Learning Analytics Tools

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Lecture 3.1

Introduction to Machine Learning

Welcome back to Learning Analytics Tools course. In this week we will talk about the introduction to Machine Learning. So first let us start what is machine learning?

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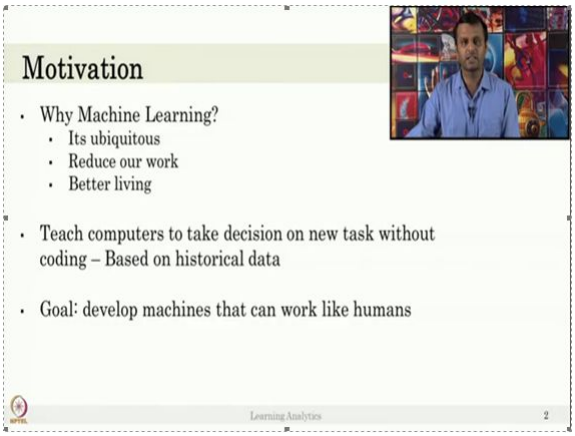

The aim of this course is not to teach machine learning in LA but in order to understand the tools, the algorithm we use in this course you should know

1. What is machine learning?
2. What are the basics?
3. What is a supervised machine learning algorithm?
4. What are the algorithms in learning methodologies?

So let us start it.

why we have to learn machine learning? So you can take time and think of machine learning and why you have to learn it.

So whatever device you are using - a mobile, a tablet or a browser in your laptop taking this course machine learning algorithms are used in them. It is used to reduce manual work.

So it is everywhere. Imagine you are creating a system which classifies the road signals. A human has to go and classify the road signals for an automated car.

In machine learning what happens is it naturally classify the road signals, it can classify the road conditions automatically. It helps a driver, reduces cognitive load and it helps him to save time for other productive works. And the whole idea of the machine learning algorithm is for improving the living of the humankind.

So what is machine learning? In very basic terms, it is teaching computers to make a decision on a new task without human intervention or without writing an explicit code.

So how does it work? It learns the algorithm based on historical data. So the computer should take its own decisions when the new task comes without humans intervention.

How to make the decision? It is based on the historical data - the computer collected or human-created data using some algorithm.

The goal of machine learning or AI is developing machines that can work like humans, that can mimic human intelligence and that can do all activities that human can do.

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By now you might know by seeing this colour in this slide there is an activity. So I do not need to tell that you have to pause the video and write down answers and resume to continue. Whenever you see this colour slide you have to pause the video, do the activity then resume to continue.

So here first why understanding machine learning concepts is important for learning analytics. I have mentioned that machine learning is everywhere and it is helping humans to live better. So why we have to understand this machine learning concept in LA? Please write down in answers.

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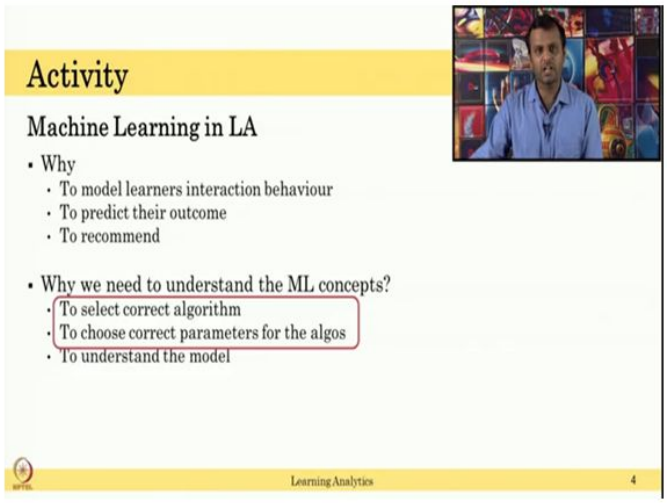

So let us go with the why. We have to model the learner's interaction behaviour. We have already seen learners interaction behaviour in different environments. We can collect data but

we have to model the learner's interaction behaviour. In order to model that we need to know what machine learning algorithms can be used in order to predict the outcome?

Suppose given actions we want to predict what will be the student's performance in the mid-sem or in end semester examination.

So how do you create a model to predict their outcome? That is also needed. Also if you know this student is not going to pass the exam in the next mid-sem or mid-term how do you provide recommendations? What recommendation should work? So in order to do this, we need to know what is machine learning.

But why we need to understand the concepts in machine learning? Why I cannot simply use the existing machine learning tools and apply it? Why do I need to know what are the algorithms? Why I should know the machine learning concepts? The reason is we should know how to select the right algorithm for your problem.

And to choose a correct parameter or to adjust or tune the variables in the algorithms to get better performance on your algorithm. Also for you to understand the model you developed. Some cases the machine learning algorithm or model looks like a black box but if you do not know how the machine learning model is able to predict or classify or able to recommend your student if you do not know the information about it you will not be able to use it effectively.

So you have to understand how the model works. I mentioned that you need to understand machine learning concept for the first two reasons

1. You have to select an algorithm or select the corrective variable. However, in a current scenario some tools like big ML or auto ML which helps you to do that. Given a data it fits into all the available tools or all the algorithms you select and it has a grid search algorithm to change the variable values over the particular grid and able to tell you which algorithm with which parameter work for your data. So currently the applications help you to do that.
2. In order to understand how the model works? Why the model predicted a student as a low scorer/high scorer you should understand the machine learning concepts.

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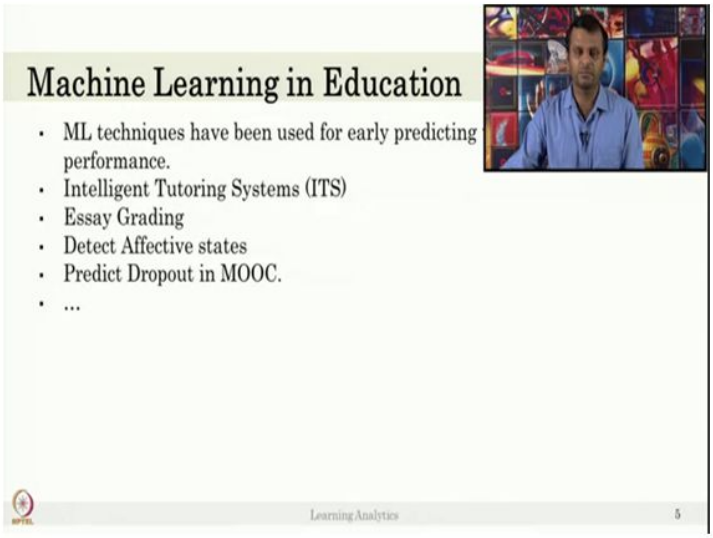

So machine learning in education. Machine learning techniques are being used for predicting students performance before they even appeared to the exams so that we can provide recommendations and we can help the students to pass the exam. Machine learning has been used in an intelligent tutoring system, personalized adaptive learning environments that are very common nowadays. Based on the student's response, the necessity of actions - content and questions has been created. This is how machine learning algorithms have been used.

Also, machine learning is used for essay grading. The students submit essays or topics, automatic grading of their essays is done by applying the natural language processing techniques.

And machine learning also can be used to predict the student's affective states like a student is bored, confused in a during the online lecture or during the classroom environment. So I am giving the examples on different scales. One is using the log data that is you can predict their performance.

You can use NLP to predict their essay gradings or you can use the facial expression and log data and some other sensor data to predict their affective states. Also if you want to predict the student's dropout in MOOC, you can use a log data with machine learning to predict which student will dropout in which week or which student is in the risk of dropping out of the course. And much more for machine learning in education.

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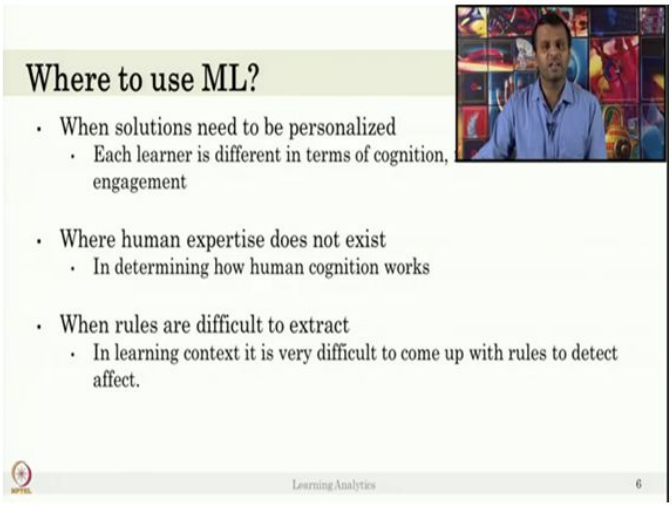

So where to use machine learning? When a solution needs to be personalized, for example, in Intelligent tutoring system we need a solution for each an individual student or at least some cluster of students. Now we can use the machine learning algorithm because we have not seen the students behaviour before they are coming into our learning environment. We have seen similar student performance in the environment. So if the solution you are going to provide needs to be personalized for students, a machine learning algorithm can be used. As each learner is different in terms of cognition, in terms of the learning ability, the skills, the motivation. So if you are making a recommendation based on a different set of users you might use a machine learning algorithm.

Also where human expertise does not exist for example how human cognition works? Till now we do not know any model that explains how the cognition works. So if you do not know how human cognition works for any particular subject on any particular interval time or if you are given this kind of example it is not possible for humans to create a model for that.

So maybe we can use machine learning algorithms and get the data from the students interaction and provide a recommendation or feedback.

When the rules are difficult to extract we can apply the machine learning algorithms. Like it is not easy to create a model by manual intervention or manual looking at the data.

For example, if you want to compare the student's attendance versus performance, if you have only 2 variables like attendance and performance, you might be able to say if the student's attendance is more than 70 per cent he might pass or he might get more than 80 marks that it comes from your experience also you can create that hypothesis and test it that kind of rules is possible or if any other rule is possible or you can create a filtering rule. But if there are too many variables and human cannot create a hypothesis or create new rules from the data then machine learning can be used too. For example, in the learning context, it is very difficult to come up with rules to detect affective states. For example, when the students will be bored? So students boredom or affect can be visible in times from the facial expressions, the way they speak or their language they use for writing or their sensory data from physiological senses. So how do you create a model to predict students emotions? A human can do that.

When we talk to someone, we can observe their gesture, their facial expressions, their tone. We can guess or we can say which emotion is the student is in. Is he angry, is he sad, is he bored, confused but can we create a model and apply it to predict 60 students in the class? We want to remove the human from the loop because a human cannot go and do observation for each and every student and provide feedback.

Can we remove that and machine can predict the student's emotions so that the machine can give the recommendations? So if you want to claim the machine then you have to collect a lot of data. Here the machine learning algorithms can be helpful.

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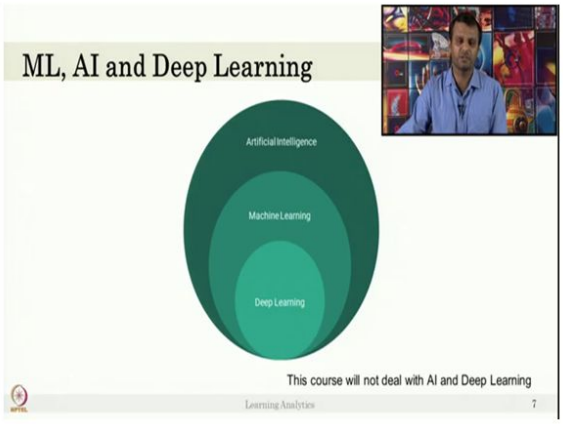

So there will be a big question what is the difference between machine learning, AI and deep learning? So I want to use this slide to clarify that doubt if you have. So in general artificial intelligence is something we want the machine to mimic like a human.

So we want to create the intelligence which works like a human and machine learning is part of it. There are many other methods to do that. So machine learning is one of this. In machine learning, there are a lot of algorithms like decision tree or probabilistic algorithms or statistical algorithms.

We have trees. We have clusters or we have regression models, Naive-Bayes but one of the algorithms in deep learning is the neural network. So the neural network is the subset of machine learning. Machine learning includes a lot more algorithms other than neural network and machine learning can be considered as a subset of artificial intelligence. Some may not agree with the machine learning versus artificial intelligence subset and set.

It is a debate and still going on. Let us consider for this course that machine learning is a subset of artificial intelligence and neural network is a subset of machine learning and in this course, we will not deal much about artificial intelligence algorithms or deep learning. We will talk about some of the machine learning concepts.

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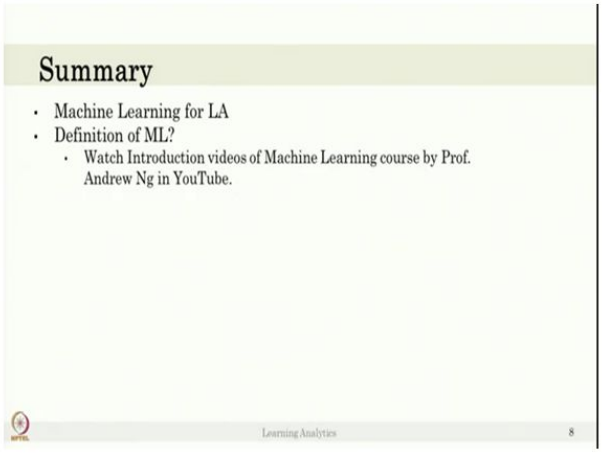

So in this video, we saw what is machine learning and how machine learning can be used for learning analytics. We will talk more about machine learning in subsequent videos. You might

be expecting a definition of machine learning because we did not give any definition for machine learning. If you are expecting a definition for machine learning I recommend you to watch the introduction videos of machine learning course by Andrew Ng.

It is offered on Coursera but this course is available on Youtube if you do not want to register in the course in Coursera. So please watch Andrew Ng's introduction videos of machine learning where he gives definitions and explains. We will talk about that most of his course contained in this our course but we will talk about a bit and we recommend you to go and watch this course on Youtube. Thank you.