Saliency in Image and Vision Computing

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1 Project Description

The evolution of technology has led to many research concerning machines that act like humans. The purpose of this project is to explore on how models (programmes that see like a human) visualise a new dataset in comparison to human data. Similar experiments have been done before, however, the novelty of this project is the introduction of distortions to the models. These models have been exposed and created to visualise perfect images with zero or minimal distortion. The dataset will contain high quality images along with its distorted counterpart. To further explore how models, compare to human data, the original images are distorted into several distinct levels of distortion such as high level distortion and low level distortion. The images within the dataset are categorised ranging from Action, Black and White, Outdoor Natural, Outdoor Man-made and even Patterns. Categorisation is used to expand the different types of images and not just a specific type.

There are several ways to compare models against human data and I shall be creating an interface for the data visualisation aspect of the project. The models are then ranked by order of closest match and saliency maps are created. The interface can be manipulated to select a subset of images from the dataset and even specified models for comparison. The first application of my project involves creating different levels of distortions per image. I shall be using MATLAB to resize the images into a fixed size while keeping the image quality as high as possible. These will be considered as my original image. The images taken are royalty free and was taken beforehand during my CUROP summer internship. The images shall be resized to 1920 x N where N is a size set by MATLAB to maintain the image quality and prevent any geometric distortion. Each individual image is then cropped to 1920x1080 using GIMP.

Distortion of the image will involve using MATLABs built-in function. Using these functions, parameters can be set to achieve different distortion levels. The procedure for data collection will include using the eye-tracker BeGaze to get the human data. When the images are distorted, the parameters used are kept in a database as unique IDs when comparing the image.

All data is inserted into a large-scale database which can be extracted and visualised using my interface. I shall need to research how the data can be read and extracted for visualisation. Research is needed also for choosing the most suitable programming language when creating the interface and also considering my level of experience as a factor when choosing either Java, Python, Matlab or R. The visualisation will be useful on how to improve these models for further research that involves distortion such as for robotics.

2   Project Aims and Objectives

Aims: Pre-process original image and resize

Objectives:

- Use MATLABs resize function to generate a down sized version of the image
- Use GIMP to crop image to fixed size
- Resize the image such that the quality of the image is maintained

Aims: Selection for new dataset

Objectives:

- Generate several distortions of the original image
- For each distortion, implement different levels of distortion
- Reduce and select equals amounts of images per category

Aims: Understanding Saliency Models

Objectives:

- Understand how each model functions
- Data collection of each model for each image of the new dataset (distortions included)

Aims: Human Data Collections

Objectives:

- Find a suitable experimental area for eye tracking

- Ensure conditions are kept the same as much as possible such as lighting conditions

- Divide images into smaller subsets where images are not repeated to avoid biased data

- Divide people into smaller groups to reduce experimentation time

Aims: Interface Creation

Objectives:

- The interface should be able to read the collection large scale data

- Output and visualise data that has meaning

- User can change parameters of the interface for a more specific data visualisation

Aims: Ranking System

Objectives:

- Research different types of similarity comparison

- Test how the ranking system can be improved by using more than one comparison

- Evaluate if a dual comparison is necessary

Aims: Language selection

Objectives:

- Research libraries of different programming languages
- Test performance of each language when outputting data
- Select the most suitable programming language for visualisation

3   Ethics

Due to the nature of the project where human data is needed, I shall need an Ethical Approval from the Research Ethics Group (REG) in able to ensure that my project agrees with the Data Protection Act as well keeping the data collection confidential. I shall need to fill up an ethical approval form at least 2 weeks before conducting the human data collection.

4 Weekly Plan

I shall be having weekly short meetings with my supervisor to ask for guidance about the progress of my project. However, the meetings may be altered to fortnightly meetings depending on the nature of the project. I aim to keep track of my project using my weekly plan listed below and all my notes will be kept to use for my final report. The weekly plan is as follows:

Week 1: Jan 23 - Jan 27

- Complete Initial Plan
- Revisit Distortion Code from CUROP Project
- Amend Distortion Code if necessary

Week 2: Jan 30 - Feb 3

- Research saliency models and understand how each algorithm function
- Background research on saliency articles and publications
- Application of Ethical Approval Form

Week 3: Feb 6 - Feb 10

- Research different ways of comparison of data e.g. Euclidean Distance of Fixations
- Research public saliency data and saliency benchmark

Week 4: Feb 13 - Feb 17

- Per category, choose collected images from CUROP to be used for the dataset

- Use built distorter programme created from CUROP to generate distortions

- Research on the number of distortion levels to be used for the experiment

MILESTONE: Generated a new dataset containing original images and its distortions

Week 5: Feb 20 - Feb 24

- Review with supervisor on effective ways of collecting data

- Set up an environment suitable for the data collection

- Human Data Collection

Week 6: Feb 27 - March 3

- Generate results of data from each individual model

- Continuation of Human Data Collection as schedules are considered

- Research on which language is most suitable for visualisation

- Review Meeting with Supervisor

Week 7: March 6 - March 10

- Create a rough draft of the report stating what has been accomplished from the previous week

- Continue with tasks that are not yet completed from previous weeks

- Understand raw data collected and how they can be used for the interface

- Initiate interface creation and GUI

Week 8: March 13 - March 17

- Implementation of the interface where the programme can read the data from both human and model

- Test and Debug the basic programme

- Review Meeting with Supervisor to show current working programme

MILESTONE: Implement a simple interface where the data collected from both models and human are inputs and visualisation of data and rankings are the output

Week 10: March 27 - March 31

- Implement the interface to compare and rank the models against human data using a subset of images from the dataset

- Allow user to select which images are used for comparison as well as pre-set subsets e.g. Action, Object, CGI

Week 12: April 10 - April 14

- Research ways of making the programme more user friendly

- Research how to implement two comparisons to create a ranking for future projects

- Review Meeting with Supervisor

- More implementation of the interface if needed

Week 13: April 17 - April 21

- Create a first draft of final report using notes taken every week

- Implement a more user-friendly programme if necessary

- More implementation of the interface if needed

MILESTONE: A fully functional interface has been implemented

Week 14: April 24 - April 28

- Structure and refine the report and add extra details

Week 15: May 1 - May 5

- Additional refinement of final report and submit

MILESTONE: Report completed and submitted

Report Deadline Set: May 5