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A Machine Learning–Based Sentiment Analysis Framework for Assessing and Predicting Teacher Performance Using QEC Data

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ABSTRACT

Data of any organization or institute is an important source for future planning and decision-making. Using Educational Data Mining we can explore educational data by applying different data mining and techniques of machine learning. It is a well-thought-out research topic that supplied fundamentals for important facts of learning and teaching procedures to improve education. The primary goal of every academic institution is to offer students a high-quality education. As a result, the primary goal of this research is to uncover information that will aid in improving the quality of education for children. High-level quality in education can be achieved by acquiring knowledge, which is obtained by the data related to students, teacher courses, and institutes. Many patterns can be discovered which help to make better decisions in the education sector. The experimental data consists of students' evaluation forms obtained by the QEC and filled by the students of an institute. We used the WEKA and PYTHON data mining tool for the analysis of the dataset. We used J48, Naïve base, RT (Random-Tree), and RF (Random-Forest) algorithms in WAKA for the evaluation of teacher performance and predict how to perform well. Then we used python as a tool and NLTK and Text Blob or Vader sentiment Library for the sentimental analysis of student's opinions. In our experiment, we achieve 95.56% accuracy and acceptable kappa statistics of 0.8038 using random forest. And the

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results showed that reviews have a prime role in the evaluation the educational data. This research provides the best direction for the development of the education field.

Key words: Data Mining, Machine learning, Sentiment Analysis, Data Classification

Introduction

Data has become one of the most valuable assets in modern organizations, playing a critical role in planning, decision-making, and performance evaluation. Every sector—including education, healthcare, business, government, and industry—generates massive amounts of data through digital platforms, information systems, and everyday operations. However, without proper tools and analytical techniques, this data remains unused and cannot contribute to improving institutional outcomes [6]. Educational institutions also generate a significant amount of data through student records, feedback forms, learning management systems (LMS), attendance logs, and academic performance reports. Unfortunately, most of this data remains underutilized due to a lack of technical expertise, analytical tools, and structured methodologies. In higher education, evaluating teaching performance is essential for ensuring instructional quality, enhancing student learning, and strengthening institutional development. Universities and colleges often rely on student evaluation forms collected by Quality Enhancement Cells (QECs) to assess the performance of faculty members. These forms include numerical rating scales as well as open-ended comments, both of which contain valuable information about teaching effectiveness [2]. The challenge lies in analyzing this data effectively. While numerical scores can be processed easily, written comments require advanced techniques such as text mining and sentiment analysis to extract meaningful insights [3]. This research applies data mining, machine learning, and sentiment analysis to evaluate teacher performance using both structured and unstructured feedback data.

Big Data and Data Types

Structured Data

Structured data is organized in rows and columns, typically stored in databases. Examples include student enrollment forms, attendance records, grades, and QEC rating scales. This type of data is easy to store, query, and process.

Semi-Structured Data

This type of data contains tags or metadata but does not follow strict tabular formatting. Examples include XML/JSON files or LMS-generated logs.

Unstructured Data

Unstructured data is the most complex form and includes text comments, emails, social media posts, recorded lectures, and multimedia files. Nearly 80% of educational data is unstructured, making text mining essential for extracting useful insights.

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Data Mining and Its Importance

Data mining (DM) refers to extracting meaningful patterns, associations, and knowledge from large datasets using machine learning, statistical analysis, and computational algorithms. It plays a critical role in domains that rely heavily on data-driven decision-making.

In education, data mining helps:

Predict student performance
Identify at-risk students
Evaluate teacher effectiveness
Improve curriculum design
Enhance quality assurance processes

Educational Data Mining (EDM)

Educational Data Mining (EDM) focuses specifically on analyzing data generated within academic settings. By applying DM techniques to educational datasets, institutions can understand student behavior, teaching practices, organizational performance, and learning outcomes. Applications of EDM include student performance prediction, teacher evaluation, curriculum enhancement, and personalized learning [1][2].

Text Mining and Sentiment Analysis

Text mining is used to analyze unstructured text data and extract meaningful information. In this study, text mining is applied to students' written feedback about instructors [1]. This enables a deeper understanding of teaching quality beyond numerical ratings. Sentiment analysis uses NLP techniques to determine whether a student's written comment is positive, negative, or neutral. Python libraries such as NLTK, Text Blob, and VADER were used to analyze written comments.

Machine Learning Techniques Used

The research uses four classification algorithms to evaluate instructor performance using

QEC feedback:

J48 Decision Tree
Naïve Bayes
Random Tree (RT)
Random Forest (RF)

Random Forest achieved the highest accuracy of 95.56% with strong kappa statistics.

Research Methodology

The methodology includes:

Data collection
Data preprocessing
Feature extraction
Model training
Sentiment analysis
Integration of results

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Un-Supervised Machine Learning (ML)

This is called Un-supervised ML because dissimilar to managed learning above there are no correct answers and there is no educator. Calculations are left to their own devices to discover and illustrate the intriguing structure of data. Further, there is 2 main model of un-supervised machine learning:

Clustering: In this task data automatically divides into groups or of clusters similar items.

Association: This allows you to set associations between data in a larger database. This uncertain technology is about finding interesting relations between variables in a large database. The data source, location, and database affect how information is processed and combined. Various Data Mining methods are characterized by certain properties that can be decisive when choosing a data analysis method. Methods can be compared by comparing the attributes of their properties. Accuracy, scalability, interpretability, testability, labor intensity, adaptability, speed, and popularity are the primary aspects and characteristics of Data Mining methodologies [2]. When computing resources are added to a computing system, scalability is a characteristic that offers a predictable improvement in system attributes such as responsiveness, overall performance, and so on. Data mining isn't only about running complicated queries on the data stored in the database. You must work with the data, format it, or restructure it, whether you are using SQL document-based databases or simply flat files. You'll need to specify the format of the data that will be used in your technique and analysis. After that, you can use several approaches (individually or collectively) to find the information in the correct format, regardless of the underlying data structure.

Machine Learning Algorithms

Algorithms Used in this Work

Algorithm

This is a straightforward C4.5 DT classifier that may be used to tackle a variety of classification problems. A tree is built for the model classification task [3]. During the construction of a tree, the tree is compared to each tuple in the database and resulting in classifications. J48 skips missing values in circumstances when a prediction can be made based upon what is known about those records' attribute values. J48-C4.5 permits classification using DT or rules created from them.

Random Forest (RF)

In the case of high-dimensional data, this algorithm is the best classifier [4]. Each tree in this approach is based on the values of a randomly sampled vector that is distributed equally across all trees. Tree classifiers in random forests rely on the strength of individual trees and the association between them in the forest. To train each tree, a distinct subset of training data is chosen with replacement. The remaining training data are utilized to calculate the importance and error of the variables. The number of votes from all of the trees is used to determine the class assignment, and the average of the results is used to determine the deterioration.

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Random Tree (RT)

[6] An RT is constructed at random from a set of possible trees, with random properties at each node. In this case, (random) indicates that each tree in the group has an equal chance of being sampled. Random trees may be efficiently constructed, and combining large collections of random trees results in accurate models and substantial research in recent years.

Naïve Bayes (NB) Algorithm

The NB algorithm is probability-based. The NB algorithm is a straightforward probabilistic classifier that generates a set of probabilities by counting the frequency and combinations of values in a dataset [7]. Given the value of the class variable, the algorithm applies the Bayes theorem and assumes that all qualities are independent. In various supervised classification situations, the naïve method tends to perform well and learn quickly.

Sentiment Analysis

This type of analysis is also called opinion mining or NLP, and it is used to identify whether the data is neutral, positive, or negative. This examination is carried out on test data to have a better grasp of consumer feedback and its requirements. Clients or customers convey their thoughts, emotions, and feelings through sentiment analysis [5]. This technique is an important tool for monitoring and understanding people's feelings. It automatically analyses customer feedback such as survey responses and opinions etc. Sentiment analysis focuses on polarity, which refers to whether people's responses are ‘positive’, ‘negative’, or ‘neutral’, as well as moods and emotions such as anger, happiness, and sadness. You can define and customize your grouping to match your SA (Sentiment-Analysis) needs. The first type is "Fine-grained analysis"—it uses important polarity precision such as: very positive, positive, neutral, negative, very negative. This is usually referred to as fine-grained analysis [7]. The second type is "Emotion Detection Analysis"—used for emotion detection like Frustration, Sadness, Happiness, Anger, etc. The third type is "Aspect-based Analysis"—analyzing sentiments of texts that include specific features or aspects people mention. The fourth type is "Multilingual Sentiment Analysis"—involves many resources and preprocessing, such as lexicons and sentiment lists.

Significance of the Study

This research provides a data-driven approach to evaluating teacher performance, enhances QEC processes, and improves teaching and learning practices.

Review of Literature

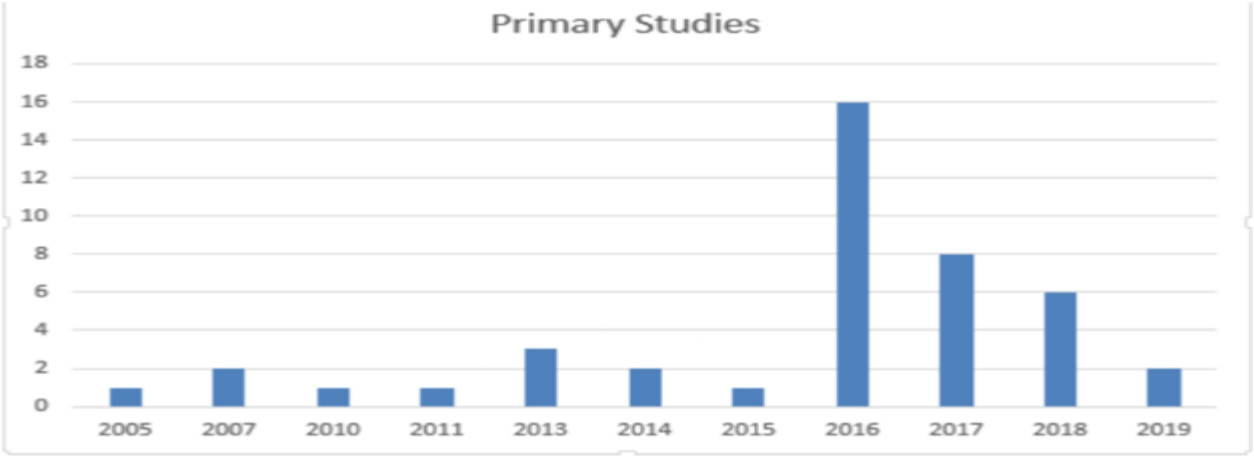
There is a many work in the field of prediction of educational dataset. Predictions and knowledge discovery on educational datasets are also a favorite field of many researchers [8]. There are many literature studies found which work shows that educational datasets can be utilized to make better decisions and for pattern discovery for any institute a large of papers and reports discuss the feature evaluation methods and attributes which can be helpful for any institute make any decisions. With the help of literature, we also check the tools which are helpful to extract and making the

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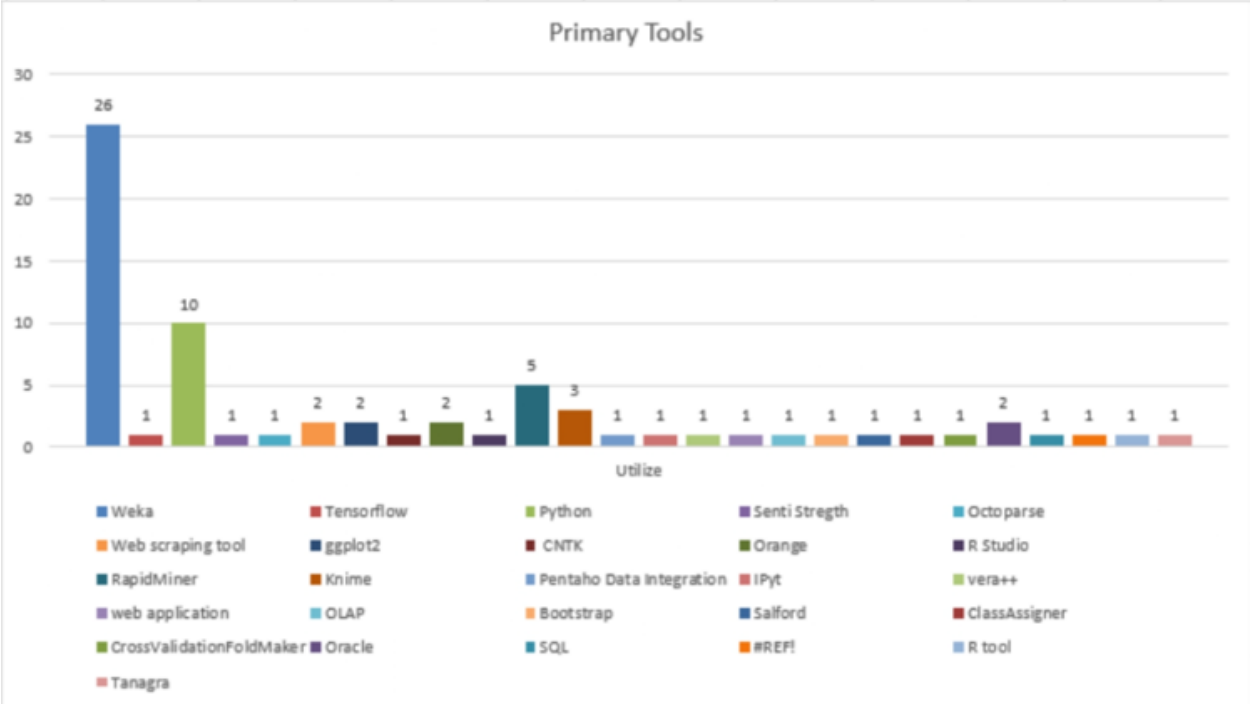
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results in the following section we observe the literature which is according to our research [9]. There are many works in this area on improving student achievement, enhancing the curriculum and how it reflects in the educational process, and improving teacher performance. This section shows how researchers used clustering and classification techniques to analyze educational datasets. To see all related work, see below:



The above graph is showing the included studies and their publications years these all studies between 2005 to 2019. This graph shows that with time the interest of the researcher is increased by time.

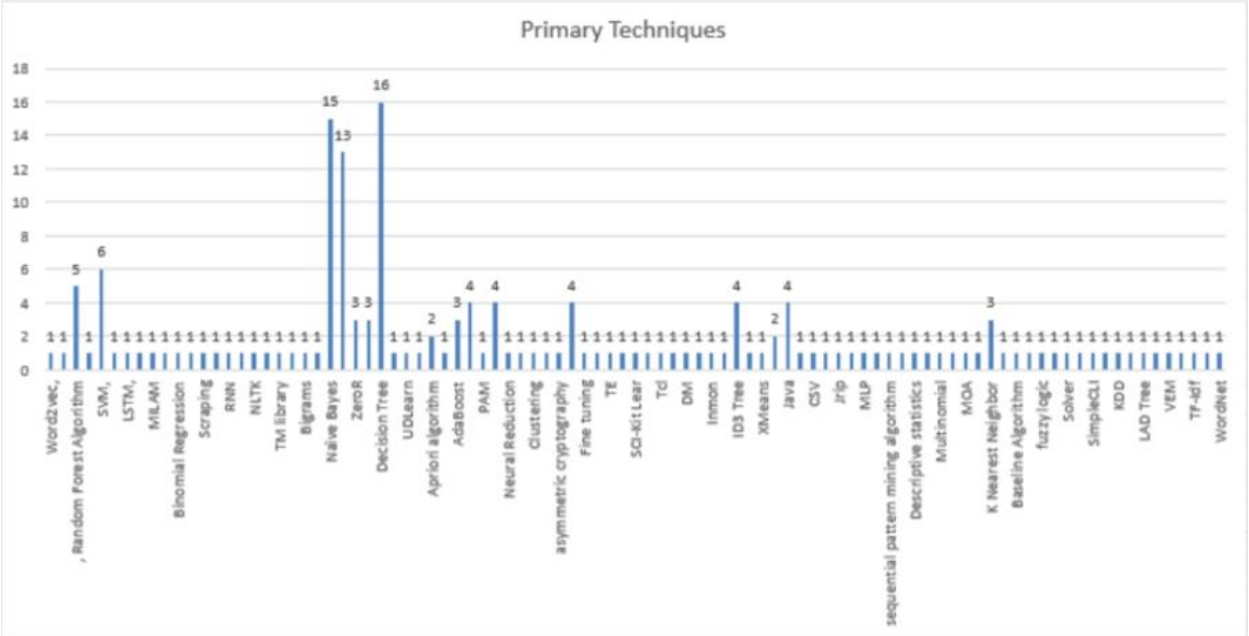


The above graph shows that the tools discussed and adopted. The above graph shows that the most tool was used by the researcher is WEKA, in most studies researchers

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used it for the analysis of data. And the second tool which is also used by many researchers is PYTHON. In the third number, the tool was used in the literature is rapid miner.



The above graph showing the machine learning algorithms which are mostly adopted by the researcher On the top is the Decision Tree and then the Naive Byesis mostly utilized.

Related Work

[10] explained the WEKA pre-processing methods. The Weka workbench is a sorted-out gathering of cutting-edge data pre-processing tools and machine learning algorithms. The simple method of interrelating with these procedures is by conjuring them from the order line. Be that as it may, advantageous intuitive graphical UIs are accommodated information investigation, for setting up huge scale probes disseminated registering stages, and for structuring configurations for gushed information handling. These interfaces comprise a propelled domain for test information mining. The framework is written in Java and appropriated under the terms of the GNU.

[11] used the j48 method to classify and predict the post-graduate options of their students (M-Phil or Ph.D.), using a decision tree. Because directed learning implies the ability to produce possible yields, DT classifiers are commonly used in information mining to consider the information and generate the tree and it determines that will be used to define prediction [12]. One of the significant difficulties for information revelation and information mining frameworks remains in building up their information examination capacity to find strange models in information. The magnificence of a college is indicated among different worries by its adjusting ability to the consistent changing needs of the financial foundation, the nature of the

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administrative framework dependent on an abnormal state of polished methodology, and on applying the most recent advancements. This article speaks to an execution of a J48 calculation investigation apparatus on information gathered from studies on various specialization understudies of my workforce, to separate and foreseeing their decision in proceeding with their instruction with post-college thinks about (ace degree, Ph.D. thinks about) through choice trees.

[13] presented how the DM techniques and machine learning can be used in the education field and to improve the quality of this field. In recent time, a lot of data and it contains huge usable information which not yet discovered. DM and ML techniques are used to analyze the hidden data which is beneficial to the field's forecast and decision-making. Through these procedures, different algorithms and techniques such as association rules classification rules, and many more uncover the knowledge which is hidden in the data sets. At some time, data mining use in the marketing field is uncommon in Machine learning. The main goal of this article is to how we can use the different algorithms of data mining and machine learning in the academic field and improve the educational field's quality[14]. Quality education is a major need of each instructive.

are probably aware, a large amount of information is saved in an instructive database; to get the required information and to discover the hidden relationship. There are numerous well-known information mining tasks within instructive information mining, such as grouping, bunching, anomaly location, affiliation rule, expectation, and so on. It is explained how each of the information mining tasks can be linked to the training framework.

[15] Consolidated the information mining with regular language handling to separate the chunks of learning from the monstrous volume of understudy criticism dataset on personnel execution. The fundamental goal is to think about two famous affiliation rule mining and consecutive example mining calculations to be specific Apriori and Generalized Sequential Pattern (GSP) mining with regards to extricating regular highlights and feeling words. Understudy input information is slithered, pre-process, and labeled; at that point convert into tri-model information documents. The two calculations are connected to arranged information through WEKA 3.7.10 (an AI device) to separate the principles [16]. Mined principles are connected on testing documents to extricate visit highlights and conclusion words. Assessed Results demonstrate that GSP is progressively noteworthy to use for printed information mining than Apriori. A summed-up strategy is proposed to extricate referenced measurements [22]. The proposed technique executes the total cycle of information mining and applies two Sequential example calculations Generalized consecutive example mining and Apriori on arranged information to locate the most critical calculation to extricate things and descriptive words. Trial results demonstrate that GSP is 6% increasingly effective for continuous highlights and 2.03% for feeling words when contrasted with Apriori. So GSP is more compelling to use than Apriori on literary information to mine the required learning.

[15] analyzed the teacher evaluation based on the last result of the semester of teacher by using the WEKA tool. DM the extraction of hidden predictive data from massive databases is a fantastic innovation with huge promise in a variety of corporate applications, including retail sales, web-based business, remote detecting,

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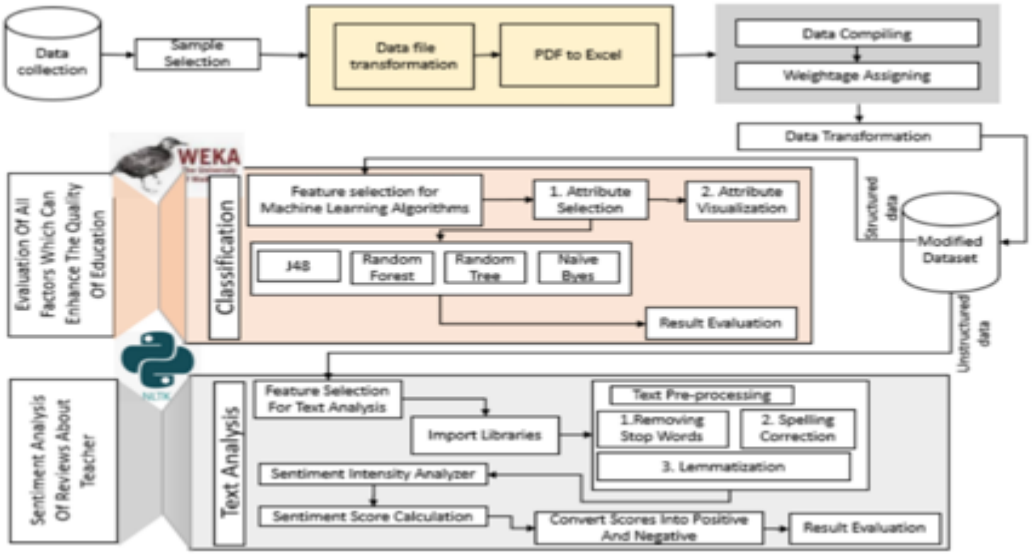
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bioinformatics, and so on. Instruction is a basic component for the advancement of a nation. Mining in instructive conditions is called EDM. The growth of new approaches to finding knowledge from an instructive database is an issue for instructional information mining [17]. This study examines the use of information mining in the Teacher Evaluation framework and presents outcome analysis using the WEKA tool to break down understudies' feelings about their instructors in the Teacher Evaluation framework. A large amount of data is stored in an academic database, and various information mining algorithms are developed and used to extract required data and uncover hidden relationships. [19]

MATERIALS AND METHODS

In this segment, the Materials and Methods of this research are discussed. The following diagram shows all steps which are necessary for the analysis of our dataset which shows the process of data collection, data transformation, data compiling, features selection, algorithm implementation of machine learning, attributes selection, attribute visualization, text preprocessing, Sentiment intensity analyzer, sentiment score calculation and data classification all the steps are elaborated one by one.

Figure: Methodology



Data Collection

The first source of getting data is the faculty of Government College Women University Faisalabad. This faculty offers more than 20 major subjects and it has a lot of Ph.D. instructors and thousands of students. Every year thousands of students passed out as a graduate in this faculty. We get data from different departments of the faculty of GCWUF. We use student data which is ranks the teachers according to QEC questioners. The questioner has more than fourteen questions that are based on the teacher's features. Every student fills out the questioners according to their own choice and rates the teachers.

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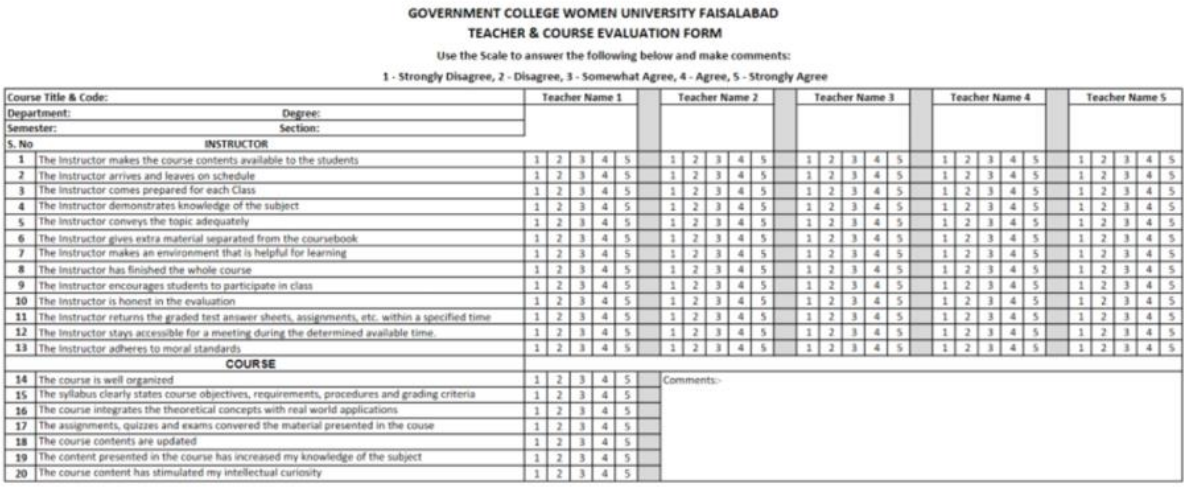
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Features of Questioner

The criteria for measuring students' academic behavior used in this study include all these attributes of the questioner.

The Instructor makes the course contents available to the students
The Instructor arrives and leaves on schedule
The Instructor comes prepared for each Class
The Instructor demonstrates knowledge of the subject
The Instructor conveys the topic adequately
The Instructor gives extra material separated from the course book
The Instructor makes an environment that is helpful for learning
The Instructor has finished the whole course
The Instructor encourages students to participate in class
The Instructor is honest in the evaluation
The Instructor returns the graded test answer sheets, assignments, etc. within a specified time.
The Instructor stays accessible for a meeting during the determined available time.
The Instructor adheres to moral standards.

Figure 3.2: Teacher and Course Evaluation Form



GOVERNMENT COLLEGE WOMEN UNIVERSITY FAISALABAD
TEACHER & COURSE EVALUATION FORM
Use the Scale to answer the following below and make comments:
1 - Strongly Disagree, 2 - Disagree, 3 - Somewhat Agree, 4 - Agree, 5 - Strongly Agree

Course Title & Code:		Teacher Name 1	Teacher Name 2	Teacher Name 3	Teacher Name 4	Teacher Name 5
Department: Degree:						
Semester: Section:						
S. No	INSTRUCTOR					
1	The Instructor makes the course contents available to the students	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2	The Instructor arrives and leaves on schedule	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3	The Instructor comes prepared for each Class	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4	The Instructor demonstrates knowledge of the subject	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5	The Instructor conveys the topic adequately	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6	The Instructor gives extra material separated from the coursebook	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7	The Instructor makes an environment that is helpful for learning	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8	The Instructor has finished the whole course	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9	The Instructor encourages students to participate in class	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10	The Instructor is honest in the evaluation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11	The Instructor returns the graded test answer sheets, assignments, etc. within a specified time	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12	The Instructor stays accessible for a meeting during the determined available time.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13	The Instructor adheres to moral standards	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	COURSE					
14	The course is well organized	1 2 3 4 5	Comments:-			
15	The syllabus clearly states course objectives, requirements, procedures and grading criteria	1 2 3 4 5				
16	The course integrates the theoretical concepts with real world applications	1 2 3 4 5				
17	The assignments, quizzes and exams convered the material presented in the couse	1 2 3 4 5				
18	The course contents are updated	1 2 3 4 5				
19	The content presented in the course has increased my knowledge of the subject	1 2 3 4 5				
20	The course content has stimulated my intellectual curiosity	1 2 3 4 5				

Figure: Questioner Filled

Q.No	Narration	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
1	The Instructor Provides Lesson Plan in the First Lecture	1	1	7	17	59
2	The Instructor arrives and leaves on time	2	1	5	27	50
3	The Instructor comes	0	3	5	17	60

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Q.No	Narration	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
	prepared for each lecture/practical					
4	The Instructor demonstrates knowledge of the subject	1	3	1	25	55
5	The Instructor communicates the subject matter effectively	1	3	2	23	56
6	The Instructor provides additional material apart from the text book	2	2	3	27	51
7	The Instructor creates an environment that is conducive for learning	1	1	3	28	52
8	The Instructor has completed the entire course	1	2	2	29	51
9	The Instructor encourages students participation in class activity	1	2	5	27	50
10	The Instructor is fair in evaluation	0	1	4	27	53
11	The Instructor returns the graded assignments, quizzes answer sheets etc, within specified time period	1	2	4	29	49
12	The Instructor remains available for consultation during specified office hours	0	2	5	27	51
13	The Instructor follows moral and ethical norms	2	1	4	28	50
14	**Comments**					Instructor not completed the entire course

Summary of Current Course (91.01%)
Total Marks: **25**
Obtained: **21.86**

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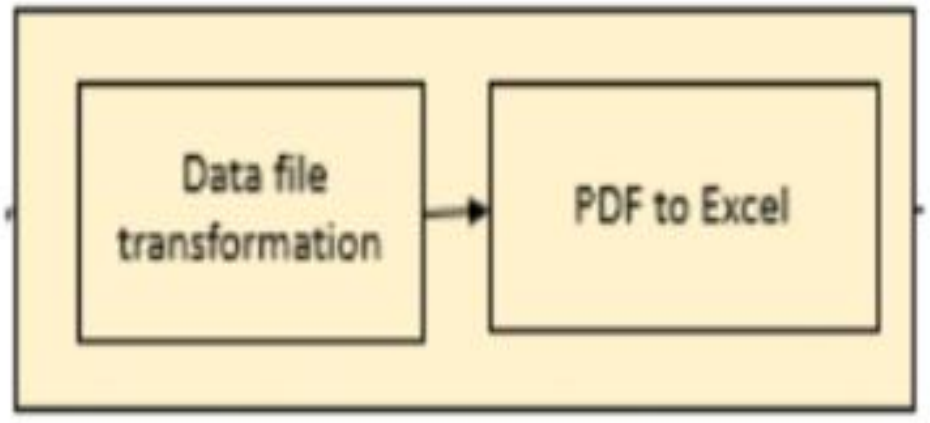
Category	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
Average % Agree Marks	1.00	1.85	3.85	25.46	52.85
Average	1.18	2.17	4.52	29.35	62.17
Marks	0.29	0.54	1.13	7.49	15.54

Data Preprocessing

Preprocessing of the data is a method which is help to convert unstructured data into an understandable data. Raw data often contains numerous Errors (missing attribute values or specific attributes or only containing aggregate data) and lacking consistency (containing inconsistencies in the code) and completeness Failure This is where data preprocessing comes into the picture and provides a proven way to resolve such issues.

Dataset was got in different files, these files had PDF format.

Figure: File Transformation



(Data file transformation → PDF to Excel)

In this stage, the dataset files are converted to CSV files for this transformation the tabula-py library is utilized. The tabula-py library installed following figure showing the installation processing.

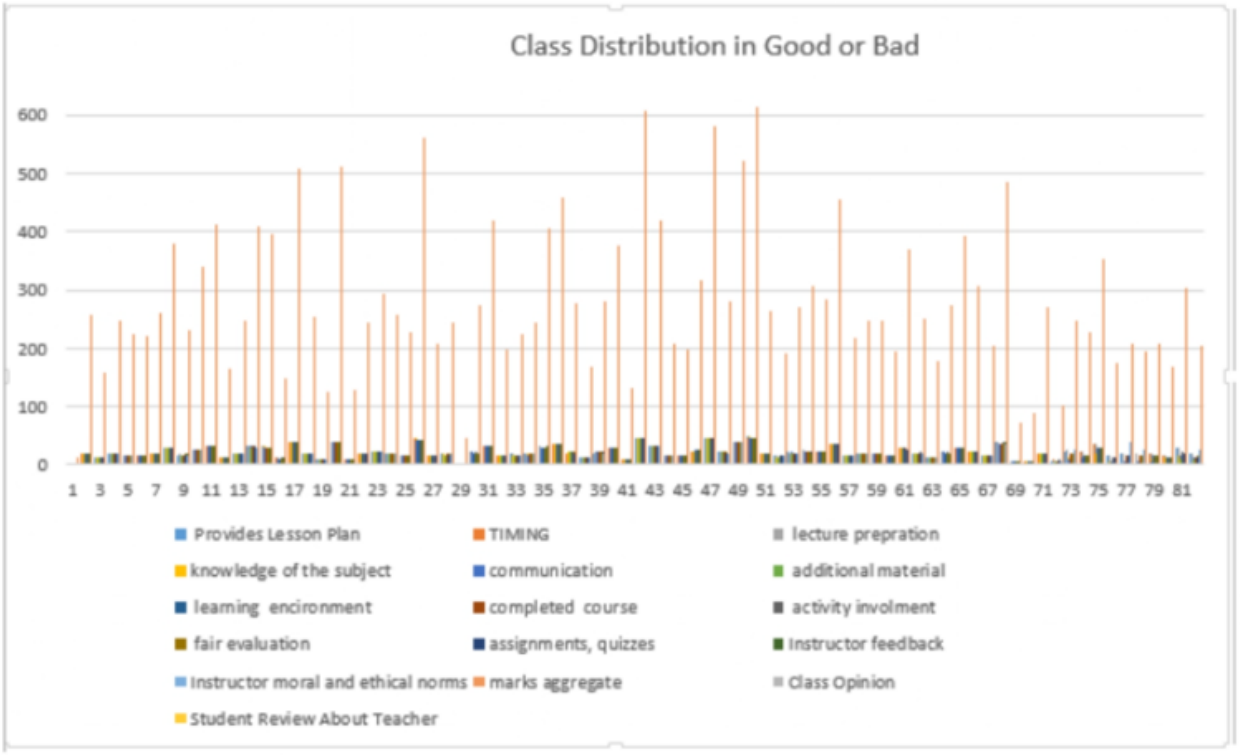
Class Distribution in Good or Bad

Graph 3.1 shows our dataset. The axis bottom line of the graph showing the teacher ID and average marks is calculated showing horizontally the y-axis value showing the minimum and maximum values. According to this, we set our threshold Value which is equal to 250. If a teacher calculated value increase from 250 then he falls in a good class otherwise his evaluation fall in a bad class this is a mechanism that we utilize to classify our dataset. which will help us to analyze the result of sentiment analysis. In the end, we will compare this class and the sentimental analysis class.

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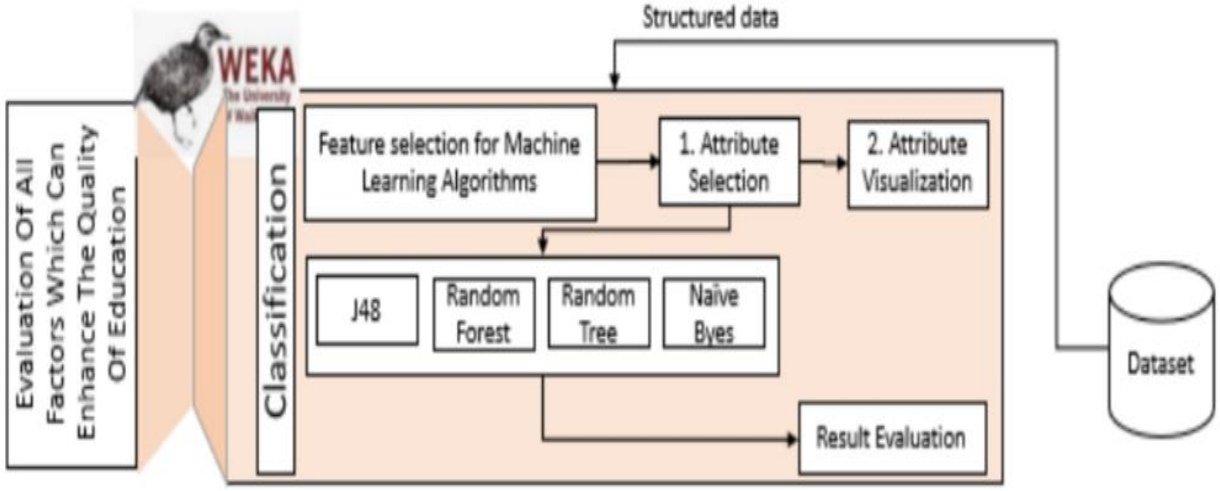
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Evaluation Factors Which Can Enhance the Quality of Education

This stage, which is shown in the following figure is followed for the classification of the structured data set. The purpose of performing these steps is to find the factors which are important for quality education from the questioner data, from this analysis factors are divided which are neglected and need to improve these factors.



Tool for Implementation

WEKA tool is used for the analysis of this structured dataset.

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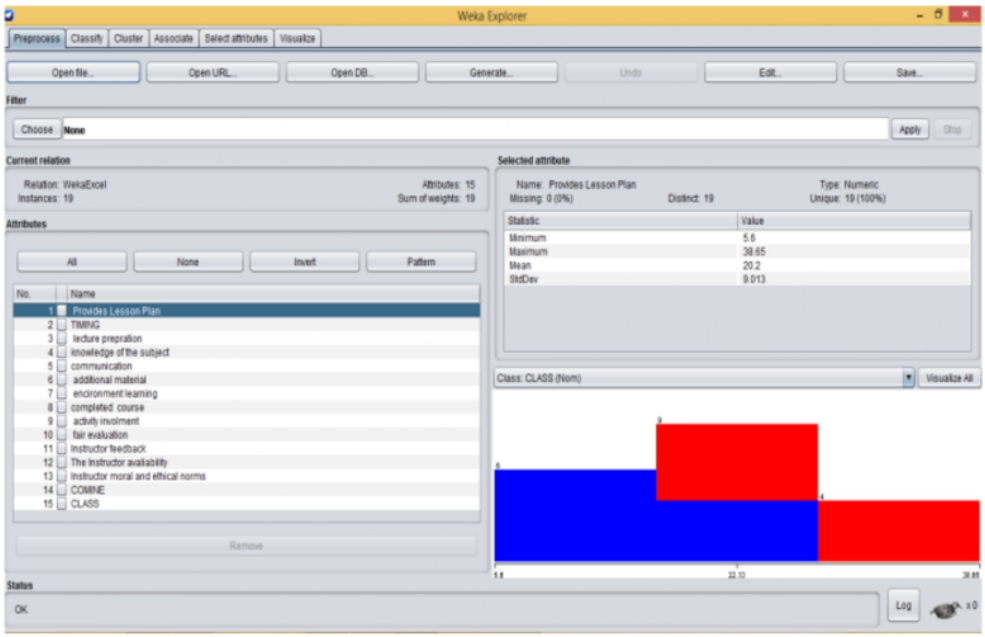
Figure 3.13: WEKA Tool for Structured Data Analysis



WEKA is a collection of many DM and ML algorithm's.
Preprocessing of data
Data classification rules
Data clustering mechanism
Data association rules

Feature Selection for Machine Learning Algorithms (MLA)
We select the 15 attributes from the dataset is selected for MLA.

Figure 3.14: Attribute Selection for MLA



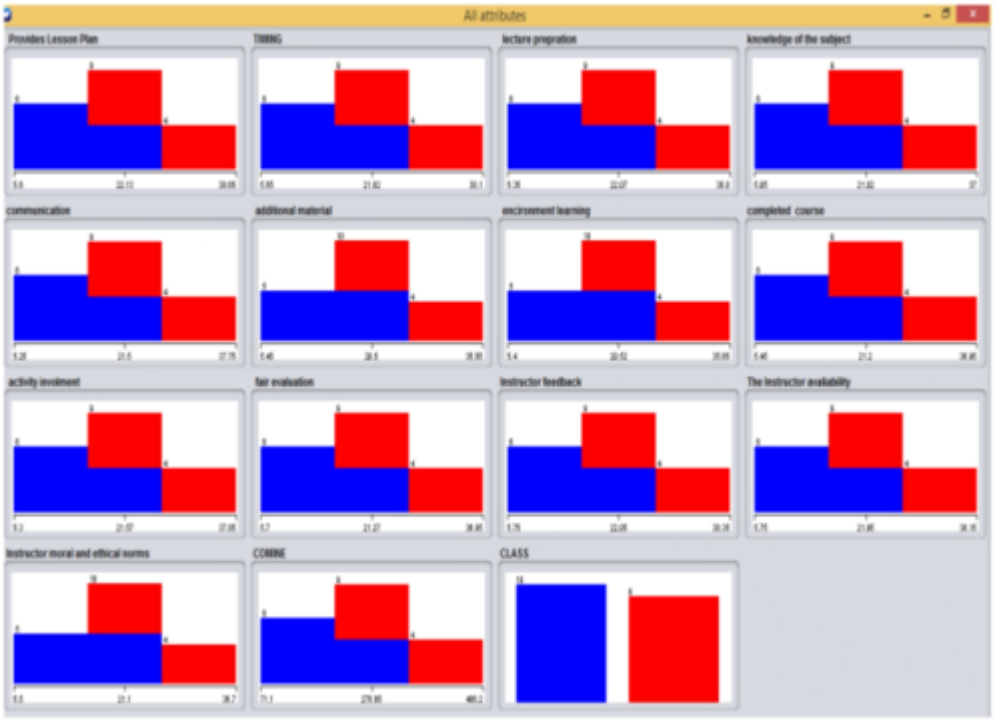
Attribute Visualization
The following figure showed the visualization of the selected attributes.

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Figure: Attributes Visualization



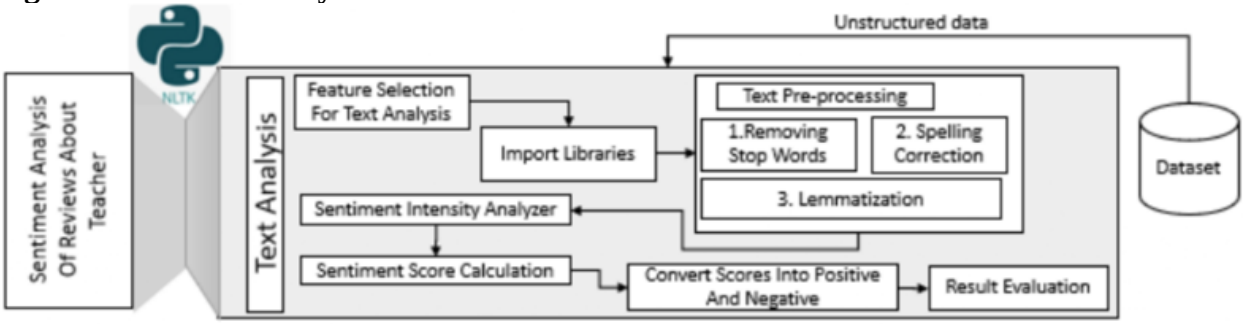
Implementation of MLA

After the selection of attributes, the MLA (J48, Random Forest, Random Tree, Naive Bayes) apply to this educational data.

Sentiment Analysis of Reviews about Teacher

This stage, which is shown in the following figure is followed for the sentiment analysis of reviews about the teacher on the unstructured data set. The purpose of performing these steps is to find the sentiments of the students about the teacher. This sentiments analysis can also be an important factor in the evaluation of teacher performance.

Figure: Sentiment Analysis of Reviews about Teacher



A thresh-hold value is set for the classification of positive or negative classification so 0 is a value that is less than zero then the sentiment is in negative class or if the

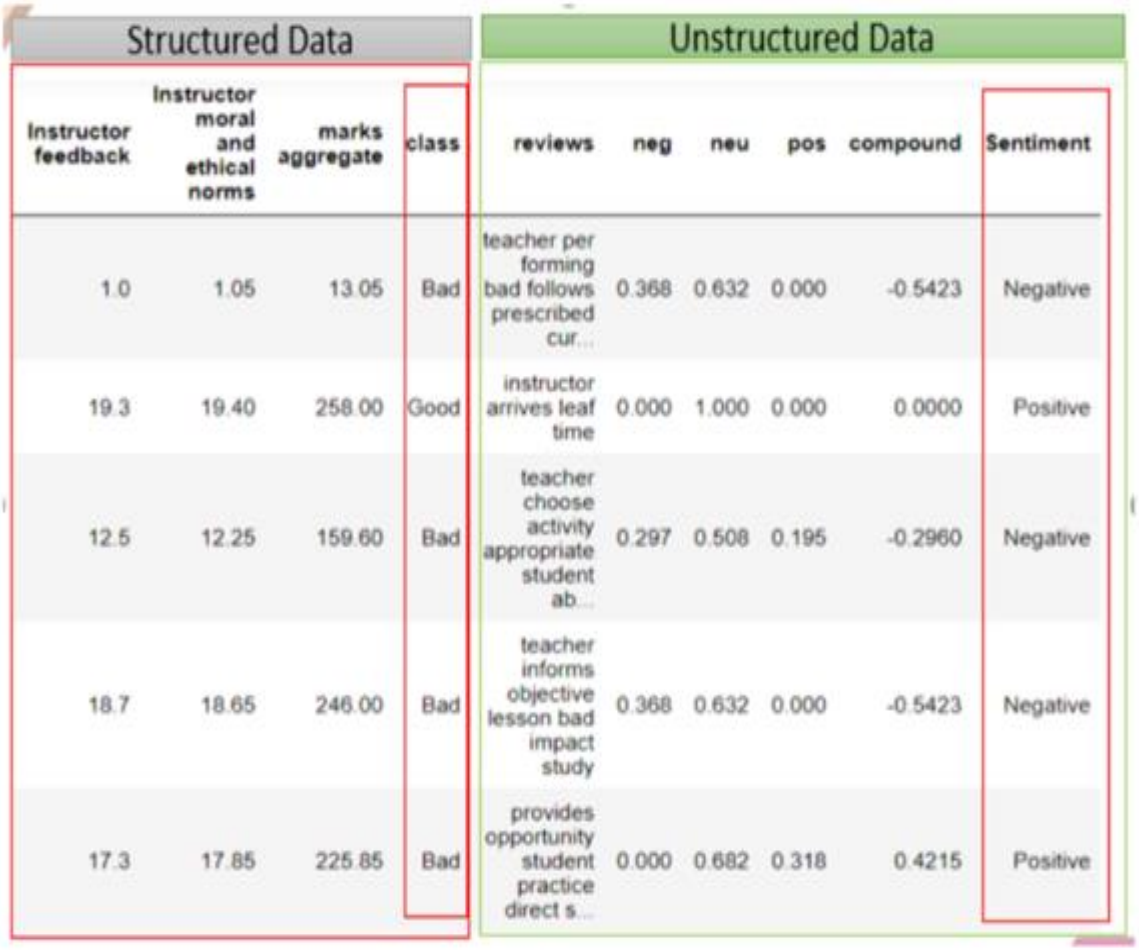
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sentiment score value is above then zero then it falls in the positive class

Figure: Sentiment in a Negative or Positive



Structured Data

Instructor feedback	Instructor moral and ethical norms	marks aggregate	class
1.0	1.05	13.05	Bad
19.3	19.40	258.00	Good
12.5	12.25	159.60	Bad
18.7	18.65	246.00	Bad
17.3	17.85	225.85	Bad

Unstructured Data

reviews	neg	neu	pos	compound	Sentiment
teacher per forming bad follows prescribed cur...	0.368	0.632	0.000	-0.5423	Negative
instructor arrives leaf time	0.000	1.000	0.000	0.0000	Positive
teacher choose activity appropriate student ab...	0.297	0.508	0.195	-0.2960	Negative
teacher informs objective lesson bad impact study	0.368	0.632	0.000	-0.5423	Negative
provides opportunity student practice direct s...	0.000	0.682	0.318	0.4215	Positive

RESULTS AND DISCUSSION

To access the results of the research study, data was gathered from two faculties in Government College Women University Faisalabad's. The first faculty is GCWUF and the faculty of Sciences and Technology. The questioner survey techniques were used by the quality enhancement cell department (QEC). In our results, we find that between the 13 features assignments and quizzes have a more important role in the education sector and students want that a teacher to focus on these factors the results showed in Figure 4.15. The data set predicts the teacher's performance and also compares them with the sentiments of a student. In many instances, the QEC form was filled by students and a review written by the students has different directions of opinions. Data results showed some students filled the form without any attention but when they write the review in a QEC form, they take more attention. So, the filled data analysis about a teacher or review sentiment analysis results can differ.

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Figure 4.1: Weka Tool Main Menu

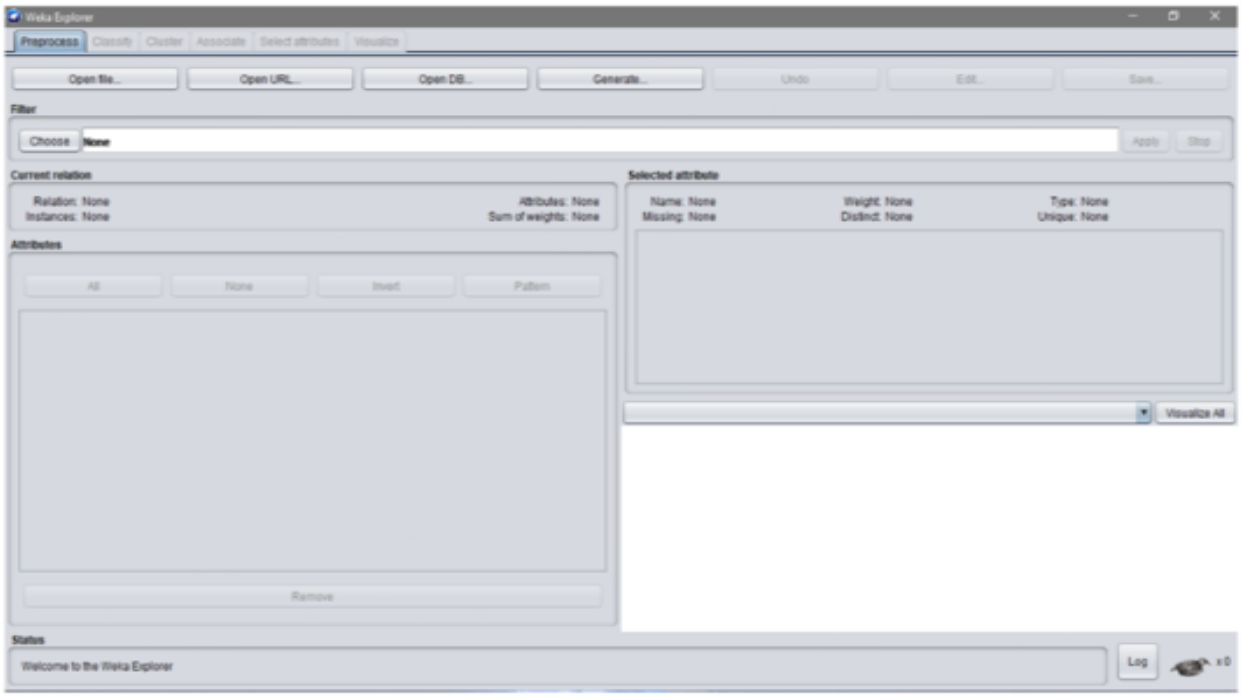
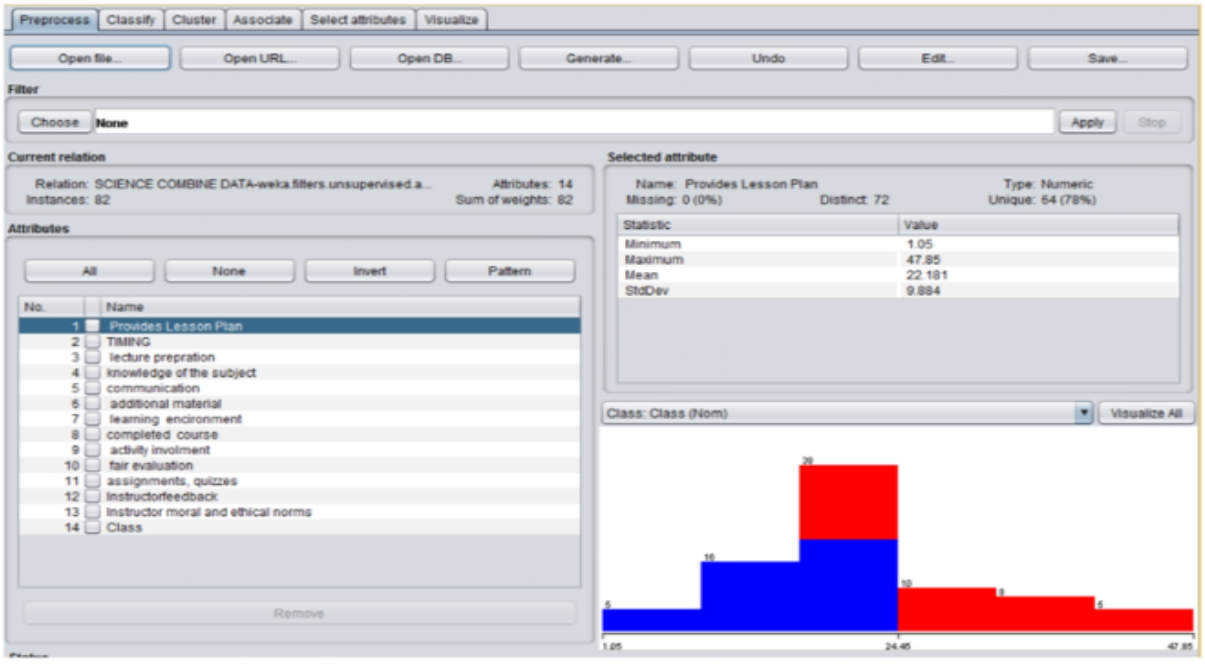


Figure 4.2: Weka Preprocessor



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Figure 4.3: Attribute in Weka

No.	Name
1	Provides Lesson Plan
2	TIMING
3	lecture prepration
4	knowledge of the subject
5	communication
6	additional material
7	learning encironment
8	completed course
9	activity involment
10	fair evaluation
11	assignments, quizzes
12	Instructorfeedback
13	Instructor moral and ethical norms
14	Class

J48-C

The use of the decision tree method was well defined and broadly utilization in data mining for organization and prediction purposes. The J48 classifiers are improved and well defined of the C4.5 decision tree for collection and prediction. The declaration tree practice makes a binary tree that is most precious in grouping problem data. In this study, a tree was built to display the categorization approach. When the tree was created it was used as a new data set.

J48-C4.5 Result

=== Run information ===

Scheme: weka.classifiers.trees.J48 -C 0.25 -M 2
Relation: SCIENCE COMBINE DATA-weka.filters.unsupervised.attribute.Remove-R14
Instances: 82
Attributes: 14
Provides Lesson Plan
TIMING
Lecture preparation
Knowledge of the subject
Communication
Additional material
Learning environment
Completed course
Activity involment
Fair evaluation
Assignments, quizzes
Instructorfeedback
Instructor moral and ethical norms

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Class
Test mode: 10-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree
---

assignments, quizzes <= 19.1: Bad (41.0)
assignments, quizzes > 19.1: Good (41.0/1.0)

Number of Leaves : 2
Size of the tree : 3

J48-C Detailed Accuracy Result
Time taken to build model: 0.02 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances	79	96.3415 %
Incorrectly Classified Instances	3	3.6585 %
Kappa statistic	0.9267	
Mean absolute error	0.0468	
Root mean squared error	0.1904	
Relative absolute error	9.3535 %	
Root relative squared error	38.0799 %	
Total Number of Instances	82	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.976	0.050	0.953	0.976	0.965	0.927	0.965	0.961	Bad
0.950	0.024	0.974	0.950	0.962	0.927	0.965	0.944	Good
Weighted Avg.	0.963	0.037	0.964	0.963	0.963	0.927	0.965	0.952

=== Confusion Matrix ===

a	b	<-- classified as
41	1	a = Bad
2	38	b = Good

shown that the J48 algorithm was providing us 96% accuracy. Out of 82 instances, it correctly identifies 79 instances and incorrectly identifies only 3 instances. There were 42 teachers, but we nominated 31 teachers who were good out of these 42 teachers only 41 were correctly identified as good and 1 teacher were incorrectly identified as good. As well as 40 teachers were bad but out of these 40 teachers only

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38 were correctly identified as bad and 2 teachers were incorrectly identified as good.

J48-C Tree



Table: Comparisons of Algorithm

Classification Model	Correctly Instances	Incorrectly Instances	Percentage of Accuracy	Test Data Instances
J48	79	3	96.34%	82
Random Forest	80	2	97.56%	82
Random Tree	78	4	95.12%	82
Naïve Bayes	74	8	90.24%	82

Sentiment Score Calculation

The following figure is showing the sentimental score of a review. Then these scores converted into positive and negative sentiments using some threshold which we set >=0 then positive other than negative sentiment.

Figure : Sentiment Score

```
# Creating new dataframe with sentiments
df_sentiments=pd.DataFrame(emptyline)
df_sentiments.head(5)
```

	neg	neu	pos	compound
0	0.368	0.632	0.000	-0.5423
1	0.000	1.000	0.000	0.0000
2	0.297	0.508	0.195	-0.2960
3	0.368	0.632	0.000	-0.5423
4	0.000	0.682	0.318	0.4215

Comparisons of Structured and Unstructured Data Results

In the following figure, the structured and unstructured data analysis is present which

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shows that the QEC utilize the structured data for the teacher evaluation but it did not consider the reviews of students so when the sentimental analysis was performed the result shows that some time structured data results and unstructured data analysis results vary. And these results show that for better teacher evaluation the sentiment analysis also has an excellent role.

Figure: Sentiment Analysis Evaluation

Instructor Feedback	Moral & Ethical Norms	Marks Aggregate	Structured Class	Review Summary	Compound Score	Sentiment
1.0	1.05	13.05	Bad	Teacher performing bad, follows prescribed curriculum	-0.5423	Negative
19.3	19.40	258.00	Good	Instructor arrives on time	0.0000	Positive
12.5	12.25	159.60	Bad	Teacher chooses inappropriate activity for students	-0.2960	Negative
18.7	18.65	246.00	Bad	Teacher informs objectives poorly, bad impact on study	-0.5423	Negative
17.3	17.85	225.85	Bad	Provides opportunity for student practice	0.4215	Positive

CONCLUSION

This thesis is based on Evaluating the teacher performance using QEC data and the methodology is used in this thesis is following algorithms (Naive Bayes, Random forest, Random tree, and j48) which are based on supervised machine learning (SML) and used for sentiment analysis which helps to provide the accurate results of our prediction, Weka tool is used for execution and simulation of algorithms. Through this method we predict the schedule and schema for a teacher which helps for taking the better decision of which course teacher should give priority, this method also helps the teacher to make the best interaction with students and the teacher know the

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student reviews that what student wants from the teacher. The proposed method's outcomes are also compared to those of other algorithms for choosing the best accurate results or method. According to the results, the Random Forest (RF) algorithm performed best and accurately than all other algorithms. Sentimental analysis results showed some students filled the form without any attention. But when they write the review in a QEC form, they take more attention. So, the filled data analysis about a teacher or review sentiment analysis results can differ. QEC generates the teacher rank scores from the student's filled form data it must include the student's reviews to evaluate the teacher performance.

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