# ISYS30221 Artificial Intelligence 2021-22

## Coursework Documentation Template

## 1- About this submission

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| Student Name | Jared Awiti |
| Student ID | N0992216 |
| Chatbot Topic | Ancient/Modern Wonders of the World |
| Tasks implemented in this submission (a,b,c) | A basic, B basic, C basic, A advanced, B advanced, C advanced |
| Files inventory (excluding this file) |  |
| Demo video URL | [Recording-20240313\_180802.webm](https://myntuac-my.sharepoint.com/:v:/r/personal/n0992216_my_ntu_ac_uk/Documents/Recording-20240313_180802.webm?csf=1&web=1&e=qp3G04&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTdHJlYW1XZWJBcHAiLCJyZWZlcnJhbFZpZXciOiJTaGFyZURpYWxvZy1MaW5rIiwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifX0%3D) |
| Checklist | I will submit this file separately (without compression) into DropBox  All other files are zipped and will be submitted into DropBox  The demo video is recorded as instructed, and the sharing link is inserted above  I have made sure that the demo video is shared according to the instructions, so that I allowed everybody in the university to view it.  All the sections below are populated accordingly. |

## 2- Design notes (shrink/grow as needed, add images where applicable)

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| General explanations of the system and its goals | My chatbot project focuses on Ancient/Modern Wonders of the World. The system is designed to address user inquiries about Wonders of the world and analyse images to identify the likely wonder depicted. It incorporates voice command inputs, converting them to text using a speech recognition Python module. The chatbot will then display the answer to this.  In cases where the user inputs unrecognised commands, the chatbot employs cosine similarity of tf/idf values to interpret and respond appropriately based on similar questions.  A logic knowledge base (kb) file, checked for consistency upon loading, allows the chatbot to verify statements as true, contradiction false, and unknown false. Users can supplement the kb with additional statements, provided they align with existing entries. These are then saved into the logic kb.  Image classification utilises TensorFlow and Keras to identify common features among multiple images of the same wonder. The chatbot uses a trained model to classify which wonder the user has shown it. |
| The system requirements, i.e., the list of what the system should do/have from a user’s perspective | The chatbot can define anything on Wikipedia. Using the Wikipedia API. Using the input “What is a \*”.  The chatbot should be able to ask questions about the Ancient Wonders of the world.  The chatbot should be able to find the most similar question to the question asked if not directly in the knowledge base.  The chatbot should be able to take voice input when a user asks so. For example, using the input “I want to speak to you”. Then the best answer will be provided to the question.  The chatbot should be able to save facts from the user, these facts should have to do with whether a Wonder is Modern or Ancient. Using the input “I know that \* is \*”. If the statement contradicts it should not save.  The chatbot should be able to check facts from the logic knowledge base too. Using the input “check that \* is \*”. If the statement contradicts it should display contradiction. If it is unrelated then it should display the appropriate message. If it is correct return True.  The chatbot should be able to recommend a wonder to visit based on the architectural beauty and historical significance ratings on a scale of 1 to 10. Using the input “Recommend me a wonder to visit”.  The chatbot should be able to classify what a certain wonder of the world is. The user should be able to type “What is this picture”. Then select a picture and the chatbot should be able to classify it. The model can classify these Wonders: Christ the Redeemer, the Pyramids of Giza, the Taj Mahal, the Roman Colosseum and the Burj Khalifa |
| The employed AI techniques, and the explanation of program codes and the supplied files. | For part A, the chatbot uses tf/idf, cosine similarity, and lemmatisation to find the most similar question to the one asked if the question asked is not directly in the CSV file. Unmatched sentences trigger the AIML library to determine the tf/idf value relative to predefined question-response pairs. This value is calculated from a CSV file containing potential questions and answers, and cosine similarity is computed against user sentences. The question with the highest similarity is selected, and the chatbot responds accordingly. Furthermore, using the Python speech recognition module the user can also input a question via their voice.  For part B, the nltk library is employed. It turns the first-order logic statements from the CSV file into expressions. Then puts these expressions into a logical knowledge base. The nltk resolution prover is then used to check for contradictions in the initial database. When a new fact is entered via the user the prover checks the logical kb and then either puts the new fact in or outputs “contradiction”. Furthermore, the chatbot uses Fuzzy logic to recommend a wonder to visit using the skfuzzy library. It takes in the user’s preference for beauty and significance the using the fuzzy memberships, rules, and inference outputs the result.  Tensorflow and Keras are used for image classification. It is trained on 5 folders each one being a wonder. A CNN model is then created and using random search the most optimal hyperparameters are chosen for the model. This increases the accuracy of the model drastically. As a result of this, the model accuracy is 99% and accurately classifies most images.  CNN model without random search is 63%.    CNN model with random search is 99%.    The random search technique goes through random combinations of values to find the most optimal hyperparameters for hyperparameter tuning. The hyperparameters tuned were the number of units in the convolutional layers, the number of units in the dense layer, and the learning rate. By doing this the CNN model improves drastically. |

## 3- Conversation log (insert text, screenshots and/or images as required) – Task A

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| Task A – Basic implementation  Similarity-based question system using cosine similarity, lemmatisation and tf/idf.    If the user enters a question directly in the CSV. The chatbot will display the answer.    If the user enters a similar question the AIML is deployed and the most similar question in the CSV is found. The answer to the most similar question is then outputted.    If an unrelated input is given the user will output an error message.  Task A – Extra  You can ask the chatbot questions using your voice using the python speech recognition library. It will then use the above techniques to display the answer.      The user can ask a question using their voice. By typing one of the several commands, for example, “I want to speak to you”. The chatbot will then tell you to speak and by using speech-to-text the chatbot then finds the exact answer or most similar and outputs it. |

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## 3- Conversation log (insert text, screenshots and/or images as required) – Task B

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| Task B - Basic  A rule-based logic system, using First order logic, that uses “check that \* is \*” and “I know that \* is \*”. The system takes a wonder of the world and categorises it as Modern or Ancient.    The user is able to input facts, whether a wonder is Modern or Ancient into the logical kb.    If the user tries to enter a contradiction into the kb, then the chatbot will detect it and output an error message.      The user can also check these facts according to the kb. If a contradiction is detected the chatbot will detect this.      If the information is not relevant to the kb, then an error message will be displayed.      If the fact is true, then the chatbot will output True.  Task B - Extra  Wonder visit recommendation system. The user gives the AI bot metrics for Architectural beauty and historical significance (0-10) then the bot will recommend and Modern Wonder of the world to visit.    A user can enter several commands then the chatbot will ask for metrics. The fuzzy system will then decide which wonder it would most recommend the user to visit. |

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## 3- Conversation log (insert text, screenshots and/or images as required) – Task C

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| Task C - Basic  Trained and saved a CNN model to predict one of 5 wonders of the world. These include: Christ the Redeemer, the Pyramids of Giza, the Taj Mahal, the Roman Colosseum and the Burj Khalifa.        Images can be inputted into the chatbot and the chatbot can classify it. The image bot can identify each wonder and output the result using the “what is this image” command.      Similarly, the “what is this picture” command can be used for this same purpose.              Task C – Extra  Hyper-tuning the parameters of the CNN model using the random search module. This finds the most optimal parameters and increases the accuracy. |

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