Computer Vision Project  
CSE 483

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**Phase 1 Pipeline:**

In phase 1, we’ve worked on the first format of the “train” dataset only, which has 33,402 images in total.

All the functions used in this phase are provided by the “OpenCV” python library.

**Pipeline Steps:**

1. Read all images from the “train” dataset, using the “imread” function. The “imread” function takes the path to an image file and reads it into a NumPy array.
2. The second step is to convert each color image to its corresponding grayscale format. Grayscale images only have one channel, as opposed to RGB images which have three channels for red, green, and blue. This makes them easier to process and analyze for certain computer vision tasks. The "cvtColor" function is used here, which converts an image from one color space to another. In this case, we would use it to convert each color image to grayscale.
3. The third step is to apply histogram equalization to enhance the contrast or sharpness of the grayscale image. Histogram equalization is a method used to stretch the brightness levels of an image so that the entire range of brightness is utilized. This can improve the contrast of the image, making it easier to identify features. The “equalizeHist” function in OpenCV is used to perform histogram equalization on the image.
4. The fourth step is to find the contours of the output threshold image. Contours are the boundaries of objects in an image. They can be used to identify and locate objects in an image. The “findContours” function in OpenCV is used to find all the contours in an image. This function takes the output of the previous step, which is the histogram equalized grayscale image, and applies a threshold to it to convert it into a binary image. Then it identifies all the contours in the binary image.
5. The fifth step is to draw the contours found in the previous step onto the copy of the original image. This will help visualize where the contours are in the image. The “drawContours” function in OpenCV is used to draw contours on an image. This function takes the copy to the original image, the contours found in the previous step, the index of the contour to draw (or -1 to draw all contours), and the color and thickness of the contour.
6. The final step is to draw bounding boxes around each of the found contours. Bounding boxes are rectangles that enclose an object in an image. They can be used to crop or isolate specific objects in an image. The “rectangle” function in OpenCV is used to draw bounding boxes around contours. This function takes the original-colored image, the coordinates of the top-left and bottom-right corners of the bounding box, and the color and thickness of the box.

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GitHub Repo Link: <https://github.com/Ahmed-Sameh-MM/Computer-Vision-Project>