Welcome to:

Machines Learning in Education

Unit objectives

After completing this unit, you should be able to:

- Learn about application of machine learning in educational technology
- Understand the advantages of machine learning in education
- Gain knowledge on the role of machine learning in learning analytics
- Understand the use of machine learning algorithms for personalized adoptive learning
- Learn how machine can help in assessment
- Understand the sentimental analysis for student’s feedback using machine learning approach
- Gain knowledge on suitable algorithms for recommendation system in education
- Understand the application of machine learning in predicting student's performance

Machine learning in education

- Advantages of machine learning in education.
  - Customized and customized learning.
  - Analytics of content.
  - Grading.
  - Simplification of tedious tasks.
  - Students' progress.

Advantages of machine learning in education

- Customized learning:
  - Machine learning is sufficiently versatile to accommodate all learners irrespective of educational level.
  - Machine learning helps the beginner to step on only after they have really understood the preceding material by using algorithms to learn how information is being interpreted by the individual.
- Analytics of content:
  - The computers are used to evaluate the data used by teachers to teach and to evaluate whether the material value satisfies the criteria necessary.
- Grading:
  - Computer technology models were utilized to shorten individual grading period.
- Simplification of tedious jobs:
  - ML techniques can minimize the time of teacher's time in routine and tedious tasks such as attending classes and gathering homework assignments in the traditional method of training.
- Shorten progress:
  - Educators can supervise each learner on a private stage by utilizing computers and independently assess their development in learning.
  - In addition, computers can supply learners with different teaching patterns to assist educators identify the finest methods to teach learners.

Learning analytics

- Learning analytics is about developing methods to assist the teaching method by utilizing academic information sets.

- Learning Analytics (LA) is a multidisciplinary area that includes:
  - Machine training.
  - Technology.
  - Data collection.
  - Analysis.
  - Simulation.

- Learning Analytics (LA) is defined as measuring, gathering, evaluating and reporting learner information and their contexts to understand and enhance teaching and the atmosphere in which it exists.

- Teaching effort describes LA as using information and designs to anticipate student's advancement and success and capacity to intervene on that knowledge (as stated in siemens, 2010).

Academic analytics

- Goldstein and Katz (2005) coined the word Academic Analytics (AA).

- Since the late 1990s, early AA services have introduced analytical approaches to satisfy the requirements of academic organization.

Action research

- Action research is a technique that has grown extremely famous and excellently-developed in teaching.
- This makes educators assess and analyse their jobs themselves.
- The aim of studies on academic intervention is to improve instructional practice and performance assurance.
- Students and teachers periodically discuss research questions that arise on the basis of a particular teaching situation, while intervention and reflection correlate.

Educational data mining

- In recent times, Educational Data Mining (EDM) has appeared as a separate research area.
- Educational Data Mining (EDM) describes a research field concerned with the application of data mining, machine learning and statistics to information generated from educational settings.
- At a high level, the field seeks to develop and improve methods for exploring this data, which often has multiple levels of meaningful hierarchy, in order to discover new insights about how people learn in the context of such settings.
- In doing so, EDM has contributed to theories of learning investigated by researchers in educational psychology and the learning sciences.
- The field is closely tied to that of learning analytics, and the two have been compared and contrasted.

Recommender system

- Recommender systems generally collect information on the actions or interests of the consumer in order to draw conclusions on the selection of products that may most likely be of interest to them.

- Technically, recommendation methods are categorized into the following forms on the basis of how they are recommended:
  - Content based recommendation.
  - Collaborative filtering.
  - Hybrid approaches.

Personalized adoptive learning

- Personalized Adaptive Learning (PAL):
  - It is a data driven assessment and remediation platform transforming learning outcomes through deep machine learning.
  - It empowers teachers with actionable intelligence.
  - It helps teachers stop guessing and make data driven decisions.
  - PAL helps in removing trending misconceptions and gaps.

Learning analytics process

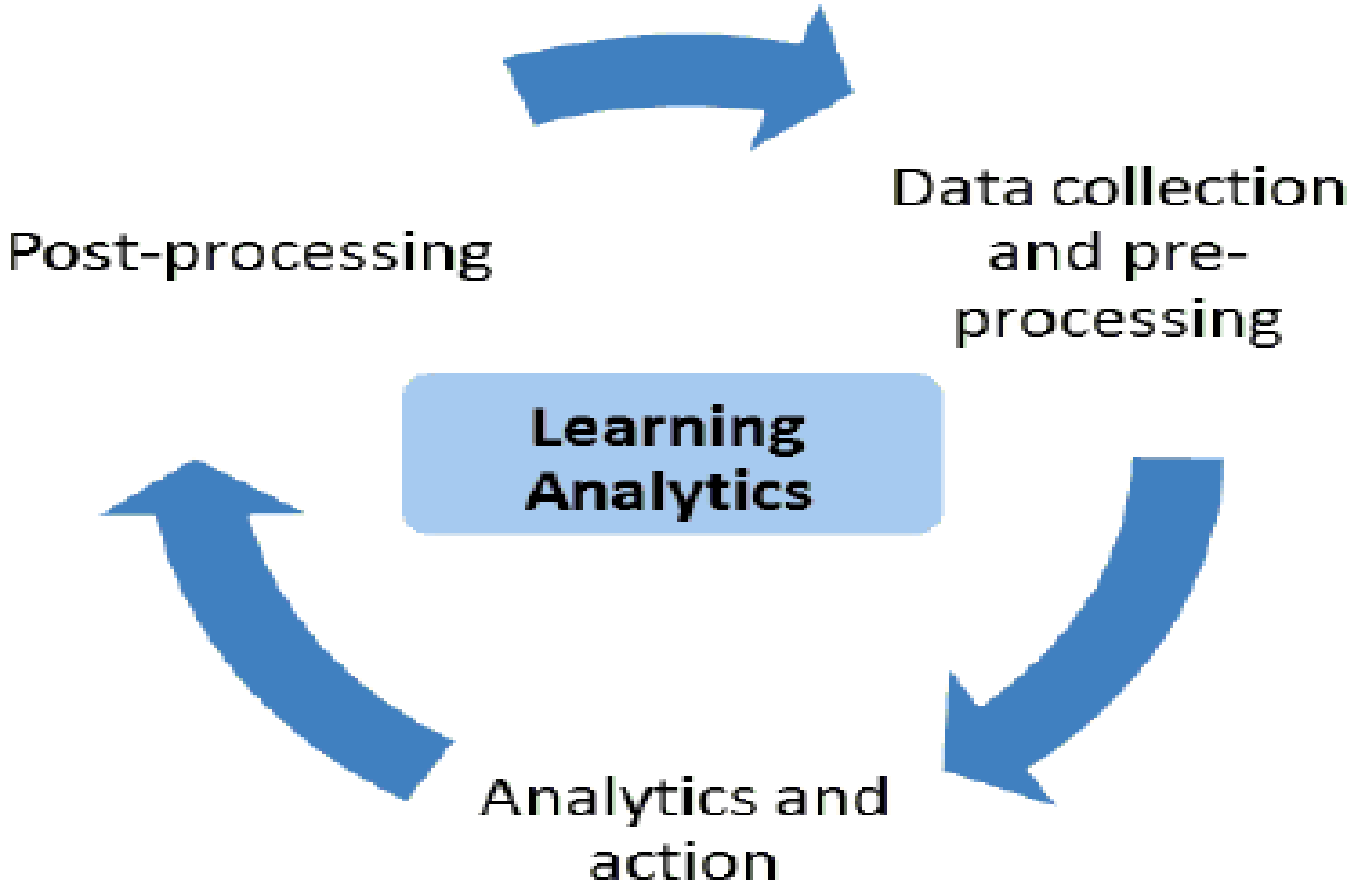

Figure: Learning analytics process

Source: case study:https://www.academia.edu/39641945/IRJET-_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Reference model for learning analytics

- **The four dimensions of the proposed LA reference model:**
  - What? What type of data is the process gathering, storing and using for analysis?
  - Who? Who is the focus of the analysis?
  - How? How does the collected data interpret the system?
  - Why? Why is the system analysing the information gathered?

Data environment: What?

- LA methods use diverse academic data sources.
- LA is a data-driven approach.
- User-generated content, facilitated by ubiquitous technologies of production and cheap tools of creativity, has led to a vast amount of data produced by learners across several learning environments and systems.

Stakeholders: Who?

- LA may be applied to various participants like:
  - Learners.
  - Educators.
  - (Smart) lecturers/advisors.
  - Academic institutions (administrators and faculty decision makers).
  - Academics.
  - Program developers with specific la exercise context.
  - Goals and expectations.

- Students may be involved in how technology can enhance their skills and enable them develop their ideal educational experiences.

Methods: How?

- To find fascinating trends found in educational data sets, LA uses various strategies like:
  - Statistics.
  - Information visualization.
  - Data mining.
  - Social Network Analysis (SNA).

Case study: Sentimental analysis for student's feedback using ML (1 of 3)

- This study focuses primarily on symbolic analysis for online reviews from participants.
- Here we identify the feeling present in text documents based on polarity–positive, negative and neutral using the approach of machine learning and lexicon.
- We used the random forest classifiers and also obtained the highest accuracy of 90 percent for performance assessment and accuracy.

Case study: Sentimental analysis for student's feedback using ML (2 of 3)

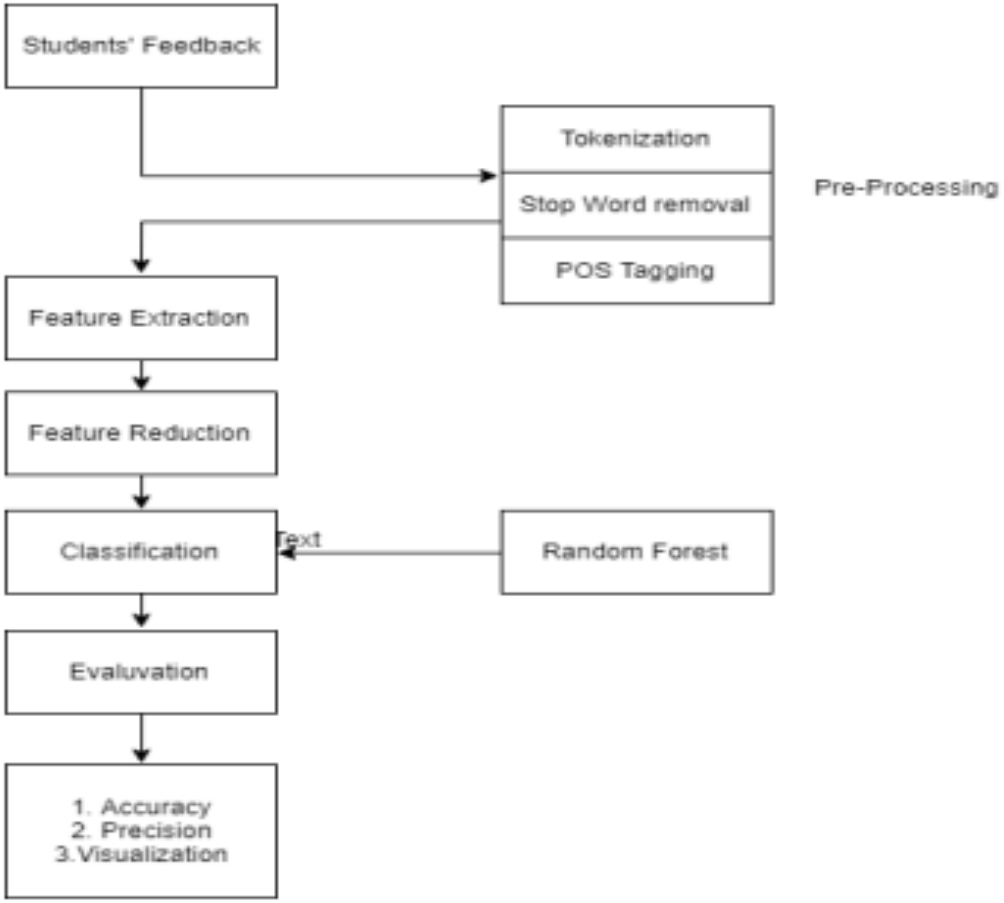

Figure: Workflow diagram

Source: case study:https://www.academia.edu/39641945/IRJET-_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Case study: Sentimental analysis for student's feedback using ML (3 of 3)

- Results

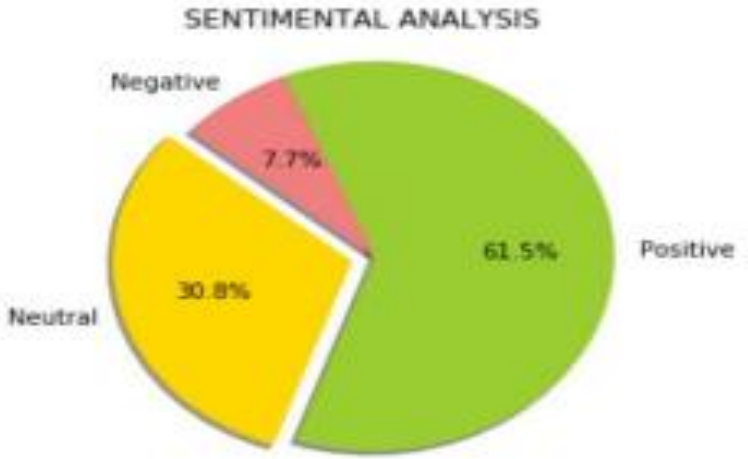

Figure: Overall results

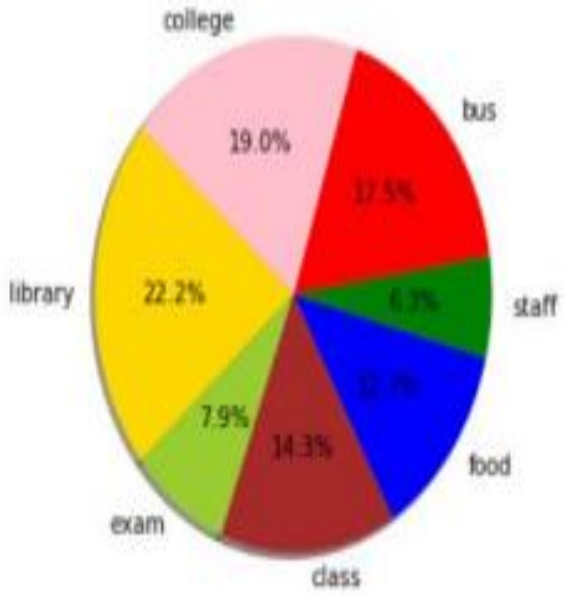

Figure: Negative feedback results

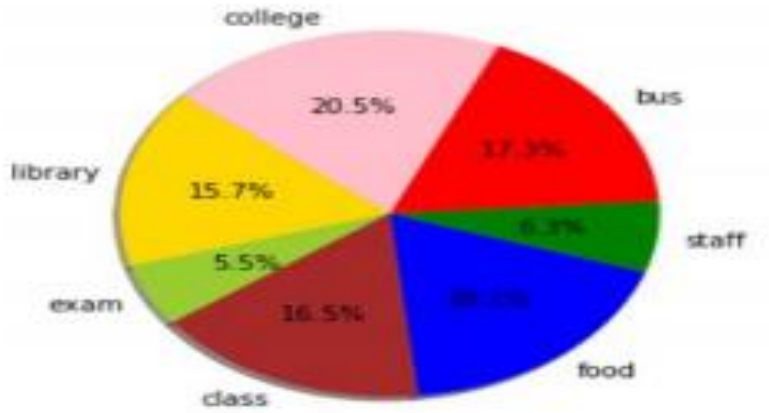

Figure: Positive feedback result

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Recommender systems in education

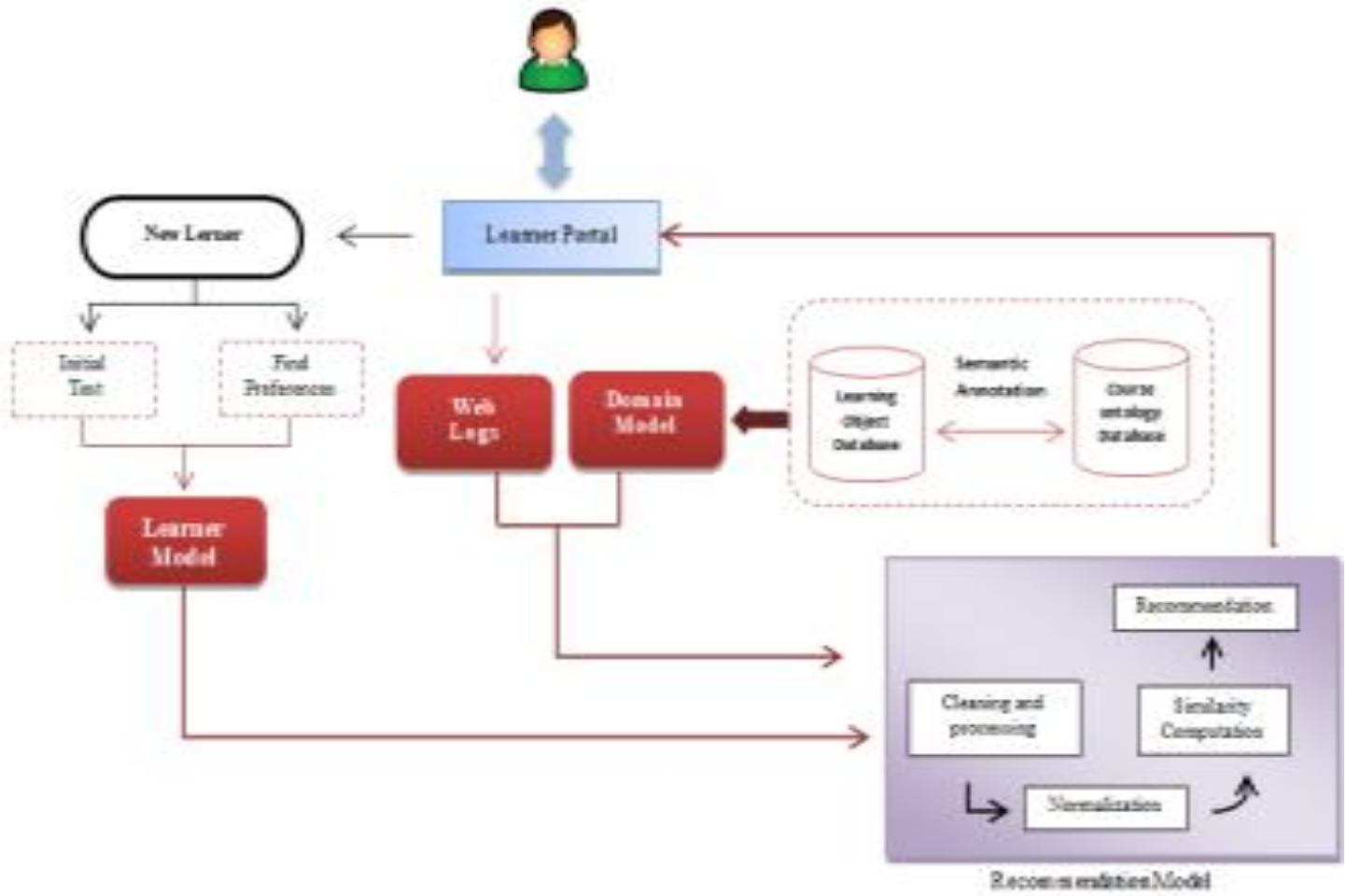

Figure: Functional models for proposed systems

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Domain model (1 of 2)

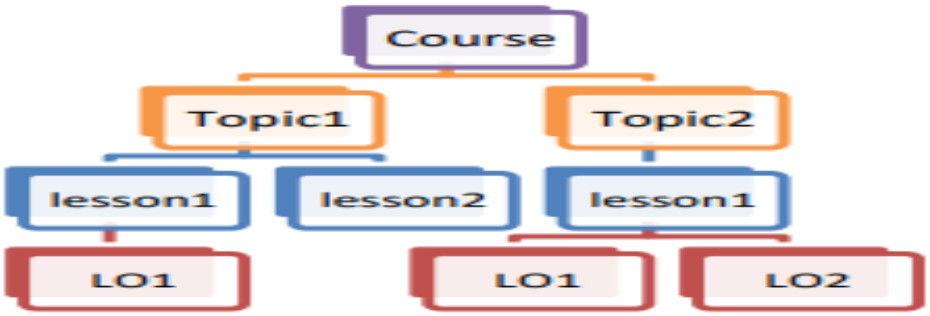

Figure: Course Organization

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

- Table: Metadata for course components.

Component	Metadata
Course	name, author, version, grading policy, prerequisites, attainment goal
Concept	name, attainment goal, attainment level, prerequisite
Topic	name, attainment goal, attainment level, prerequisite
Learning Object (LO)	name, author, creation date, version, last modified, attainment level, keyword, prerequisite, level of interactivity, instruction method, difficulty level

Domain model (2 of 2)

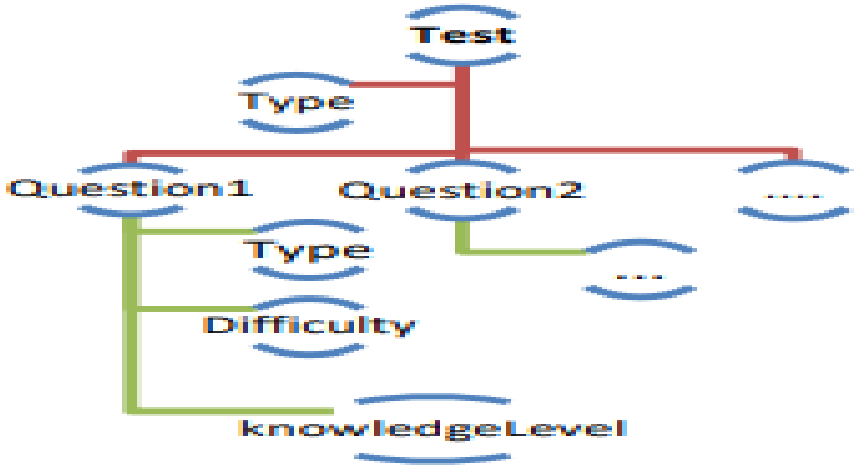

Figure: Test model

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Questions	Type	Difficulty	Knowledge Level
Q1	True/False	Easy	Basic
Q2	MultipleChoice	Medium	Basic
Q3	check boxes	Hard	Basic
Q4	One answer	Easy	Advanced
Q5	True/False	Medium	Advanced
Q6	check boxes	Hard	Advanced

Figure: Description of object X learning test (LOX)

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Learner model

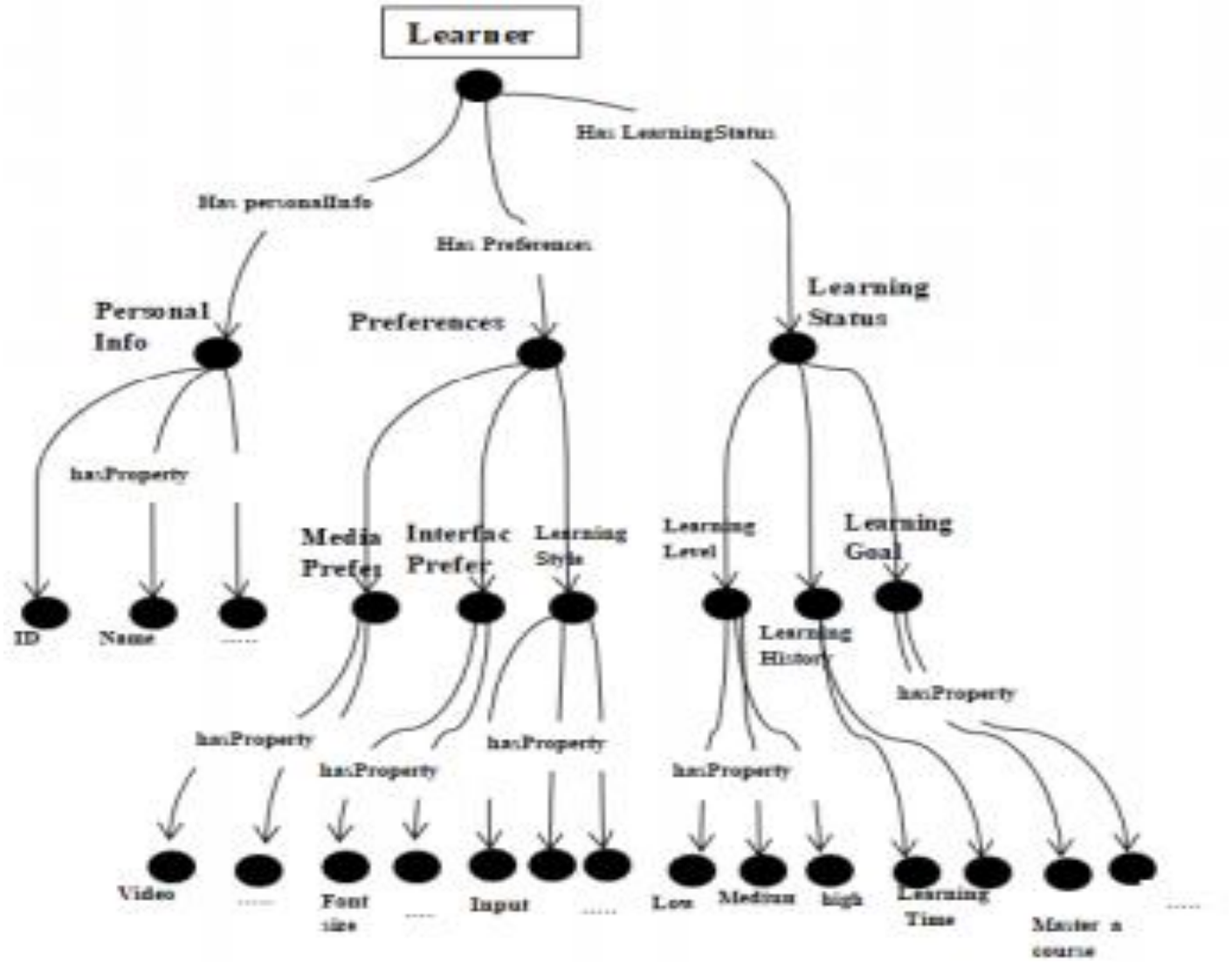

Figure: Learning ontology mode

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Students classification algorithm

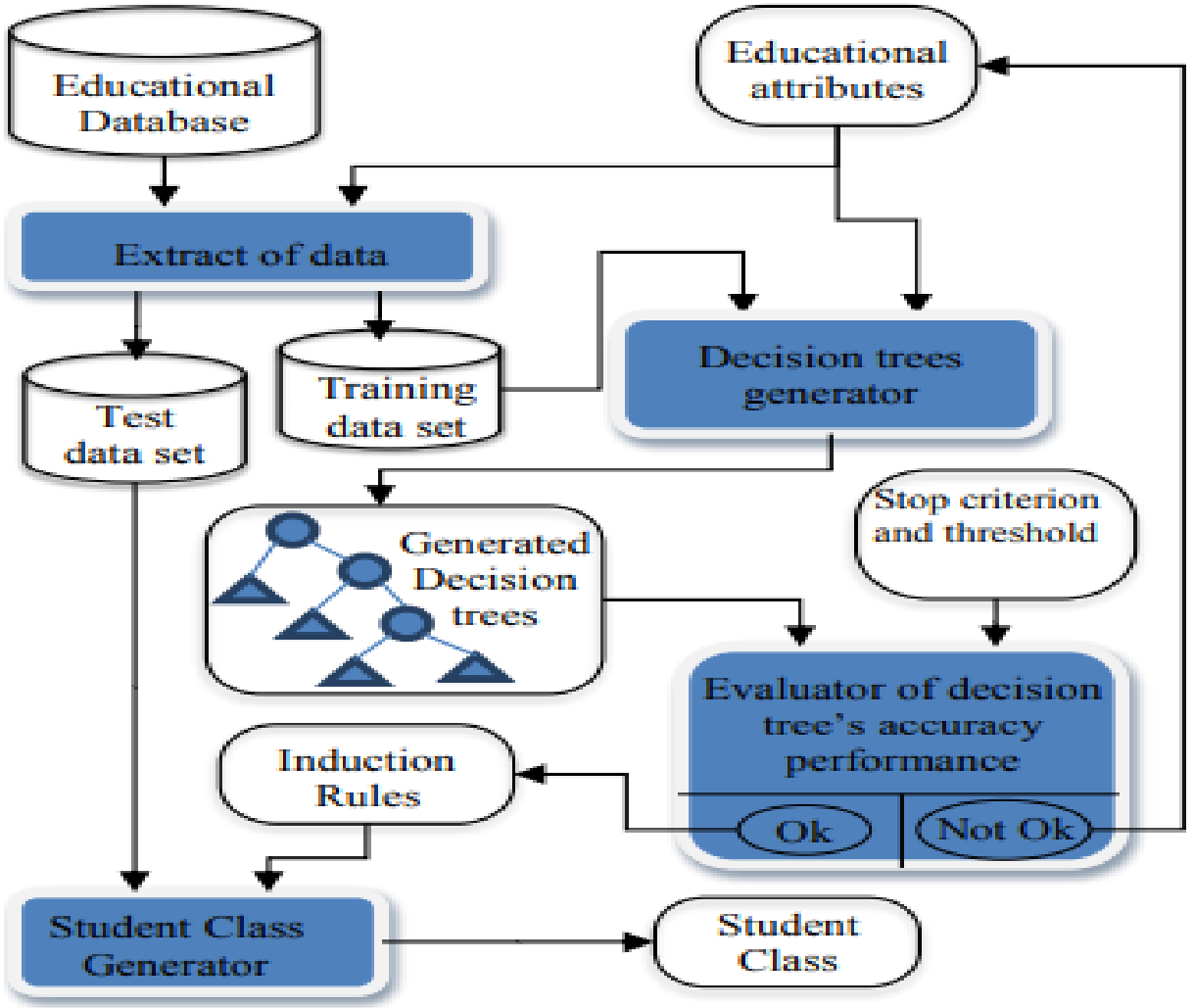

Figure: Schematic algorithm for student classification based on decision trees

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Recommendation model

- Equation 1: $RatingLO = \sum(L) + \sum(O)$
- Equation 2: $$w(x,y) : \frac{\sum_j^m R_{x,j} \times R_{y,j}}{\sqrt{\sum_j^m R_{x,j}{}^2}\sqrt{\sum_j^m R_{y,j}{}^2}}$$
- Equation 3: $$P_{x,j} = \bar{R}_x + \frac{\sum_{y=1}^{n} w(x,y)(R_{y,j} - \bar{R}_y)}{\sum_{y=1}^{n} |w(x,y)|}$$

Case study: Application of ML in predicting students performance

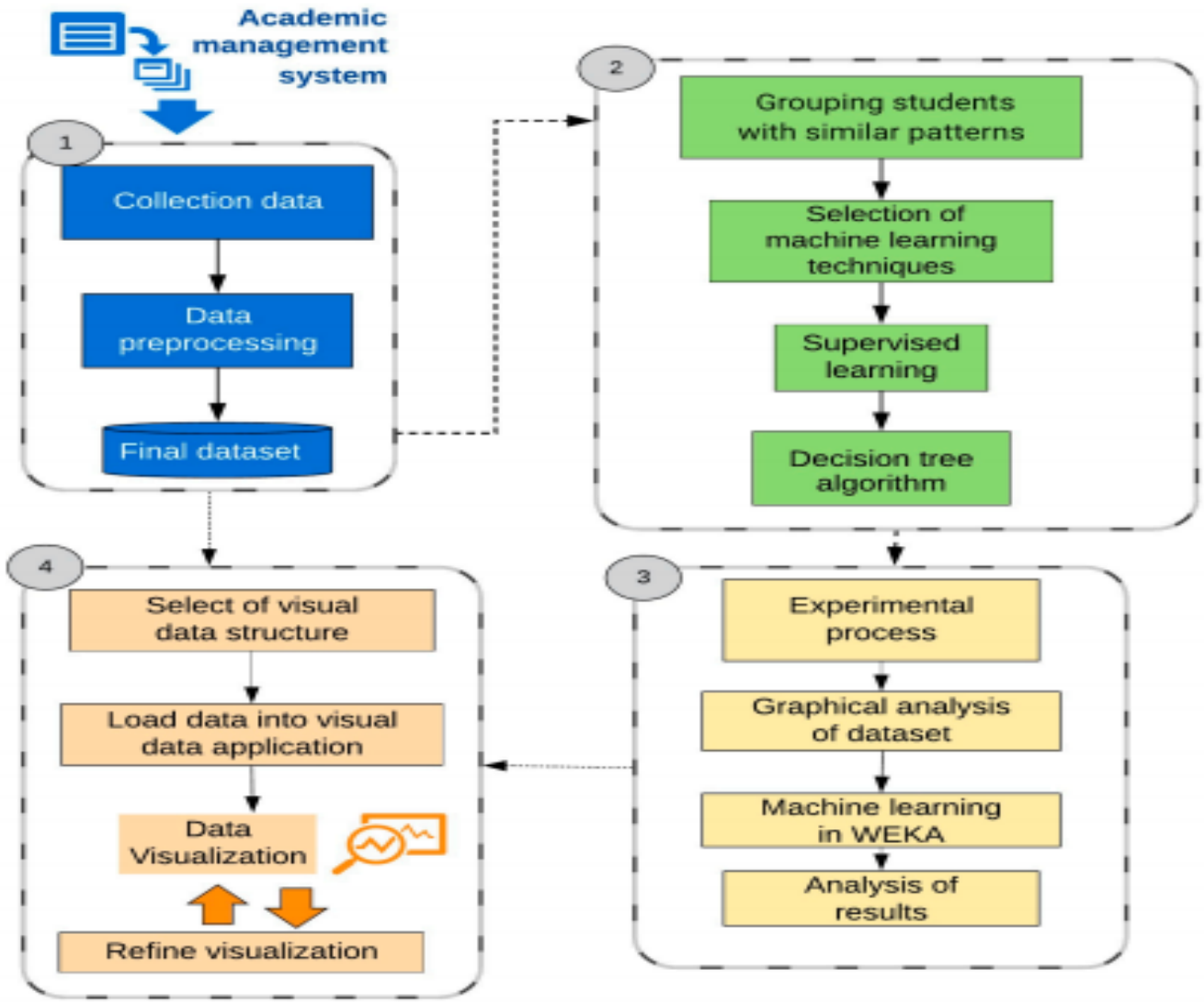

Figure: Methodology proposed

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Proposed methodology

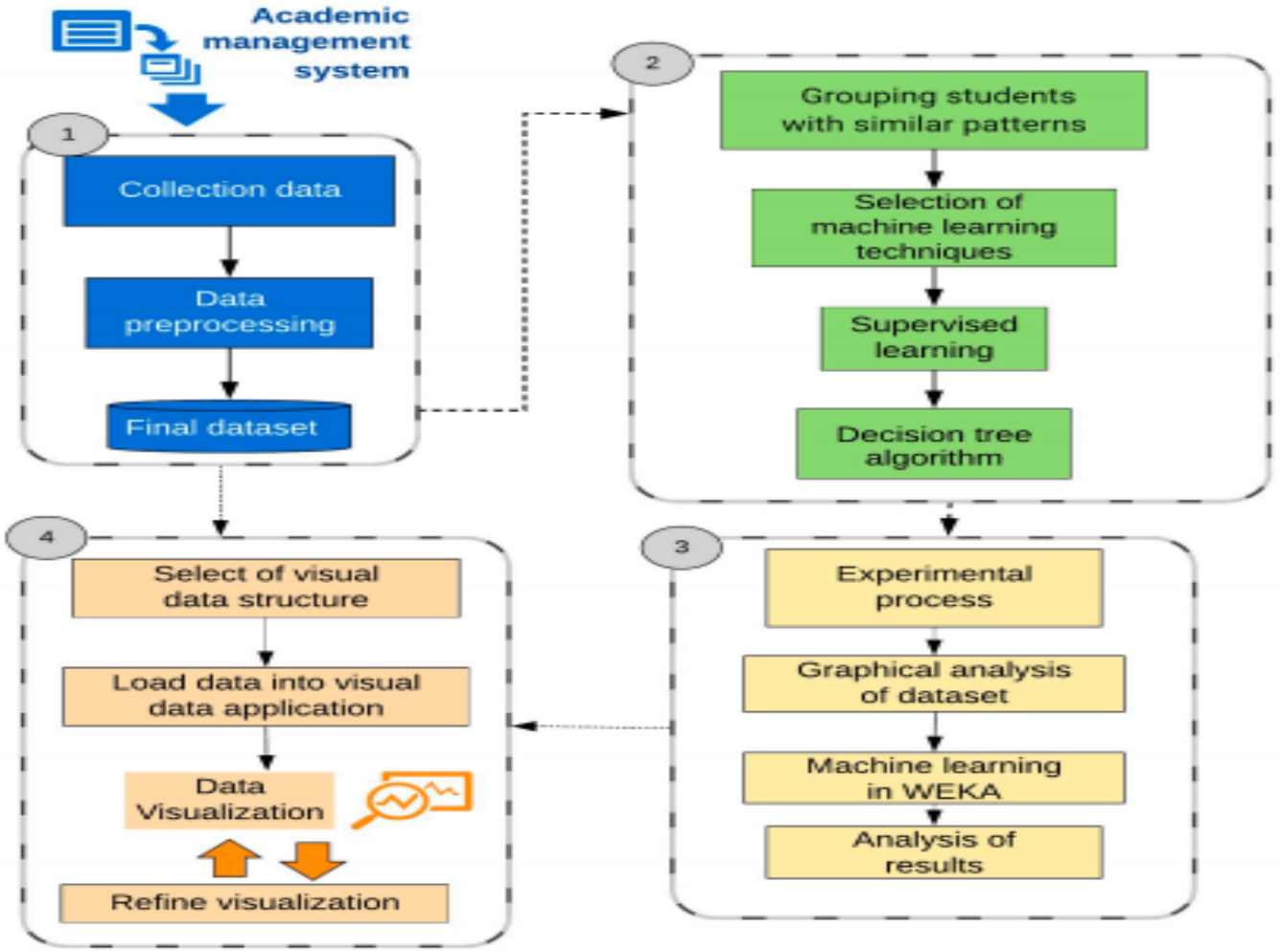

Figure: Methodology proposed

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Data description

- The data source used for this study consists of 335 student's educational documents.

- The overall quantity of cumulative documents of the grade of pupils was 6358, which applies to all the topics taken by this class of pupils.

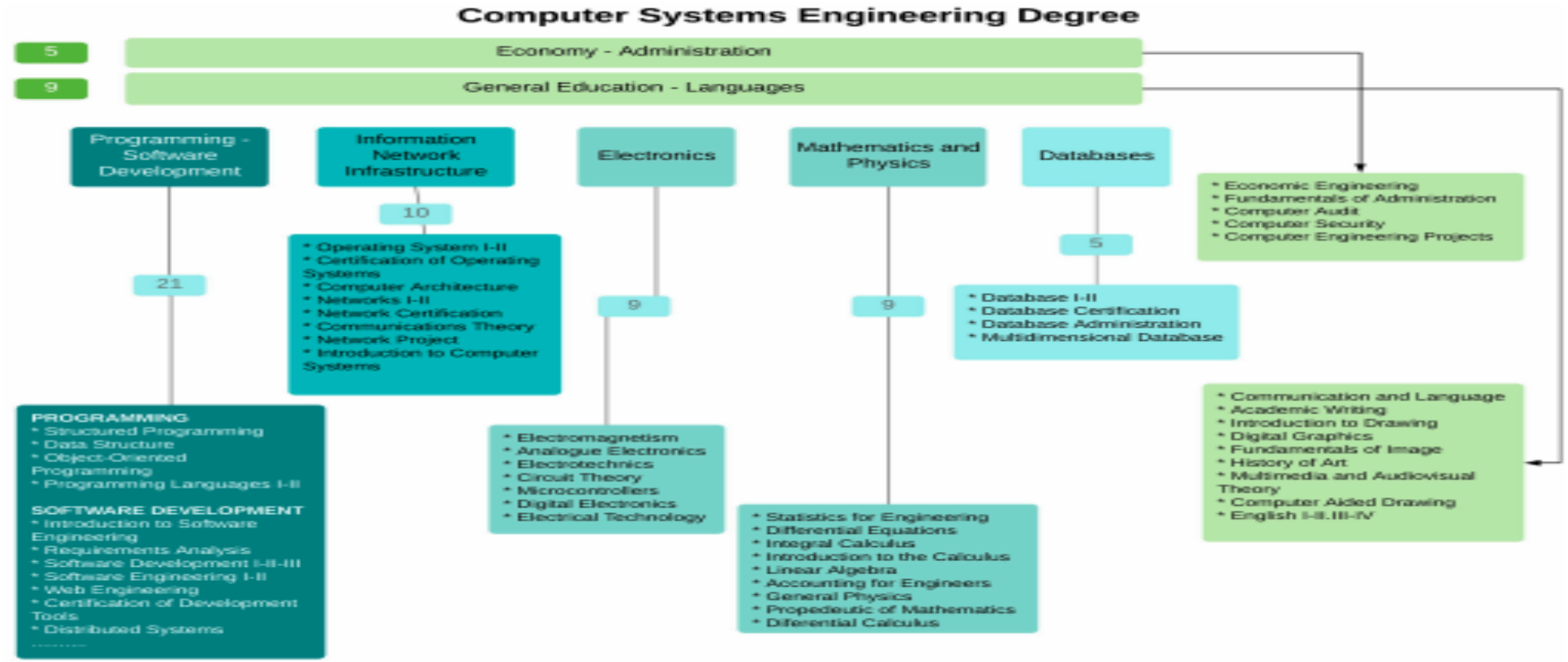

Figure: Subjects by area of knowledge

Source: case study:https://www.academia.edu/39641945/IRJET_Sentimental_Analysis_for_Students_Feedback_using_Machine_Learning_Approach

Sample data sets

Academic Period	Subject Name	PG 1	PG 2	PG 3	FG	Area	Situation
2016-1	General Physics	8.0	4.5	6.3	6.2	Mathematics and Physics	Pass
2017-1	Communication Theory	6.0	5.6	5.3	5.7	Infrastructure	Fail
2017-1	Digital electronics	4.4	8.1	6.9	6.4	Electronics	Pass

Visualization

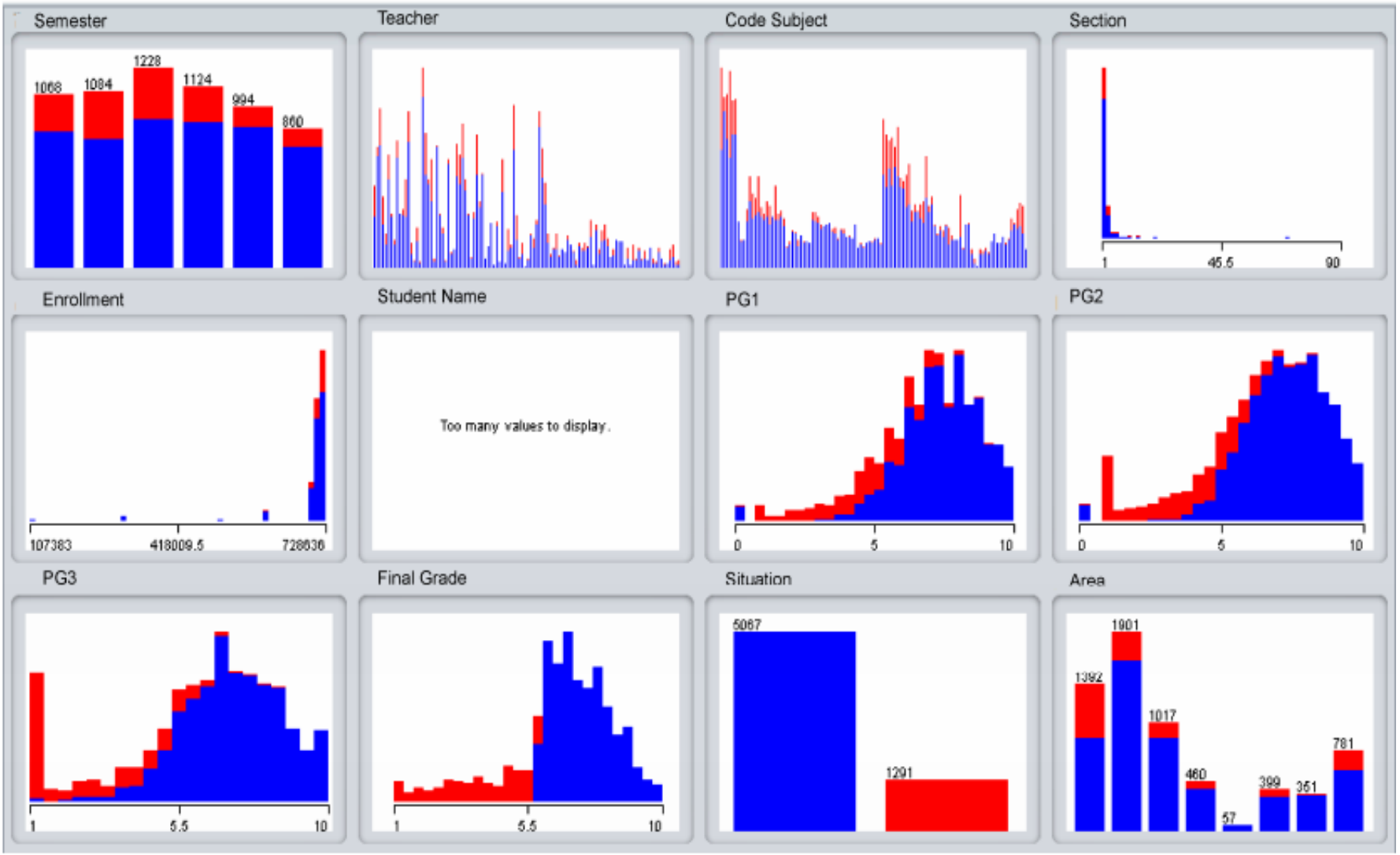

Figure: Visualization

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Selection of machine learning technique

- In this scenario, we used methods of information prospecting and artificial intelligence to offer real a precise method of predicting historical grade datasets.

- One of the most popular problems is forecasting student educational success and, at the current time, a challenging activity in instructional data collection.

Checkpoint (1 of 2)

Multiple choice questions:

1. Which of the following is a type of recommender system?
   a) Content based
   b) Picture based
   c) Image based
   d) Dimension based

2. Conventional CF-based methods use which of the following as the sole source of information for learning to make recommendation.
   a) Reviews and ratings given by the used
   b) Images captured
   c) Computer vision
   d) Real time data

3. Which of the following techniques are used to extract useful knowledge from raw data?
   a) Data mining
   b) Data execution
   c) Data extraction
   d) Educational data mining

Checkpoint solutions (1 of 2)

Multiple choice questions:

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Checkpoint (2 of 2)

Fill in the blanks:

1. _____ is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.
2. _____ is emerging as a research area with a suite of computational and psychological methods and research approaches for understanding how students learn.
3. _____ is an educational approach that aims to customize learning for each student's strengths, needs, skills and interests.
4. _____ are an important class of machine learning algorithms that offer "relevant" suggestions to users.

Checkpoint solutions (2 of 2)

Fill in the blanks:

1. **Learning analytics** is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.
2. **Educational data mining** is emerging as a research area with a suite of computational and psychological methods and research approaches for understanding how students learn.
3. **Personalized learning** is an educational approach that aims to customize learning for each student's strengths, needs, skills and interests.
4. **Recommender systems** are an important class of machine learning algorithms that offer "relevant" suggestions to users**.**

Question bank

Two mark questions:

1. What is learning analytics?
2. What is academic analytics?
3. What is education data mining?
4. What is recommendation system?

Four mark questions:

1. Describe learning analytics process.
2. Write a note on social network analysis.
3. How recommendation system can be used in recommendation system?
4. Describe the importance of educational data mining.

Eight mark questions:

1. Write a short notes on personalized adaptive learning.
2. Explain how sentimental analysis can be used for analysing students feedback.

Unit summary

Having completed this unit, you should be able to:

- Learn about application of machine learning in educational technology
- Understand the advantages of machine learning in education
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