Applications of Machine Learning in Improving Learning Environment

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Abstract Machine learning are having a tremendous impact on the teaching industry. Teaching industry is adopting new technologies to predict the future of education system. It is Machine learning which predict the future nature of education environment by adapting new advanced intelligent technologies. This work explores the application of Machine Learning in teaching and learning for further improvement in the learning environment in higher education. We explore the application of machine learning in customized teaching and learning environment and explore further directions for research. Customized teaching and learning consider student background, individual student aptitude, learning speed and response of each student. This customized teaching and learning approach provide feedback to teacher after real-time processing of the data. This way a teacher can easily recognize student attention and take corrective measures. This will improve student participation and hence the overall results. Individual student concepts and goals can easily be track with the help of Machine learning by taking real-time feedback. Based on that feedback, curriculum, topics and methodology can be improved further. In simple terms, machine learning makes the process automatic for decision making process and analyzed the individual student data. Overall, the assessment process is made more streamlined, accurate and unbiased with the help of machine learning. In the near future, machine learning will be more efficient and produce even better results.

Finally, Machine learning will help educators to make our teaching and learning environment more fun and challenging with the aid of intelligent technologies and take

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our education to new heights, as soon as education system implement the machine learning concept in their curriculums.

Machine learning can potentially redefine not only how education is delivered, but also foster quality learning on the students' part. Probably the most important part of the role of machine learning in teaching is customized teaching. With machine learning, we are moving away from the one-size-fits-all methodology. Machine learning promises to deliver custom in-class teaching by providing real-time feedback based on individual student behavior and other factors. This improves the chances of better learning. Machine learning also plays an important role in assessments or evaluations by removing biases. Customized teaching is the direct opposite of the one-size-fits-all methodology or philosophy. It considers individual student aptitude, learning speed, background, response and other variables. It processes the data in real time and provides feedback to the teacher, so that the teacher can recognize flagging student attention or poor response immediately and take corrective actions. This can potentially improve student participation and, in the process, the overall results. Machine learning will be able to explain the concepts as well as set the goals for individual students. On the other hand, teachers will be able to track whether or not the students are able to digest the concepts. Based on that feedback, educators can change or modify the methodology, curriculum or topics accordingly. And, the result is more accurate and targeted for individuals. In simple terms, machine learning does the analytics based on individual student data, and makes the decision-making process automatic and uniform. Assessment is a major part of the teaching and learning process. Machine learning technology can help teachers assess or evaluate tests objectively and provide feedback. Machine learning applications can do the assessment and provide scores. The process is taken care of by the machines, removing human intervention and helping to remove human prejudice or bias from the process.

However, at the same time, we need to remember that the assessment is done by machine learning algorithms, based on the data feed. Therefore, some human intervention might be required on a case-to-case basis. For example, occasions such as research paper evaluation, interactive work, oral examination, etc., some human intervention is still necessary. Overall, the assessment process is made more streamlined, accurate and unbiased with the help of machine learning.

To date, lesson plans have been made in a generic way, so they are the same plan for all the students. However, students have different types of learning ability, so the same lesson plan may not be ideal for all students. Imagine a scenario where a student is able to learn quickly through visual representations/figures/diagrams, but he/she is given text-based study material—the student may struggle with learning the material. Before AI and machine learning, there wasn't a practical way to detect this and find a possible solution. As a result, it imposes a tremendous amount of pressure on the student and sometimes leads to failure, although the student might have had a good potential. If the material had only been presented differently, the student may have easily understood and learned it.

AI applications are a great solution to this situation. Custom lesson plans can potentially result in better learning because the technology can assess student data

and determine the best methods in which students can learn. It will also determine a better mapping of subjects based on student interest.

Feedback is an important part of any learning system. In teaching as well, feedback is one of the most important components. When we talk about feedback, it means 360-degree feedback. Here, it is applied to both student and teacher. Machine learning analyzes the student data (grading, interest, score, behavior, etc.) and provides feedback. Machine learning also analyzes teachers' data (subject taught, method of teaching, acceptance, etc.) and prepares feedback. This feedback helps both parties. Students are able to get constructive feedback and act accordingly to get better results. On the other hand, teachers are able to adjust themselves to provide a better teaching experience. While the teacher does already provide student feedback, machine learning will go further and deeper. It will assess student behavior, responses and historical data, and arrive at data-based conclusions and provide objective feedback. As for assessments, it will eliminate the possibility of human prejudice while providing feedback.

Career Prediction is one area where students can get confused and make a decision that may not work out for the best. The career path of a student is very important for their future. If the path is not chosen with care, frustration and disappointment can be the result. In general, the decision for a student's career path can be greatly influenced by a number of factors, including the family profession, parents and neighbors—and, of course, the most lucrative careers options. However, the most important thing is missing: the interest of the individual student. AI and machine learning can play a major role here. Machine learning applications for career path prediction are able to track student interest, aptitudes and dislikes. It analyzes student behavior and reactions. Based on the analysis, it can fairly predict interest areas in which the student can excel. (For more on cutting-edge education, see Education Must Turn to the Cloud.)

Artificial intelligence and machine learning are having a tremendous impact on the teaching industry. Before the introduction of AI/machine learning, a generic, one-size-fits-all type of approach was commonly used. As a result, students were forced to try to adjust their style of learning to the lesson plan, rather than the other way around. On the other hand, educators were facing a lot of trouble, trying to understand the students' needs and the possible solutions. So, the teaching experience and the success rate was not as per expectation. With the advent of machine learning and AI, it is becoming more focused, accurate and successful. Machine learning, if harnessed, can revolutionize teaching just based on data. In the near future, machine learning will be more efficient and produce even better results.

1 Machine Learning in Education

Tools developed with Machine Learning and Artificial Intelligence can be useful to enhance teaching capabilities. It can work independent of teachers and can be useful to support teachers [1]. Main areas utilizing these applications are [2]:

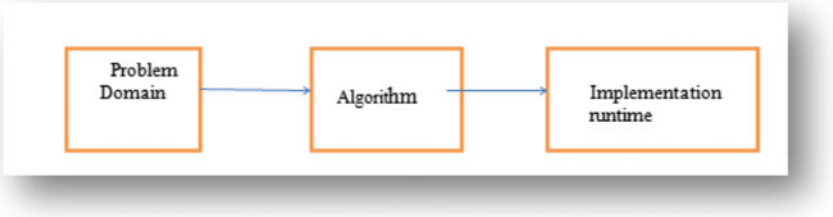

Fig. 1 Testing of software

(i) **Tutoring**: Intelligent tutoring systems are the adaptive tutoring systems that are capable of engaging students in dialogues, answering them and they can also provide feedback.
(ii) **Customized Learning**: Adaptive tutoring systems can be customized as requirement of students in terms of learning material, sequence of the learning, material and understanding of different students in different topics. It is also useful for the students with special needs in enabling them to identify facial expressions.
(iii) **Automated Assessment**: Automated are highly efficient to evaluate the understanding level of the students as these systems are able to adjust the difficulty level of successive questions based on past performance.
(iv) **Teachers Support**: Machine learning algorithms could be utilized to perform routine task of taking attendance, evaluating assignments and to generate the questions. This is helpful for the teachers.

Machine Learning in Testing of the Educational Software: Educational software are required to be very precise as they impact upon the learning process of students. They are also utilized for the assessment and tutoring of the students. Hence, they are required to undergo intensive testing process before implementation. Software testing is validates the alignment of a software with attributes of the system and also verifies that it is able to meet the intended goals. With the increase in the complexity of the software, testing process becomes more intensive [3]. Metrices and specification of software, Control flow graph, call graph execution data, test case failure report and coverage data are elements of learning. Testing of the software includes the following steps:

(i) Analysis of problem domain and its corresponding data sets.
(ii) Analysis of the algorithm.
(iii) Analysis of the implementation runtime options.

Automated testing process is used to reduce the cost of testing and time required in the testing. Various Machine learning algorithms Artificial Neural Networks, Decision trees, Genetic algorithms, Bayseian learning, Instance base learning, Clustering etc. are used in the testing of the software. These methods also enhance the performance in the testing [4] (Fig. 1).

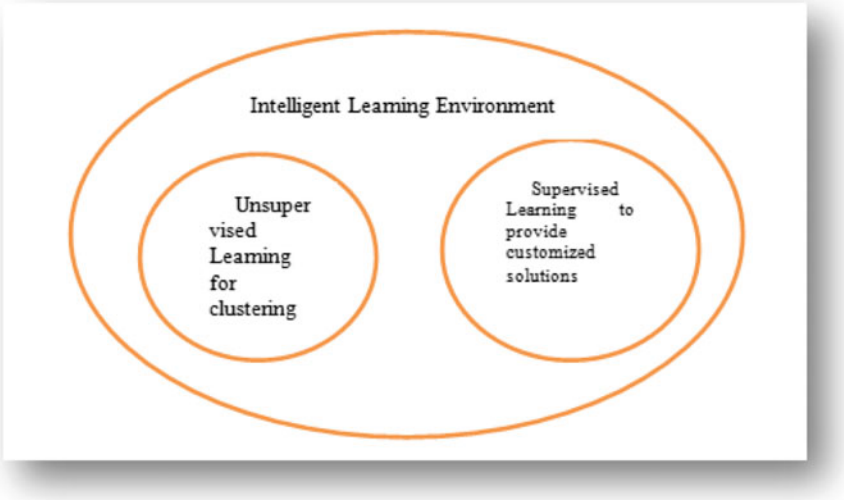

Fig. 2 Intelligent learning environment utilizing both supervised and unsupervised learning

Machine Learning in Intelligent Learning Environment: Intelligent Leraning environment are referred to the systems that utilize both Supervised and Unsupervised learning. This is highly useful to represent the learning of the students in traits like knowledge, meta-cognitive abilities and learning behaviour to predict the future behavior of student. These systems are generally based on statistical pattern recognition [5]. These patterns are achieved by data acquisition, processing, learning and testing. This can be done through manually labeling of data and then applying supervised learning algorithms to identify behavior. To reduce the implementation time can be further achieved by using Unsupervised learning algorithms like k means clustering to identify common learning behavior and supervised learning is implemented to actually build the user model from the identified patterns. Intelligent learning environment provides tools to support the exploration of student in certain subject and adaptive models can provide customized suggestions to improve the exploration of students (Fig. 2).

Machine Learning for Career Prediction and Career Planning: This appears to be an interesting application of Machine learning for the career prediction and career planning.

(i) **Career Prediction**: Career Prediction is based on the activity of individuals on various social websites. This is achieved by multi-view multi-task learning. It provides both feature heterogeneity and task heterogeneity both. Thus it is more suitable for complex problem like career prediction. This type of learning mainly uses the graph based approach. Multi view learning makes use of the consistency among different views to achieve the better performance as information from multiple social sites of the same user can reveal their characteristics

from different views and Multitask learning can model the tasks that are related to each other. In general, it has been found that features that are extracted from multiple sources are in high dimension and sometimes this information is highly sparse in nature. LASSO regression analysis is used to control sparsity and to identify task- sharing and task specific features that are crucial in determining the influential factors that have a effect on the career progression of specific User [6].

(ii) **Career Planning**: For the career planning, data related to the qualification, present and past experience of the user is collected and based on the given profile, best career option is presented to the user [7]. To create this model, k-means clustering is done to identify the users with similar backgrounds and then Markov's chain model is used to estimate transition probability matrix. It makes an assumption that next state depends on present state. Log likelihood method is used to extract the goals with maximum probability from transition probability matrix and Langrangian is helpful while optimizing the results. Shortest path based on these optimized results is calculated by Dijkstra's Algorithm. Model is able to guide the user for career planning by suggesting the most appropriate career path. If a person wants to join as a Director in a financial firm, then model will guide him to obtain a degree in finance and then follow a complete path through joining as a assistant manager, Manager and then reaching the position of manager. This is a drawback of this system that it works in small steps. So, cannot provide the solution based on other factors like expertise of person, their reputation etc.

Machine Learning in Automated Assessment: Assessment is a powerful learning tool that can enhance learning and education. The process of student assessment should align with curricular goals and educational objectives. Identifying the assessment strategies necessary for the proper evaluation of students' progress within individual programs is as important as establishing curricular content and delivery methods. The purpose of this paper is to discuss elements to be considered in assessment design and implementation as well as common challenges encountered during this process. Elements to be considered during assessment design include purpose of assessment, domains to be tested, and characteristics of the assessment tools to be employed. Assessment tools are evaluated according to four main characteristics: relevance, feasibility, validity, and reliability. Based on the evidence presented in the literature, the use of a variety of assessment tools is recommended to match diverse domains and learning styles. The assessment cycle concludes with the evaluation of the results and, based on these, the institution, program, or course can make changes to improve the quality of education. If assessment design aligns with educational outcomes and instructional methods, it improves the quality of education and supports student learning.

Assessment methods are the strategies, techniques, tools and instruments that are developed with heuristic for collecting information to determine the extent to which students demonstrate desired learning outcomes. Machine learning has been

variedly employed to generate the questions and also in evaluation [8]. Different types of machine learning applications utilised for the automated assessment are:

(a) **Neural Network**: These are the layered network. They have input layer, hidden layers and output layers [9, 10]. For the assessment, weights are allocated to each questions and on the basis of the correctness of the answer, difficulty level of the next question is adjusted.

   (i) **Long Short Term Memory**: These are specific types of recurrent neural networks that are able to model temporal sequence [11]. They are also able to accurately model long range dependencies. These are reward based systems and show fast response [12].
   (ii) **Convolutional Neural Network**: Convolutional Neural Networks are more sophisticated version of the ANN. They are the class of deep feed forward Artificial Neural Networks. In artificial neural networks, each neuron is connected with neuron of the next layer whereas in CNN, only spatially similar neurons are connected to neurons of next layer it means they are grouped on the basis of their functionalities. This makes use of the process of feature extraction and feature map to reduce the number of free parameter [13]. CNN reduces the task of learning for all neurons and enhances the efficiency of the systems. This method is more useful in the systems that have more images so pattern recognition is done efficiently. In the assessment of subject, same words can be repeatedly used and most of the words are related so, this is quite useful in assessment [14].
   (iii) **Deep Reinforcement Learning**: Deep Learning is useful in question setting of the difficulty level of the next question in the automated assessment. This supports a flexible environment with high dimensional state and action spaces. These algorithms are capable of altering their own consequence of actions on the basis of interaction and rewards. It works on the paradigm of trial and error [15].

(b) **Natural Language Processing**: Natural Language processing has been used for the generation of multiple choice questions where labels are extracted from given sentence. These labels are extracted from Semantic Role labeler [16]. Informative sentences are selected to find key and distractors. NLP can categorize each word into its part of speech through the series of coded rules of Grammar. These grammar rules rely on the algorithms that are based on statistical rules Maximum Likelihood estimators, Methods of parametric estimation, Non-parametric distribution, Standard distribution, Binomial distribution, Multinomial and standard distributions. Semantic analysis and is achieved by various methods like Context free Grammar etc. [17]
Informative sentences, key and distractors are found with the Syntactic and lexical features. With the help of all these entities, similarity between the question is determined through all the existing knowledge in database (Fig. 3).

(c) **Fuzzy Logic**: Fuzzy logic is popular in many applications now because of it reasoning and computation capabilities. Systems that utilize fuzzy logic are

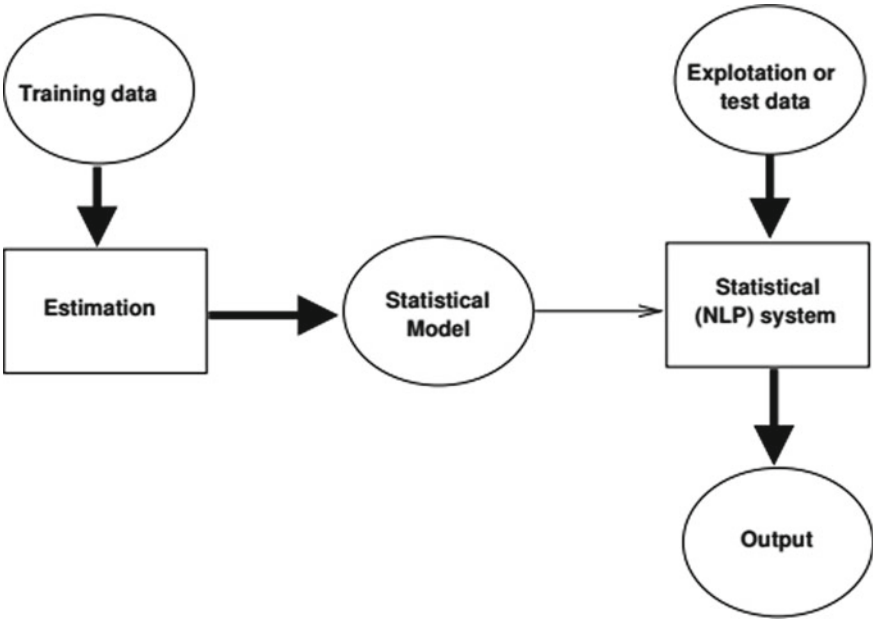

Fig. 3 Natural language processing based system [17]

good in approximate and precise, both type of reasoning. This ability of these system has been exploited in setting of the question paper as the framing of a question paper counts a number of parameters [18]. These parameters includes difficulty level, numerical and theoretical content, weightage of the marks for particular questions etc.

For some subjects like literature, behavior sciences etc., fuzzy logic is used for setting of question paper. In fuzzy logic, membership function is defined and output is chosen on its basis. Fuzzy mathematics makes use of set theory.

(d) **Genetic Algorithm**: Genetic Algorithms are good at taking large, potentially huge search spaces and navigating them, looking for optimal combinations of things. Genetic Algorithm is able to provide a specific solution that has been designed in order to determine the difficulty level of open questions in an automatic and objective way. In the context of Outcome based education, questions can be matched and validated with the specifications that are already defined with the course [19]. Auto generated systems are good in setting up of difficulty level of questions. Genetic Algorithms are a part of evolutionary algorithms and they are categorized as global search heuristic. They are inspired by process of evolution such as inheritance, selection, mutation and crossover(recombination). These algorithms are implemented in computer simulation where various solutions are optimized towards better solutions. This is achieved by initially evaluating the fitness function of each candidate (solution) in the population (set of possible solutions)and modifying them through recombination and mutation

to form new population. Algorithms will keep on iterating until the optimized result is achieved based on the fitness function [20].

Apart from these techniques combination of various technique is also used to design automated assessment systems like combination of PCA with NLP or SVM with NLP, Neural network with fuzzy system or genetic algorithm with fuzzy system. Development of multiple choice questionnaires using the adaptive graph has also been developed recently [21, 22].

2 Machine Learning in Virtual Learning

Over 78% of Virtual learning systems that has been developed are being utilized in the Education sector. Machine learning can analyze and extract data, to find correlation and patterns from large data sets to make useful information. Various techniques that are used in creating Virtual learning environment are Neural networks that are a network of highly connected nodes that work collectively to provide solution, Support Vector Machine (SVM) are useful to classify the data to provide the best solution space, Decision trees create a pictures of decision to determine a strategy for finding best suitable path that reaches to solution, Fuzzy logic is good in reasoning and comprehending the possible set. Others algorithms that are utilized to create Virtual learning system are Roulette wheel Algorithms that maximize the choice of learning path and evolutionary algorithms provides the optimal paths in data and processes similar to the behavior of living organisms like ants, swarms etc [23].

It has become important explore these techniques as in Virtual learning system consist of a very large amount of Data that remains available to be captured and exploitation. Multi-dimensional analysis is required due to the increasing complexity and interdependence of large number of data classes and attributes.

Various techniques that have been developed for research and development in the education System are grouped like Adaptive Learning Systems, Intelligent Tutor Systems, Cognitive Systems and recommender Systems.

Machine Learning to Predict Learning Outcomes: Machine learning can be utilized to predict the learning outcomes of the students. This system is useful to improve the dropout rate of the students by early intervention. System are accurate, sensitive and specific in terms of utilizing Machine learning algorithms to predict the performance of the students on early stages of training [24]. They mainly complete the following tasks:

(i) Automatic collection of exam scores
(ii) Data available on the exam scores

Unobservable variables are then find out based on this data like pre-knowledge, talent and diligence of the student. On the basis of this information predictive model is created to predict the Learning outcomes of students.

3 Machine Learning in Agent-Based Educational Applications

In the era of Artificial intelligence, Machine Learning facilitate customized teaching and learning process to improve efficiency of educational application. Efficiency and effectiveness of the education system can be improve by Dynamic adaptive learning and teaching strategies. In current pedagogical systems only few learning systems exist which are dynamic and able to satisfy individual students need. Availability of these systems needs to be increase by incorporation of agents and learning objects in educational applications. Such intelligent learning systems must be adaptive, able to learn and dynamic [25]. Many educational technology are projects available as either stand-alone learning systems or Web based learning tools. All these projects involve the use of techniques such as multimedia interaction, learning models and asynchronous learning. Required integrated approach has been given for the architectural design of pedagogic information [26].

An agent-based educational architecture system defines the key functions for dynamic and adaptive learning system. To address the challenges of modern education system agent-based technology is being used to provide dynamic adapting learning [27]. Various types of agent types frameworks are:

(i) **Simulation Based Study**—Simulation is done by the application of Machine Learning to analyze the architecture of Agent-based system. This analysis enables the approach to be student centered and handle individual students' requirements. This also improve the dynamic adaptivity in education systems. Learning adaptability at conceptual level can also be achieved by combining the learning theory with agent-based systems. This analysis is based on the presentation of learning objects to individual students using multi-disciplinary approach. Practical level adaptivity is achieved through multi-agent system. This system uses a pre-built knowledge to determine the learning objects and learning styles that are appropriate for the need of individual students.

(ii) **An Agent-Based Distributed Framework**—This framework uses machine learning and data mining. It enables agents to exchange local learning processes model and integration of processes among different number of methods. Individual learning processes model among agents is supported by exchange of meta-level descriptions which ensure online reasoning about learning progress and learning success by learning agents. The mechanism of interaction among agent allows to apply to distribute various tasks of machine learning. It requires a powerful coordination among agents available in agent-based computing. Learning decisions with in agents enables agents to engage in *meta-reasoning process*. Conceptual frameworks are used in applications where different learner uses different data sets to implement the architecture of Modern real world distributed clustering.

(iii) **Agent-Based Computational Economics (ACE)**—Analysis of non-linear processes and representation of such system is based on the computer simulation method of Agent-based Computational Economics. Agents and learning

processes of ACE models are represented through artificial intelligence and methods of machine learning. These systems are developed by reinforcement learning framework that are realized in Simulation system. They are able to illustrate the features of learning framework and to analyze the non-linearity of the agent-based modeling.

4 Machine Learning in Education Data Mining

Educational Data Mining is concerned with the data which comes from educational setup that is related with the improvement in the teaching learning processes by developing various methods. Educational Data mining can be categorized as: statics and visualization of Data, Web mining and Text mining. Educational data mining is done to predict, classify, regression, estimation of density and clustering. Various types of techniques are used to implement these goals like relationship mining, association mining, correlation mining, sequential mining etc.

Data is collected from varied sources including the learning of individual from software used for education purposes, collaborative learning supported by computer, and various automatic testing. Main aim of all the analysis is to improve upon students models. These models represent the information about students in terms of their current knowledge, level of motivation and cognitive skills as these factors are associated with performance of the students with the help of educational data mining methods. It is interesting to know that with the help of various models developed with the help of data mining tools, it is possible to find about real-time monitoring of students as when they are gaming on system or when they are experiencing poor efficacy or getting bored or frustrated. With the help of these models, it is possible to predict the student's retention, non-retention or failure in different courses taught at college as these model represents information about student's characteristics or attitude.

Space searching algorithms from Machine learning have been applied for the developing automated approaches to make accurate domain structure models from the data itself. Methods like making q matrix based on the responses of the students and feedback from students [28]. Skills labels from different item types can be assigned to different items by utilizing the method of covariance. It helps in identifying the role of various skills in learning of the complete domain. Partial order knowledge structures are being used to analyze relation between statistical tools like covariance for outcome relationship in item type. Relationship between item type and duration are found by Pearson correlation.

Educational Data mining is also being used to find out the student-pedagogical relations. It is able to find as which types of pedagogy will be effective for a group of students or individual in various situations. Hence, it has application in the collaborative learning also. This can be achieved by using learning decomposition methods. Data pertaining to performance of the students in varying pedagogies is plotted on a curve mostly the success of student. Best fitted model is created based on the curve

and weights relative to each of the pedagogy in the model is supportive to select the suitable pedagogy for learning.

Another application of Educational Data Mining is to refine and extend the understanding of educational theories and phenomenon for better understandings and improvement in it. Education at different levels is required to be taught in different ways and to extract the information in various situation related with the performance of the students is highly important. In an educational system, it becomes essential to monitor student's behavior and improvement in academic performance.

5 Machine Learning in Education Science for Educational Research

Earlier research related to education was mostly limited to the students studying is any course, area or Institute. So the data related with the educational research was limited. Statistical tools used to analyze these amount of data were not sufficient o model the parameters is received from this huge amount of data number in millions of students through Massive open online courses.

Various Machine learning have greater potential for the analysis of large data sets that are generated through the Massive Open Online courses. Data sets of these courses is also varying in nature due to high diversity in the backgrounds of the students, their conceptual knowledge, their demographic location etc. Many data Scientist are collecting data from these sites and this data is utilized by educational researchers and scientist for analysis [29].

Machine learning based data –driven predictive models provide support in forming and testing of the hypothesis for problems associated with these huge data sets (Fig. 4).

To analyze the deeper context of the data, hypothesis is set and is based on the questionnaire, independence of the course with respect to structure of the course and course content is found for example, if we want to analyze Java programming and C++, then, its basic structure is same, but course content is different, still, they both object oriented programming. If the same course is taught by different teachers, then mode of delivery may be different.

Information extracted from questionnaire, is processed and part of the information that supports the hypothesis is used to create Predictive models. In an Online system, data is collected on the various aspects like number of students registered for course, lecture view, lecture review, submission of the quiz based on video (lecture), resubmission of quiz, completion of the assignments, re-submission of assignments, completion of Complete course.

Various types of Machine learning can be used to predict the output of students. Supervised learning is utilized the independent variable to predict the behaviour of dependent variable. Data is transformed using techniques like exploratory Data Analysis and based on these transformed data, relevant data is filtered for example

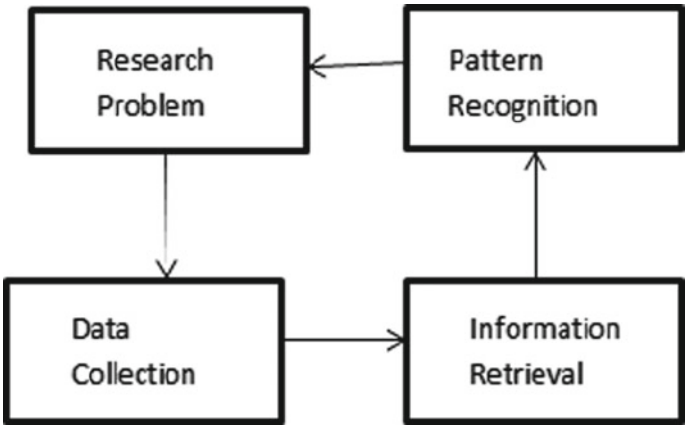

Fig. 4 Data driven predictive model through machine learning

percentage of students completing the course or submitting assignment, predictive model is created that can predict the grades of students, if they have completed course [30].

6 Machine Learning in Instructional Applications

Machine Learning based Instructional applications requires the knowledge in domains:

(i) Conceptual Knowledge: In the computer algorithms, conceptual knowledge is represented in the form of Semantic networks. Concepts is the knowledge about facts and relation between different facts. Nodes in the semantic networks represnts the concepts and links represents the relation between these concepts (Fig. 5).
(ii) Procedural Knowledge: Procedural knowledge is the knowledge to understand the subjects that follows a definite pattern or procedure during learning for example Mathematics, spoken sentences, computer programming etc. These systems typically consists three parts; working memory, rule set and rule Interpreter.

Working Memory: It contains information about the solution. It also hold the intermediate calculations and also stores information about the attention of problem solver.

Rule Set: It is set of rule that works for providing solution and it also has potential for changing the working memory based on the current results in intermediate calculation s. It has two parts:

(a) Condition: Base on the condition, rules are applied on working memory.
(b) Action: It governs the process applied to working memory.

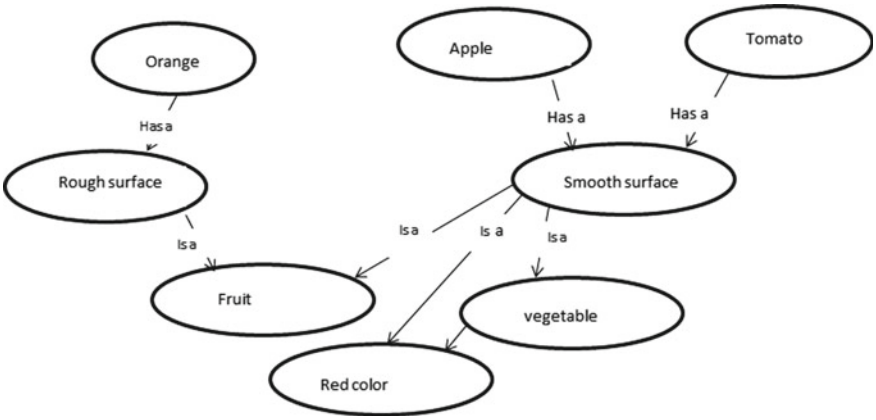

Fig. 5 Example of a semantic network

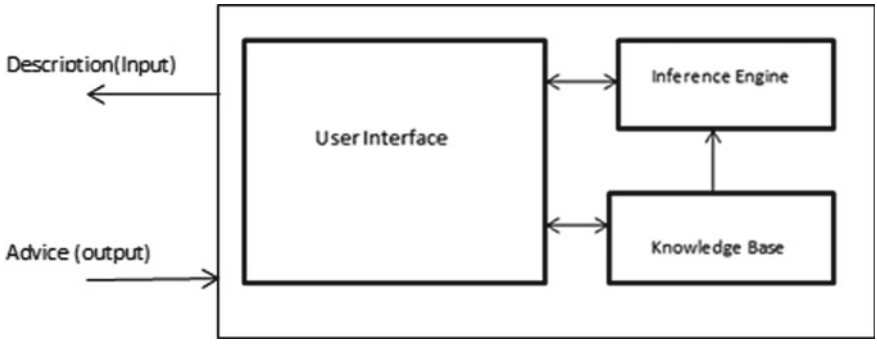

Fig. 6 Major part of expert system

One or more than rule may be applied during the execution by interpreter. Rule based systems are used in expert system used to solve tough technical problem using *Inference engines* [31].

(iii) Imaginal knowledge: Imaginal knowledge seems to be basically about the perception of things. Computer graphs are mainly used in such application. However, with the advancement in Machine learning, systems based on pattern recognition are also applied to create application.

(iv) Problem Solving Skills: Problem solving skills requires forward reasoning and backward reasoning. These methods are specifically termed as Artificial Intelligence. Importance of expert systems in academics is intelligible so it generates necessity of brief discussion on Inference engines in academics where problem solving skills has a significant role. These engine generally utilizes forward and backward chaining as a part of reasoning systems (Fig. 6).

Inference engines works on forward chaining and backward chaining models to obtain logical conclusion. They can utilize top to bottom or bottom to top computational models. Facts and knowledge pertaining to any task and rules required to implement that task is kept with Knowledge base of system [32].

(a) Forward Chaining:

It is based on bottom- model of computation. It uses information from known facts to draw a reasonable conclusion. New facts are generated with the knowledge of known facts to reach a pre- determined goal. This works in cycles and continues until no new rule can be drawn. Facts are checked against the predetermined goals indicating forward movement of inference towards goals from the facts.

(b) Backward Chaining:

Backward chaining is a goal driven search and it is based on the hypothesis testing. Here goal is known and different variables are searched to valid facts in data. It is based on top-down model of computation. In an expert system, it works by checking memory for new goal, to confirm, whether, rules are listed in memory and to continue the recursive program to find any area where any rule is not applied. Information about this area proves the sub goals and original goals.

Machine learning has a wider role in educational application and system. These applications can be utilized as setting up of course module, tutoring, assessment, determining learning outcome and even in predicting the career. Adaptive learning systems can be customized based on the cognitive skills and behavior of individual or a group of students.

Apart of learning processes, it is highly useful in the assessment and evaluation that sometimes becomes monotonous tasks for teachers. It can provide substantial time to teachers to create innovative methods for improved learning environment.

Huge data sets received from Massive open online Courses is quite useful in educational research. This large amount of data can be modeled using machine learning technique to create predictive models.

Education is one of the sensitive area and new and accurate methods of Module delivery, feedback systems and problem solving are developed.

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