Learning Analytics Tools

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Lecture 10.5: NLP - Examples

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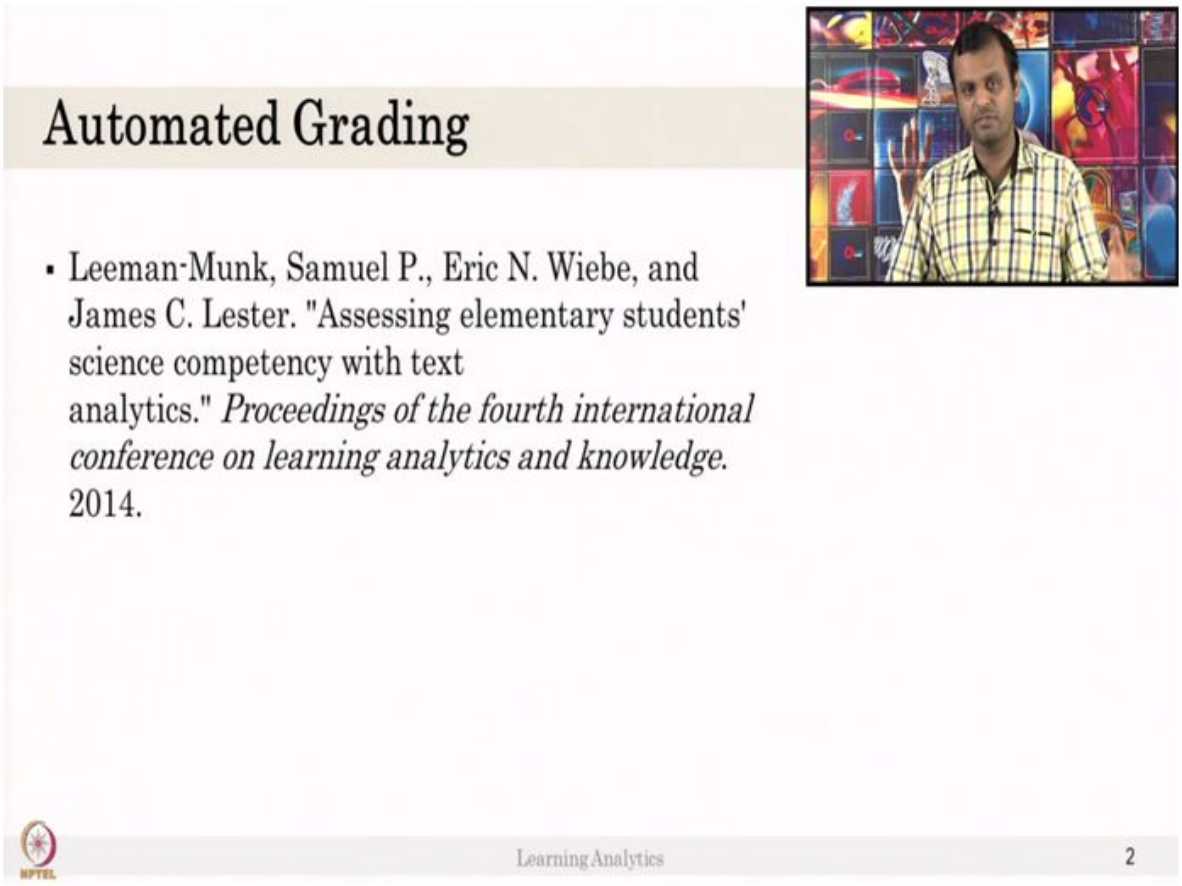

Let us see the application that is a couple of research papers using NLP. We are doing it for the last few weeks so let us do a one research paper this week. So for Automated Grading, there is a paper from James C Lester's group. It is, Accessing elementary students' science competency with text analytics. Let us look at this paper, it is 2014, so I just tried to pick up a paper which is a bit old so that we can see the automated grading system using the Bag of Words approach.

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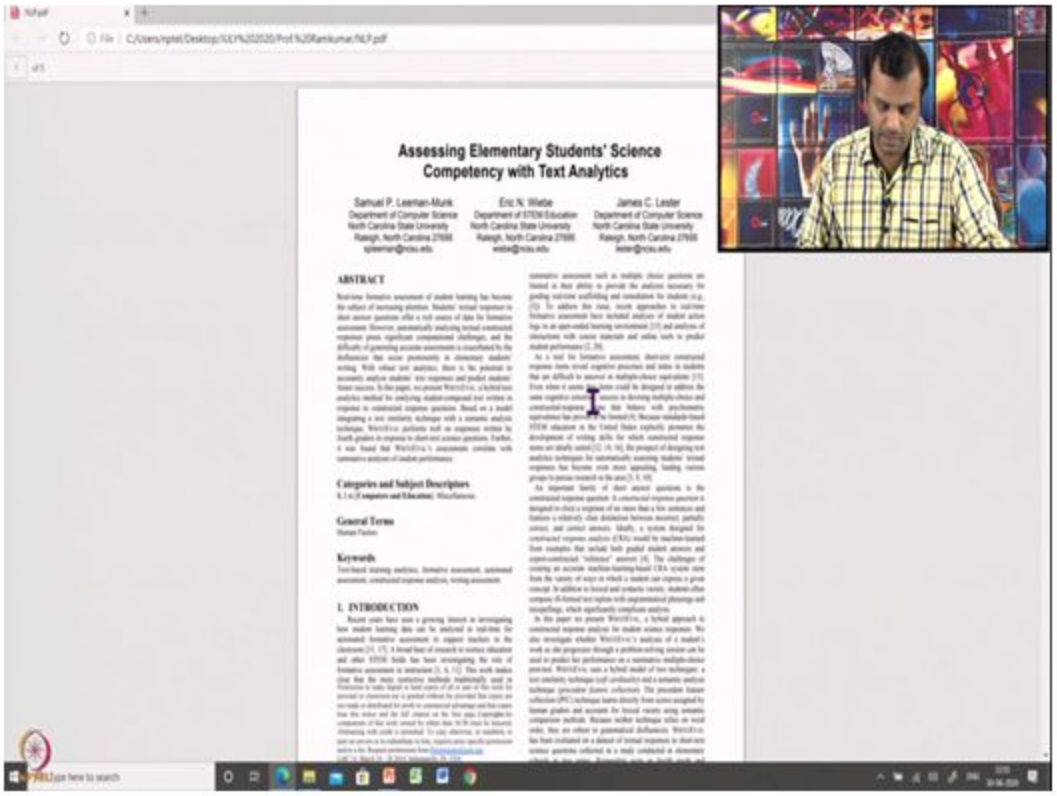

Assessing Elementary Students' Science Competency with Text Analytics

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ABSTRACT

Categories and Subject Descriptors

General Terms

Keywords

1. INTRODUCTION

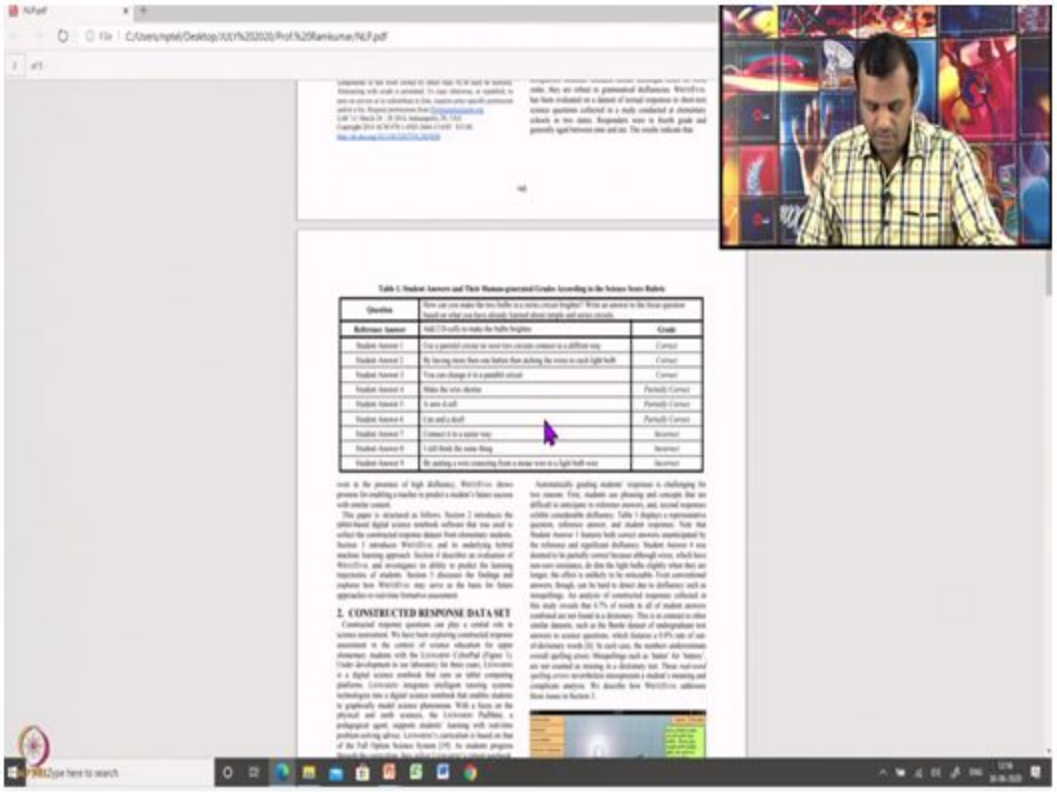
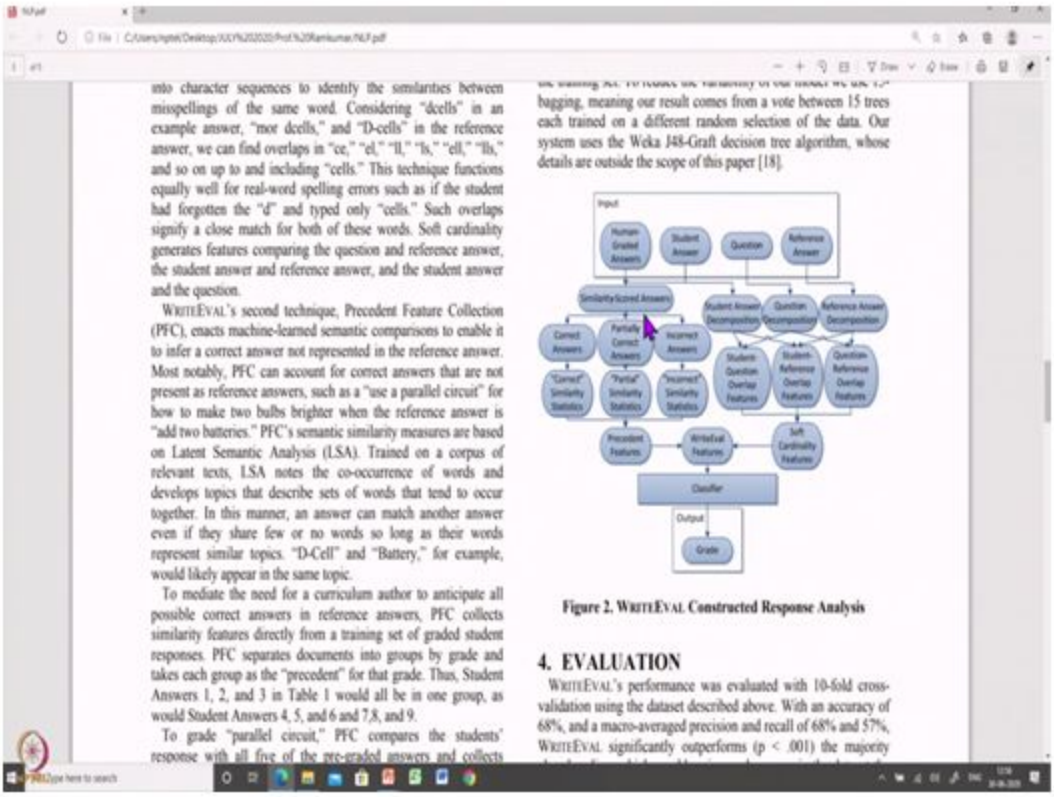


Table 1. Student Answers and Their Human-generated Grades According to the Science Score Rubric

Question	How can you make the two bulbs in a series circuit brighter? Write an answer to the focus question based on what you have already learned about simple and series circuits.	
Reference Answer	Add 2 D cells to make the bulbs brighter.	Grade
Student Answer 1	Use a parrelel circuit or wire two circuits connect in a different way	Correct
Student Answer 2	By having more than one bulbes than sticking the wires to each light bulb	Correct
Student Answer 3	You can change it to a parallel circuit	Correct
Student Answer 4	Make the wire shorter	Partially Correct
Student Answer 5	A wire d cell	Partially Correct
Student Answer 6	I do and a dcell	Partially Correct
Student Answer 7	I connect it in a saree way	Incorrect
Student Answer 8	I still think the same thing	Incorrect
Student Answer 9	By putting a wire connecting from a straw wire to a light bulb wire	Incorrect



into character sequences to identify the similarities between misspellings of the same word. Considering "dcells" in an example answer, "mor dcells," and "D-cells" in the reference answer, we can find overlaps in "ce," "el," "ll," "ls," "ell," "lls," and so on up to and including "cells." This technique functions equally well for real-word spelling errors such as if the student had forgotten the "d" and typed only "cells." Such overlaps signify a close match for both of these words. Soft cardinality generates features comparing the question and reference answer, the student answer and reference answer, and the student answer and the question.

WRITEEVAL's second technique, Precedent Feature Collection (PFC), enacts machine-learned semantic comparisons to enable it to infer a correct answer not represented in the reference answer. Most notably, PFC can account for correct answers that are not present as reference answers, such as a "use a parallel circuit" for how to make two bulbs brighter when the reference answer is "add two batteries." PFC's semantic similarity measures are based on Latent Semantic Analysis (LSA). Trained on a corpus of relevant texts, LSA notes the co-occurrence of words and develops topics that describe sets of words that tend to occur together. In this manner, an answer can match another answer even if they share few or no words so long as their words represent similar topics. "D-Cell" and "Battery," for example, would likely appear in the same topic.

To mediate the need for a curriculum author to anticipate all possible correct answers in reference answers, PFC collects similarity features directly from a training set of graded student responses. PFC separates documents into groups by grade and takes each group as the "precedent" for that grade. Thus, Student Answers 1, 2, and 3 in Table 1 would all be in one group, as would Student Answers 4, 5, and 6 and 7,8, and 9.

To grade "parallel circuit," PFC compares the students' response with all five of the pre-graded answers and collects

bagging, meaning our result comes from a vote between 15 trees each trained on a different random selection of the data. Our system uses the Weka J48-Graft decision tree algorithm, whose details are outside the scope of this paper [18].

Figure 2. WRITEEVAL Constructed Response Analysis

4. EVALUATION

WRITEEVAL's performance was evaluated with 10-fold cross-validation using the dataset described above. With an accuracy of 68%, and a macro-averaged precision and recall of 68% and 57%, WRITEEVAL significantly outperforms ($p < .001$) the majority

So let us look at this paper Assessing Elementary Students Science Competency with Text Analytics. I request you to go out and read the paper. It has very interesting things called Write Eval. It is just used this particular grading system. So there are nine students answer, how can you make the two bulbs in a series circuit brighter? So the student has answered, the answers here. And the grading is also done probably correct, incorrect, correct okay, so average poor, better, good, something like that.

So they have sentences. So from these sentences, they form the set of dictionary from that they are able to identify the grading systems. So, yeah, let us go and see. So it is not simply that grading system only based on the Bag of Word approach. What they did, they add out some combination, for example, they find the similarity scores of answers between the correct answer and the given answer by the student. The student answer and the human-guided answer is compared to find the similarities, the correct answers, partially correct, incorrect. The statistics are used and also the students answers from the Bag of Word and under reference answers.

Everything has been used to create into a classifier, that classifier generates the output. So the basic approach is what we saw in a Bag of Words approach with 100 student's response you create a big dictionary, and use that dictionary to create a feature set. And you are grading by giving label, and you train the system. Similarly, they used the similarities, indexes and other indexes what we saw in this week's course. So check this video and they use Weka, they use a decision tree, check this video and try to understand this paper. Hope you will be able to do that. That is, that is all I wanted to tell you about.

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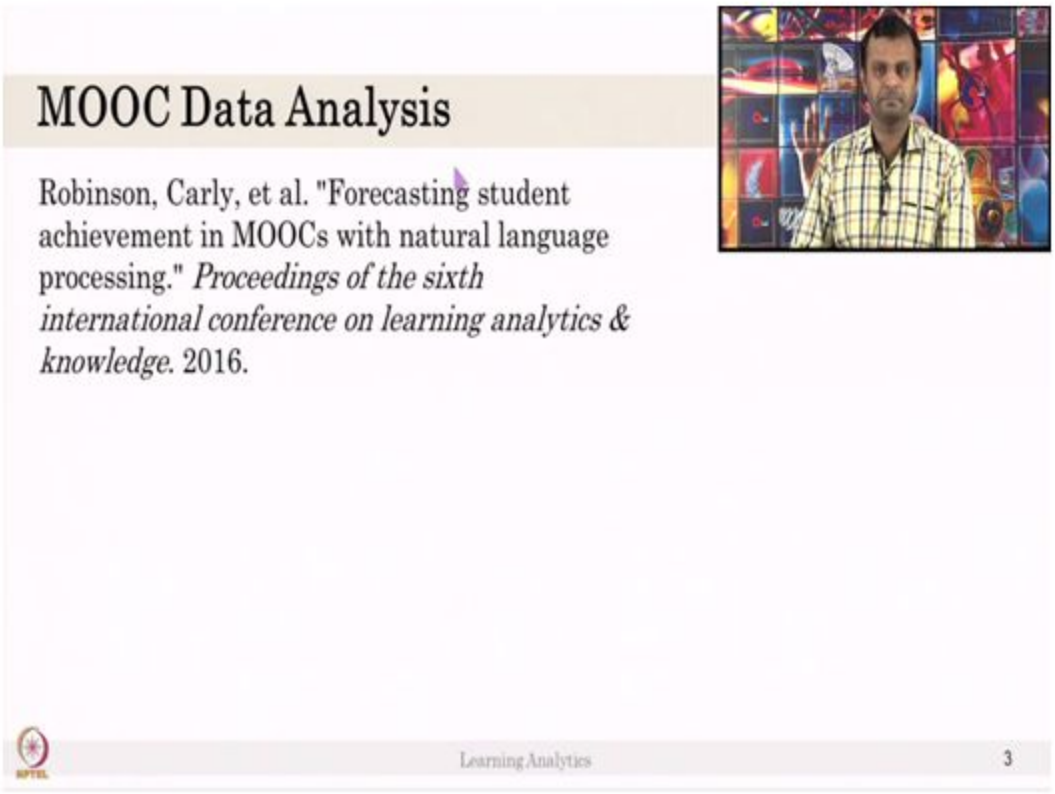

That is also another paper on MOOC data analytics. It is based on the student's response to the forums in the MOOC. We were seeing in the last weeks, we constructed features based on the interaction between the forum like, how many times they answer, how many times they uploaded, how many active actions, plus the content they are writing. What are they writing? So that is where the NLP is used here, not just the features you can also extract the content you are

writing. So check this paper I am not going to look at this paper. It is interesting paper check this paper is from the LAC 2016 check this.

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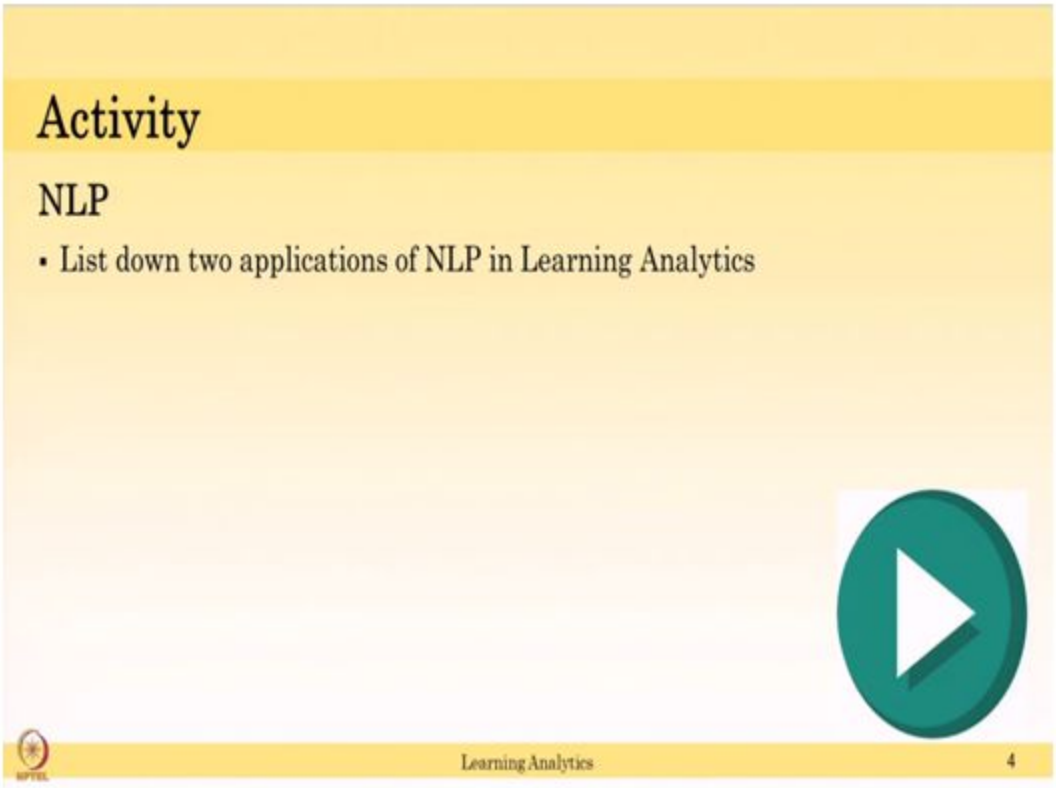

Given this knowledge of basic concepts of NLP and a Bag of Words, or similarity, or N-gram, all this information, can you, can you think of two applications of NLP in learning environments? You might have had a question why we are talking about NLP in learning analytics. That one week course I just wanted to introduce what is NLP because it is very, very important to understand the content analytics. Can you think of two applications of NLP in Learning Analytics and write it down. Once you write it down please resume the video to continue.

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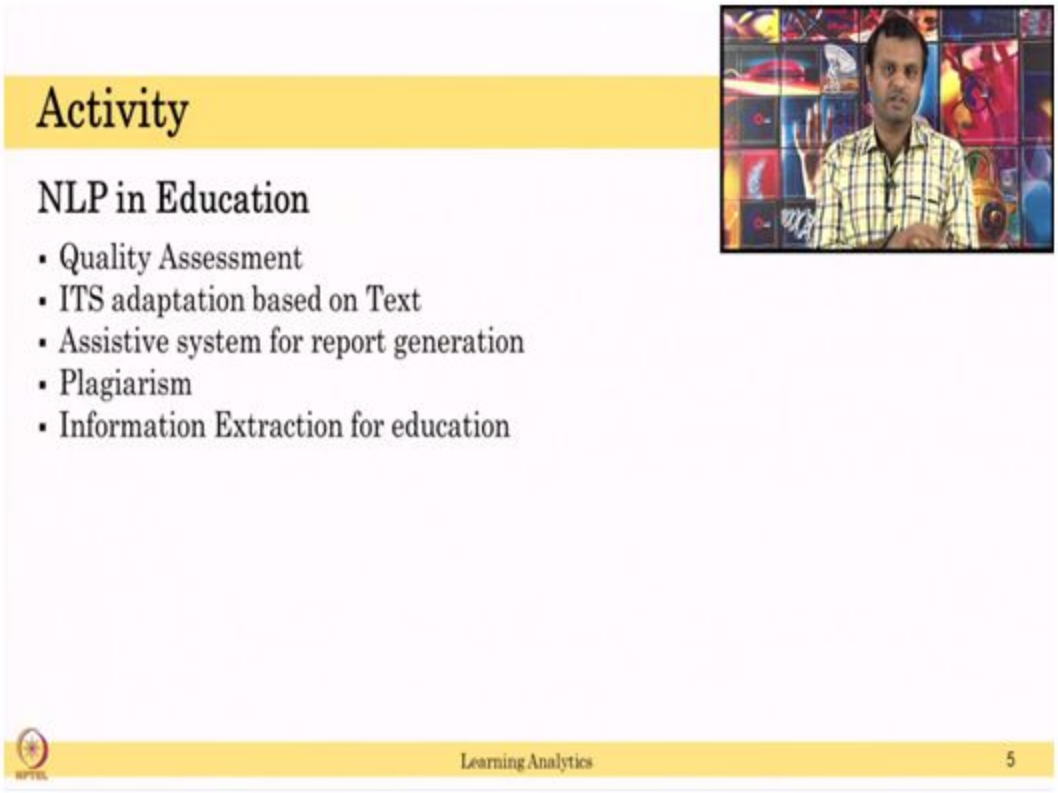

So, I just listed very few of this based on my interaction with some of the students and other participants when they go out and present this talk about NLP or Text Analytics to the students or other participants. And these are the answers, there are a lot of possible answers, like Quality Assessment of the content, you can check whether the content is really good or not. Now you know part of speech, you know the identifiers, whether the sentence is written correctly or not, whether the sentence has a proper sentence, the quality of writing, the spelling mistakes, everything can be automatically identified.

And that is interesting. And Intelligent Tutoring Systems so can adapt based on the text input feedback from the students. Till now I was talking about Intelligent Tutoring Systems can add up feedback and content based on the student's interaction, given their clicks or their responses and the assessment. But they are writing feedback, they are writing in the forum, that can be also used to provide content feedback that it is very interesting but nobody has done it.

An interesting suggestion is one of the participants where I presented this. And Assistive systems for report generation, that is very important. And you can also use this to detect plagiarism and

exactly what was happening in plagiarism detectors like Turnitin, all the existing plagiarism detection software use natural language processing. And Information Extraction for education, it has not been done quietly, not very popular. extracting the information of educational context.

IEE(Information extraction for education) has been done for movie industries, other industries banking, marketing and all these things, but for education, you might able to create a concept map of concepts we are teaching in your education, your domain or in your topic, all these things can be done automatically, and that is also interesting to see. Very interesting application areas of NLP, most of them are still in infant level, infancy level. So, go ahead and try if you are interested in NLP and learning environment.

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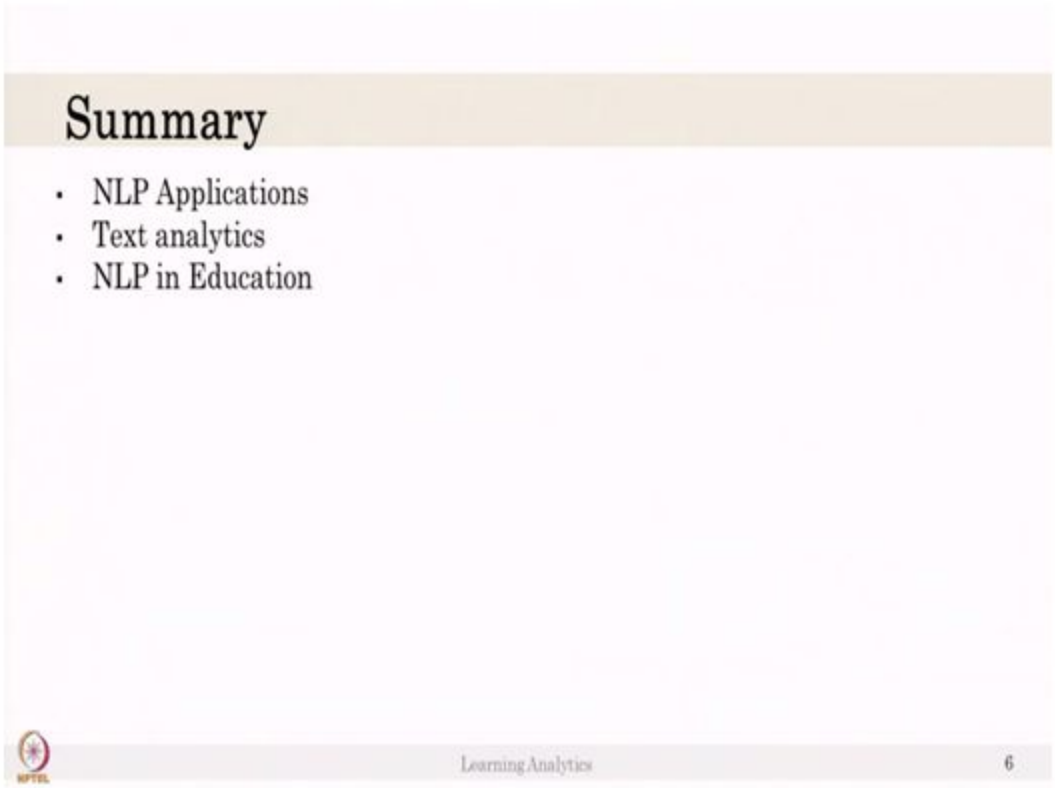

So in this video, we saw what is NLP application, but this week we saw Text Analytics and why NLP is important for education. Thank you.