

PROJECT SPECIFICATION - Project (Technical Computing) 2020/21

Student:	██████████
Date:	24/09/2020
Supervisor:	██████████
Degree Course:	Computer Science
Title of Project:	Classification of hand gestures using a neural network and computer vision

Elaboration

Hand gestures are used widely even before computer vision. They are easily understood by humans however getting a computer to recognise gestures is much harder. Advances in deep learning are improving computers ability to detect human like communication. The main aim of this project is to train a neural network on a set of gestures so that it can recognise those gestures given a video stream.

This trained network then could be used to translate sign language into English or be the basis of gesture-controlled software such as a game, robotics or smart devices in the home such as a stereo system or lights. Gesture recognition could also be useful in situations where surface contamination might be a concern. For example in a medical environment or fast food restaurant where a particular device might be used by many different people, gestures could be used to interface with a computer so that users don't spread or catch contaminants by having to touch a touch screen or keyboards and mouse.

There are many different approaches to gesture recognition, part of my research will be finding out what techniques/algorithms work best for this application. I will begin with building a convolutional neural network for classification then evaluating and iterating from there to improve modal accuracy. I will consider using established pre-trained networks for this task and try to develop them for the problem area.

Project Aims

Aims

- Implement image pre-processing to condense the image/input for the neural network as to focus on only the features we care about. (Background subtraction/Colour flattening)
- Build a prototype that can recognise trained gestures through the user's webcam.
- Improve my knowledge of machine learning. (Notably – Convolution Neural Networks, TensorFlow, Performance metrics)
- Consider approaches to detect user's hand in a larger image.
- Evaluate the neural network using performances metrics to test whether the approach was effective.

Objectives

- Investigate how to detect a gesture in an image/video using computer vision and neural networks.
- Research most appropriate languages/frameworks for computer vision and neural networks.

- Research network architectures that might be better suited to this application than a classic neural network.
- Learn and apply the fundamentals of deep learning to improve performance metrics.
- Collect sufficient data to train and develop the neural network.
- Test the application thoroughly and iterate to improve accuracy of the network.

Project deliverable(s)

The deliverable for this project will be a Python desktop application that uses the TensorFlow framework for neural network and OpenCV to capture frames from the users' webcam. Users will be able to show gestures that have been trained into the neural network to their webcam and the neural network will predict what gesture it is.

Action plan

Task	Details	Submission Date
Find a Supervisor	Discuss feasibility with project supervisor	9 th October
Preliminary research	Undertake research to confirm that the project is feasible. Download all software needed. (Python/TensorFlow/OpenCV/PyCharm) Research into neural networks and computer vision – Pick an approach that my research shows work the best.	15 th October
Project Specification and Ethics form	Flesh out specification to clearly describe the aims and objectives	23 rd October
Information Review	Pool research and write information review	20 th November
Develop Prototype	Build a small version of the application to get to grips with the frameworks I will be using and write any useful functions.	20 th December
Develop Application	Build and test deliverable to meet specification. Test the application to a satisfactory level of accuracy.	30 th January
User testing	Allow people to test application. Provide participant information sheet and	5 th February
Contents Page		15 th February
Draft Evaluation/ Draft Report		19 th March

Finish and Submit report and deliverable		15 th April
Demo of work		29 th April

BCS Code of Conduct

I confirm that I have successfully completed the BCS code of conduct on-line test with a mark of 70% or above. This is a condition of completing the Project (Technical Computing) module.

Signature: 

Publication of Work

I confirm that I understand the "Guidance on Publication Procedures" as described on the Bb site for the module.

Signature: 

GDPR

I confirm that I will use the "Participant Information Sheet" as a basis for any survey, questionnaire or participant testing materials. This form is available on the Bb site for the module and as an appendix in the handbook.

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PROJECT SPECIFICATION - Project (Technical Computing) 2020/21

Student:	██████████
Date:	20 th October 2020
Supervisor:	██████████
Degree Course:	BSc (Hons) Computer Science for Games
Title of Project:	A gamified application, which allows the user to safely practice the skills necessary to drive an electric wheelchair.

Elaboration

For many people with mobility issues an electric wheelchair is a necessity. However, learning to drive one can be a daunting prospect. The learning curve can be quite steep depending on the user's confidence in using technology; mistakes and accidents can be potentially painful and/or costly.

The Assistive Technology Team at Barnsley Hospital have requested that an application be developed to provide the user with a safe way to practice their wheelchair driving skills. Initial discussions clarified that the team would like the application to operate in a game-like manner encouraging self-directed play in a home environment, rather than a specialist tool to be used specifically within the department. The application would ideally provide a close to real-life experience for the user, but they are willing to compromise on realism provided the underlying skills are being taught. The application would ideally be able to be controlled using a real wheelchair input device, such as a joystick, or switch/es. Common obstacles such as Kerbs, Roads, Stairs, and other objects should be incorporated into the experience. The team would also like it if realistic effects of driving over different surfaces types and cambers could be included, but these are not necessary.

This project aims to build upon that request and explore whether a gaming experience could be considered a valuable tool in the process of learning to drive an electric wheelchair.

Project Aims

- Investigate real-world wheelchair operation, existing wheelchair training solutions and other applications that offer a simulation experience.
- Investigate the possibility of implementing an actual wheelchair joystick as the application controller.
- Implement the research findings into a realistic driving experience and include gamification.
- Improve the application experience using feedback from Assistive Technology Professionals.

Project deliverable(s)

I will develop an application that provides a game-like experience which will allow the user to practice some of the skills required when driving an electric wheelchair.

This application will be targeted towards low powered mobile devices to ensure usability by the maximum possible target audience. Initial development will be for the android platform as access to Apple hardware is limited.

The application experience will:

- Offer a semi-realistic wheelchair driving experience to the user.
- Provide situations with static obstacles to allow basic control practice.
- Provide situations with moving obstacles to best represent real world situations.

- Utilise gamification to improve engagement amongst target audience.

I will manage the project using the SCRUM framework as a baseline for defining and allocating workload. I will also set up a release pipeline that allows for continuous delivery to a remote host, allowing product testing to be much more dynamic. I also intend to use unit and integration tests as much as possible to ensure that the application is as bug free as possible due to the nature of its intended audience in the long term.

Action plan

Action	Suggested Completion Date
Find project supervisor	9 th October 2020
Submit project specification and ethics forms	23 rd October 2020
Set up project management solution	23 rd October 2020
Research into game engine technologies	23 rd October 2020
Set up development environment / game engine	23 rd October 2020
Research into continuous deployment pipelines	23 rd October 2020
Set up continuous deployment solution	23 rd October 2020
Research other examples of wheelchair training software.	Ongoing throughout the project and beyond.
Produce first version of the app that contains basic wheelchair movement as proof of concept	16 th October 2020
Research physics interactions associated with driving an electric wheelchair	23 rd October 2020
Research different wheelchair models and their handling characteristics	23 rd October 2020
Produce second version of the app with improved wheelchair physics	30 th October 2020
Research input methods available on devices with a view to enabling control with an actual wheelchair joystick controller.	6 th November 2020
Produce third version of the app that is controllable with a generic gamepad device.	13 th November 2020
Research wheelchair users' experiences and identify situations determined most difficult.	Ongoing throughout duration of the project.
Research government regulations on wheelchair use with a view to incorporate any legal restrictions.	Ongoing throughout duration of the project.
Research other examples of existing driving simulation games.	Ongoing throughout duration of the project.
Research gamification techniques	Ongoing throughout duration of the project.
Produce fourth version of the app with a small selection of gamified levels	11 th December 2020
Continue to refine application based on feedback, and research additional areas where necessary	Ongoing throughout duration of the project.
Submit Information Review	4 th December 2020
Submit provisional contents page	19 th February 2021

Draft critical evaluation	19 th March 2021
Submit report to TurnItIn	15 th April 2021
Submit Report to Blackboard	15 th April 2021
Demonstration of the work	Before 29 th April 2021

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PROJECT SPECIFICATION - Project (Technical Computing) 2020/21

Student:	
Date:	12 th October 2020
Supervisor:	
Degree Course:	Computer Science
Title of Project:	Application to educate those who are unfamiliar with handling sensitive information online

Elaboration

Using money for the exchange of goods and services online is a modern convenience for most. Unfortunately, there is still a large minority of people who lack fundamental computer skills. As a result, online services like e-commerce sites are difficult for these users to understand and operate. This can leave many people feeling socially excluded from the modern world. The goal of this project is to educate those who are unfamiliar or fearful about using online services that require the use of sensitive information.

My solution is to produce a secure online application that simulates common procedures a user is expected to go through on sites where sensitive information is required. The application will function with two core users; a teacher and a learner. The final result will allow the learner to visit any trusted e-commerce website and confidently handle private information.

Through the help of Barnsley Adult Skills Community Learning I will be able to demonstrate and conclude the usefulness of the deliverable.

Project Aims

Identify common procedures users will experience when handling their sensitive information online.

Identify development frameworks and libraries that will help create a realistic and learner friendly experience.

Identify software and methods that ensure all data collected by the solution is relevant and secure.

Identify the most appropriate approaches for educating users through online applications.

Use an agile development approach by making use of the resources available.

Develop a back-end system that supports storing and distributing the application data.

Develop a front-end single page application that simulates experiences where the user must deal with sensitive information.

Develop a teacher and learner based environment that will allow learners to access the application with minimal computing knowledge.

Conclude, when done correctly, if an online educational tool can be utilised effectively to reduce the feeling of social exclusion for users who lack fundamental computer skills.

Project deliverable(s)

The core deliverable from this project will be a prototype of a full stack web application that educates users on how to handle sensitive information online.

This will include the following:

- A secure, teacher and learner based user system where learners require little to no skills to access the application.
- Multiple simulated tasks based around users having to handle sensitive information.
- Analytical information for all users to help highlight areas where learners require improvement.

Action plan

Task	Deadline Date
Find project supervisor	9 th October 2020
Project specification & ethics form	23 rd October 2020
Background Research <ul style="list-style-type: none"> - <i>Target audience.</i> - <i>Existing applications and teaching/learning methods.</i> - <i>Technologies available and required to build all aspects of the deliverable.</i> - <i>Engineering approaches, methodologies, and tools available.</i> 	27th November 2020 (Overall) <ul style="list-style-type: none"> - <i>31st October 2020</i> - <i>7th November 2020</i> - <i>14th November 2020</i> - <i>21st November 2020</i>
Information review	4 th December 2020
Design stage <ul style="list-style-type: none"> - <i>Application architecture structure</i> - <i>Database structure</i> - <i>User experience and interface</i> 	21st December 2020 (Overall) <ul style="list-style-type: none"> - <i>7th December 2020</i> - <i>14th December 2020</i> - <i>21st December 2020</i>
Development stage <ul style="list-style-type: none"> - <i>Database</i> - <i>Application back-end</i> - <i>Application front-end</i> 	12th February 2021 <i>(These tasks will be worked on and completed concurrently)</i>
Provisional contents page	19 th February 2021
Prototype testing and collection of evaluable data with learners and teachers from Barnsley Adult Skills Community Learning	1 st March 2021
Project modifications based on testing evaluation	13 th March 2021
Draft critical evaluation	19 th March 2021
Sections of draft report	19 th March 2021
Upload report	15 th April 2021
Demonstration	29 th April 2021

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PROJECT SPECIFICATION - Project (Technical Computing) 2020/21

Student:	██████████
Date:	22.10.2020
Supervisor:	██████████
Degree Course:	BEng Software Engineering
Title of Project:	Development of a Soundtrack Recommendation engine to list soundtracks based on user behaviour.

Elaboration

I will be creating an application that lists various soundtracks to the users. The application will allow users to create an account and start using features, like rating soundtracks, and saving them in their favourites list etc. The focus of this project is to create a recommendation engine. This would be used to enhance the users experience by listing soundtracks that are like ones they have preferred, and rated etc. The algorithm would analyse the user's data and determine patterns of similar soundtracks by predicting the user's behaviour. It will require researching different filtering techniques such as Item-based / User-based collaborative filtering and model-based systems.

The recommendation engine would also ensure that soundtracks that have not been viewed or listened to by the user's would also be listed to the user in their recommendation list. The main difference in this engine will be to ensure that users are able to discover various new soundtracks alongside the most popular rated.

To advance this project, I will be developing an API that will be used to manipulate and pass through the relevant data to the web-application. In this case the data items will consist of soundtracks and will be manipulated by the algorithm so that it displays the recommended soundtracks to the user. The web-app will absorb the data from the API and consider the user's ratings for each soundtrack, their preferred genres and other factors etc. which will be recorded against each soundtrack in the database. The API will then collect this data and then generate a list of recommended soundtracks to the user, this will be done by predicting the user's behaviour and then determine a pattern.

User's will need to log in or create an account for the recommendation feature to work, and then store their credentials in a database. The API would ensure that the data would easily be shared more efficiently and allow a smoother user experience displaying relevant up-to-date information.

Project Aims

- Develop a complex Web-Application to display various soundtracks with a recommendation engine.
- Implement an API to transmit the soundtracks data to the web app.
- Research and acquire knowledge of recommendation systems and filtering techniques.
- Design a recommendation algorithm to filter soundtracks based on user's interaction with the web app:
 - Performing logical step-by-step instructions.
 - Building blocks.
- Recommend soundtracks to users to enhance their experience of the web app.
- Evaluate the web app and suggest possible improvements at the end of the project.
- Handle and manipulate soundtrack data from a database in a Web-Application to output the recommended soundtracks.

- Identify useful software tools and libraries to help develop the recommendation engine and web app in the best way.

Project deliverable(s)

I will develop a prototype for the recommendation algorithm which is going to contain the logical step-by-step instructions to display recommended soundtracks.

I will also develop a web-application prototype, which will be used to display the soundtracks recommended to the user, based on their preferences (e.g. genre) and ratings generated from the API data, and allow them create an account to like, rate and save soundtracks to their list.

Alongside both, I will develop an API that will be used to push data across to the web app, that will be manipulated by the algorithm, based on the user's interaction with the data. This will include soundtracks that stored in the database.

Action plan

Task:	Deadline Date:
Find Project Supervisor	9 th October 2020
Complete the Project Specification	23 rd October 2020
Research the best project methodology such as Agile, waterfall etc.	6 th November 2020
Investigate project planning tools	6 th November 2020
Set up version control (GitHub) for project	8 th November 2020
Research how to develop an API	12 th November 2020
Research how to consume an API into a Web-Application and push data	13 th November 2020
Learn about data filtering techniques used in item recommendation	20 th November 2020
Research in generating recommended items automatically based on user activity and preferences	25 th November 2020
Research suitable databases for storing soundtracks	28 th November 2020
Information Review	4 th December 2020
Design and develop the database for soundtracks	11 th December 2020
Develop the API	24 th December 2020
Develop the Web-application front-end and back-end	11 th January 2021
Connect the database to the API	12 th January 2021
Consume the API into the Web-app and push the data	16 th January 2021
Test the web-application and API with sample of	25 th January 2021

participants	
Fix any issues / bugs from user feedback	14 th February 2021
Agree contents page with supervisor	19 th February 2021
Create Draft Report	19 th March 2021
Create Draft Critical Evaluation	19 th March 2021
Submit the final Project report, deliverable and video of deliverable	15 th April 2021
Demo to Supervisor and second marker	Before 29 th April 2021

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