AI-OPTIMISATION

YARRA RANGES TECH SCHOOL (YRTS)

PROJECT DIARY

DEAKIN UNIVERSITY
SIT764 - PROJECT ANALYSIS AND DESIGN
YR-Optimization-A

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TABLE OF CONTENTS

1. Project Goal

The Yarra Ranges Tech School seeks the development of a web application to promote learning and understanding of the principles of Data Science and AI-Optimisation problems.

The AI should utilise global food distribution and sourcing data to simulate the effects of changing weather patterns, water availability, and increasing population have on global food supply.

The Project address long-term sustainable solutions and address key functions of Affordability and pricing and maximising yield.

The application should allow for visual design and operation to undertake analysing global food supply and promote the role and use of Data Science and AI-Optimisation problems in making informed decisions.

2. Project Value

2.1. Value Hypothesis

Changing weather patterns, water availability, and increasing population have the potential to lead to significant food shortage in the future. Our task and challenge is to investigate the global Agribusiness market and leverage Artificial Intelligence to make informed decisions.

Our Business model is based on the volume of data that we used to predict the solution. Mainly we have to tasks,

1. Model Selection: Define the hypothesis space.
2. Optimization: Selection a most suitable hypothesis within that space.

The most important thing is to identify the relevance of the parameters that provides the finest test set accuracy.

2.2. Growth Hypothesis

The Proposed solution is function as follows

Integration

1. The final deliverable is based on Google AIY Voice KIT v1.0
2. Utilise the Google Assistant SDK
3. Handle event ON_RECOGNIZING_SPEECH_FINISHED to return text interpretation of user question
4. Utilisation of NLTK Chat http://www.nltk.org/_modules/nltk/chat/eliza.html

Capability of the project (The areas of agriculture which we are going to address)

1. Global Food data
2. Global calorie data
3. Global crop data

As a deliverable we provide 1x Functional Chat-bot meeting the above context and scope requirements.

The final system require input as follows,

1. Text based interface to send questions to the Chat-bot
2. Speech input (off by default)

The final system provide output as follows,

1. Text based responses to questions
2. Speech responses to questions

As future extension allow for the Chat-bot to be trained to include different datasets which is not limited to food and agriculture technology.

2.3. Metrics

We measure our success by delivering fully functional Chat-bot to our client Yarra Ranges Tech School which provide a proper specific answers to following types of questions which relates to food and agriculture field.

Examples:

1. What is future calorie requirements per country?
2. Find the calorie consumption by
    a. Country
    b. Year
3. What is the crop production in 2022?
4. What is the annual food wastage of United State America in 2017?
5. Which countries produce what kinds of crops?
6. Which countries produce what crops

3. Project Plan

3.1. Communication Strategy

Our project's internal communication mainly carried out via slack, which is a communication tool. As it brings all the group members into one platform, all the team members can work collaboratively, share assets amongst them and communicate effectively with each other.

We also use emails as our formal communication strategy to communicate with our supervisors and clients.

Also we use google onedrive for share documents with each other and edit documents in real time.

3.2. Task Management Strategy

We use Trello as our Task management tool, which made task management easier amongst the team. Trello help our team to keep track of all the tasks and stages that all the team members are working on.

3.3. Iteration Plans

Iteration 1	Working successfully with Raspberry pi Google AIY voice kit.		
Start Date	29/07/2018	End Date	05/08/2018
Description	Gathering the data required for Raspberry pi Google AIY voice kit and communicating with it without the help of algorithm.		
Result	Communication with Raspberry pi Google AIY voice kit is successful without the help of the channel.		
Follow Up	Analyse the data given to the Raspberry pi Google AIY voice kit.		

| Iteration 2	Analyse the data given to the raspberry pi Google AIY voice kit.		
Start Date	05/08/2018	End Date	12/08/2018
Description	Fixing the communication with the help of algorithm.		
Result	Raspberry pi Google AIY voice kit can communicate as the algorithm is designed and it is able to answer all the questions from the data implanted into it.		
Next Step	Working for a better algorithm for communication with the Raspberry pi Google AIY voice kit.		

4. Design

Client provided us all the design requirements and hardware requirements that need for the completion of the project. The main hardware component is Raspberry Pi Google AIY Voice Kit (https://aiyprojects.withgoogle.com/voice/), the Chat-bot.

5. Architecture

5.1. Overview

Key:
NLP - Natural Language Processing
NLU - Natural Language Understanding
NLG - Natural Language Generation
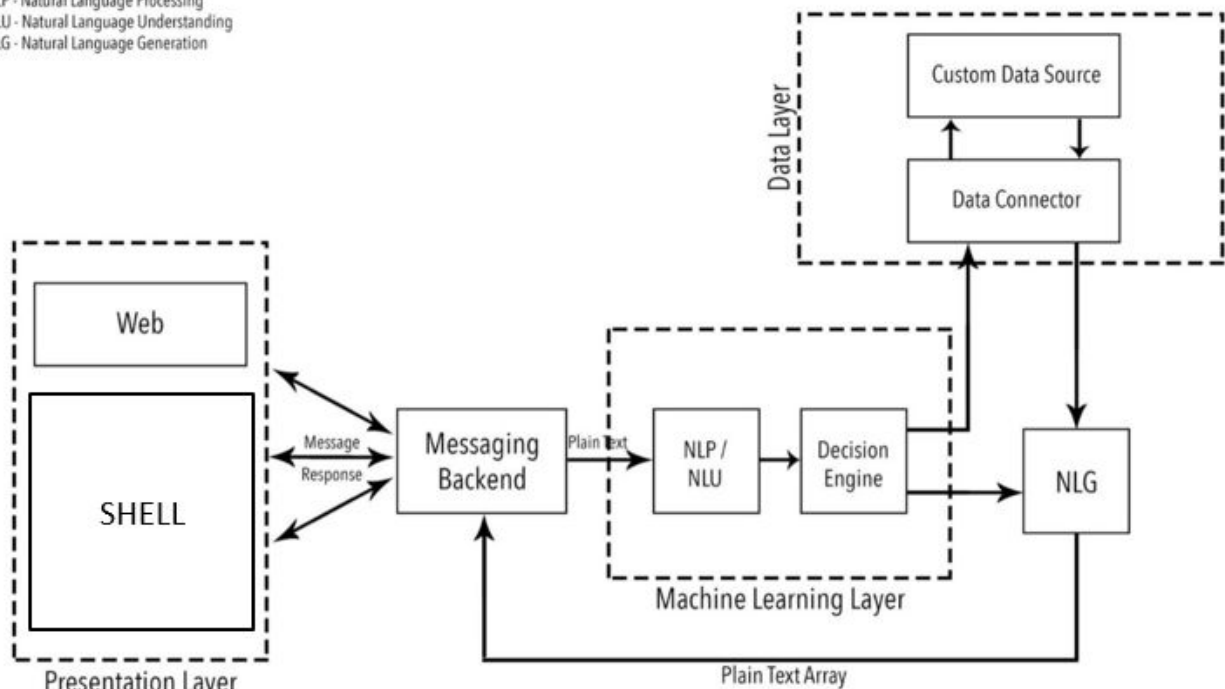
Presentation Layer: Presentation layer is a combination of Chat-bot and a shell. Chat-bot is a Raspberry Pi Google AIY Voice Kit for retrieve inputs and provide output in a voice format. Shell is for provide input and output in text format. This presentation layer transfer the input to messaging backend as well as retrive the final response from messaging backend.

Messaging Backend: Messaging backend responsible for retrieving input and providing output to and from presentation layer. It convert the voice input to a plain text and send the output to the Machine learning Layer.

Machine Learning Layer: Machine Learning layer consists with two parts, natural language processing/understanding (NLP/NLU) and Decision Engine. NLP/NLU responsible to correctly identify the input (question) and send it to decision engine. Decision engine make the interaction with the Data layer and send the identified input to the decision layer.

Data Layer: Data layer is where all the intelligence part happens. All the data require to deliver the correct solution is stored in data layer. It consists of two parts, data connector and data source. Data connector deals with decision engine and the data source to provide the exact solution to the Natural language generation.

Natural Language Generation (NLG): Natural language generation converts the text based output which received from data connector or decision engine to a voice message and send it back to the messaging backend.

5.2. Architectural Decisions

The following technology decisions have been made when designing the project:

- Choice of natural language processing API
- Choice of natural language generation API

AD001	Choice of natural language processing API
Problem Statement	One of the core functionality of the application is being able to recognise voice input. We need to determine which natural language processing API is best suited for our application.
Available Options	
Option 1.	**Google Natural Language API** Description: Google Cloud Natural Language explains meaning of the text and structure of the text in a pre-trained compelling machine learning models. Pros: • Easy to use REST API • Easy to build with AutoML Natural Language • The service provider company is reliable • Support all feature in all languages. Cons: • Some feature like emotions are not recognize. • Not apply for custom Machine Language models

Option 2.	**Watson Natural Language Understanding**
	Description:
	Watson Natural Language Understanding is a combination of APIs that generates a text based analysis using natural language processing. These collection of APIs support to identify keywords, concepts, entities etc.
	Pros:
	● Supports for many features like emotions etc.
	● The service provider company is reliable
	Cons:
	● Not Straightforward
Decision	
Selected Option	The selected option is **Option 1**.
Justification	Option 1 better than IBM Watson for our project. Basically because of our client prefer Google NL. Also Google NL has the benefit of being straightforward and support all their features in all languages as well as having a bit more granularity in their score.
Implications	We need to create a project in Google cloud platform and Enable the Cloud Natural Language API for that project.

6. Retrospective

 Mainly we are focused on two iteration plans to complete this project. First one is Working successfully with Raspberry pi Google AIY voice kit. In this stage we need to gather the data required for Raspberry pi Google AIY voice kit and communicate with it without the help of algorithm. As a result we hope to deliver a mechanism for successfully communicate with Raspberry pi Google AIY voice kit without the help of the channel.

As the second iteration we decided to analyse the data given to the raspberry pi Google AIY voice kit. The main aim of this iteration is to fix the communication with the help of algorithm. As a result Raspberry pi Google AIY voice kit can communicate as the algorithm is designed and it is able to answer all the questions from the data implanted into it. After successful completion of this iteration we hope to work for a better algorithm for communication with the Raspberry pi Google AIY voice kit as the next step.

When discuss about the architecture of the project, there are three main layers,

1. Presentation Layer
2. Machine Layer
3. Data Layer

Presentation layer is a combination of Chat-bot and a shell. Chat-bot is a Raspberry Pi Google AIY Voice Kit for retrieve inputs and provide output in a voice format. This presentation layer responsible for transferring the input to messaging backend as well as retrive the final response from messaging backend.

Machine Learning layer consists with two parts, natural language processing/understanding (NLP/NLU) and Decision Engine. NLP/NLU responsible to correctly identify the input (question) and send it to decision engine.

Data layer is where all the intelligence part happens. All the data require to deliver the correct solution is stored in data layer.

Combination of these three layers provide the intended output, 1x Functional Chat-bot meeting the below over the below areas in agriculture,

● Global Food data
● Global calorie data
● Global crop data