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CISC 442

Final Project

Our project goal is to count the number of heads in a given image taken from an overhead angle. First, we needed to extract globs from the image that have the potential to be heads. These candidates are given to Adaboost, a machine-learning algorithm, to determine if the extracted object is actually a head.

We tried many different methods to extract candidates for our Adaboost algorithm. In our first attempt, we used an algorithm that detects circles in an image and returns their center point and radius. This failed, because not all heads are circular. People with long hair do not produce a circular shape when their picture is taken from above. We also tried detecting hair by searching for blobs in the image and creating a window around the centroid. This proved ineffective, as some people’s hair (particularly women with blonde highlights) wouldn’t be detected as a blob due to having

The method we settled on applied a Laplacian filter to the image to capture the gradients of the image. Then we use connected component labelling to distinguish different regions within the image. Then we iterate through this new matrix, looking for border regions. Once a border is found, a marker is placed and the borders in the surrounding area are erased to prevent duplicate areas being covered by the Adaboost algorithm. The result is a series of relatively evenly spaced points in which surrounding area is most likely to contain a head. This process involved a lot of guessing and checking algorithms to get the best results.

We use training data to train Adaboost for head identification. Our training data consists of pictures that contain a head and pictures that don’t contain a head. We use 3 measures to classify images, contrast (measure of intensity contrast between a pixel and its neighbor over the entire image), the SSD of the inverse Gaussian, and entropy (for texture analysis) of the images. We then set arbitrary thresholds for each of measurements in an attempt to maximize the amount of correct head classifications and minimize the incorrect classifications.

TALK ABOUT IMPLEMENTING ADABOOST HERE

Overall, we encountered many problems in our attempts to count heads. Unusual hair colors, hats, and hoodies make it difficult to distinguish a head from an object. Views from above force us to rely mostly on hair, so we can’t use facial recognition techniques to identify a head. Our method for finding candidates could have be improved by implementing background subtraction to separate moving objects in the foreground from the objects in the background. This could speed up our candidate finding process and make it more accurate, but we opted to try identification through one still image because we lacked the equipment to take pictures from a consistent overtop angle. We also went over dozens of different combinations of calculations to achieve the best possible accuracy for our head classifications, but could only obtain a classification accuracy of around 70%.

TALK ABOUT OTHER PROBLEMS YOU ALSO HAD IN THE PARAGRAPH ABOVE