Modern technology has shifted the human species into an era of accommodation, global connection, and information accessibility. Our technology continues to surpass the expectations and imaginations of just about everyone. Furthermore, software technology branched into almost every filed of work and can even replace the need of a human employee in some instances. One current example of this is the recent public release of Artificial Intelligence programs capable of producing artworks. This software was able to compete and win an art competition from the Colorado State fair [1]. Now if an AI is capable of creating pieces of art well enough to win competitions, are they capable of competing in other forms of art such as a debate competition? Well, that is what one team of researchers wanted to find out.

Publish by *The International Journal of Science* on March 18, 2021, the article was written and worked on by a team of fifty-three people. Lead by Noam Slonim, this team designed an artificial intelligence that could be capable of compete against a simplistic version of a parliamentary debate. Their system had to manufacture an opening speech, a second rebuttal speech, and a closing statement for the debate. The system accomplished these tasks through its sophisticated architecture, appropriate data sources to feed the machine, and implementation of neural and knowledge-based methods. [2]

When it's put to the test, the system, or Project Debater, first initiates its Argument Mining module. Argument Mining module will first decompose a corpus of 400 million newspapers [2] into sentences so that the information can be indexed based by Wikipedia references, mentioned entities, and predefined lexicon words. Once the system is online, the module moves on its second stage in where it retains relevant claims, evidence, arguments of its position, and even arguments beyond the scope of its current arguments. Project Debater accomplish this via queue in sentences with high propensity, using a neural model to rank the high propensity sentences to

the probability of their relevant arguments, and implementing a combination of neural and knowledge-based methods to classify stance of every argument.

The next module that Project Debater executes is the AKB (Argument Knowledge Base) which contributes to the system's rebuttal module and filters the commonalities of different debates, quotes, analogies, and counterarguments. This is in efforts to have diver's library of texts that might be related to the generality of the debate topic. The article provides a great example of this in action, as stated in "An Autonomous Debating System" they said, "when debating whether to ban certain substances or activities, the system can exploit more general arguments relating to the emergence of a black market." [2].

The Argument Rebuttal is the penultimate module of Project Debater. In this module, Project Debater predicts claims the opponent might mention by using the previous two modules and extractions from a debate database called iDebate. The system needs a way to listen to the opponents' arguments, so the team implemented IBM's Watson to feed Project Debater speech to text documents. With knowledge of what their opponent said, the system will cross reference pre-identified claims with the opponent's statements to propose a rebuttal. [2]

The final module of Project Debater conjuncts all the information gathers from the previous modules and utilizes a rule-based system that uses cluster analysis to thematically sort each argument in clusters. This is where the debate is constructed and has the most NLP implementation. This module goes through each clustered sentence to apply various text normalizations and rephrasing to generate a paragraph from a pre-defined template. But to do that it must filter contents that are apart of the debate topic to begin with. [2]

In the end, Slonim's team compared their Project debater's speech along with three other AI debate machines against four speeches written by humans, two of which were opening speeches. With the judges/annotators left in the dark in the origin of these eight speeches, they unknowingly rated Project Debate's speech a neutral score of three and for 50 out of 78 statements had an above average score of four. This demonstrates that even a well-trained AI would only perform a decent stance in comparison to a human. While this would show that Artificial Intelligence could possibly be apart of debate, this game environment is far from the reality of competitive Debate contest. As stated in the article "annotators consider only S1 and S3, and the comparison is with simple controls rather than the performance of an experienced debater participating in a full debate" [2]. Furthermore, this type of game is far beyond a typical AI would attempt to compete against as debate competitions typically do not have a concise winner and loser. This game is also not an open state game, where all the information is openly available to every player. There is also no definitive strategy of winning a debate competition as the audience has some weight in determining the better debater. Lastly, the lack of data in debate competition of every possible subject will not be enough for an AI to properly compete.

It is thanks to these people; we can really see the capabilities of Artificial Intelligence competing against humans in competitions outside of the current comfort zone of AI. This article helps future software engineers of artificial intelligence to know the capabilities of this developing technology and may even set a few goals to be accomplished. Between all fifty-three people that contribute to this article, it is safe to say that Ranit Aharonov, the advisor of this team, has the most citations.

List of authors:

1. Noam Slonim   2. Yonatan Bilu   3. Carlos Alzate

4. Roy Bar-Haim

5. Ben Bogin

6. Francesca Bonin

7. Leshem Choshen

8. Edo Cohen-Karlik

9. Lena Dankin

10. Lilach Edelstein

11. Liat Ein-Dor

12. Roni Friedman-Melamed

13. Assaf Gavron

14. Ariel Gera

15. Martin Gleize

16. Shai Gretz

17. Dan Gutfreund

18. Alon Halfon

19. Daniel Hershcovich

20. Ron Hoory

21. Yufang Hou

22. Shay Hummel

23. Michal Jacovi

24. Charles Jochim

25. Yoav Kantor

26. Yoav Katz

27. David Konopnicki

28. Zvi Kons

29. Lili Kotlerman

30. Dalia Krieger

31. Dan Lahav

32. Tamar Lavee

33. Ran Levy

34. Naftali Liberman

35. Yosi Mass

36. Amir Menczel

37. Shachar Mirkin

38. Guy Moshkowich

39. Shila Ofek-Koifman

40. Matan Orbach

41. Ella Rabinovich

42. Ruty Rinott

43. Slava Shechtman

44. Dafna Sheinwald

45. Eyal Shnarch

46. Ilya Shnayderman

47. Aya Soffer

48. Artem Spector

49. Benjamin Sznajder

50. Assaf Toledo

51. Orith Toledo-Ronen

52. Elad Venezian

53. Ranit Aharonov

[1]   Kevin Roose, A*n A.I.-Generated Picture Won an Art Prize. Artists Aren't Happy.*, *The New York Times,* https://www.nytimes.com/2022/09/02/technology/ai-artificial-intelligence-artists.html?smid=url-share, [Accessed November 15, 2022].

[2]   Slonim, N., Bilu, Y., Alzate, C. *et al.* An autonomous debating system. *Nature* **591**, 379–384 (2021). https://doi.org/10.1038/s41586-021-03215-w