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Machine Learning
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Image Detection for Non-Verbal Behaviors

Write a brief description (a page/more) of the main concept of your project:

- What is the main purpose and high-level functionality of your system

We aim to create an image detection software that will detect and categorize non-verbal behaviors. We plan on working on this project in various steps; starting with detecting a person's emotion through facial expressions in portrait photos. Our next step will be to tell a person's emotion through their body language, so the photos for this step would have to capture the full body of the subject. The next step is a potential step and would be incorporated if we have time; this step would analyze videos of people and detect through full body language and facial expressions how the person is feeling. This project looks at nonverbal cues to tell how a person is feeling which is done by looking at facial expressions and how the person is holding their body (body language). The software will scan the images and then categorize them by giving a score depending on the markers or flags it finds in the photos. That score tells the software what emotion the person is expressing.

- What are some lower-level functionalities that are part of the system

With our nonverbal communication image detection program, the following paragraph describes more of the lower-level functionalities that are involved. First, we need to clean the images and isolate and localize the face. We need to turn images into grayscale so that the images are consistent across the board. An important part of this

project is to map out the facial features and categorize these facial features into their appropriate emotion they are expressing. Afterward, the program must model and train using the dataset which is then put to the test by accepting, reading, and then categorizing the test dataset.

Data

The dataset we will be using for this project is the Fer2013 from Kaggle. We originally wanted to create our own dataset but ran into some troubles while programming the project. We decided that we are going to start out with a pre-existing dataset, figure out how that all works, and then, potentially use the dataset that we started to create. The dataset includes a train and test csv file; the train dataset contains a column for a number that corresponds to an emotion and the pixels of the image, and the test dataset just contains the pixels. Those pixels need to be created into images which we wrote a script to take to pixels and turn them into grayscale images. The images must then be rescaled so that the size is consistent across the whole dataset, and the images file name must be renamed to a series of incrementing numbers to make working with them easier. The script created not only turns the pixels into images, but it, also, renames the images, saves them into separate directories, and resizes the images to 48 by 48. Examples of the test and train csv file and images created from the python script are below.

Test Dataset Example

pixels
254 254 254 254 254 249 255 160 2 58 53 70 77 76 75 78 68 18 32 29 0 54 73 75 72 68 75 77 76 76 75 80 51 36 47 40 44 42 37 48 40 64 54 54 86 16 0 161 254 254 254 254 254 248 255 120 2 38 50 47 76 76 83 63 51 142 174 159 88 59 48 67 37 61 46 77 77 75
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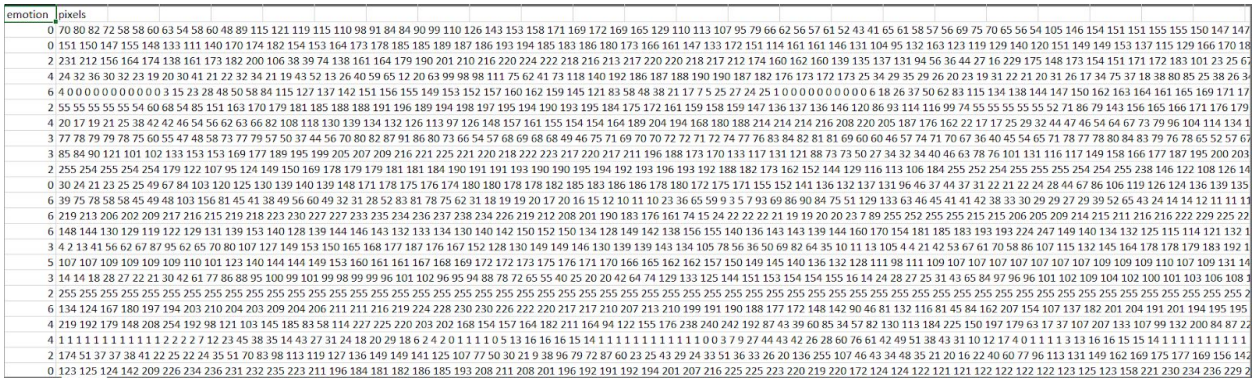

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Train Dataset Example

 Angry  Disgust  Fear  Happy  Neutral  Sad

 Surprised

Initial solution

- How will you design and implement the system (this will probably change with additional details later)

  As previously stated, we will be using the Google Images Downloader to download images in bulk to create our datasets for facial expressions and body language. For the system, we will be writing this in Python, using the OpenCV, Keras, and Dlib libraries. We will be using the k-fold cross validation method to divide our sets of images into several subsets, and then into training sets and test sets. For each set of images, we will start by feeding the training set of images, which we will annotate, into the system so that the algorithm will learn what each facial expression and body language expression looks like. We will then randomly select images for the test set. They will not be labelled so we can find out if the algorithm is

accurately labelling them or if we need to further refine the algorithm. Once our algorithm is refined to our liking, the system will be able to take in an image of a person, clean it up, and then categorize it. If we have time, similar steps will be taken with videos.

List your initial Resources and references

https://medium.com/swlh/emotion-detection-using-opencv-and-keras-771260bbd7f7

https://towardsdatascience.com/emotion-detection-a-machine-learning-project-f7431f652b1f

https://www.pyimagesearch.com/2017/04/03/facial-landmarks-dlib-opencv-python

https://github.com/ultralytics/google-images-download/blob/master/README.md

https://www.kaggle.com/c/challenges-in-representation-learning-facial-expression-recognition-challenge/data