Autophotographer

CS39440 Major Project Report

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Declaration of originality

I confirm that:

- This submission is my own work, except where clearly indicated.
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Name: Oscar Pocock

Date: 29th April 2022

Consent to share this work

By including my name below, I hereby agree to this project's report and technical work being made available to other students and academic staff of the Aberystwyth Computer Science Department.

Name: Oscar Pocock

Date: 29th April 2022

Contents

Chapter 1

Background & Objectives

1.1 Background

1.1.1 Context

Background preparation: In preparation of this project, research was done in the following areas: - existing systems - methods

1.1.2 Related Work

Trophy Camera In 2017, fine artist Dries Depoorter and professional photographer Max Pinckers developed a camera ”that can only make awards winning pictures” [1]. This camera was built using Raspberry Pi and was programmed to only save award winning photographs which were subsiquently uploaded to a website: trophy.camera [2]. The AI was trained using previous winning photographs from the WPPY (World Press Photo's of the Year) contest (*Warning: Website includes images some might find disturbing including death, extreme voilence, and suffering*) [3]. By comparing the photos featured on *trophy.camera* and the previous winners of WPPY, you can see the success of this project is debatably. The majority of the photographs submitted to the WPPY are taken by professional photographers using high-end cameras and mostly depict global conflict. In contast the Trophy Camera is limited to the walls of a gallery, using a low-end camera, and the photos are taken by the general public. The use cases does not fit the data it was trained on and thus the results don't look necessarily ”award winning”.

1.1.2.1 Machine Learning

NIMA: Neural Image Assessment

Effective Aesthetics Prediction with Multi-level Spatially Pooled Features

Attention-based Multi-Patch Aggregation for Image Aesthetic Assessment

Photo Aesthetics Ranking Network with Attributes and Content Adaptation

1.1.3 Motivation

Within computer science, aesthetics is an area of active research. Historically, the most common and successful approaches to grading the aesthetic quality of images has been through machine learning. This involves creating a neural network, typtically a CNN (Convulution Neural Network), and training it with professional photography based datasets. The most common of these datasets being AVA (Aesthetic Visual Analysis), which is comprised of a set of professionally taken photographs and an aesthetic rating provided by numerous professional photographers that acts as a ground truth for aesthetic quality.

Many people believe aesthetics are subjective. We can observe this when the aesthetics of certain art pieces can often be contested and contraversial. Considering the percieved subjective nature of aesthetics, there seems to be certain ideas that are almost universally accepted as aesthetic. In art we often hear about composition rules like the golden ratio, rule of thirds, and symmetry which are meant to invoke a positive sentiment.

For others, aesthetics can't be reduced down to a set of predifined rules.

Firstly, this project does not aim to compete with professional photographers. Instead, this project aims to be used as an accessibility tool for those who don't have the skills or physical ability to take their own conventionally aesthetic photographs. This tool may be less useful for those who are technically and physically abled to take conventially aesthetic photos and are passionate about manually setting up and taking the perfect photograph.

1.2 Analysis

1.2.1 Problem Description

In order to create a program to detect and select aesthetics images from a video, several components need to be created. Firstly, the video file needs to be broken down into individual frames, then each frame needs to be analysed against certain aesthetic features and rules like (rule of thirds, contrast, brightness, focus). Each of these filters will need to be implemented in such a way that allows any order and combination of filters to be used. Lastly, a machine learning approach can be taken by ordering the remaining images. For this we can use a CNN (Convolution Neural Network) which will need to be trained on professional photographs as they can be considered a good base for what is considered ”aesthetic”.

1.2.2 Approach

1.2.3 Alternative Approaches

This project could also be approached from a coventional computer vision approach, which would require writing specific code to recognise aesthetic photographic techniques (like rule of thirds and vanishing point) and using those to help determine the aesthethic quality of an image

In the context of this project, using exclusively a machine learning approach would be computationally wasteful. (due to the use case where it's a video feed)

1.2.4 Aim

The aim of the project is to develop a piece of software that will take a video or a set of images as an input, process them through filtering, and output a subcollection of "aesthetic" images or frames. The set will be processed through filters which will be implementated as part of the project.

1.2.5 Objectives

- Convert a video into frames
- Implement numerous "filters" that can discard images based on technical and aesthetic features
- Create a CNN (Convolution Neural Network) to rank the remaining images

1.2.5.1 Research Questions

- How effective is the machine learning approach compared to a more conventional one
- Which order of filtering is most effective

1.3 Research Method and Software Process

1.3.1 Research Method

1.3.2 Software Development Process

To help keep the project on track and measure it's progress, I decided to follow an Agile approach to development. An iterative approach to development.

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