

## Role of Adaptive Machine Learning in Educational Environment

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**Abstract**— Adaptive learning is playing very vital role in educational models. It represent as computer based online education system that modifies study material presentation based on performance of students. This is intelligent technique of digital learning, where it captures each and every decision made by students and then on the learning experiences of student provides summative and formative data to be understood. Recently adaptive learning technology is used for simulation training in NASA, safety model in US army for educating soldiers in warfare. It has greatest potential in educational model from KG to higher education.

**Keywords**— Machine Learning, Adaptive Learning.

### I. INTRODUCTION TO MACHINE LEARNING

Machine Learning is branch of artificial intelligence which is able to design programs that can learn rules from data, system becomes adaptable to changes, and enhance performance by taking experience. This is the technology that can fulfil dreams of Computer Science, Machine Learning solves complex problems has becomes more popular and integrated into our daily lives. Coding of computer program means writing sequence of instructions which can be executed millions times faster than human being. Yet many of the problems we now want computers to solve are no longer tasks we know the method of explaining to computer how to do task. Consider the application like identifying faces in images, driving autonomously in the desert, searching relevant documents from large database or detecting irrelevant ones, like spam email), recognizing patterns in large volumes of scientific or applicative data, and controlling parameters of systems to increase performance. We know, we can directly identify people in photographs, but we can't explain it directly to computer. For this, need methods that take input as labeled training data (images labeled by identity of person, or email labeled by spam or non -spam). After that learning appropriate rules from such data. This is the best approaches for finding solution to these problems. So, we require a systems that may be adaptable to changing environment, can be self- modifiable, self-monitoring and that can increase performance massively over time.

### II. ADAPTIVE LEARNING

Adaptive learning have been originated from the concept of machine intelligence that can be used to integrate human with machine learning environment.

We can classify machine learning on the basis of generation or advancement and techniques implemented in machine learning. Now a days human analyst are very busy in building smarter, faster and easily interpreting machine intelligence. Adaptive learning combines previous generation approaches like rule based, simple machine learning and deep machine learning to implement such a smart system.

#### A. Rule based machine learning

We can say this is first generation machine intelligence in which people create their rules manually. Consider the case of text analytics, suppose we have create a rule that the word "Tata" followed by "Sumo" meant that "Tata" referred to a car, and they would create a separate rule that "Tata" preceded by "Ratan" meant that "Tata" referred to a person.

The rule-based approach is very time consuming and not very accurate. Even after an analyst has exhausted all the words and phrases they can think of, there are always other contexts and new innovations that aren't captured.

## **B. Simple Machine Learning**

Simple machine learning is one of the dominant approach of machine intelligence today. This machine learning having ability making decisions for data processing. Suppose the sentence having the word “Ford” is labeled with object as a car, then algorithm of machine learning will learn by its experiences that the following word “Focus” is evidence that “Ford” is a car.

Simple machine learning is considered as one of the fast learning method, in which we already need to labeled examples for ‘supervised learning’. This is more accurate, because of decisive capability. Supervised machine learning need the trained or labeled the examples, this is one it major drawback. If number of labels are very few of the entire data set, then the accuracy of algorithm becomes very is low or limited.

## **C. Deep Machine Learning**

Recently the use of machine learning is raised very rapidly that learns associated relationships between features, this is called as deep learning. Let we take same example, consider the sentence “Harrison Ford Focus on Star Wars”, there is too much confliction between “Focus” and “Harrison” which is difficult to identify whether “Ford” is a person or a car. Deep learning is capable for automatically learning, It knows how to combines features for making a decision. In simple machine learning, we need to provide input as combination of features to the algorithm. Deep learning saves the cost of human time and precisely 5% more accurate results can be provided if compare with the simple machine learning

## **D. Adaptive Machine Learning**

Human analyst plays very important role in case of adaptive learning at every process. This is different than rule-based learning, simple machine learning and deep learning algorithm in which the humans only design rules and label data when process get started. Consider an example, in following sentence “Tom Ford Escape from California”, and algorithm never seen any examples of “Tom Ford” or “Ford Escape”, in this case we need human input to bring out the knowledge.

Adaptive learning systems require the minimum effort by human, it only requires to interact human when need to expand their knowledge after getting new information. This is most accurate technique as they combine the all above types of machine learning, ‘unsupervised machine learning’ and methods are added to optimized system performance.

## **III. IMPORTANCE OF ADAPTIVE LEARNING IN EDUCATIONAL FIELD**

Distance or e-learning have becomes very trendy in modern education, which has provided new platform of learning to everyone. Now anyone can study at any places and anytime to update and upgrade their knowledge. E-learning is sub-branch of Adaptive learning, which provides personalization and adaptation to the learning users. Learning materials or teaching methods varies with different people by analyzing their characteristics like task, knowledge, experience, interest, and background data. These characteristics or information is bind in a format which is known as user model. User model is the heart of adaptive learning system. User modeling system is used to control and manage user model. User model and adaptive learning system can be built up by many theories and practical methods and each method plays particular role. But it is very difficult task to decide which method or system will be best to implement because each method have some advantages and limitation and evaluation standard is not available.

User modeling is the sub-branch of human and computer interaction which define the method of building up and modifying a conceptual understanding of the user. The main goal of user modeling is customization and adaptation of systems to the user's specific needs. The system needs to "say the 'right' thing at the 'right' time in the 'right' way". To do so it needs an internal representation of the user. Another common purpose is modeling specific kinds of users, including modeling of their skills and declarative knowledge, for use in automatic software-tests. User-models can thus serve as a cheaper alternative to user testing. A user model collect and classify user specific personal data. Hence, it is the basis for any adaptive changes to the system's behavior. Data to be

included in the user model is based on the goal of its application. Personal data like name of user, his ages, his interests, skills and knowledge, his plans and objectives, and behavior and his interactions to the system.

### **Followings are the design patterns of user models**

- **Static user models**

Static user models are the most basic kinds of user models. They never change after the collection of main data. They are having static and behave according to user preference. This model do not implement learning algorithm.

- **Dynamic user models**

Users need to be more up to date in case of dynamic user models. Changes in users interests, their learning progress or co-ordination with the system are closely monitors, which also influence the user models. Users need and goals can be considered to update the system in this model.

- **Stereotype user models**

Stereotype user models are based on demographic statistics. Collected information of users categorized into common stereotypes. These stereotype can then be adapted by the system. Hence the application can make prediction about a user even though data is not available of specific area, because according to demographic studies, other users in this stereotype can show the same features. Stereotype user models depend on statistics and personal attributes may not be take into consideration to match the stereotype. They only allow predictions about a user even though very less information is available about the users

- **Highly adaptive user models**

Only one particular user is represented in highly adaptive user models and it allow a very high adaptivity of the system. As stereotype user models depends on demographic statistics, this model do not rely on it. This model able to find specific solution to the system and user can take advantages this high adaptively. Model only needs to collect a lot of information first.

## **IV. APPLICATION OVERVIEW OF ADAPTIVE LEARNING**

### **A. Distance learning**

Distance learning and group collaboration are the emerging content on the internet, where the adaptive learning system can be used to implement.

Today the adaptive learning concept is incorporated in the field of distance learning. Before the commencement of adaptive learning, system was able to provide feedback to students who are presented questions from a preselected question bank. This approach had limitation, it was lacking in the guidance which teachers provides in the classroom. Current trends in distance learning are to use adaptive learning to implement dynamic and intelligent behavior in the learning environment.

With this approach students can spends time in learning a new concept on the basis of their abilities and databases can monitor their progress by applying one of the model. The latest generation of distance learning systems uses the concept of 'cognitive scaffolding' in which the students' answers takes into the consideration and adapt themselves to the student's cognitive abilities. Cognitive scaffolding is able to provide automated learning system to build up cognitive knowledge for assessment from lowest to highest based on the ability of adaptive system. The Maple engine of WebLearn is the successful application of adaptive learning distance learning is implemented by RMIT University. WebLearn is most advanced and capable to assess questions provide to students even if those questions is not having unique answer.

Adaptive learning can be applied to facilitate group collaboration to the environments of distance learning such as forums and resource sharing services. Adaptive learning along with collaboration provides automated grouping of users with the same profile, and interest, such an information links sources are based on user's activity and behaviors.

## **B. Game Design style**

In 2014, academicians or academic investigators over a multi-year study of adaptive learning for educational game style. The analysis developed and validated the ALGA (Adaptive Learning GAME DESIGN) model, a comprehensive adaptive learning model supported game style theories and practices, educational methods, and adaptive models. The analysis extended previous research in game style, educational methods, and adaptive learning, combining those 3 parts into one advanced model. The study resulted in the development of an adaptive academic game style model to function as a guide for game designers, educational designers, and educators with the goal of skyrocketing learning outcomes. Survey participants validated the worth of the ALGA model and provided specific insights on the model's construction, use, benefits, and challenges. This ALGA model relies on these insights. The model currently is a tenet for the planning and development of academic laptop games. The model's pertinence is assessed as being cross-industry as well as government and military agencies/units, game business, and academe. The model's actual price and also the acceptable implementation approach (focused or unfocused) are going to be absolutely accomplished because the ALGA model's adoption becomes additional widespread.

## **V. CONCLUSION**

Adaptive learning is a simple and hardwired system. The system is able to monitor the effect of adaptation and is responsible for making changes in behavior accordingly. It is a self-meditating system that can monitor the effect of adaptation on educational or other models before putting it into practice and having the capacity to make changes in representation by reasoning of interaction to the system model.

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