tree software solutions"),
    new Label("2. Green tree technologies"),
    new Label("3. Naresh technologies"));
}
if("C".equals(language)) {
    verticalLayout.removeAll();
    verticalLayout.add(
        new Label("1. Naresh technologies"),
        new Label("2. Green tree technologies"),
        new Label("3. Omega solutions"));
}
if("C++".equals(language)) {
    verticalLayout.removeAll();
    verticalLayout.add(
        new Label("1. Naresh technologies"),
        new Label("2. Green tree software solutions"),
        new Label("3. Omega solutions"));
}
if("Machine learning".equals(language)) {
    verticalLayout.removeAll();
    verticalLayout.add(
        new Label("1. Green tree software solutions"),
        new Label("2. Green tree technologies"),
        new Label("3. Omega solutions"));
}
if("C#".equals(language)) {
    verticalLayout.removeAll();
    verticalLayout.add(
        new Label("1. Naresh technologies"),
        new Label("2. Omega solutions"));
}
if("Automation".equals(language)) {
    verticalLayout.removeAll();
    verticalLayout.add(
        new Label("1. Green tree software solutions"),
        new Label("2. Green tree technologies"),
        new Label("3. Omega solutions"));
}
});

reset.addClickListener(event -> {
    verticalLayout.removeAll();
});

layout.add(comboBox);
add(layout);
add(actions);
add(verticalLayout);
}

```

```

}package com.suggest.next.step.views;

import java.util.HashMap;
import java.util.Map;
import java.util.Optional;
import java.util.stream.Collectors;

import com.suggest.next.step.models.IntermediateSubject;
import com.vaadin.flow.component.button.Button;
import com.vaadin.flow.component.formlayout.FormLayout;
import com.vaadin.flow.component.html.Div;
import com.vaadin.flow.component.html.H1;
import com.vaadin.flow.component.html.Label;
import com.vaadin.flow.component.orderedlayout.HorizontalLayout;
import com.vaadin.flow.component.orderedlayout.VerticalLayout;
import com.vaadin.flow.component.textfield.IntegerField;
import com.vaadin.flow.data.binder.Binder;
import com.vaadin.flow.data.binder.BinderValidationStatus;
import com.vaadin.flow.data.binder.BindingValidationStatus;
import com.vaadin.flow.data.validator.IntegerRangeValidator;
import com.vaadin.flow.data.value.ValueChangeMode;
import com.vaadin.flow.router.Route;

@SuppressWarnings("serial")
@Route(value = "intermediate-to-college", layout = MainView.class)
public class IntermediateToCollege extends Div {
    public IntermediateToCollege() {
        add(new H1("Intermediate (+2) to College suggestion"));

        final FormLayout formLayout = new FormLayout();
        Binder<IntermediateSubject> binder = new Binder<>();

        IntermediateSubject subjectBeingEdited = new IntermediateSubject();

        IntegerField maths = new IntegerField();
        maths.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField physics = new IntegerField();
        physics.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField programming = new IntegerField();
        programming.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField electronics = new IntegerField();
        electronics.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField chemistry = new IntegerField();
        chemistry.setValueChangeMode(ValueChangeMode.EAGER);

        Button save = new Button("Suggest");
    }
}

```

```

Button reset = new Button("Reset");

formLayout.addFormItem(maths, "Mathamatics");
formLayout.addFormItem(physics, "Physics");
formLayout.addFormItem(electronics, "Electronics");
formLayout.addFormItem(chemistry, "Chemistry");
formLayout.addFormItem(programming, "Programming");

HorizontalLayout actions = new HorizontalLayout();
actions.add(save, reset);
save.getStyle().set("marginRight", "10px");

binder
.forField(maths)
.withValidator(new IntegerRangeValidator("Maths score is not correct", 0, 100))
.bind(IntermediateSubject::getMaths, IntermediateSubject::setMaths);

binder
.forField(electronics)
.withValidator(new IntegerRangeValidator("Electronics score is not correct", 0,
100))
.bind(IntermediateSubject::getElectronics,
IntermediateSubject::setElectronics);

binder
.forField(chemistry)
.withValidator(new IntegerRangeValidator("Chemistry score is not correct", 0,
100))
.bind(IntermediateSubject::getChemistry, IntermediateSubject::setChemistry);

binder
.forField(programming)
.withValidator(new IntegerRangeValidator("Programming score is not correct",
0, 100))
.bind(IntermediateSubject::getProgramming,
IntermediateSubject::setProgramming);

binder
.forField(physics)
.withValidator(new IntegerRangeValidator("", 0, 100))
.bind(IntermediateSubject::getPhysics, IntermediateSubject::setPhysics);

Label infoLabel = new Label();
VerticalLayout collegesList = new VerticalLayout();
save.addClickListener(event -> {
if (binder.writeBeanIfValid(subjectBeingEdited)) {

Integer electronicsScore = subjectBeingEdited.getElectronics();
Integer mathsScore = subjectBeingEdited.getMaths();
Integer chemistryScore = subjectBeingEdited.getChemistry();

```

```
Integer programmingScore = subjectBeingEdited.getProgramming();
Integer physicsScore = subjectBeingEdited.getPhysics();
```

```
Map<String, Integer> scoreMap = new HashMap<>();
scoreMap.put("electronicsScore", electronicsScore);
scoreMap.put("mathsScore", mathsScore);
scoreMap.put("chemistryScore", chemistryScore);
scoreMap.put("programmingScore", programmingScore);
scoreMap.put("physicsScore", physicsScore);
```

```
Map.Entry<String, Integer> maxEntry = null;
for (Map.Entry<String, Integer> entry : scoreMap.entrySet())
{
    if (maxEntry == null
    || entry.getValue()
    .compareTo(maxEntry.getValue()) > 0)
    {
        maxEntry = entry;
    }
}
```

```
final String preferredSubject = maxEntry.getKey();
```

```
if ("electronicsScore".equals(preferredSubject)) {
    infoLabel.setText("ECE / EEE / EIE are recommended");
    collegesList.removeAll();
    collegesList.add(new Label
    ("1. Saastra Institute of technology and sciences"));
    collegesList.add(new Label
    ("2. SRM Institute of technology and sciences"));
} else if ("mathsScore".equals(preferredSubject)) {
    infoLabel.setText("AI / ECE are recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
    ("1. Sathyabhama Institute of technology and sciences"));
    collegesList.add(new Label
    ("2. Saastra Institute of technology and sciences"));
} else if ("physicsScore".equals(preferredSubject)) {
    infoLabel.setText("CIVIL / MECH are recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
    ("1. Saastra Institute of technology and sciences"));
    collegesList.add(new Label
    ("2. Vellore Institute of technology and sciences"));
} else if ("chemistryScore".equals(preferredSubject)) {
    infoLabel.setText("CHEMICAL is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
}
```

```

collegesList.add(new Label
("1. Vellore Institute of technology and sciences"));
collegesList.add(new Label
("2. SRM Institute of technology and sciences"));
} else if("programmingScore".equals(preferredSubject)) {
infoLabel.setText("CSE / IT are recommended");
collegesList.removeAll();
collegesList.add(new Label("Suggested colleges are"));
collegesList.add(new Label
("1. Sathyabhama Institute of technology and sciences"));
collegesList.add(new Label
("2. Hindustan Institute of technology and sciences"));
}

} else {
BinderValidationStatus<IntermediateSubject> validate = binder.validate();
String errorText = validate.getFieldValidationStatuses()
.stream().filter(BindingValidationStatus::isError)
.map(BindingValidationStatus::getMessage)
.map(Optional::get).distinct()
.collect(Collectors.joining(", "));
infoLabel.setText("There are errors: " + errorText);
}
});
reset.addClickListener(event -> {
// clear fields by setting null
binder.readBean(null);
infoLabel.setText("");
collegesList.removeAll();
});

add(formLayout);
add(actions);
add(infoLabel);
add(collegesList);
}
}package com.suggest.next.step.views;

import java.util.HashMap;
import java.util.Map;

import com.vaadin.flow.component.Component;
import com.vaadin.flow.component.applayout.AppLayout;
import com.vaadin.flow.component.applayout.DrawerToggle;
import com.vaadin.flow.component.tabs.Tab;
import com.vaadin.flow.component.tabs.Tabs;
import com.vaadin.flow.router.BeforeEnterEvent;
import com.vaadin.flow.router.BeforeEnterObserver;
import com.vaadin.flow.router.Route;
import com.vaadin.flow.router.RouterLink;

```

```

@SuppressWarnings("serial")
@Route
//@PWA(name = "Suggestion App", shortName = "Suggestion")
public class MainView extends AppLayout implements BeforeEnterObserver
{

    private Tabs tabs = new Tabs();
    private Map<Class<? extends Component>, Tab> navigationTargetToTab =
    new HashMap<>();

    public MainView() {
        addMenuTab("School to Intermediate (+2)",
        SchoolToIntermediateView.class);
        addMenuTab("Intermediate (+2) to College", IntermediateToCollege.class);
        addMenuTab("Career Development", CareerDevelopmentView.class);
        tabs.setOrientation(Tabs.Orientation.VERTICAL);
        addToDrawer(tabs);
        addToNavbar(new DrawerToggle());
    }

    private void addMenuTab(String label, Class<? extends Component> target)
    {
        Tab tab = new Tab(new RouterLink(label, target));
        navigationTargetToTab.put(target, tab);
        tabs.add(tab);
    }

    @Override
    public void beforeEnter(BeforeEnterEvent event) {
        tabs.setSelectedTab(navigationTargetToTab.get(event.getNavigationTarget()));
    }
}package com.suggest.next.step.views;

import java.util.HashMap;
import java.util.Map;
import java.util.Optional;
import java.util.stream.Collectors;

import com.suggest.next.step.models.SchoolSubject;
import com.vaadin.flow.component.button.Button;
import com.vaadin.flow.component.formlayout.FormLayout;
import com.vaadin.flow.component.html.Div;
import com.vaadin.flow.component.html.H1;
import com.vaadin.flow.component.html.Label;
import com.vaadin.flow.component.orderedlayout.HorizontalLayout;
import com.vaadin.flow.component.orderedlayout.VerticalLayout;
import com.vaadin.flow.component.textfield.IntegerField;
import com.vaadin.flow.data.binder.Binder;

```

```

import com.vaadin.flow.data.binder.BinderValidationStatus;
import com.vaadin.flow.data.binder.BindingValidationStatus;
import com.vaadin.flow.data.validator.IntegerRangeValidator;
import com.vaadin.flow.data.value.ValueChangeMode;
import com.vaadin.flow.router.Route;

@SuppressWarnings("serial")
@Route(value = "school-to-intermediate", layout = MainView.class)
public class SchoolToIntermediateView extends Div {
    public SchoolToIntermediateView() {
        add(new H1("School to Intermediate (+2) suggestion"));

        final FormLayout formLayout = new FormLayout();
        Binder<SchoolSubject> binder = new Binder<>();

        SchoolSubject subjectBeingEdited = new SchoolSubject();

        IntegerField maths = new IntegerField();
        maths.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField physics = new IntegerField();
        physics.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField social = new IntegerField();
        social.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField biology = new IntegerField();
        biology.setValueChangeMode(ValueChangeMode.EAGER);

        IntegerField chemistry = new IntegerField();
        chemistry.setValueChangeMode(ValueChangeMode.EAGER);

        Button save = new Button("Suggest");
        Button reset = new Button("Reset");

        formLayout.addFormItem(maths, "Mathamatics");
        formLayout.addFormItem(physics, "Physics");
        formLayout.addFormItem(biology, "Biology");
        formLayout.addFormItem(chemistry, "Chemistry");
        formLayout.addFormItem(social, "Social");

        HorizontalLayout actions = new HorizontalLayout();
        actions.add(save, reset);
        save.getStyle().set("marginRight", "10px");

        binder
            .forField(maths)
            .withValidator(new IntegerRangeValidator("Maths score is not correct", 0, 100))
            .bind(SchoolSubject::getMaths, SchoolSubject::setMaths);
    }
}

```

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binder
.forField(biology)
.withValidator(new IntegerRangeValidator("Biology score is not correct", 0,
100))
.bind(SchoolSubject::getBiology, SchoolSubject::setBiology);

```

```

binder
.forField(chemistry)
.withValidator(new IntegerRangeValidator("Chemistry score is not correct", 0,
100))
.bind(SchoolSubject::getChemistry, SchoolSubject::setChemistry);

```

```

binder
.forField(social)
.withValidator(new IntegerRangeValidator("Social score is not correct", 0, 100))
.bind(SchoolSubject::getSocial, SchoolSubject::setSocial);

```

```

binder
.forField(physics)
.withValidator(new IntegerRangeValidator("", 0, 100))
.bind(SchoolSubject::getPhysics, SchoolSubject::setPhysics);

```

```

Label infoLabel = new Label();
VerticalLayout collegesList = new VerticalLayout();
save.addClickListener(event -> {
if (binder.writeBeanIfValid(subjectBeingEdited)) {

```

```

Integer biologyScore = subjectBeingEdited.getBiology();
Integer mathsScore = subjectBeingEdited.getMaths();
Integer chemistryScore = subjectBeingEdited.getChemistry();
Integer socialScore = subjectBeingEdited.getSocial();
Integer physicsScore = subjectBeingEdited.getPhysics();

```

```

Map<String, Integer> scoreMap = new HashMap<>();
scoreMap.put("biologyScore", biologyScore);
scoreMap.put("mathsScore", mathsScore);
scoreMap.put("chemistryScore", chemistryScore);
scoreMap.put("socialScore", socialScore);
scoreMap.put("physicsScore", physicsScore);

```

```

Map.Entry<String, Integer> maxEntry = null;
for (Map.Entry<String, Integer> entry : scoreMap.entrySet())
{
if (maxEntry == null
|| entry.getValue()
.compareTo(maxEntry.getValue()) > 0)
{
maxEntry = entry;
}
}

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final String preferredSubject = maxEntry.getKey();

if("biologyScore".equals(preferredSubject)) {
    infoLabel.setText("BiPC is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
        ("1. Narayana Junior college"));
    collegesList.add(new Label
        ("2. Sree chaitanya Junior college"));
} else if ("mathsScore".equals(preferredSubject)) {
    infoLabel.setText("MPC is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
        ("1. Sree chaitanya Junior college"));
    collegesList.add(new Label
        ("2. Narayana Junior college"));
} else if ("physicsScore".equals(preferredSubject)) {
    infoLabel.setText("MPC / BiPC is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
        ("1. Sree chaitanya Junior college"));
    collegesList.add(new Label
        ("2. Narayana Junior college"));
} else if ("chemistryScore".equals(preferredSubject)) {
    infoLabel.setText("MPC / BiPC is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
        ("1. Sree chaitanya Junior college"));
    collegesList.add(new Label
        ("2. Narayana Junior college"));
} else if ("socialScore".equals(preferredSubject)) {
    infoLabel.setText("CEC is recommended");
    collegesList.removeAll();
    collegesList.add(new Label("Suggested colleges are"));
    collegesList.add(new Label
        ("1. Roots Junior college"));
    collegesList.add(new Label
        ("2. St.Mary's Junior college"));
}

} else {
    BinderValidationStatus<SchoolSubject> validate = binder.validate();
    String errorText = validate.getFieldValidationStatuses()
        .stream().filter(BindingValidationStatus::isError)
        .map(BindingValidationStatus::getMessage)

```

```

.map(Optional::get).distinct()
.collect(Collectors.joining(", "));
infoLabel.setText("There are errors: " + errorText);
}
});
reset.setOnClickListener(event -> {
// clear fields by setting null
binder.readBean(null);
infoLabel.setText("");
collegesList.removeAll();
});

add(formLayout);
add(actions);
add(infoLabel);
add(collegesList);

}
}

```