OSCRES

Overseas Study Course REcommendation System

A project report for Graduate Certificate in Intelligent Reasoning Systems

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Table of Contents

EXECUTIVE SUMMARY

With globalization and ease of global mobility more students decided to pursue their education overseas, thus boosted the overseas education market, the majority of which are undergraduate students. This leads to raise in demand for overseas study consulting services. According to the non-profit organization NAFSA, Chinese students contributed US$13 billion to the US economy last year. Chinese students also made up 11 percent of all students in Australia in 2017 and many top universities have 'extraordinary levels' of exposure to the Chinese market, according to the Sydney-based Centre for Independent Studies.

This project, OSCRES (**O**verseas **S**tudy **C**ourse **RE**commendation **S**ystems) aims to leverage the power of Artificial Intelligence to transform the oversea study consultancy service. It is built to provide a one-stop oversea course recommendation and study aboard associated services for students who want to discover their enriching oversea study experience.

1.0 PROBLEM DESCRIPTION

1.1 OVERSEAS EDUCATION MARKET

China and The Overseas Education Market

The increase of globalization and ease of global mobility boost the overseas education market. More and more students decided to pursue their education overseas, the majority of which are undergraduate students. In China, statistics have shown there is more than 4 times increment from 2006 to 2016, (Sohu.com, 2017) and according to the Chinese Ministry of Education, more than 662 thousand students choose to pursue oversea education in 2018 alone.

One the other hand, there is a raised from university to recruit more international students. The ratio of international students became one of the key measurements of the inclusiveness and success of the university. Multiple university ranking agencies such as Times Higher Education (topuniversities.com, 2020) also place international student ratio as one of the key ranking factors. Additionally, international students have a heavy impact on university revenue and country economic. According to the non-profit organization NAFSA, Chinese students contributed US$13 billion to the US economy last year. Chinese students also made up 11 percent of all students in Australia in 2017 and many top universities have 'extraordinary levels' of exposure to the Chinese market, according to the Sydney-based Centre for Independent Studies. (John, 2019)

China became the number one source of international students and Chinese students are impacting on the overseas education market heavily.

Raised of The Demand for Overseas Study Consulting Services

There are multiple pathways that students can take to apply to their dream universities. Sourcing for university offering is easy, but finding the matching university courses, successfully enrolled at the university and settle down all required documents will not be smooth sailing. To ensure smooth University application enrolment raised the need for the oversea study consulting agency. Universities, on the other hand, may collaborate with those agencies to source their potential international students.

In the Chinese oversea education market, a consultant from an oversea study consulting agency will connect to the student one by one and communicate with them either face to face or via social media tools such as WeChat. As shared by the subject matter expert, in the initial conversation, consultant's capability to solve students' queries and providing good course recommendation are critical factors for the student to consider continuing using that oversea study consulting services.

Due to the outbreak of coronavirus, major universities around the globe have been slowing down their intake of international students. Additionally, major English level tests provide such as IELTS have postponed or cancelled their offline test. Proof of English capability is part of the university entry required in major universities in English speaking countries.

Therefore, consider all raised factors, students from mainland China have postponed their oversea study plans.

Since international student intake is such an important part for the university, governments and universities around the globe are likely to open more seats for international students after the global recovery from the outbreak. Students are also more likely to resume their oversea study plans. This raised the huge demand for oversea study consulting services. Oversea study consulting agencies will demand a better way to facilitate the students' need for course recommendation.

1.2 PROJECT OBJECTIVE

OSCRES aims to leverage the power of Artificial Intelligence to transform the oversea study consultancy service. It is built to provide a one-stop oversea course recommendation and study aboard associated services for students who want to discover their enriching oversea study experience.

OSCRES will bring in the following key benefits:

1. Connect potential student with overseas study consulting agency
2. Create a better user experience/consumer satisfaction by providing fast course matching and query answering
3. Assist oversea study consulting agency to provide seamless consulting experience to meet the students' demand after global recovery from Coronavirus outbreak

1.3 PROJECT SCOPE

Taking the consideration of time and system quality, OSCRES will start the pivot phrase with selected university and undergraduate courses proposed by the subject matter experts. China will be the target market in the first phrase of the project.

2.0 KNOWLEDGE MODELLING

For knowledge modelling step, OSCRES is using the three stages of Knowledge Model Construction method proposed by Schreiber and Wielinga. This includes Knowledge Identification, Knowledge Specification and Knowledge Refinement.

2.1 KNOWLEDGE IDENTIFICATION

Table 1 illustrate the detail knowledge source and acquisition techniques:

S/N	Information Source	Knowledge Acquisition Technique	Insight
1	Overseas Study Consultant	- Elicitation of tacit knowledge through interviews, calls and chats	- Understand the overall background information about the overseas education market - Understand the overall consulting process starting from getting student till enrolment and settle down in the new university - Understand the frequently asked questions by students - Understand the most important factors to decide the course recommendation
2	Online	- Web scraping to get university ranking records from QS - Online search to get course information for selected university - Online search to get country and city information	- Receive the university ranking record -Receive information for selected universities and courses information. - Receive background information for country and city such as cost of living
3	Students who have enrolled or completed their course of study	- Elicitation of tacit knowledge through interviews, calls and chats	- Receive students' past high school records and their current enrolled course
4	Students who are planning their oversea study	- Elicitation of tacit knowledge through interviews, calls and chats	- Understand the key concerns of study aboard from potential students - Receive a list of overseas study related questions from potential students

Table 1: Knowledge Source and Acquisition Technique

2.2 KNOWLEDGE SPECIFICATION

To provide the best overseas course recommendation service to students. The team has consulted multiple parties to understand the current oversea education landscape. This includes online school information, potential students, more than 3 consultants from leading Chinese Overseas Study Consulting Agencies, and students who have enrolled or completed their course of study.

The team have identified the following key factors deciding course match for the students:

1. School reputation and ranking
2. Country & City
3. Course of study
4. Pre-university school test result

The following points highlighted the key reason why students choose to use or not use an oversea study consulting service:

1. The expertise from the connect consultant
2. The response speed from the consultant
3. The friendliness of the consultant
4. Cost of consultation and other service fee
5. Complexity of university application process and requirement
6. Other benefits by applying through the oversea study consulting agency

2.2.1 Student High School Score Model

The team have interviewed Chinese students who have successfully enrolled into an overseas collage by using their high school result. The team have gathered those student's high school subject with a 1 to 10 scale range, 1 indicates heir high school subject result is ranging between 10% - 19%, where 10 indicates their result is ranging between 90% - 100%. Students also indicate their current enrolled university subject area.

The team have decided to use decision tree to construct the student high school score model and the course they are currently enrolled or graduated. The rule generated from the decision will be plugin and used as part of the course recommendation knowledge base.

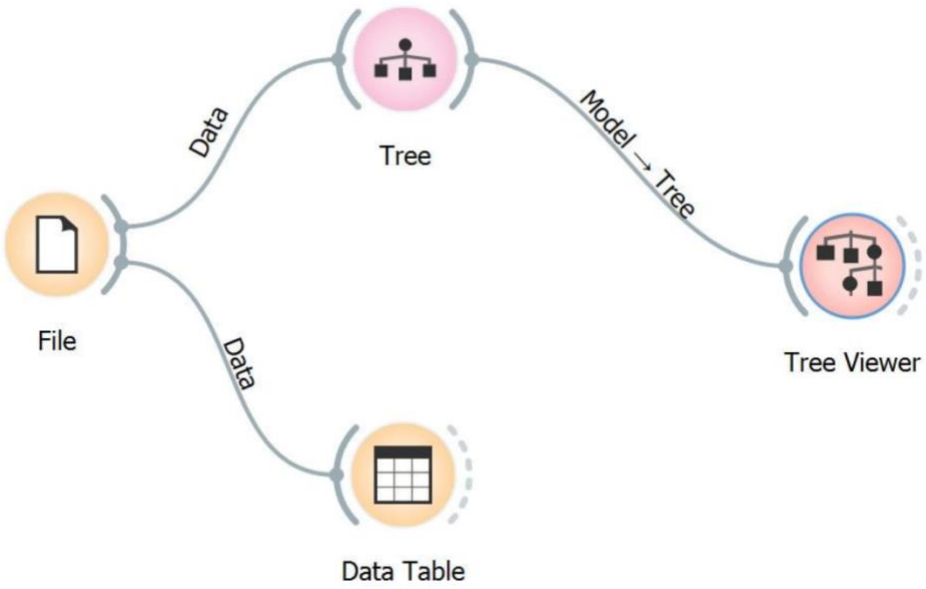

Figure 1: Decision Tree Training Sequence in Orange

Figure 1 illustrate the overall decision tree construction process in Orange.

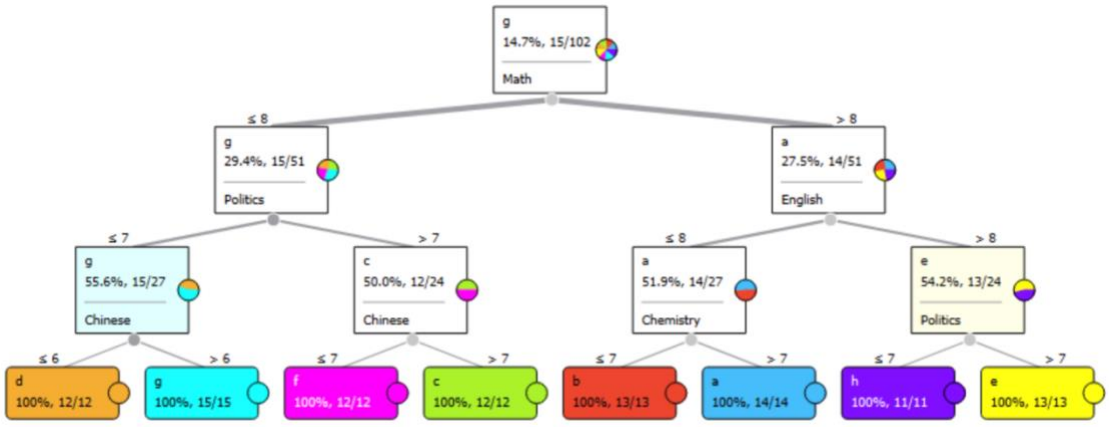

Figure 2: Student High School Subject Score Course Matching Decision Tree

Figure 2 displayed the decision tree for high school subject score and course matching.

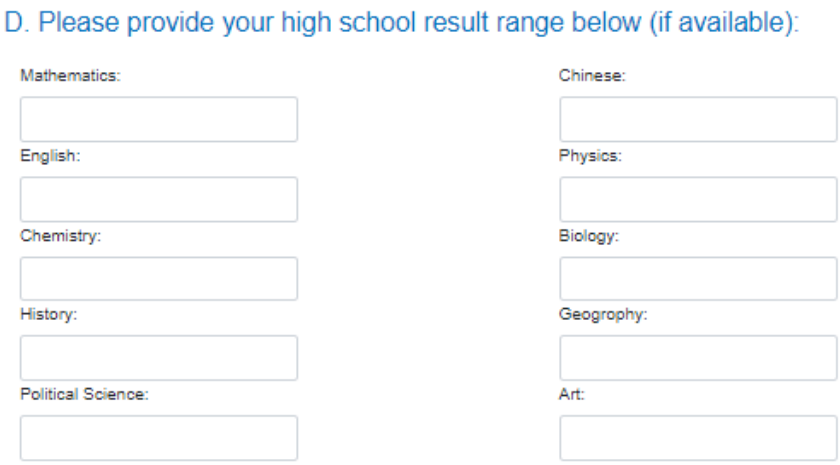

Figure 3: Application UI – Student high school scoring fields

Figure 3 shows the fields for student to fill in their high school scoring, and these fields will be passed to the backend for the model to process and generate the recommendation.

Below is the mapping from the decision tree into rules in Forward Chaining:

IF
Student's Math Score is lower or equal than 8 ***AND***
Student's Political Science Score is lower or equal to 7 ***AND***
Student's Chinese Score is lower or equal to 6 ***AND***
THEN
Student should consider d (Medicine)

IF
Student's Math Score is lower or equal than 8 ***AND***
Student's Political Science Score is lower or equal to 7 ***AND***
Student's Chinese Score is higher or equal to 6 ***AND***
THEN
Student should consider g (Arts & Humanities)

IF
Student's Math Score is lower or equal to 8 ***AND***
Student's Political Science Score is higher than 7 ***AND***
Student's Chinese Score is lower or equal to 7 ***AND***
THEN
Student should consider f (Law)

IF
Student's Math Score is lower or equal to 8 ***AND***
Student's Political Science Score is higher to 7 ***AND***
Student's Chinese Score is higher than 7 ***AND***
THEN
Student should consider c (Business & Management Studies)

IF

Student's Math Score is higher than 8 ***AND***
Student's English Score is lower or equal to 8 ***AND***
Student's Chemistry Score is lower or equal to 7 ***AND***
THEN
Student should consider b (Computer Science & Information Systems)

IF
Student's Math Score is higher than 8 ***AND***
Student's English Score is lower or equal to 8 ***AND***
Student's Chemistry Score is higher than 7 ***AND***
THEN
Student should consider a (Engineering & Technology)

IF
Student's Math Score is higher than 8 ***AND***
Student's English Score is higher than 8 ***AND***
Student's Political Science Score is lower or equal to 7 ***AND***
THEN
Student should consider h (Accounting & Finance)

IF
Student's Math Score is higher than 8 ***AND***
Student's English Score is higher than 8 ***AND***
Student's Political Science Score is higher than 7 ***AND***
THEN
Student should consider e (Economics & Econometrics)

2.2.2 University Rule-based model

Based on the identified key factors, the team had conducted data collection using web scrapping from various website. Together with the data that the user key in at the application User Interface, these data are stored and then be passed to the knowledge engine's working memory as the University Facts and Student Facts.

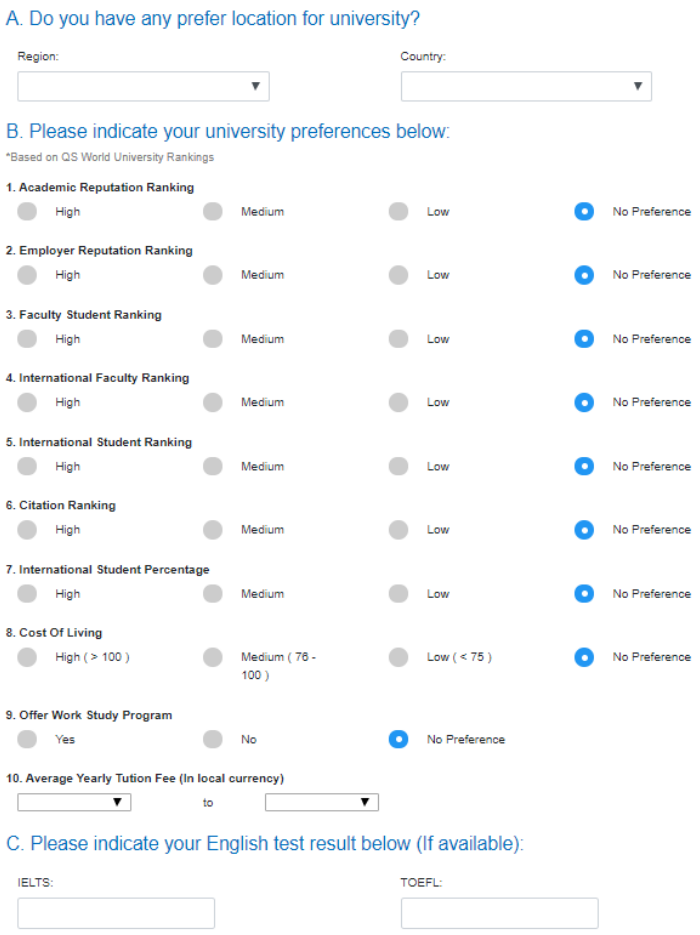

Figure 4: Application UI – Student preference options

Figure 4 shows the preference options available in the Application UI, which will be passed to the knowledgebase as the Facts for the student preference.

University Facts	**Student Facts**
Name(u)	Preferred_Country(s)
Country(u)	Preferred_Region(s)
Region(u)	Preferred_academic_reputation_rank(s)
academic_reputation_rank(u)	Preferred_employer_reputation_rank(s)
employer_reputation_rank(u)	Preferred_faculty_student_rank(s)
faculty_student_rank(u)	Preferred_international_faculty_rank(s)
international_faculty_rank(u)	Preferred_international_student_rank(s)
international_student_rank(u)	Preferred_citation_rank(s)
citation_rank(u)	Preferred_field_of_study(s)
min_IELTS(u)	IELTS(s)
min_TOEFL(u)	TOEFL(s)
cost_of_living_index(u)	Preferred_cost_of_living_index(s)
international_student_percentage(u)	Preferred_international_student_percentag
offer_work_study_program(u)	e(s)
average_tuition_fee(u)	Preferred_offer_work_study_program(s)
	Preferred_minimum_tuition_fee(s)
	Preferred_maximum_tuition_fee(s)

When matching the student to the University, if the student did have no preference for specific field, that empty field will be marked as satisfy matching condition.

Rules
IF Preferred_Country(s) is empty **THEN** Is_Preferred_Country (u)
IF Preferred_Region(s) is empty **THEN** Is_Preferred_Region(u)
IF Preferred_academic_reputation_rank(s) is empty **THEN** Matched_academic_reputation_rank(u)
IF Preferred_employer_reputation_rank(s) is empty **THEN** Matched_employer_reputation_rank(u)
IF Preferred_faculty_student_rank(s) is empty **THEN** Matched_faculty_student_rank(u)

IF
Preferred_international_faculty_rank(s) is empty
THEN
Matched_international_faculty_rank(u)

IF
Preferred_international_student_rank(s) is empty
THEN
Matched_international_student_rank(u)

IF
Preferred_citation_rank(s) is empty
THEN
Matched_citation_rank(u)

IF
IELTS(s) is empty ***AND***
TOEFL(s) is empty
THEN
Satisfy_English (u)

IF
Preferred_cost_of_living_index(s) is empty
THEN
Matched_cost_of_living_index (u)

IF
Preferred_international_student_percentage(s) is empty
THEN
Matched_international_student_percentage (u)

IF
Preferred_offer_work_study_program(s) is empty
THEN
Matched_offer_work_study_program (u)

IF
Preferred_minimum_tuition_fee(s) is empty ***AND***
Preferred_maximum_tuition_fee(s) is empty
THEN
Matched_tuition_fee (u)

IF
prefered_region(s) = region(u)
THEN
is_prefered_region(u)

IF
prefered_country(s) = country(u)
THEN
is_prefered_country(u)

IF
ielts(s) >= min_IELTS(u)
THEN
satisfy_english(u)
has_english(u)

IF
toefl(s) >= min_TOEFL(u)
THEN
satisfy_english(u)
has_englishe(u)

IF
prefered_academic_reputation_rank(s) = academic_reputation_rank(u)
THEN
is_prefered_academic_reputation_rank(u)

IF
prefered_employer_reputation_rank(s) = employer_reputation_rank(u)
THEN
is_prefered_employer_reputation_rank(u)

IF
prefered_faculty_student_rank(s) = faculty_student_rank(u)
THEN
is_prefered_faculty_student_rank(u)

IF
prefered_international_faculty_rank(s) = international_faculty_rank(u)
THEN
is_prefered_international_faculty_rank(u)

IF
prefered_international_student_rank(s) = international_student_rank(u)
THEN
is_prefered_international_student_rank(u)

IF
prefered_citation_rank(s) = citation_rank(u)
THEN
is_prefered_citation_rank(u)

IF
prefered_min_tution_fee(s) < average_tuition_fee(u) ***AND***
prefered_max_tution_fee(s) > average_tuition_fee(u)
THEN
is_prefered_tuition_fee(u)

IF
prefered_international_student_percentage(s) = international_student_percentage(u)
THEN
is_prefered_international_student_percentage

IF
prefered_cost_index(s) = cost_of_living_index(u)
THEN
is_prefered_cost_index(u)

IF
prefered_work_study(s) = offer_work_study_program(u)
THEN
is_offering_work_study(u)

IF
satisfy_english(u) ***AND***
is_prefered_region(u) ***AND***
is_prefered_country(u) ***AND***
is_prefered_tuition_fee(u) ***AND***
is_prefered_international_student_percentage(u) ***AND***
is_prefered_cost_index(u) ***AND***
is_prefered_academic_reputation_rank(u) ***AND***
is_prefered_employer_reputation_rank(u) ***AND***
is_prefered_faculty_student_rank(u) AND
is_prefered_international_faculty_rank(u) ***AND***
is_prefered_international_student_rank(u) ***AND***
is_prefered_citation_rank(u) ***AND***
is_offering_work_study(u)
THEN
preferred(u)

IF
satisfy_english(u) ***AND***
(is_prefered_country(u) OR is_prefered_region(u)) ***AND***
is_prefered_cost_index(u) ***AND***
is_prefered_academic_reputation_rank(u) ***AND***
is_prefered_employer_reputation_rank(u) ***AND***
is_prefered_faculty_student_rank(u) ***AND***
is_prefered_international_faculty_rank(u) ***AND***
is_prefered_international_student_rank(u) ***AND***
is_prefered_citation_rank(u)
THEN
recommendedbyAcademic(u)

IF
satisfy_english(u) AND
(is_prefered_country(u) OR is_prefered_region(u)) AND
is_prefered_tuition_fee(u) AND
is_prefered_cost_index(u) AND
is_offering_work_study(u)
THEN
recommendedbyFinancial(u)

IF
satisfy_english(u) AND
is_prefered_region(u) AND
has_english(u)
THEN
matchBasic(u)

University matched under ***preferred(u)*** have met all preference by the student.

University matched under ***recommendedbyAcademic(u)*** have met Academic ranking preference by the student.

University matched under ***recommendedbyFinancial(u)*** have met Financial preference by the student.

University matched under ***matchBasic(u)*** have met country/region preference of the student and English requirement of the university.

The university list is sorted by the number of non-empty preference matched and return the top 3 university with the highest matching preference, together with the Course recommendation to the User Interface.

2.3 KNOWLEDGE REFINEMENT

To verify our understand of the student course selection process and align with the actual requirements from the students, an iterative knowledge refinement process will be required. Figure 3 illustrated the process of knowledge refinement with the involvement from subject matter experts and potential students. The feedback received from all parties will be used to refine the current knowledge model and UI design.

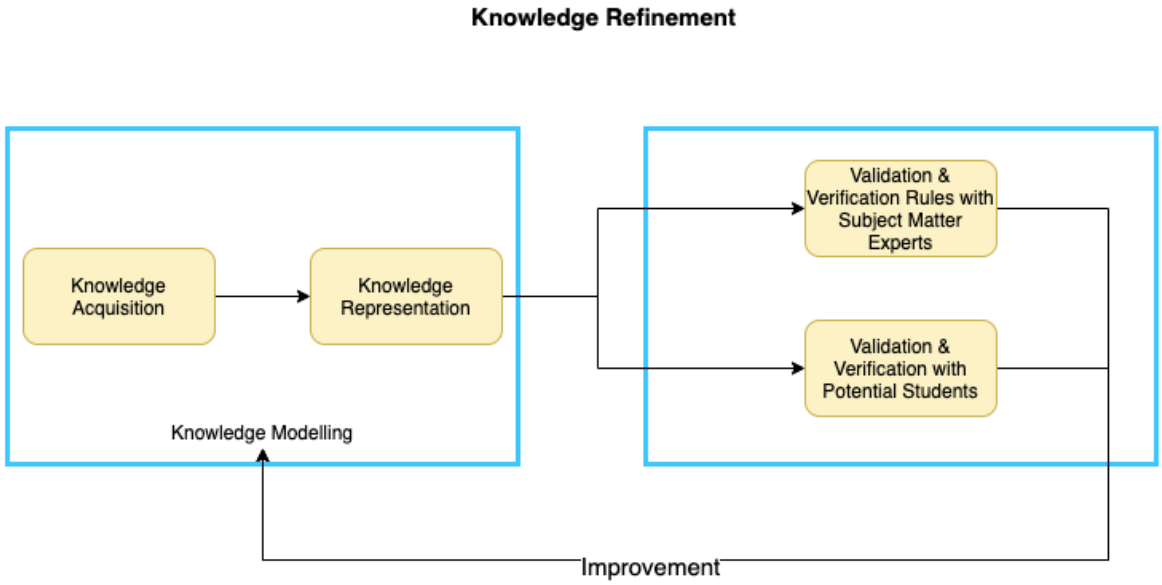

Figure 5: Knowledge Refinement Process

3.0 CHATBOT DESIGN

The objective of having the Chatbot system is to provide an automated interface that can be used by student to clear some of their generic doubts during the initial preparation phase.

The team have consolidated a list of frequently asked questions from students during their initial course searching phase. If student have a university in mind, they are more likely to ask questions related to university information such as like location, campus settings, academic ranking, tuition fee, subject offered and English score requirement. If student does not have any university in mind, he might want to search university within his desired overseas study location or university that are more budget friendly.

3. 1 Intent

With this in mind, we have designed the list of Intent as shown in Figure 6.

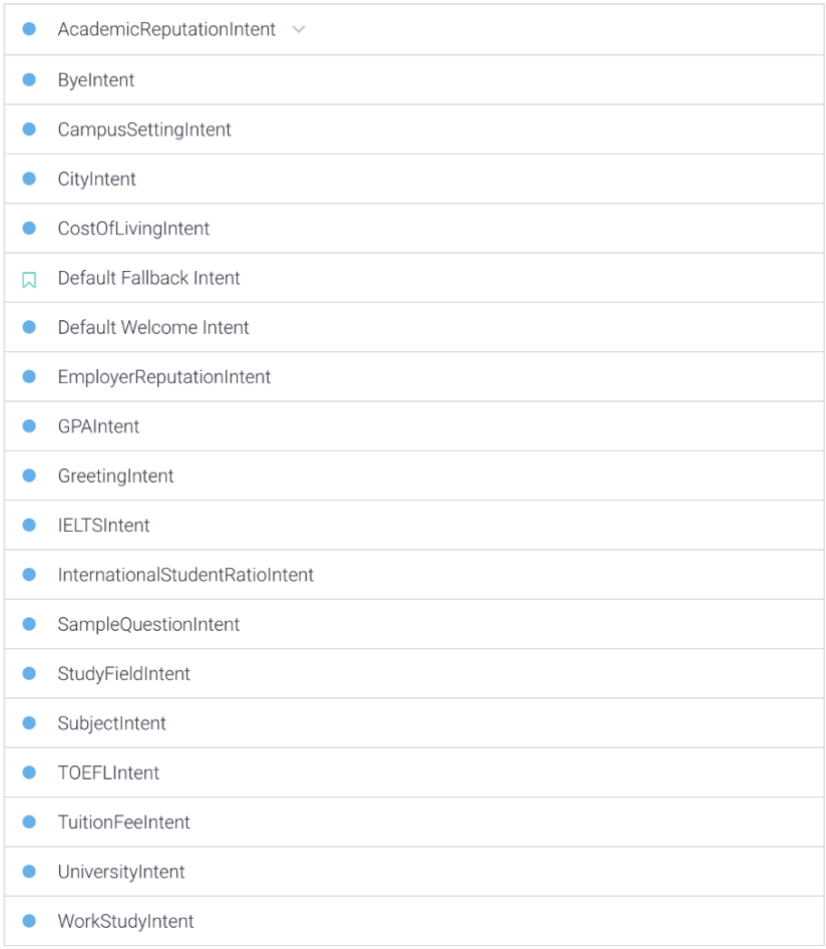

Figure 6: Intents definition in Google DialogFlow

3.2 Slot/Parameter

Each intent support different slots, these slots will get mapped into parameters in the codes.

These slots are defined as Entity in DialogFlow, as shown in Figure 6:

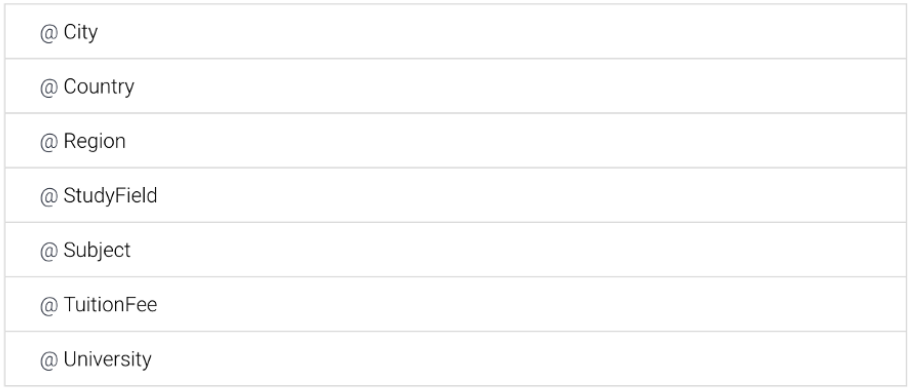

Figure 7: Entities definition in Google DialogFlow

Due to the limited scope of the project and suggestions from the subject matter experts, we are only covering few countries in each region and some universities for each country. In this initial stage, we are only supporting limited range of value for each slot/parameter.

for example, in the question of *"what is the academic reputation of @University",* the supported university values are the one that we are having in the database, information retrieved are based on the current available university.

Synonyms are fuzzy matching are supported at Entity, which means below 3 questions will have same response:

" what is the required IELTS for ROYAL INSTITUTE OF TECHNOLOGY?"
" what is the required IELTS for ROYALE INSTITUTE OF TECHNOLOGY?"
" what is the required IELTS for KTH?"

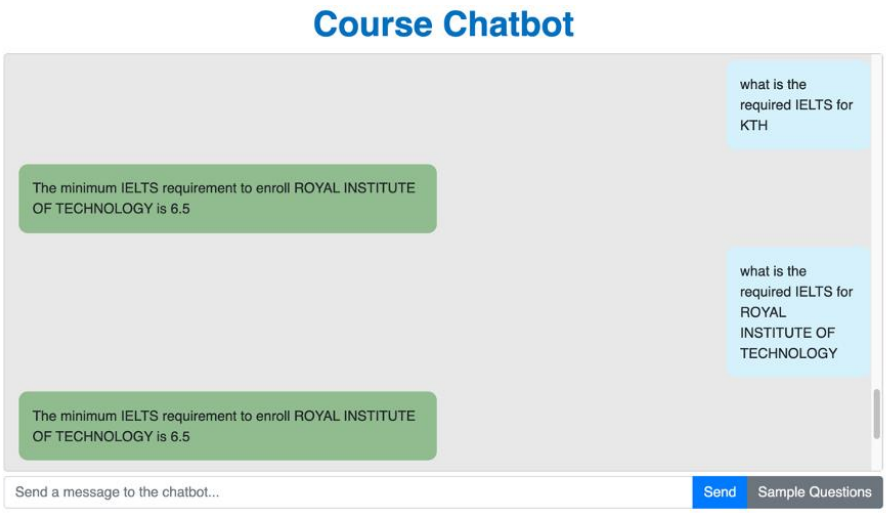

Figure 8: Chat UI

3.3 Fuzzy Values

We have identified the fuzz values for some of the field, for example

low_cost_of_living = [50, 75]
medium_cost_of_living = [76, 100]
high_cost_of_living = [101, 130]

These values will be used in the fulfilment implementation when it comes to questions involving subjective judgement:

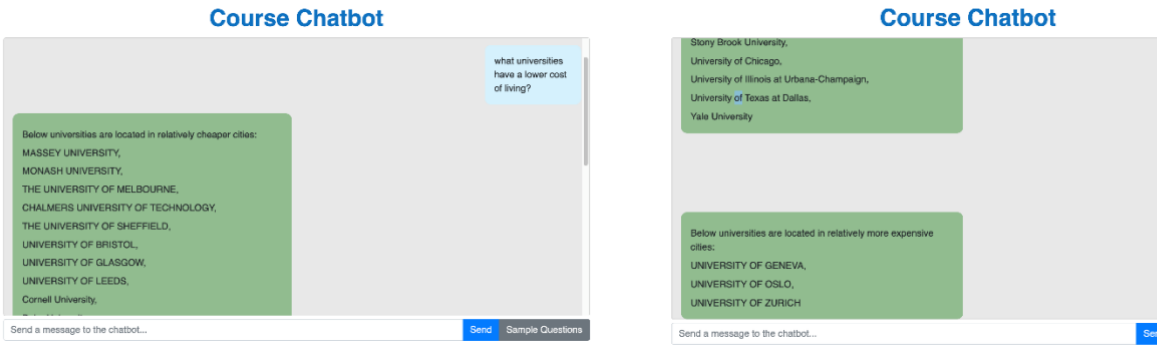

Figure 9: Chat UI

3.4 System Flow

Below illustrates the flow of the chat system:

- 1. Client Sends question to the API service handler through HTTP call
- 2. The question is sent to Google DialogFlow for Intent and Slot detection
- 3. Fulfillment handler generate fulfillment by filtering the corresponding data from the database and customizing the response.
- 4 Response is sent to the UI as answer.

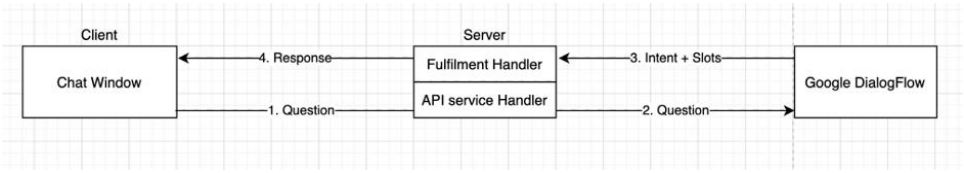

Figure 10: Flow of Chat System

Please also refer to the System Architecture part in section 4.1.2

4.0 SOLUTION

4.1 Key System Feature Description

OSCRES was designed to provide fast overseas course recommendation service for students. As shown in Figure 11, the three level of course discovery support students with different course discovery needs.

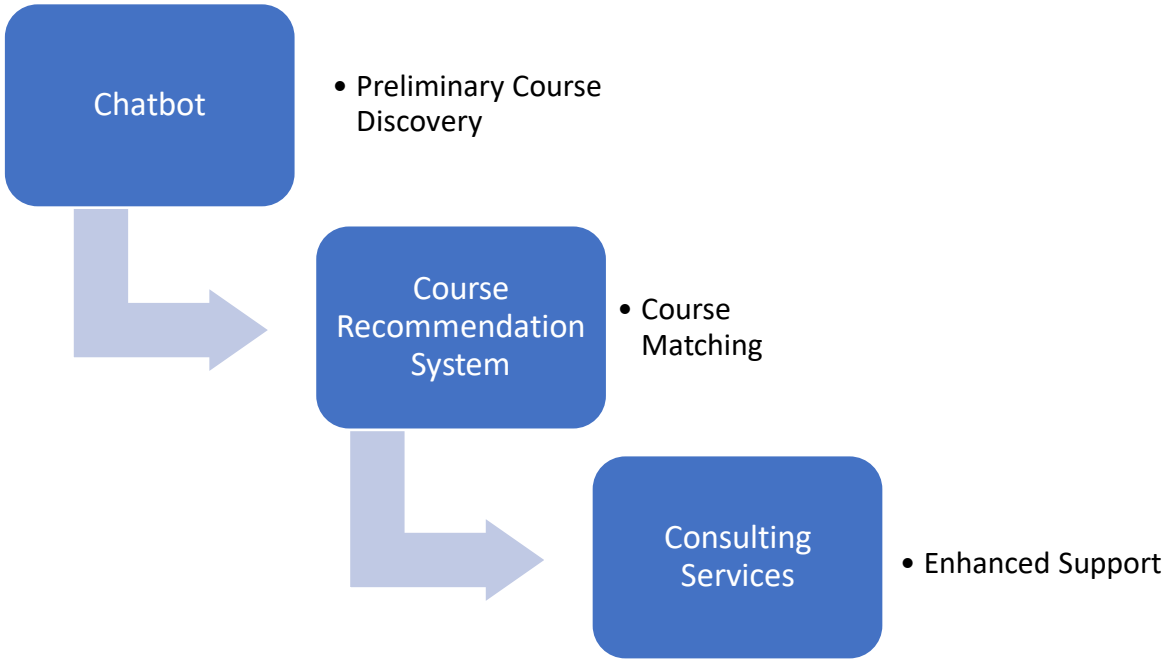

Figure 11: 3-Level of Course Discovery

1. **Chatbot**
   A Chatbot service allows the student to receive answers related to overseas education in a friendly and interactive manner. This is will act as the first touchpoint between the student and oversea study consulting agency and the first level of course discovery, preliminary course discovery.

2. **Recommendation System**
   Course Recommendation Systems allows students to minimum the input information required and discover their matched schools right away without waiting to consult an oversea study consultant. The dynamic matching of universities' demographic/entry reequipment data to student preference/demographic data will always try to produce an optimal recommendation. In the case of no perfect matching is found, less optimal university will get recommended. Additionally, course matching based on student's strength on different subject area increases the chance of student to excel their university study.

3. **Consulting Services**
   All student input data will be saved in the backend server and shared to an overseas study consultant to assist students further in university application and other enhanced services such as document preparation, arrival services which cannot be

performed by the recommendation systems and chatbot. This will provide the third level of course discovery, enhanced support.

Additionally, the system is highly scalable, it provides utility to import/add additional university data into the database to easily expand the supported regions/countries/universities.
The rules defined in the knowledge engine can be easily extended to include more comprehensive rules.

4.2 SYSTEM ARCHITECTURE

The system mainly contains 2 parts: the UI and the backend API service.
The back end is where the restful API is developed together with the integration of mySQL database, the knowledge engine and Google DialogFlow agent.

Below show the high-level technologies used in this project:

Technology	Purpose
Python 3.7	Main Programming Language
Django	MVC framework for python
PyKnow	Knowledge Engine for Python
Mysql	Database
Orange	Knowledge Induction Tool
Google DialogFlow	Chatbot agent

Let us breakdown the architecture into sub-systems:

4.2.1 Recommendation System

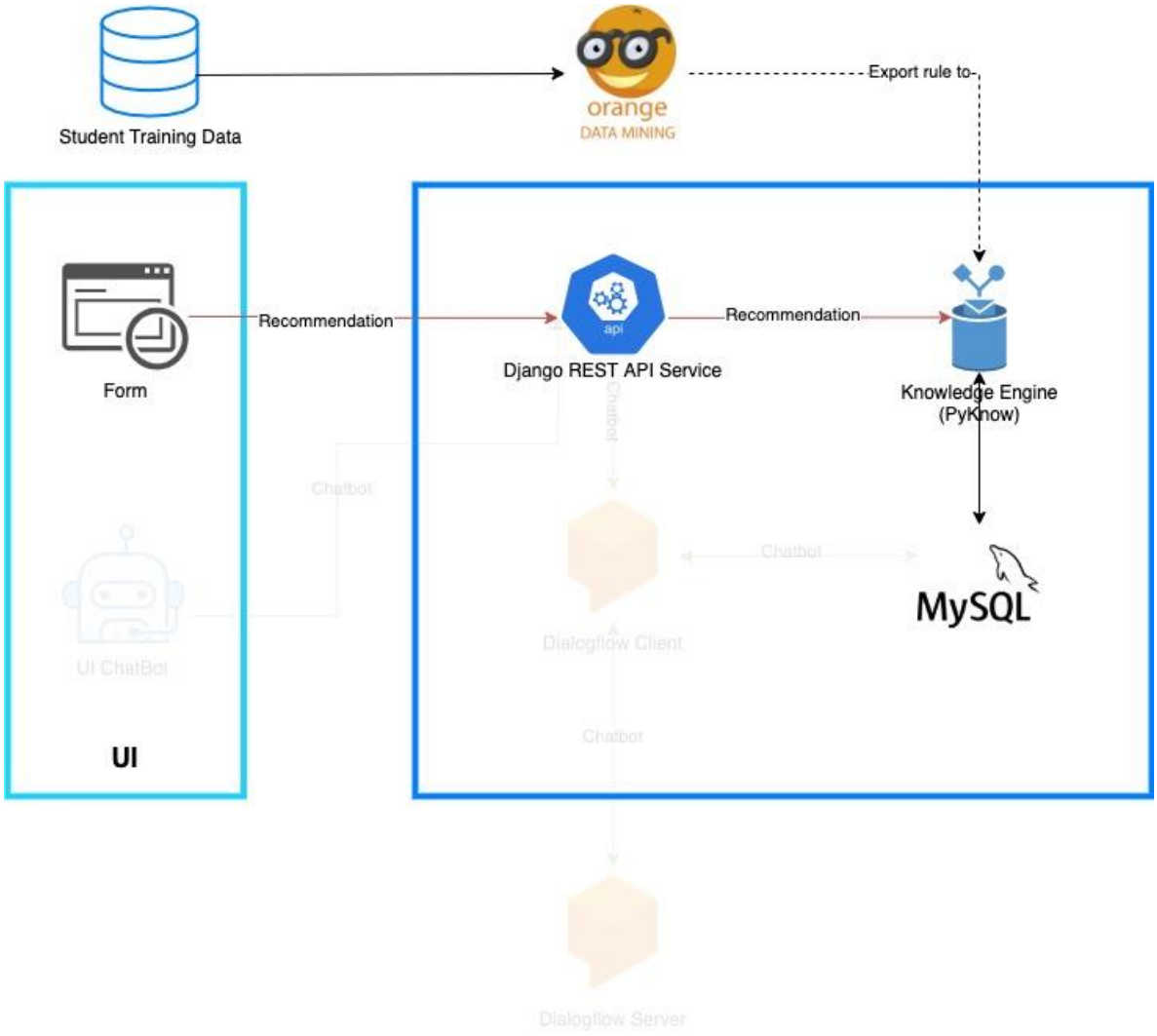

Figure 12: Recommendation System Architecture

At the heart of the recommendation system is the knowledge engine developed using PyKnow. There are two major types of rules defined, first is the university rules which gives recommendation on **university** based on student profiles and requirement. Second type is the **course rules** which are used to recommend the field of study based on students' high school subject test score.

The course rules were generated through Knowledge Induction process using Orange, as illustrated at the top of the diagram. This is a standalone process which is not included as part of the project code. However, the decision trees generated from the orange is extracted and incorporated as rules in the knowledge engine.

When the user or the student's keys in the form data and then click recommendation button, it will send a POST HTTP call with the student data in the JSON body to the API

service. Student data will be declared as a Student Fact inside the knowledge engine, meanwhile the university list fetched from MySQL database is sent to the knowledge engine as a list of University Fact. The knowledge engine will match the Student facts and the University facts based on the rules in the working memory. Matched University will be returned to the form as JSON format. Frontend will consume the received JSON and displayed the recommendation result.

4.2.2 Chat System

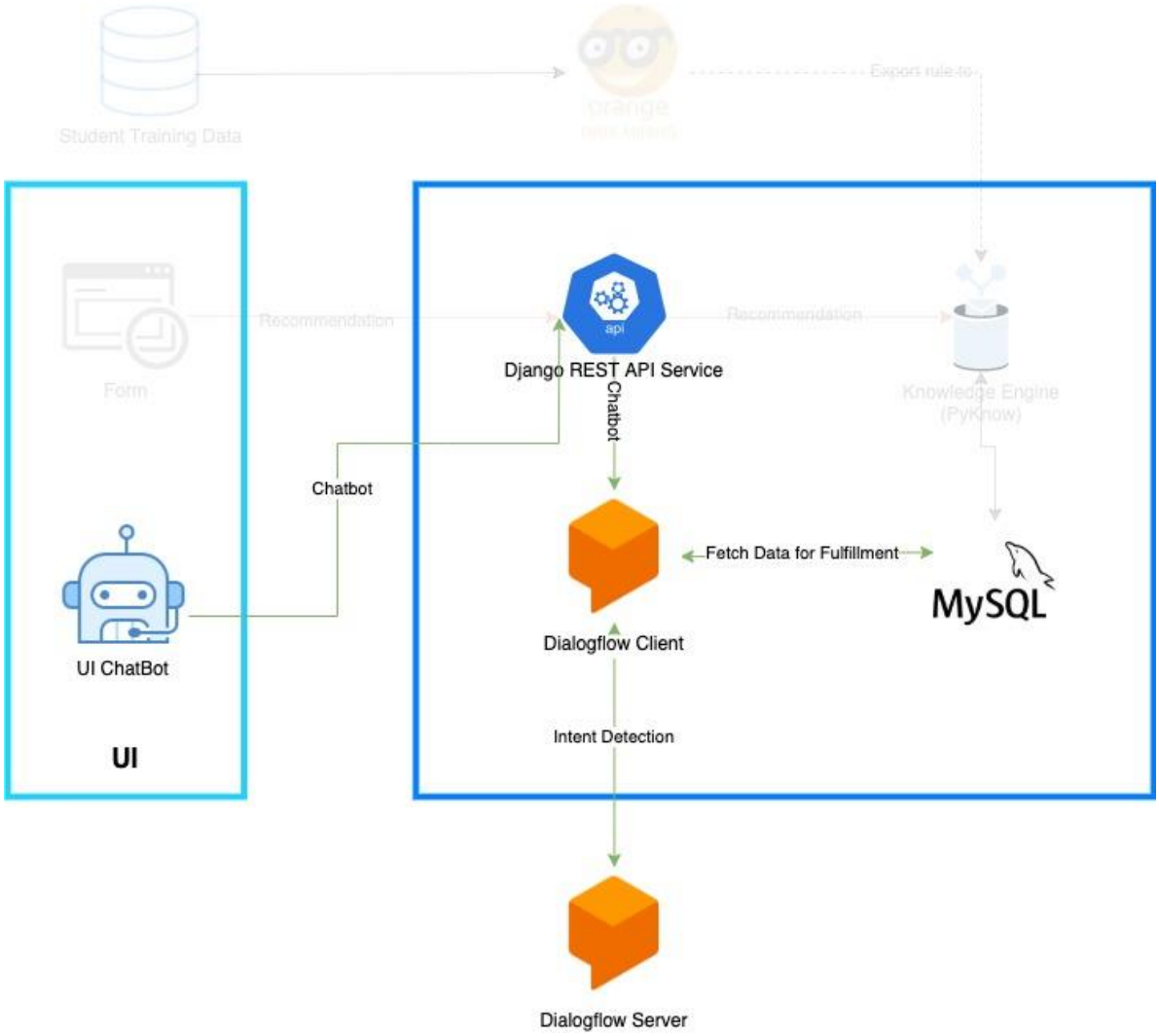

Figure 13: Chatbot System Architecture

The chat system consists of three parts: UI, API service and a Google DialogFlow agent running on Google cloud.
The list of Intents and Entities have been predefined in the DialogFlow agent. When a use asks a question, the UI sends the question to the API service using a post HTTP call, the API service connect to the Google DialogFlow agent through DialogFlow client for intent and slot detection.
Note that there is no webhook involved here since the APIservice is initializing the connection to DialogFlow, the purpose of DialogFlow is simply for intent/slot detection.

Fulfillment is developed in the API service accordingly based on the detected intent/slot and the data is customized into response sent back to user.

4.3 FUTURE IMPROVEMENT

There is a limited amount of university data within our database and these data are onetime extractions. More university can be included to cover a wider and more accurate recommendation, and these data can be updated periodically to keep the information up to date.

We came to know that some agency service also includes the service of linking a new student to an existing one so that later can act as a Student Bubby to help guide the new student. This can be incorporated to our system since we have the student demographic data stored in the database, this allows us to make cluster analysis and recommend a student from within the same cluster as the Student Buddy. Of course, we would need to enhance the current student model to include more features, like personality, hobby, interest, etc.

We can achieve offline chatbot capability by making use of native chatbot library to remove the internet dependency on DialogFlow. We would like to also enhance the chatbot capability to answer higher degree of questions by including more supported intent. Finally, we can improve user experience for the chatbot by creating a more intuitive chat UI, for example clicking on sample questions to get response directly for that question.

APPENDIX

Appendix A: System Functions Mapping Against ISS-IRS Graduate Certificate

Main Function	Feature	ISS-IRS Module	Skill Learnt
School Recommendation Systems	Rule-based Recommendation	Machine Reasoning	Knowledge Acquisition, Knowledge Representation, Conflict Resolution
Course Recommendation Systems	Rule-based Recommendation	Reasoning Systems	Knowledge Discovery, Data Mining (Decision Tree), Orange
Chatbot	Chatbot	Cognitive Systems	Chatbot Design, Google DialogFlow
Overall	System Design	Reasoning Systems	Hybrid Reasoning System Design

Appendix B: Installation Guide and User Guide

Please refer to the Installation and User Guide

Appendix C: Team Contribution

Official Name	Student ID	Contribution
Li Yuejun	A0213494E	Project Proposal, SME interview and Modeling, System Architecture Design, Project setup, Chatbot development, Code repo management
Zheng Bingbing	A0213517M	Data Acquisition, Intent Entity Creation, UI Design and Development, Mid-term Presentation, Report Writing, Video Creation
Zheng Min	A0213482L	Data Acquisition, Rule-based model design and development, System Design, System build Test
Zhu Weiwei	A0213545L	System design, Knowledge discovery, Project development, Feature implementation.

Appendix D: Individual Refection

Name: Li Yuejun
Id: A0213494E

In this project, I have proposed the idea of implementing the Overseas Study Course REcommendation System (OSCRES) which was accepted by the team after seeing huge market values in the domain. The idea was based on the experienced observed from my wife who works as a Student Enrolment Advisor for a study agency where the main responsibility was to help Chinese graduating high school student prepare their overseas study journey. I feel that this is a very good project candidate not only because of the business value, but also the fact that the nature of the job role (handling consultation, profile extraction, profile matching, recommendation, etc) being able to fully automated. I have then interviewed my wife as well as some of her previous colleagues (SME) then worked with the team to convert that knowledge into models and rules.

Apart from project proposal and expert interview, I have done research on various of technologies that can be incorporated into the system, and finally decided to use PyKnow for the Knowledge engine and Google DialogFlow as Chat Engine. With that, I created the system design and initialized the project setup with different components (models, views, API controllers, DialogFlow client, fulfillment handler, scripts, etc) that connects together to form the basic structure of the project. I have also created a Google dialogue flow projects with all the defined intents and slots and integrated with our Python application and I have developed the fulfillment in the python code which is integrated with the UI that the team built.

On the other side I was making effort to lay out the execution plan and coordinate with team members on various tasks progress, creating project setup guide, meanwhile maintaining the GitHub repository.

The most meaningful thing I've learned throughout the project is the integration of Google DialogFlow with a custom Python application.
Due to time limitation we have not explored extensively on chatbot implementation techniques, but I'm really interested to continue exploring the chatbot, maybe with the integration of different technologies including machine learning, rule-based approach etc. I will definitely enhance the application and make the chat bots more comprehensive.

Name: ZHENG BINGBING
Id: A0213517M

This group project is an existing and enriching experience for me. My main contribution to the project including initial idea brainstorming, data gathering and cleaning, assist in creating a knowledge model in the initial project phase. I also work on intention entity detection for Chatbot, frontend UI development and is the key person in report writing and video editing.

The graduate certificate in Intelligent Reasoning System boosts my understanding of how to create an intelligent system. It layout board and foundation ground on artificial intelligence, machine learning, and the application area such as natural language processing. I think one of the most useful techniques will be the full knowledge model process including knowledge acquisition, knowledge representation, and how to use the knowledge model to construct a knowledge base. This allows me to understand how to create a typical rule-based system.

The knowledge on how to create a hybrid reasoning system teaches me system-level thinking for AI architecture. It is extremely useful to combine all the knowledge that we have learned from this class to draft an effective and robust architecture decision before developing the system.

But I think the application portion for this graduate certificate is the most useful part for me. The exposure of the application and basic practical exercise for cognitive system including computer vision, natural language process, speech recognition allows me to pick up that domain knowledge quicker and have a more comprehensive view of artificial intelligence.

By gaining the above knowledge, I am able to start communicating with people within my organization who are creating intelligent systems or AI solutions. The cognitive system module will enable me to create a simple chatbot for the team by using Google DialogFlow to act as a knowledge repository to answer commonly asked questions from the team. It can also be scaled up to become an enterprise project, allowing the full department to use it as a quick Q&A tool, especially for the newly joined team members.

Additionally, the system-based understanding of different AI architects and hybrid AI systems enables me to have a critical view of how to construct an AI system. It is not limited to AI architects, that knowledge is transferable in all architecture design decisions. I will be able to consider integrating AI system into any new system designs. This enables the newly designed system will have the capability to add on AI system now or in the future.

I truly believe the knowledge gained from this certificate lays out the solid foundation for my future pursue of Artificial Intelligence and its applications.

Name: ZHU WEIWEI
Id: A0213545L

1. **Personal Contribution**.

When starting this project, as a member of team I propose an idea of our practice project. I learned a lot when we communicate with each other even this idea was not be selected.

In the development stage, I helped to build the system as follows items:

- use Django techniques to build FE.
- use Orange to discover knowledge from raw data which got from the survey.
- help to enhance the rule engine.
- Prepare video demo, scripts, and user guides in the final stage.

Actually, each member of our team participated in every stage and contribute to this project. We cannot build a system without any one of us.

2. **What have learned**.

There are three main parts I learned through this practice project.

a. Introduce new Techniques.

use Django python framework because it encourages raid development.
use Pyknow as a rule engine in the backend as it is very convenient to implement rules and knowledges derived from data.
DialogFlow let us to define as many intents and entities as possible in it to fuzzy matching possible questions the students could ask.

b. How to implement knowledges learned in class.

What is the relationship between high school test and field of study when student choosing their university? You have data in hand how to discover the knowledge in it? This is what we learned from this module. With the help of tools like Orange we can find the hints from complex data easily.

c. The way to make different techniques talk to each other.

In order to make the application works, we need to integer different components together and exclude all possible issues.

3. **Prospect of the Knowledge and skills**.

I have a deeper understanding of what I have learned in this module after I completed this project. These handled skills and knowledge will have a big impact in the future when I choose carrier or in workplaces.

- new techniques will boot my confidence in the short term when building your projects.
- new knowledges will change the way of thinking in the long term.

Name: Zheng Min
Id: A0213482L

Throughout the project, at the starting phrase I have participated in the brainstorming of the possible project ideas, finalizing on the project idea, and outlining the system design and technology. Then I have involved in the data mining and web scrapping of the data required for building the model. And then reiterate through to system design to finetune the system blocks and technology use to implement the system.
We have weekly meeting to update individuals progress and check if any suggestion or changes required for the system.
At implementation phrase, I am focusing on building the knowledge-based system using Python with the PyKnow python package; for checking if a school is recommended for the user and then returning the result to the UI interface.

The most useful things I have learnt is ability to identify the business process that can be automated with the knowledge gained in class, and build the systems out from scratch by constructing the systems design and exploring the various technology to fit into the system to form a complete system.

The knowledge and skill obtained during the course can use to optimized some of the existing process.
For example, currently we have many ETL (Extract Transform Load) pipeline pointing to various data server, and all these data server have available timing, and there are also constraints on the timing for the data to be processed and ready for further consumption. Thurs, I can apply the optimization skill to build a small system for optimizing existing pipeline timeslots to fulfil the time constraints and minimizing time slot wastage which can be used by future ETL pipelines when new data sources is required.

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