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Proposal to Develop a Chat Bot Using Deep Neural Network Architecture

Recent studies show that the progress of artificial chat bot has gradually slows down due to the difficult of natural language processing. In September 2016, Google updated its translation system using deep neural network architecture. The improvement Google Translator has on its natural language processing provides a hope that the deep neural network can also be used in developing chat bots. Therefore, I propose to start a research project to develop the first artificial conversational entity with deep neural network architecture. The result of the project will have significant influences to the entire computer sciences society, especially to those who study artificial intelligence. The goal for this project is to develop a human-like chat bot that can pass the Turing test with a result higher than 40%. With the power of neural network, and the support of the department, I certainly believe our goal is achievable.

Since Alan Turing first proposed his measurement of machine intelligence in 1950, Turing Test became the main constrain to determine whether a chat bot is considered intelligent or not. Over 60 years, only one artificial chat bot has passed the Turing Test. However, a recent study showed that even Eugene Goostman is the first chat bot that passed the Turing Test, many people still think it is machinelike after they had a conversation with Eugene. In October 2015, the Google DeepMind team used deep neural network to developed a computer Go program that

became the first AI who defeat a top ranking professional Go player. Similar architecture was used to test if deep neural network can improve the performance of natural language processing. According to Ronan Collobert and Jason Weston's study, they were able to use deep neural network architecture to significantly improve the correctness when performing semantic role labeling task without any explicit syntactic features. In September 2016, Google successfully used deep neural network to improve the correctness of Google Translator by more than 60%.

All these examples provide a sign of hope that we can use deep neural network architecture and training policies to improve the performance of chat bots. In theory, an ideally human-like chat bot will "listen" from the user, and replies appropriate message back to keep the conversation going. This means that the chat bot not only needs to understand the meaning of the statement, but also to combine the previous conversation to computer the most appropriate reply. This ultimately maximized the difficult of the problem. However, by using deep neural network and different training policies, I have the confidence that our team will develop the most human-like artificial conversational entity.

In this project, my research team will be constructing two different deep neural networks, the RP network, and DP network. The RP network will be used to handle natural language process, and the DP network will be used to generate solutions. When the user inputs a string of message, the RP network will phrase the string down through several different layers to and matches different phases to its corresponding value to determine the meaning of the string. The string will then be store into a self-expand database, which contain data about the previous conversation. After the string is processed, the DP network will search through the network to construct the most reasonable reply based on the previous data, it will then send the data to RP network. The RP network compiles the data from its bottom network to the top to generate the

corresponding reply. Unlike the two neural networks AlphaGo has, which perform the decision separately, the DP and RP network will simultaneously transfer data between each other.

Theoretically, such structure will improve the performance in both speed and correctness. After we construct the network and related algorithms, we will first train our chat bot with ordinary human conversations. With large enough data, the program start to be human like. After that, we will allow the program to perform self-training by having conversation with itself. The self-learning procedure will allow the chat bot to constantly improve its communication skills. I believe that with enough conversation, our chat bot will develop a unique “personality” just like every human being.

To examine the result of our product, our research team will randomly select 100 students and faculties around the campus. The candidates will be categorized based on their gender, age, ethnicity and major. Each candidate will have 5 minutes conversation with our program. After they are done with the conversation, the candidates should give a rating from 0 to 100, where 0 means machine like and 100 means human like. According to a previous study, Eugene Goostman scored a 63.56 out of 100 in a similar experiment. If our program scored better than Eugene Goostman, it means our chat bot is more human like. We will then send our program to compete the Turing test. The result for all these experiment will be present in our report with different graphs to visually present the significant of our data.

Since the project will require significant amount time to design and develop. It will be the best to form a 10 people research group to keep the project go smoothly. These research members should have outstanding skill in algorithm analyze and design and have a strong research background in deep neural network. I will also request to have access to one of the rooms in the new computer science building as our research base. The project should take

approximately 1 year to complete. We will delivery monthly progress reports to present the current progress of the project.

As mentioned previously, if we successfully accomplish the goal, the result of the project can be guarantee as a groundbreaking in the field of artificial intelligence. The program will not only extend the possibility of neural work's usage in other scientific fields, but also enrich our limited knowledge about artificial intelligence. Furthermore, if our project succeeds, we can start to combine machine learning, natural language processing and problem solving together to develop an actual AI that acts like a real human. This is the key to the progress of artificial intelligence, thus, I once again propose this research project.

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