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Natural Language Processing and its Use in Education

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Abstract - Natural Language Processing (NLP) is an effective approach for bringing improvement in educational setting. Implementing NLP involves initiating the process of learning through the natural acquisition in the educational systems. It is based on effective approaches for providing a solution for various problems and issues in education. Natural Language Processing provides solution in a variety of different fields associated with the social and cultural context of language learning. It is an effective approach for teachers, students, authors and educators for providing assistance for writing, analysis, and assessment procedures. Natural Language Processing is widely integrated with the large number of educational contexts such as research, science, linguistics, e-learning, evaluations system, and contributes resulting positive outcomes in other educational settings such as schools, higher education system, and universities. The paper aims to address the process of natural language learning and its implication in the educational settings. The study also highlights how NLP can be utilized with scientific computer programs to enhance the process of education. The study follows qualitative approach. Data is collected from the secondary resources in order to identify problems faced by the teachers and students for understanding the context due to obstacles of language. Results provide effectiveness of linguistic tools such as grammar, syntax, and textual patterns that are fairly productive in educational context for learning and assessment.

Keywords*: *Natural Language Processing; education; application; e-learning; scientific studies; educational system

1. Introduction

Natural language process is an effective process to assist students in the process of scientific[1] learning. Implementing NLP in the educational setting not only helps in developing effective language process, but it is also significant for enhancing the academic performance. The NLP techniques follow the approach of the natural process of language acquisition integrated with the scientific approach of using computer programs.

1.1. History Of NLP In Education

The approach in NLP is more focused on developing educational software systems and educational strategies that can assist in utilizing the natural languages for education, for example, e-rater and Text Adaptor.[2] The software systems with the NLP have the ability to identify the process of language learning in natural processing.

2. Natural Language Processing And Education

Natural Language processing has various applications for educational purpose. It is very significant to develop new software systems and advanced techniques in the educational settings. The major purpose of using NLP in educational

setting is to bring improvement in the educational system by implementing efficient and effective policies, which can assist in utilizing advance technologies for the bringing improvement in the educational system. For example, application of NLP in education for e -learning is very significant approach, which assist in producing educational material with technological development. Another significance of NLP application is the participation of both teachers and students. There are a number of various electronic, online sources available in English language, which assists students and teachers to access materials. Apart from the convenience of availability of large number of online resources, another major concern is associated with the increase in use of blogs, Wikipedia, and unreliable resources. This requires intelligent automatic processing for preventing the use of such unreliable resources and promoting the use of authentic resources. Application of NLP in education is also effective for mining, information retrieval, and quality assessment.

Application of Natural Language Processing in Education

There are a number of different effective approaches, which assist in the process of e-learning and using web based current information related to the educational course and curriculum. [6] E-learning applications and tools provide assistance for the learners to improve their education. Teachers also assist their students for enhancing their skills and knowledge for getting current information using the online resources, which assists in getting information from the online sources. NLP is also very effective for providing knowledge and information to the students for application of e-learning and NLP in understanding and dealing with the need of analyzing text. Understanding of text is based on the development of research-based analysis of the general and contextual learning. Based on the research outcome, it is clear that students' output can be increased by implementing the NLP in the education. NLP is very effective approach for developing the understanding of students in the natural settings and assessing the information available from the various sources. The better understanding of information and ability to access the information from large amount of data available on websites and other online sources can assist in generating and gathering information. NLP in the educational context, it is clear that NLP can be effectively applied for academic writing, assessment purposes, writing tests questions, and utilizing automatic writing systems for preparation of objective tests etc. The application of NLP in education system is also very effective for analysis of errors in objective assessments and for the assessment of essays. Various linguistic approaches and tools can be utilized for analyzing the errors such as grammatical and stylistic errors. Teachers can easily mark these errors in the papers of students. There are various effective grammar checkers and evaluation sources, which assist in resolving the problems of dealing with the current process of learning. Teachers can use NLP for assessment of multiple-choice questions and analysis of grammatical pattern in the text that needed to be analyzed. The application of Standard e-learning method is very effective in order to ensure that student can efficiently apply the data in the e-learning system. This approach is not only affective for its application in assessment, but it is also effective for writing purposes such as writing material for digital libraries, websites, and various other sources.

(i) Text Evaluator® Capability

For getting valid and reliable feedback about the complexity characteristic of reading passages selected for use in instruction and assessment, to determine an appropriate grade-level classification for a text, Text evaluator can be used. Text evaluator is designed to evaluate any edited text(informational text, literary text and text a mixture of both informational an literal elements) that is formatted as continuous prose.

It has not been designed to evaluate texts with syntax, spelling and word choice errors. It is a tool which represents a new approach for modeling text complexity, designed to help test developers evaluate source material for use in developing new reading comprehension passage and items. The Text Evaluator tool combines large, cognitive based feature set with advanced psychometric technique in order to provide text complexity classification that are highly correlated with classifications provided by experienced educators.

(ii) LanguageMuse Application

LanguageMuse is a web-based, instructional authoring application intended to support teachers in the development of curricular materials for English-language learners (ELLs). The application offers linguistic feedback that highlights vocabulary, sentence structures and discourse relations found in classroom texts that may be unfamiliar to ELLs. The linguistic feedback supports teachers in creating linguistically-informed lesson plans, texts, activities and assessments with appropriate scaffolding. The LanguageMuse application has been used in formal teacher professional development settings to help teachers cultivate linguistic awareness so that they are better able to create a curriculum that addresses students' English language learning needs. The application contains self-guided professional development, so teachers can complete that portion on their own and continue to use the application in the classrooms to more easily design scaffolded materials appropriate to every grade level.

(iii) Automated Test Item Generation

Another area in which ETS has applied its natural language processing technology is in the automated generation of test items. This includes research both on completely automated generation of items from item models (in order to reduce the cost of item development and control item difficulty) and semi-automated item creation tools to help assessment . developers identify appropriate source material for items or create draft items that can be augmented and edited by experienced item writers.

(iv) Writing Mentor

The Witing Mentor application is a Google Docs writing support add-on. The app targets a wide range of postsecondary users, including struggling writers and English learner (EL) populations enrolled in 2- and 4- year colleges. The app is intended to provide one-stop-shopping for writers who are looking for some writing help. Students who are using Google Docs can install the app and use it to get feedback for text — specifically, actionable feedback about their writing related to claims and sources, topic development, coherence, and English conventions and word choice. Feedback leverages ETS's natural language processing (NLP) capabilities and lexical resources, and synonyms for unfamiliar words they may encounter while reading external sources. In addition to feedback, the app provides a report illustrating the different feedback types that the user viewed. The report can be saved as a PDF file to show to their instructor. It can give the instructor a sense of how their students may be engaging with the tool, and what aspects of writing they are working on.

3. Teaching about Language

One of the oldest yet still very active educational application areas for NLP involves language assessment. Summative language assessment typically involves evaluating assessment. Summative language assessment typically involves evaluating student proficiency in reading, writing, or speaking a first or sec-ond language (e.g., grading an essay as in in automated es-say scoring (Shermis and Burstein 2013)) as an end in itself. Formative language assessment, in contrast, typically evalu-ates student work to support downstream activities such as human or machine tutoring to improve current proficiency. Work in language assessment uses NLP to assess typed or spoken student artifacts with respect to linguistic dimen-sion(s). Syntactic analysis has been used to detect and poten-tially correct writing errors such as incorrect preposition us-

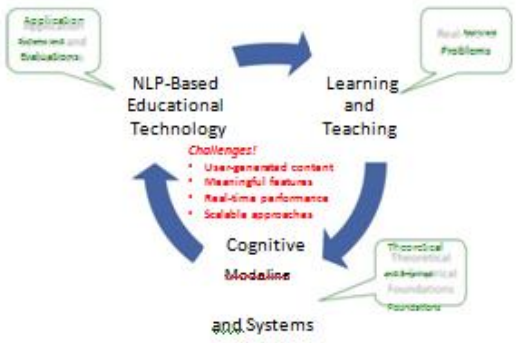

Figure 2: Typical NLP for education research lifecycle

age for populations such as ESL or deaf students (Michaud and McCoy 2006; Tetreault and Chodorow 2008; Gamon et al. 2008). Since standard “proofreading” tools do not focus on errors that are particularly important for language learn-ers, a grammatical error detection community has emerged to address this particular need (Leacock et al. 2010). There is also interest in exploring whether methods for detecting the errors of machine translation systems might be applicable to language learners (Xue and Hwa 2010).[3] analysis of discourse has been used to score the co-herence of student essays .

This has helped expand research from the analysis of writing gen-erated during standardized assessment to more classroom-oriented types of writing. In addition,[2]because some MOOC platforms use student peers rather than automated systems to grade writing due to concerns about poor reliability and/or validity of automated systems, semi- rather than fully- automated assessment methods are being explored. Even within the field of standardized assessment, a wider vari-ety of writing tasks are being considered.

Research address-ing the challenges generated by such expansions include modifying classic assessment methods to deal with nois-ier student inputs (e.g., from younger automating new types of assessments for tasks such as source-based writing , argumentative discourse, summary writing and picture-based story narration and using automated assessment to scaffold human peer grading . With respect to speech, the needs of language assessment will likely require a modification of supporting technologies such as speech recognition and spoken dialogue systems, since language learners are more likely to speak with incorrect pronunciation and to use incorrect lexical and grammatical structures. Nevertheless, McGraw and Seneff (2007) sug-gest that language learning applications have properties such as user tolerance or pedagogical value of system errors that system designers can exploit to yield robust systems - at least from the speech and language perspective. educational technology systems suggest that some aspects of student writing can improve after re-ceiving formative feedback from an automated scoring sys-tem much work remains to be done to improve the utility of such systems. For example, Chapelle et al. (2015) found that nearly 50% of the system’s feedback was not addressed by students; also, the primary revision type was just chang-ing a word/phrase.

My own work in language assessment is largely focused on both the summative and formative assessment of argu-mentative dimensions of source-based writing at the upper elementary school level which provides opportunities for tackling many of the research challenges noted above. For example, organization as con-ceived by our grading rubric concerns how well pieces of evidence provided from a source text are organized to make a strong argument. This has led to the development of a new method for analyzing discourse coherence at the top-ical rather than the lexical level (Rahimi et al. 2015).

papers (Nguyen and Litman 2015), and for classifying revisions of such papers with respect to argumen-tative purposes (Zhang and Litman 2015).

In ad-dition, because our essays are written by students in grades 4-8, they are shorter, contain more grammatical and spelling errors, and are less sophisticated in terms of use and organi-zation of evidence compared to writing

from older students. We have thus had to tackle the challenges of modifying prior computational techniques to be robust with such data. Fi-nally, due to our long-term goal of supporting both summa-tive and formative

assessments, our scoring model required the development

of new features to reflect the detailed cri-teria of human grading rubrics for evidence and organization. I am also de-veloping techniques for argument mining in high school and college student

4. Open Source NLP Libraries

These libraries provide the algorithmic building blocks of NLP in real-world applications. Algorithm provides a free API endpoint for many of these algorithms, without ever having to setup or provision servers and infrastructure.

• Apache OpenNLP: a machine learning toolkit that provides tokenizers, sentence segmentation, part-of-speech tagging, named entity extraction, chunking, parsing, coreference resolution, and more.

• Natural Language Toolkit (NLTK): a Python library that provides modules for processing text, classifying, tokenizing, stemming, tagging, parsing, and more.

• Standford NLP: a suite of NLP tools that provide part-of-speech tagging, the named entity recognizer, coreference resolutionsystem, sentiment analysis, and more.

• MALLET: a Java package that provides Latent Dirichlet Allocation, document classification, clustering, topic modeling, information extraction, and more.

5. Natural Language Processing Examples

• Use Summarizer to automatically summarize a block of text, exacting topic sentences, and ignoring the rest.

• Generate keyword topic tags from a document using LDA (Latent Dirichlet Allocation), which determines the most relevant words from a document. This algorithm is at the heart of the Auto-Tag and Auto-Tag URL microservices.

• Sentiment Analysis, based on StanfordNLP, can be used to identify the feeling, opinion, or belief of a statement, from very negative, to neutral, to very positive. Often, developers with use an algorithm to identify the sentiment of a term in a sentence, or use sentiment analysis to analyze social media

• NLP algorithms can be extremely helpful for web developers, providing them with the turnkey tools needed to create advanced applications, and prototypes.

4. CONCLUSIONS

In conclusion, Natural Language Processing and its Educational Application provide a perfect solution to the various problems and barriers in the educational system, which result in affecting the academic progress and learning of the students. Language is one of the major concerns for the students. NLP with an effective approach for assisting the progress and improvement in the learning ability of students based on development and implementation of various effective tools, assist writing, learning, and assessment of texts, such as use of search engines, electronic resources and analysis of grammatical construction, syntax, sentence composition, etc.

All these are the effective techniques, which can be utilized to develop the structural framework for analysis of texts. The use of grammar, syntax, and sentence composition can be efficiently utilized through linguistics software systems such as grammar checkers, which are saves times and provides assistance for both teachers and learners. Therefore, there is need for developing effective approach for the social and cultural perspectives. Implementation of NLP is also effective for using the e-learning approach in order to understand and learn from the data available from the electronic sources. There are also future implementations of this research, which can assists in identifying the complex pattern in language. Further research can be conducted to identify its impact in individual learning, understanding of context, and effectiveness of NLP in writing and assessment procedure.

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