UG Project Plan
CSC-30014

Project Overview and Description

Student Name: Thomas Herward
Student Username: X3D82
Student Number: 20014189
Degree Title: Computer Science single honours
Supervisor Name: Dr Vishwash Batra
Project Title: Queue management system with photo recognition to estimate wait time

Please provide a brief Project Description:

This project aims to investigate the use of neural networks and photo recognition capabilities to be able to determine the current wait times in a queue. This will work by using a randomly selected person on entry to the queue and then waiting until the software recognises them again at the end of the line to work out the queue time, harnessing neural network algorithms. The project would have wide use in shops, banks, and theme parks to be able to increase customer satisfaction and give the abilities for companies to have data to improve upon and understand when to allocate extra resources. The project will investigate the effectiveness of the photo recognition system, assessing its accuracy and reliability in estimating queue times.

What are the aims and objectives of the Project?

In this project I am to research Neural Networks to be able to investigate their effectiveness in being able to provide businesses with vital data on queues within the business.

I aim to create a version of the software used to estimate the queue times to be able to demonstrate the concept and be able to aid in concluding on its effectiveness within businesses. I will demo this software at the end of the projects development.

I aim to conduct an ethical assessment on the final concept of the software and evaluate on the ethical considerations a business would need to consider before implementing the software in everyday use. I also aim to make a review on the accuracy of the software and whether its an improvement on current methods of measuring the queue wait times.

Please provide a brief overview of the key literature related to the Project:

'Queue Time Estimation in Checkout Counters Using Computer Vision and Deep Neural Network by Muhammad Atif Irfan, Muhammad Zohaib, and Muhammad Aamir Shahzad' is a paper that proposes a system for estimating queue time in checkout counters using computer vision and deep neural networks. This system works by detecting and tracking people in the queue, and then using a deep neural network to estimate the time it will take for each person to reach the checkout counter.

'Waiting-Time Estimation in Bank Customer Queues using RPROP Neural Networks by R. K. Jena, S. K. Rath, and R. Panda' is another paper that proposes a system for estimating waiting time in queues, but this time using RPROP neural networks. This system works by collecting data on the number of customers in the queue, the number of servers available, and the average service time. This data is then used to train a neural network to estimate the waiting time for each customer.

'Y'OLO: Real-Time Object Detection with Region Proposal Networks by Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi' is a paper that introduces the YOLO algorithm for object detection. YOLO is a fast and accurate object detection algorithm that can be used in real time. This is important for queue time estimation, as it allows us to identify and track customers in a queue in real time.

'A time series forecasting approach for queue wait-time prediction by A. S. Kumar and H. V. P. V. N. Rao' is a paper that proposes a time series forecasting approach for predicting queue wait times. This system works by collecting historical data on queue wait times and then using a time series forecasting model to predict future wait times. This is important for queue time estimation, as it allows us to predict waiting times in advance, so that we can take steps to reduce them if necessary.

'TensorFlow 2: A Practical Guide for Beginners by Anirudh Koul and Learning PyTorch: A Hands-On Guide for Beginners by TutorialsPoint' are two books that provide comprehensive introductions to TensorFlow 2 and PyTorch, respectively. TensorFlow 2 and PyTorch are two popular libraries for machine learning and deep learning. They are both well-suited for use in applications such as queue time estimation, where they can be used to train and deploy neural networks.

Project Processes and Methods

Please provide a brief overview of the Methodology to be used in the Project (inc. an overview of best practice within the Methodology):

Within my project I have chosen to go for an Agile methodology which will involve me dividing the project up into smaller, more manageable targets. An Agile Method allows for continuous reviewing and adaptation to ensure that the project will remain on time. However, as I am completing the project by myself and not as part of a team, I will need to ensure that I hold my self-accountable and have discipline to the target. I will set myself realistic goals and ensure I review my progress on a weekly basis and make any required adaptations to ensure I'm on target.

Overall using an Agile methodology will be beneficial in my project and ensure that I'm completing it effectively. It will give me the ability to review my progress and make improvements during the project but also help me stay on track ensuring the project gets completed on time.

Will any special Data Collection Methods will be employed (e.g card sorts, questionnaires, simulations, …)?

I do not plan to use any special data collection methods such as card sorts and questionnaires. I do however plan to simulate my program by using stock images of queues to try and replicate how it would work in a real-life environment. For example holding up a stock image of a person and removing it from the cameras view, brining it back into view should then get amount of time that that photo was away from the camera as the result. It will then later be tested as a photo of a queue of people where the software will have to pick out one person from that group, it will then be tested again after a period to get the required data to show the program is functioning. This method will be ethical as it will be using widely available stock images of people / queues which will have already gone through with asking the people within the photos if they approve it being used. The photos will only be of adults.

Briefly describe how you will ensure your project is in line with BCS Project Guidelines (BSc Computer Science Single Honours Students only)?

To ensure that my project is in line with the BCS Project Guidelines, I will first define the scope of my project clearly and concisely. I will then develop a project plan that outlines the tasks and the resources that will be needed, and the timeline for completion (the Gantt Chart). I will also identify the risks (risk table below) that could impact my project and develop mitigation plans. Throughout the project, I will keep monitoring my progress and ensure to update the project plan of the progress of my project and any changes that have happened to the project.

In addition to the general guidelines, I will also make sure to follow the specific BCS Project Guidelines which includes ensuring that my project is a significant piece of work that is relevant to computer science, that it is completed independently, that it is submitted in the form of a written report, and that it is assessed by a project supervisor and an external examiner

Time and Resource Planning

Will Standard Departmental Hardware be used? YES (standard computer with webcam to be used)

Will Software which is already available in department be used? YES (will be developed as an example in XCode)

Will the project require any Programming? YES (Python)

If YES please list the (potential) Programming Languages to be used (including any IDEs and Libraries you may make use of):

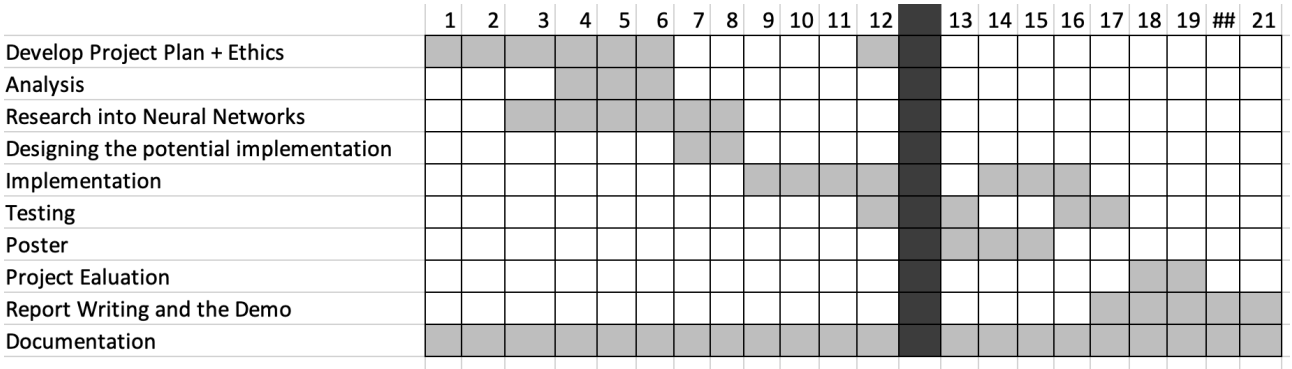
Programming Language – Python
IDE – XCode, Visual Studio is planned as the backup IDE incase any issues with XCode arise.
Libraries potentially to be used:
TensorFlow
DLib (python adapted implementation)
YOLO (A facial recognition library)
PyTorch

Table of Risks (*if non Standard Hardware and/or Software to be used please also include backup options/ contingency plans here)*:

Risk-id Description	Probability/Likelihood of occurring	Best practice prevention measures	Remedy
Loss of work	**low**	**To keep backups stored elsewhere and also make backups on the same computer as the program progresses in production.**	**To load an old backup and re-do the lost work.**
Hardware Failure	**Low**	**To keep backups in the cloud so that I can access them from another computer if needed.**	**To use computers within the lab and from an old backup before my personal computer broke**

Falling behind the plan	**Low**	**Create achievable goals within the Gannt Chart**	**To look back at the Gantt Cart and make changes to ensure the goals are achievable**
Inaccurate data (queue times) being produced by the implementation	**Medium**	**Train the neural network on a much wider data set to improve the generalizability**	**Keep monitoring the performance of the model and give it more data if needed.**
False Recognition (the program may recognise things as people when they are not)	**Medium**	**Train the neural network with a wide data model**	**To go back and train the model more, ensuring to monitor progress**
Privacy Concerns	**Medium**	**Only use stock images of queues held up to the system to ensure I do not cross any GDPR regulations.**	**Review the GDPR Checklist**
Technical Issues	**Medium**	**Thoroughly test the software before the demo and keep track of past bugs and changes**	**Go back to a previous version of the software if a new change is causing issues.**

Gantt Chart (must include milestones and deliverables):



References

Please include a list of References used in this Plan (using Harvard reference style):

Waiting-Time Estimation in Bank Customer Queues using RPROP Neural Networks by R. K. Jena, S. K. Rath, and R.Panda: https://www.sciencedirect.com/science/article/pii/S1877050918314339

YOLO: Real-Time Object Detection with Region Proposal Networks by Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi: https://arxiv.org/abs/1506.02640

A time series forecasting approach for queue wait-time prediction by A. S. Kumar and H. V. P. V. N. Rao:https://www.diva-portal.org/smash/get/diva2:1458832/FULLTEXT01.pdf

Queue Time Estimation in Checkout Counters Using Computer Vision and Deep Neural Network by Muhammad Atif Irfan, Muhammad Zohaib, and Muhammad Aamir Shahzad: https://iopscience.iop.org/article/10.1088/1742-6596/1964/6/062108/pdf

TensorFlow 2: A Practical Guide for Beginners by Anirudh Koul:https://www.tensorflow.org/tutorials/quickstart/beginner

Learning PyTorch: A Hands-On Guide for Beginners by TutorialsPoint: https://m.youtube.com/watch?v=c36lUUr864M

Submission Date:

PLEASE NOTE THAT SHOULD YOUR PROJECT UNDERGO ANY MAJOR CHANGES FOLLOWING THE SUBMISSION OF THIS PLAN YOU ARE EXPECTED TO SUBMIT AN UPDATED PLAN WHICH ACCURATELY REFLECTS YOUR PROJECT.