Project Specification

Work Overview

My project is going to focus on the concept of synthetic media, which is becoming huge in recent years with technology like deep-fakes and face filters. Synthetic media is currently revolutionising the media landscape and changing the way we consume and create our media.

I want to create a system that will allow companies to advertise in videos without the need to film it themselves, saving time and money. It has a wide range of use cases, but examples include advertising on YouTube, allowing content creators to agree to have a product shown in a video they've already filmed or uploaded, or if a company creates an advert for a certain region but would like to use the same advert for the product that falls under a different branding. E.g. walkers – lays, milky way – mars bar. As an example of the model's potential, I plan to swap Pepsi cans with coke cans in a gif or set of images. In the future, I would like to have a website containing a collection of stock videos and allow people to implement their own product, saving them money and time filming it themselves. A similar concept exists for face movements from the company Synthesia who used their AI video synthesis technology to replace "Just Eat" with "Menu Log" by changing the lip movements in all the shots in the advertisement.

The network will be written in python and use several techniques including Machine learning and Neural networks to perform calculations on data and will examine the inputs to translate patterns to new images. The output will be displayed using Data Visualisation techniques and matplotlib.

Technologies and Materials

The model will be created using Python as it is the most used language for machine learning and comes with extensive libraries. Using python will make it very easy to experiment with a range of methods due to is simple syntax and broad online presence.

The image translation model will be created using CycleGAN as a base with an EfficientNet architecture for the generators. I am also planning on using denoising methods to obtain a higher accuracy. The combination of the two alterations to the CycleGAN network should provide a unique model and an improved image that will be generated as the output.

To achieve this, the following technologies will be used:

- TensorFlow – Machine learning library that will facilitate the creation of the GAN (https://www.tensorflow.org/)
- Keras – Deep learning framework that offers simple APIs to be used with TensorFlow (https://keras.io/)
- NumPy – Mathematical library for python adding support for multi-dimensional arrays and matrices, along with a range of other mathematical functions. (https://numpy.org/)
- Matplotlib – Graph plotting library for data visualisation in python. (https://matplotlib.org/)

Motivation research

I have been very interested in the concept of synthetic media since seeing huge development in the industry in recent years. With the advancement technologies like deepfakes, now even face filters have become available to anyone who possesses a mobile phone. GANs have been developed to generate images of human faces which are now almost indistinguishable from an image of a real person (https://syncedreview.com/2019/02/09/nvidia-open-sources-hyper-realistic-face-generator-stylegan/). With the current rate of growth of technology, its incredible to think where this industry will be in future. (https://www.synthesia.io/)

My research led me to Generative Adversarial Networks, and from there I decided I wanted to work with these to create my own model. The CycleGAN ended up fitting best to what I want to achieve as it allows for image translation with unpaired data which is more realistic for most real-world use cases (https://junyanz.github.io/CycleGAN/). I was drawn to this project due to my interest in python and machine learning. The project will allow me to develop my knowledge in these areas and will provide me with something that I can use to display my skills to future employers.

Existing knowledge

I am drawing on my prior knowledge from both first- and second-year programming modules including, 'Introduction to programming' and 'Principles and Applications of Programming'. Although they covered JavaScript and Java, they helped to gain an understanding of logic and programming concepts. Since, I have been learning Python by completing several algorithm problems and small personal projects. The current third year 'Data Visualisation and the Web' and 'Artificial Intelligence' modules are also helping to build upon my Python knowledge, as well as learning how to use matplotlib to display the outputs of my network. I have also completed Andrew Ng's Coursera specialization on machine learning and neural networks over the summer break from which I have gained a solid foundation of the concepts involved. The data collection stage of my project is already complete, and in doing so I have gained a better understanding of how to use NumPy and TensorFlow Datasets

New knowledge

To complete the project, I will need to develop my understanding of how the CycleGAN model works in detail, focusing on the loss functions and cyclic training method that it uses. (https://junyanz.github.io/CycleGAN/). More research on other image translation and generation models will need to be done to learn how to implement the EfficientNet architecture (https://arxiv.org/abs/1905.11946), denoising techniques or any other improvements to my own network. More work into displaying the data will have to be done to ensure the output and performance of the model is displayed as clearly and effectively as possible so I can compare it with current image translation techniques. This will be done through both the Data Visualisation module and my own research on the topic. Generally improving my knowledge of machine learning and neural networks will also be important to the success of my dissertation as the model I plan to produce is more complicated than those covered in the Artificial Intelligence module.

Timeline and Milestones

Date	Milestone	Completed	Allocated Time
09/11/2020	Finalise Project idea and have good understanding of MVP		1 week
16/11/2020	Research CycleGAN algorithm		1 week
23/11/2020	Compile larger dataset		1 week
30/11/2020	Complete CycleGAN base model		2 weeks
07/12/2020			
14/12/2020	Research and implement EfficientNet architecture in CycleGAN		2 weeks
21/12/2020			
28/12/2020	Research denoising techniques for GANs		1 week
04/01/2021	Implement denoising for outputs		2 weeks
11/01/2021			
18/01/2021	Interim report		1 week
25/01/2021	Interim report due		
01/02/2021	Test Model and make changes as necessary		4 weeks
08/02/2021			
15/02/2021			
22/02/2021			
01/03/2021	Set up basic site to display the synthetic advertisement service		1 week
08/03/2021	Tweaking model to obtain best output		1 weeks
15/03/2021	Project Report		9 weeks
22/03/2021			
26/03/2021	Draft report submission due		
29/03/2021			
05/04/2021			
12/04/2021			
19/04/2021			
26/04/2021			
03/05/2021			
10/05/2021			
14/05/2021	Final report is due		