Final Year Project Plan

[Industrial Based]

AI Bot to Make the Best Decision for the Customer

Client: Microsoft Hong Kong

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1. Introduction

People tend to get lost when facing various choices. For companies like Microsoft, they produce a large number of digital products that are quite similar in many aspects. On Microsoft online store, even though all products are classified into different types, within each particular category, customers may still find it an unpleasant experience to distinguish the disparity among models that differ in CPU, RAM or hard disk size, etc. At the retail place, generally it is not possible for sales consultants to take care of every single customer on his or her special needs and make the recommendation accordingly.

Thus, customers are at the risk of failing to select the right product they want, especially for those with little knowledge of the technical specifications of a device. Furthermore, it turns out that people have no idea of the exact performance they expect from a machine until they have actually used it for a certain period of time.

With the huge advancement of natural language processing and machine learning techniques, we intend to create an AI Chat Bot to solve this problem. The bot serves to guide Microsoft customers to spend their money wisely in an interactive and effective manner. By chatting with them in natural languages, the bot is able to discover their characteristics including who they are and what they intend to achieve with the device and finally make the appropriate recommendation for each individual.

The remaining of this project plan proceeds as follows. In the first place, the overall objectives of our product are provided, followed by the project scope. Then, we present our planned implementation steps, methodologies used to achieve our purpose, together with project management details. Next, foreseen risks and corresponding mitigations are clearly stated. Finally, we close with our schedule and deliverables of the project.

2. Objectives

The primary objective of this project is to develop an AI Chat Bot that communicates with customers mainly using online conversations in natural languages and recommend them with the particular product that fits their requirements best. The bot can be hosted on different platform for users to access. Optional functionalities including facial and voice recognition may be added to the bot if time allows. Unlike other existing recommendation bots, ours will stand out because:

- Rather than directly asking customers questions and giving them multiple choice questions, our bot supports natural language communication in both English and Chinese. Customers can type in the chat box and get response immediately in sentences, as if they were chatting with an experienced shop assistant.

• We use machine learning techniques to train the bot and improve the accuracy of recommendations. The bot will also improve its performance during work as well, which means it will become more and more "intelligent" during usage through the process of being trained by more realistic input data.

3. Project Scope

The project scope is comprised of three main aspects, the natural languages supported, the pool of our recommendation results and the host platforms.

3.1. Natural Languages

In this project, we are going to implement the bot to understand English, Traditional Chinese and Simplified Chinese and give response according to the language used by the customer. This is required by our client Microsoft, because these three languages are most widely used in Hong Kong. In addition, no mixture of English and Chinese is allowed at this stage.

3.2. Recommend Models

When making recommendations, the bot will eventually lead customers to the most suitable model or several candidate models that are equivalently good enough to meet their specific demands. According to our first meeting with our client, the models will be initially restricted to Microsoft's own products, including Surface, Xbox and peripherals. Recommendations on other brands (such as HP, Dell) may also be taken into consideration depending on the future negotiation between Microsoft and its partners.

3.3. Host Platforms

The final bot will be hosted on the website of Microsoft HK Online Store as well as Skype. Also, it shall be capable of being hosted on Facebook Messenger since Facebook is one of the most popular social media in Hong Kong.

4. Implementation Steps and Milestones

The implementation will be based on the Bot Framework of Microsoft, the Language Understanding Intelligent Service (LUIS) and Azure Machine Learning Studio (Azure). The implementation will be divided into six phases:

1) Develop a prototype of the bot. The milestone should be a runnable standalone bot that can give pre-defined responses to specific questions and "I don't understand" for anything else.

2) Incorporate the waterfall model into the bot. That means that after this stage, the bot can deal with a conversation as a whole rather than regard them as separate questions. The milestone of this stage is a bot that can respond to queries from users based on previous

conversations. The bot does not need to understand the meaning, which means no machine learning technologies are involved at this stage.

3) Define the language model and train the model using data. This is the core step of our project. A language model can be regard as a program that takes a sentence as input, disassembles it into different grammatical elements, analyzes each element independently and generates the meaning as the output. According to Microsoft side, there is already an language model in the system. We will make a test and decide whether we will use the existing model or define our new one. We also need to collect training data and train the bot. For more details, see Section 5.2 and 5.3. The milestone of this stage is a language model that can understand input text from user.

4) Integrate the language model into the bot framework, and find a suitable recommendation algorithm. The milestone of this stage is that the bot can communicate with the user fluently, give meaningful responses and make recommendations accordingly.

5) Test the bot, beautify the User Interface and integrate the bot into Microsoft online store, Skype and Facebook Messenger. A full set of test cases will be designed and conducted. For more details, see Section 5.3. Because the bot will be used by customers, a beautiful User Interface is also quite necessary. The milestone of this stage is the final product of the bot, with all features implemented and tests passed.

6) Documentation and closure. We will generate several development documents together with the final report. We will also invite our client Microsoft to conduct acceptance testing, sign off on the final version of bot, and all of our deliverables will be transmitted to them afterwards.

5. Methodologies

In this section, we will focus on the 3 key steps of this project: collecting data, training the bot and testing.

5. 1. Collecting data

Data is quite critical in determining the performance and accuracy of our bot. Thus, we will spend some time collecting abundant data from several possible sources. We can obtain a certain amount of data from our client Microsoft. Also, we will visit Microsoft's Facebook page and get some useful data from the comments left by its potential customers. Besides, if needed, some customized data can be generated by ourselves for the training purpose.

5.2. Training the bot

Training the bot is the key step of this project. According to Microsoft side, the training is irreversible, which means we need to have a very careful design before conducting the real

training. The final training method is still pending and we will have several meetings with our supervisor and our client Microsoft before the training process.

5.3. Test case

At the initial stage of testing, we will come up with our own set of questions to be input to the bot, like “Is CPU XXX better than CPU YYY”, to see whether a desired output will be returned. Results of test cases will be stored in a log file with timestamps so that progress of refinement of the bot will be recorded for further development.

After the performance of the bot is improved to a certain stage, a survey will be conducted on a sample of 5 to 10 students from different faculties to have them directly talk to the bot. Their degree of satisfaction and comments will be recorded, like how they will rate their satisfaction from 1 to 10, and which part of responses returned by the bot they find inappropriate, etc.

6. Project Management

Since this is an industrial based project, the progress of the project will be decided together by our team and our client Microsoft. The contact point of Microsoft side is Mr. Samson Lee. There are three members in our team, namely Chen, Huang and Tan. The division of work is roughly as follows:

- **Chen Xusheng Michael:** In charge of the language model in Simplified Chinese and database deployment.
- **Huang Kai Kevin:** In charge of the language model in English, front-end UI and integration into other platforms.
- **Tan Zhanwen Francis:** The contact point of team. In charge of the language model in traditional Chinese and training the robot.

7. Risks & Mitigations

The list of the risks will be updated during the process of the project.

ID	Summary	Impact (1 = very minor, 10 = catastrophic)	Mitigation strategy
R1	Team Availability: Each teammate may has his own schedule and we face the problem of time conflict.	6	Scheduled meeting at a fixed time every week to report progress.
R2	Lack of experience with .NET and C# development.	9	Study the documents provided by Microsoft thoroughly and find some other online tutorials.
R3	Chinese Language Model: Not able to distinguish between Mandarin and Cantonese speakers. May face some language processing obstacles.	7	Use sufficient data to train the language model.
R4	Microsoft might be unwilling to provide us with their customer-related data deemed private, which is critical in training our model.	8	Ask whether Microsoft can pre-process their data and remove those sensitive information. Write an algorithm to generate some data by our own.

8. Schedule & Deliverables

Dates	Tentative Tasks
1st Sept – 2nd Oct, 2016	• Initial negotiation with the representatives from Microsoft. • Read through Microsoft's supplementary documents. • [**Deliverable 1]** Detailed project plan and the project webpage presenting basic information.
3rd Oct – 31st Oct, 2016	• Incorporate Waterfall Model by making use of states to the bot.
1st Nov – 31st Dec, 2016	• Develop the language model in English. • Develop the language model in Chinese. • Test language models.
1st Jan – 20th Jan, 2017	• Prepare for the 1st Presentation. • Collect training data from Microsoft clients. • **[Deliverable 2]** Project Intermediate Report & Preliminary implementation.
21st Jan – 28th Feb, 2017	• Train the language models with data.
1st Mar – 10th Apr, 2017	• Integrate the trained language models with the Bot Framework. • Connect the bot to the database. • Host the bot on web and Facebook. • Implement additional features such as facial recognition or voice recognition (optional). • Optimize the recommendation algorithm (optional). • **[Deliverable 3]** A fully functional web-based AI Chat Bot.
11th Apr – 21st Apr, 2017	• Prepare for the Final Presentation and Final Report. • **[Deliverable 4]** Final Report.
22nd Apr – 2nd May, 2017	• Prepare for the Project Exhibition. • Further refine the final product if necessary.