Classification of Human Emotions using MATLAB

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Abstract
In this project, we aim to analyze methods of image classification in MATLAB and use the knowledge gained to implement a human emotion recognition model. We will use image classification to identify if a face is found in an image, and if a face is found, crop the image to include only the face. Then, a second round of image classification will be used to identify the emotion demonstrated in the image. We will attempt to place the emotion into one of six common categories: happiness, fear, sadness, disgust, surprise and anger [1]. We chose this topic as we think there is potential to apply emotion recognition to a variety of situations where profile pictures are used. If we have additional time, we will explore how this type of technology could be used in different scenarios.

Methodology
For this project, our group plans to create an algorithm that utilizes the 2D Discrete Cosine Transform to extract features from Facial Expression images that depict emotions such as Happy, Sad, Fear, Anger, Disgust, and Surprise. The most common types of images used for automatic expression recognition are 2D monochrome (grey-scale) facial images [2]. So, the images used as input to the algorithm will be converted to grey-scale values and then the image will be cropped to a desired dimension during a preprocessing step within the algorithm. Once the images are monochrome and preprocessed, we will focus on two main areas of the faces, the person's eyes/eyebrows and their mouth, which help to indicate the type of emotion the person is displaying. After extracting these areas of the face, a Discrete Cosine Transform matrix will be implemented into MATLAB, which will convey information from the spatial representation of the image into its corresponding frequency domain representation. The frequency domain will contain about a dozen DCT coefficient values towards the lower end of the frequency spectrum that provide the most useful information about the facial expression [2]. Once extracting the DCT coefficients for both the eye and mouth region of an image, in addition to the functions supplied to us in MATLAB's Image Processing Toolbox, we can also utilize their available Machine Learning Toolbox that features a built-in app that can be used for different classification models, such as Neural Networks, Kth Nearest Neighbor Models, and more. In order to create an algorithm that is accurate in its predictions, we will need to provide a good amount of images to train the classification model across the variety of emotions we hope to classify. Thus, our group will provide the necessary images to both train and test the classification model, in hopes of achieving a reasonable accuracy result as an output to the classification model. We plan to provide images of ourselves expressing the emotions we hope to classify, but may also need to find other facial expression images

so that the algorithm and results are not only biased towards our group's faces. The desired outcome will be a MATLAB function that provides classification results of the identification of the person's face, their facial emotion that was classified, and a confidence level of the results to some percentage between 0% - 100% accuracy.

Deliverables

In evaluating images, we will quantify our results with a few different metrics. Firstly, we will determine whether or not a face is identified in the image. Then we will determine our emotion classification, along with the confidence level of our results. As with any application of image classification, it is important to consider the context of confidence levels when providing results.

References:

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