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CS461 – Artificial Intelligence Homework 5

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Introduction

In this homework, we were required to investigate the artificial intelligence LUIS (Language Understanding Intelligent Service), which is a machine learning-based service to build NLP (Natural Language Processing) into WEB and IoT (Internet of Things) applications. The specific demo [1] that we are required to investigate shows a picture of a house with several lights in four rooms. The rooms are given as bedroom, study room, living room and kitchen. We also observe a textbox in order to present statements to the AI, so that appropriate action is taken. The start state of the page is presented below.

Figure 1 – Opening Page of the Demo [1]

In the page, we observe many preset suggestions that are offered. These are given such that their working is already tested and proved. Since we can only integrate with this AI using a black box approach, meaning we can only give inputs and observe outputs, we will be using similar commands that look like the preset suggestions but different in meaning to observe if the model is generalized enough. Furthermore, in the footnote, we are recommended to place the comments

on the bottom of the screenshot, however for purposes of readability, we have placed the intention of the command, the output and the comment in that order.

1- I can't find the spoon.

This statement is an altered version of the preset statement "I can't find the remote." When that command is executed, the lights on the living room are turned on. This is a meaningful response since the remote is an object that can be associated with the living room. Hence, we have run the statement "I can't find the spoon" in order to observe if the lights on the kitchen will turn on, since "spoon" is a noun related with the kitchen than other rooms. The output is as follows.

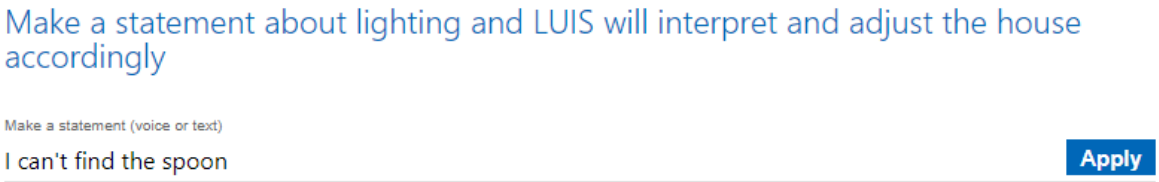

Figure 2 – The response of "I can't find the spoon"

Here, we observe that the AI did not perform the way we hypothesized. We initially thought that only the kitchen lights will turn on but all the lights in the house has turned on. We believe that this is due to the algorithm inspecting the sentence by dividing it into parts. In that case LUIS was able to understand the phrase "I can't find" and was able to turn on the lights however, the noun

"spoon" was unrecognizable so it could not understand which light to turn on and turned them all on as a result.

2- It's time to study.

In the second statement, we have tried a variation of the statement "It's time to go to sleep", which is a preset suggestion. When that is executed, the algorithm responded by turning off all the lights, which was an expected outcome. Hence, we have run "It's time to study" with the expectation of the lights turning off except the lights in the study room. The response is given below.

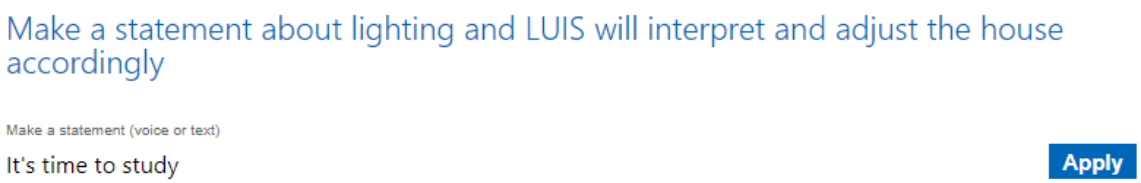

Figure 3 – The response of "It's time to study"

Here we observe that all the lights in the house turned off. This was not the outcome that we have expected. We believe that the algorithm overfit to the phrase "It's time to" and it doesn't comprehend that the object of the sentence could change the meaning of the sentence and the way the result should behave. We believe this is due to the framework of LUIS. We believe that the

top scoring “intent” extracted from the sentence is “time” hence it is correlated with the preset response of turning the lights off.

3- Turn on kitchen. / Turn on kitchen lights.

In this part we have observed two very similar statements instead of one. In a completely dark setting, we have tried to open only the kitchen’s lights. Hence, we have prepared these two command statements: “Turn on kitchen.” and “Turn on kitchen lights.”. The responses of LUIS are presented in the next page.

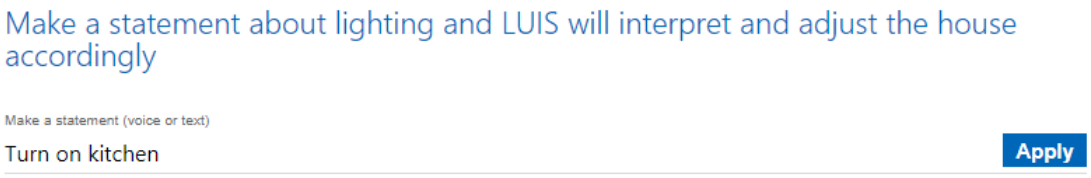

Figure 4 – The response of “Turn on kitchen”

Figure 5 - The response of "Turn on kitchen lights"

Here, we see that the AI correctly applying what we have requested by "turning on" the "kitchen" in Figure 4. Then, we try the second statement and the outcome is not what we expected. Instead of turning on only the "kitchen" lights, the algorithm preferred to open all the "lights". We observe that the weight of the word "lights" suppressing the weight of the word "kitchen", making it more important. The solution to that might be to retrain the machine learning algorithm according to the word phrases and not the words only.

4- Turn on the outer door. / Turn on the outer door light.

With these statements, we aim to investigate the issue in the 3rd section even further. In the house, there exists a lighting on the outer door of the house opened with the preset suggestion "I'm expecting guests". In this part, we aim to open the outer door lights with two separate commands: "Turn on the outer door" and "Turn on the outer door light". The outputs are as follows.

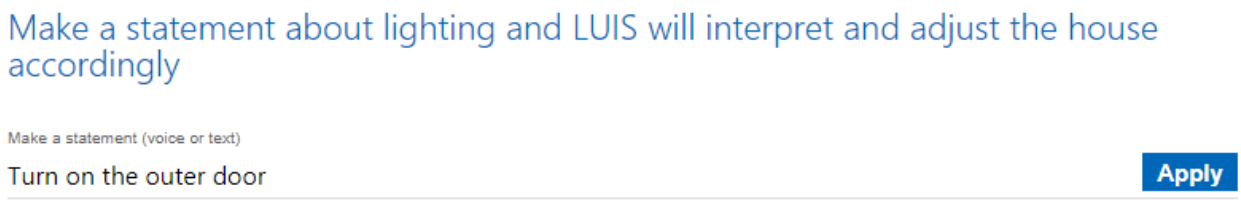

Figure 6 - The response of “Turn on the outer door”

With this command, we saw that the outer door lights did not turn on, furthermore, the lights inside the house are turned on and got brighter. This was not the expected output for this statement. LUIS was not able to recognize the “outer door” as it did with the “kitchen” word. Then we try the other statement from the starting state.

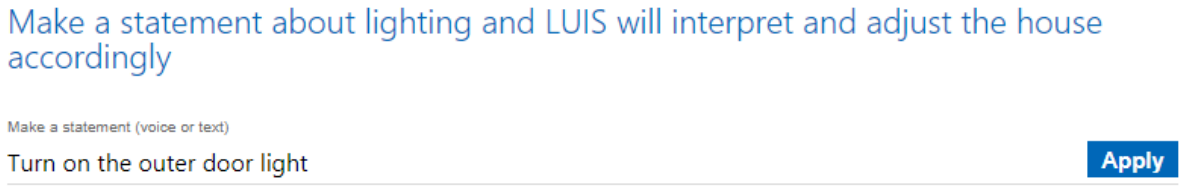

Figure 7 - The response of "Turn on the outer door light"

This time, we see that LUIS has understood our intention. On the contrary with the 3rd part, LUIS was able to understand the "outer door light" instead of "outer door". This can be because we are commanding about a specific light and not a room structure that contains many lights inside it. To improve this behavior, we believe that outside/out should be considered as a field entity like the kitchen.

5- I need more light to study.

The objective of this statement is to observe if the behavior observed in the commands "I need more light to read my book" and "I need more light to cut carrots". In the first statement, we observe that a dim lighting is placed on the bedroom in a completely dark setting (we turn all the lights off with "turn off" statement). We see the same behavior on the kitchen with the second statement. Hence, this is the response when the command is applied.

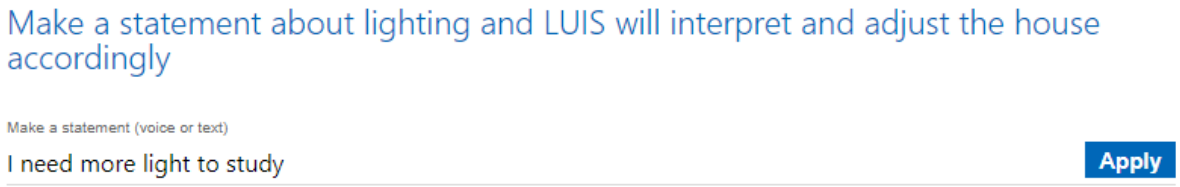

Figure 7 - The response of “I need more light to study”

We see that LUIS was able to understand our intentions with this command, which shows that the “I need more light to” structure is generalized enough to branch out for different verb phrases. We are impressed that LUIS learned this complex sentence structure.

References

[1] “AI Demos,” *AI Demos*. [Online]. Available: https://aidemos.microsoft.com/luis/demo. [Accessed: 15-Dec-2019].