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Research Plan

a. Rationale

Deep learning is a branch of artificial intelligence that deals with the use of algorithms and statistical models to perform a specific task without using explicit instructions. In other words, computers rely on inferences and patterns to function. deep learning has become one of the most revolutionary aspects in the field of computer science due to the variety of industries it has been implemented in. These industries range from government to financial services and even to the healthcare industry. However, we believe that this implementation has not been very successful for the general public. While modern society has been successful in decreasing the number of bacterial or viral diseases, there has been an increase in the number of human-caused health issues. These issues include insomnia or acne vulgaris which cannot be completely resolved by modern medication. Instead, humans must take courses of action to deal with these issues. Researchers have created databases of images that highlight these issues. However, the general human lacks the knowledge to understand these databases and create their own programs capable of detecting these issues.

Thus, we will be proposing new deep-learning modules to assist the general public. These modules will be compatible with a device called the Magic Mirror. The Magic Mirror is a raspberry pi powered monitor behind a double-sided mirror. The raspberry pi has an associated black web page, coded in that allows the user to add their own widgets into the Mirror. We plan to create two new widgets for the Magic Mirror that will help a user identify eye bags and acne.

b. Research Questions

The goal of our research is to help computer scientists create fully functioning modules that assist people in their daily lives. We plan to create the fundamentals of the deep-learning-based modules for the scientists to use as foundational knowledge. To accomplish this, we will be designing new modules

with our own deep-learning models. These models will be made using our own database of collected images. Finally, we will take our new programs and convert them into Magic Mirror widgets. This process will address the following questions:

1. How do we convert a python script to become a Magic Mirror Module?

2. How do we process datasets of images to a better fit for our use?

3. Will we be able to collect enough images to fully train our models?

c. Methodology

i. Procedures

All programs will be coded in python using convolutional neural networks and the Magic Mirror will call these programs to create modules.

Eyebag Module

We will be attempting three different approaches to the eyebag module. First we will attempt a non deep learning approach because we want to show the inaccuracy of not using deep learning for this module. The next approach will be using a database of full face images that we have collected. Finally, with these full fae images we will be cropping them into photso that contain only the eye region of the face.

Acne Module

The previous program which we will be basing the acne module on is a mobile app developed by Microsoft and Nestlé Skin Health SHIELD. We will be collecting our own database of images that consists of images from the companies' database and images from the internet. To create inputs for our model, we will implement the use of the dlib library in Python. This library contains the facial landmark command, which we will use to identify the locations of facial landmarks such as the chin, left and right cheeks, and forehead region. Using these locations we will be able to locate skin patches for our model to use as input and testing data.

ii. Risk and Safety

There are no risk or safety precaution that we will need to take to complete our research

iii. Data Analysis

We plan to use the databases of images, both collected and uncollected, to train and test our deep-learning-based modules. Approximately 60 - 70% of the images will be used to train the deep-learning model and the remaining percent of images will be used to test the model. For the acne module, the program will return a percentage of how severe a person's acne is. For the eye bag module, we plan for the program to return whether or not eyebags have been detected and the level of certainty.

d. Bibliography

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1. **Human participants**: NOT APPLICABLE
2. **Vertebrate animal research**: NOT APPLICABLE
3. **Potentially hazardous biological agents research**: NOT APPLICABLE
4. **Hazardous chemicals, activities & devices**: NOT APPLICABLE

No Addendums exist