50.035 Computer Vision Project

Checkoff-1: Team forming, Initial idea

Group 7

Edmund Ng 1004309 **|** Leon Tjandra 1004353 **|** Lim Yi Lin 1004611
Tan Yan Siew 1004665 **|** Victoria Elizabeth Yong Shu Qi 1004455

Project Topic: Image Classification with Hand Drawn Pictures (Research Track)

Initial Project Idea

This project aims to detect the subject of various hand-drawn images and classify them using a deep neural network approach. There have been multiple studies regarding sketch image classification, detailing various methods and neural network architectures. In this project, we will focus on testing and comparing the methods outlined in *The Origins and Prevalence of Texture Bias in Convolutional Neural Networks, Hermann et. al*

The paper suggests that many CNNs tend to classify images based on texture information rather than shape, a texture-based approach as opposed to the shape-based approach that resonates to how humans identify images. This makes the effect of data augmentation on images much larger as they affect the texture and shape biases which determine how a neural network identifies features of an image. The paper proposes training models that can classify ambiguous images by shape by taking less aggressive random crops during training and applying simple, naturalistic augmentations such as distortion of colour and blurring.

In our implementation, we will use a combination of open source sketch datasets such as the ImageNet dataset, as well as our own hand-drawn images. Links to the various datasets we may use can be found below:

1. HaohanWang/ImageNet-Sketch: ImageNet-Sketch data set for evaluating model's ability in learning (out-of-domain) semantics at ImageNet scale (github.com)
2. https://github.com/googlecreativelab/quickdraw-dataset
3. http://cybertron.cg.tu-berlin.de/eitz/projects/classifysketch/

Background

With the growing popularity of touch-interface devices, more people have begun using simple sketches to communicate emotions and ideas. Sketches are more simplistic than actual photos as they are often abstractions of complex objects in real life. Sketches emphasise the overall shape language of objects, which makes it a suitable subject in trying to reduce texture-bias and focus more on the shape-bias. An image classifier able to detect the subject(s) of a hand-drawn image has many wide applications in today's world, such as communication aids, novel dataset generation or even games.

Hand-drawn sketch recognition remains a difficult task, owing to the sketches' extremely abstract and symbolic features. Furthermore, with individual variance in skill, the same object may have vastly different shapes and degrees of abstraction. The subject of drawings may also break free from the realm of reality, depicting fantastical concepts such as magic, science fiction, and monsters. This poses an interesting challenge as compared to conventional image classification, which generally seeks to identify objects from our everyday environments.

Relevance to Computer Vision

Since vast amounts of image data is unstructured, Computer Vision is a relevant field of study for our chosen research project as image classification highly resonates with the usage of neural networks to identify and label object(s) found within an image. Hand-drawn images consist of an array of pixel intensity values. With this, we can bridge the semantic gap between these numbers by building from low-level to high-level features found within the images from dots, edges, to shapes, and objects using image filtering and convolution. Data augmentation techniques from the research paper highly resonates with Computer Vision techniques which includes color distortion, cropping, gaussian blur, and gaussian noise to name a few.