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FROM AN ARTIFICIAL NEURAL NETWORK TO TEACHING [ABSTRACT]

Dror Mughaz *	Dept. of Computer Science, Bar-Ilan University, Ramat-Gan, Israel, and Dept. of Computer Science, Lev Academic Center, Jerusalem, Israel	myghaz@gmail.com
Michael Cohen	Dept. of Computer Science, Lev Academic Center, Jerusalem, Israel	michael.co24@gmail.com
Sagit Mejahez	Ministry of Education, Jerusalem, Israel	sagmej@gmail.com
Tal Ades	Dept. of Computer Science, Lev Academic Center, Jerusalem, Israel	talades8@gmail.com
Dan Bouhnik	Dept. of Computer Science, Lev Academic Center, Jerusalem, Israel, and Dept. of Information Science, Bar-Ilan University, Ramat-Gan, Israel	dan.bouhnik@biu.ac.il

ABSTRACT

Aim/Purpose	Using Artificial Intelligence with Deep Learning (DL) techniques, which mimic the action of the brain, to improve a student's grammar learning process. Finding the subject of a sentence using DL, and learning, by way of this computer field, to analyze human learning processes and mistakes. In addition, showing Artificial Intelligence learning processes, with and without a general overview of the problem that it is under examination. Applying the idea of the general perspective that the network gets on the sentences and deriving recommendations from this for teaching processes.
Background	We looked for common patterns of computer errors and human grammar mistakes. Also deducing the neural network's learning process, deriving conclusions, and applying concepts from this process to the process of human learning.
Methodology	We used DL technologies and research methods. After analysis, we built models from three types of complex neuronal networks – LSTM, Bi-LSTM, and GRU – with sequence-to-sequence architecture. After this, we combined the sequence-to-sequence architecture model with the attention mechanism that gives a general overview of the input that the network receives.

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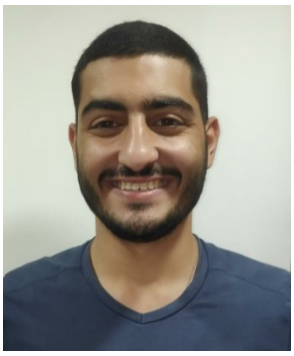
Contribution	The cost of computer applications is cheaper than that of manual human effort, and the availability of a computer program is much greater than that of humans to perform the same task. Thus, using computer applications, we can get many desired examples of mistakes without having to pay humans to perform the same task. Understanding the mistakes of the machine can help us to understand the human mistakes, because the human brain is the model of the artificial neural network. This way, we can facilitate the student learning process by teaching students not to make mistakes that we have seen made by the artificial neural network. We hope that with the method we have developed, it will be easier for teachers to discover common mistakes in students' work before starting to teach them. In addition, we show that a "general explanation" of the issue under study can help the teaching and learning process.
Findings	We performed the test case on the Hebrew language. From the mistakes we received from the computerized neuronal networks model we built, we were able to classify common human errors. That is, we were able to find a correspondence between machine mistakes and student mistakes.
Recommendations for Practitioners	Use an artificial neural network to discover mistakes, and teach students not to make those mistakes. We recommend that before the teacher begins teaching a new topic, he or she gives a general explanation of the problems this topic deals with, and how to solve them.
Recommendations for Researchers	To use machines that simulate the learning processes of the human brain, and study if we can thus learn about human learning processes.
Impact on Society	When the computer makes the same mistakes as a human would, it is very easy to learn from those mistakes and improve the study process. The fact that machine and humans make similar mistakes is a valuable insight, especially in the field of education, Since we can generate and analyze computer system errors instead of doing a survey of humans (who make mistakes similar to those of the machine); the teaching process becomes cheaper and more efficient.
Future Research	We plan to create an automatic grammar-mistakes maker (for instance, by giving the artificial neural network only a tiny data-set to learn from) and ask the students to correct the errors made. In this way, the students will practice on the material in a focused manner. We plan to apply these techniques to other education subfields and, also, to non-educational fields. As far as we know, this is the first study to go in this direction – instead of looking at organisms and building machines, to look at machines and learn about organisms.
Keywords	deep-learning, text-mining, Hebrew, subject-tagger

BIOGRAPHIES

Dror Mughaz is a doctoral student in the Department of Computer Science at Bar-Ilan University (BIU) under the supervision of Professor Yaakov HaCohen-Kerner and Professor Dov Gabbay. Dror is also a lecturer at the Computer Science Department in the Jerusalem College of Technology (JCT). Dror is a co-author of 20 papers. Dror's current main research is in Text Mining of temporal issues. Other research fields that he works on are text clustering, citation extraction and analysis, word embedding, n-gram embedding, opinion mining, features and key-phrase extraction, data enrichment and author verification. Much of his research was done on Hebrew texts with a focus on rabbinical texts. He was a member of COST research actions of the EU.

Michael Cohen is a B.Sc student in the Department of Computer Science and M.Ba student in the Department of Business Administration & Data Science at Jerusalem College of Technology. Michael's main research is in NLP By dedicating relations in Hebrew sentences with Keras & Tensorflow. Other research fields that he works on are text analysis, Big-Data solutions for data scientists, scalable data flows, data routing, transformation, and system mediation logic. Among other things Michael is a Backend Big Data Developer.

Sagit Mejahez holds an M.A. degree in Education Systems Administration from the Or Yehuda Center for Academic Studies. She holds a B.A. degree from the Department of Jewish art and from the Department of Land of Israel Studies and Archaeology she also holds a teaching certificate from Bar Ilan University. Sagit is an educator and teacher in the Ministry of Education of the State of Israel she. She has over 20 years of experience in different teaching & management positions in the elementary, middle and high schools. During her career Sagit put a special emphasis on integrating new technologies in the teaching processes. Today, her main job is elementary school education and teaching. As part of her work, she managed a young division in a heterogeneous population school. She taught in middle schools and she worked at a high school for high-risk youth in order to keep them in the community. Today Sagit is a second grade educator.



Tal Ades is a graduated B.Sc in the Department of Computer Science and M.Ba student in the Department of Business Administration & Data Science at Jerusalem College of Technology. Tal's main reaserch is in NLP By dedicating relations in Hebrew sentences with Keras & Tensorflow. Other fields of interest which he works on are fullstack web programming. Among these things Tal is a java real time backend developer.

Prof. Dan Bouhnik is the head of the Engineering and Computer Science Department in the Jerusalem College of Technology (JCT) and a faculty member in the Information Science Department in Bar Ilan University (BIU) in Israel. He is the author of a number of books used for teaching advanced computer sciences and his professional interests include knowledge management, information Security, Big Data and the infusion of new technologies in the learning environment.