Understanding the task

# Introduction

In Queens University Belfast I am enrolled upon a module called “Computer Science Challenges”. The task set is generally very difficult and is more to see just how well we get on with it rather than to complete the task. The main goal of doing this is less to complete the task but more in creating something of value.

This Blog post will hopefully give you something of value in the form of allowing you to follow on from the work I have done.

## The Task

“People often make consistent superficial judgements of a strangers’ personality and life from their appearance. While these judgements can often be very inaccurate, the fact that many people can feel a similar way is interesting and can be used to reveal cultural bias and measure the limits of human intuition. The goal of this project is to create a realistic ‘character sheet’ as a json datastructure that defines a person and their appearance in an image. By getting crowd workers to label fictional and real people we can analyse how people make judgements about others and how accurate and consistent such judgements can be.

Start by focusing on the visual appearance of an image of a person using existing academic taxonomies (for example, describing the clothes they are wearing using **X**) for areas that have yet to be formalised like haircuts and makeup, develop ways of formalising them using websites or online guides (e.g. for describing a person’s glasses they could be labelled with the closest equivalent specsavers product id).

Add invisible personality metadata – for example high level personality judgements like those used in the open psychometrics fictional character survey ([https://openpsychometrics.org/tests/characters/ (Links to an external site.)](https://openpsychometrics.org/tests/characters/)).

Add career and education estimates (what job they might do, what subjects they studied at university) (net worth)

Add romantic relationship estimates (given other images and descriptions identify the most likely partner) (potentially historical estimates e.g. many partners one, none etc.)

Friendship relationships

Family relationships

Hobby and entertainment interests – what films, music, part time activities most interested in

Medical conditions

Religious views

Weight, Height, clothing measurements

Possible names the person might have (implying nationality, class, age etc.)

Create amazon mechanical turk application to take an image of a person and fill in the corresponding character sheet data through a long questionnaire

Use images of imaginary people produced by stylegan2-ada (keeping track of the input vector, so it can be used to reproduce the images and train computer vision algorithms in the future)

https://github.com/NVlabs/stylegan2-ada

Gather images of semi-famous people (leaders of their profession but not widely known), with known information from Wikipedia e.g. profession, nationality, weight, height etc.

Use stylegan ada to get their appearance signature from their facial appearance

As there are many areas to formalise within the character sheet, multiple students can work together each focused on formalising a different part of the character sheet.

**Language and Platform**

Python and PySelenium scripts for webscraping to define a taxonomy e.g. scraping specsavers glasses images and their corresponding ids)

Amazon’s mechanical turk

**Further work – system should be able to expand to perform this functionality but doesn’t need to do it for V1 (the main focus of the module)**

Can train a stylegan-ada system to take an image and estimate properties of the person, also can adjust character sheet information to adjust the appearance”

My initial take on this was that it seems like an incredible idea, but a big undertaking, with a steep learning curve. I am to make that learning curve a bit less painful for whoever reads this.

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# StyleGAN2

## Overview

StyleGAN2 itself is a generative adversarial network (GAN) which was brought forward from Nvidia researchers in December 2018.

A GAN is a class of machine learning frameworks in which two neural networks contest with each other in a game. Given a training set, this technique generates new data with the same statistics as the training set.

A video which helped me understand GAN’s can be found [here](https://www.youtube.com/watch?v=Sw9r8CL98N0)

## Capabilities

A GAN could therefore be used to generate new images that look similar to the ones in the dataset provided.

## Relevance to the task

Labels can be attached to certain aspects of the image generation so that the user can help the GAN ‘understand’ real world characteristics.

For example if you provided a dataset of people of varying ages, with their ages as labels to the image, you could then generate images of people defining what age you want them to look. See Below as to what the output could look like

This same system could be used to take an image and work out what the values of the labels would be. For example in guessing the age of someone.

If we got this working, we could get the labels assigned to someone and from this formalise aspects of the image of a person and from this generate assumptions about them. Therefore enabling us to create the “Character Sheet” of a person.

## StyleGAN2-ada

You may have noticed that I’m talking about StyleGAN2 when im working with StyleGAN2-ada.

StyleGan2-ada is simply an improved version and boasts many improvements over StyleGan2 these include:

* Significantly better results for datasets with less than 30k training images.
* Mixed precision support meaning ~1.6x faster training, ~1.3x faster inference, ~1.5x lower GPU memory consumption.
* A cleaner codebase which is therefore easier to work with.

The github page for StyleGan2-ada can be found [here](https://github.com/NVlabs/stylegan2-ada)

# Google Colaboratory

## Overview

Basically, google Colaboratory is a free service which allows you to run your code on a virtual machine. Meaning you don’t need to worry about the power of your PC if you want to follow through on furthering this work.

## Advantages

* It Requires zero configuration and has many packages built in
* Gives free access to GPU’s for training networks
* You can easily share your work or pick up on the work of others

## Limitations

* Likes to shut off on its own once it has finished running (can be prevented)
* You have a maximum of 8 hours per session for the free version, so no very large datasets
* The data used is generally through your google drive folder which is limited to 15Gb without paying
* Generally the GPU is quite low power and therefore takes quite long to train
* You must have a google account

The link to my notebook can be found [here](https://colab.research.google.com/drive/13U2dZstwzfwE7vyiMVyNX76wYje8cfKD?usp=sharing)

# My Progress

I am currently at a stage where I have given a taken a pretrained model (one which has already learned from a different dataset) and given it 3000 example images of dogs and from this produced its own crude ‘Dogs’



To see more information on how I got to this point please check out my how to guide

I took on this task of training a StyleGAN2-ada network without labels so that later on I can train it with labels and eventually use this to produce my own images with my own parameters

## Understanding how to use Colab + StyleGAN2-ada together

The best way to learn how to do this yourself and further my work is to see an example. That is why I have fully annotated my colab notebook to help you understand and I highly recommend you check it out.

Long term goal

# What could be achieved

## Integration with peers work

Another Student, Nathan O’Donnell, is working on the same project however his focus is more on the character sheet side of things. So far he has created a basic JSON Editor web application which can be used to read and update JSON data. In the project, it will be used to create, read, update and delete character sheet data. It is still in development but in future, more complicated UI elements will be able to be used to edit complicated and large pieces of data, his project can be found [Link here]

Someone could then take this work, and do one of two things:

1. I could produce an image using the network according to the label data provided in the web application (Creating image from character sheet)
2. Extract label data from an image and upload this data to the web application (Creating character sheet from image)

## Other potential usages

Producing image of someone based on characteristics in life simulation program

## How someone could achieve it