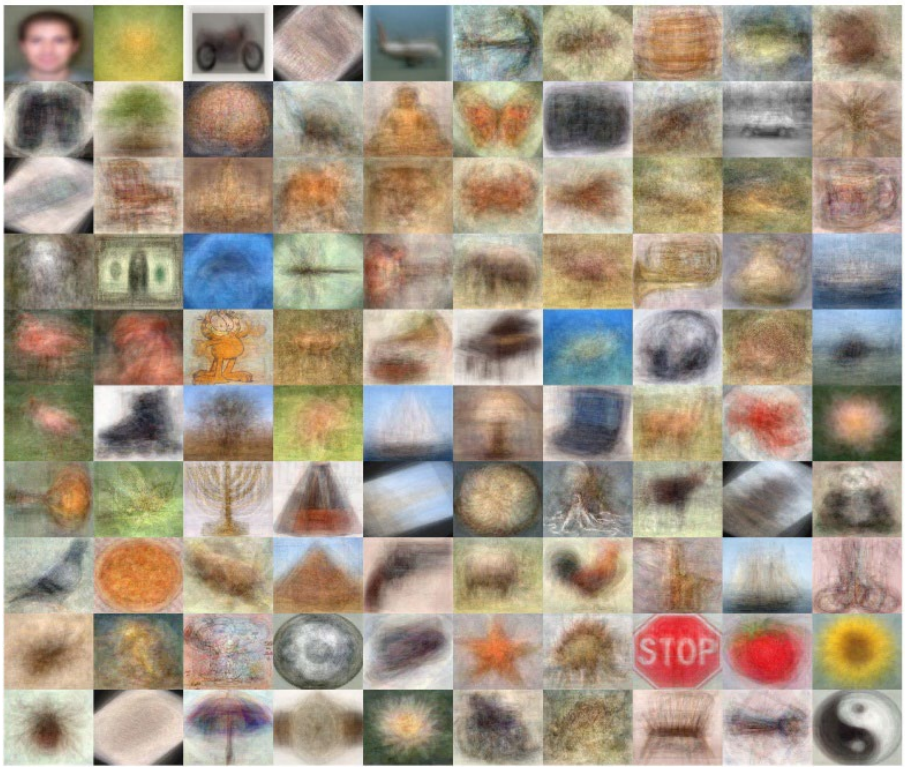
CS 450 Computer Vision and Machine Learning (Spring 2025)

Homework Assignment 4

Use Jupyter Lab/Notebook for the next few exercises and upload your notebook with the outputs. You can use Google and the Python documentation for help.

1. Use the image dataset given at this link (Caltech 101) and do the following:

    a. Download and unzip the files (just the images), and set them up in such a manner that each class is in a separate folder.
    b. Write a program to find to average images of the 100 classes, like the one given below, taken from the same link (leave out the BACKGROUND_Google and Faces_easy classes). Resize every image to a standard square such as 100x100 or 256x256 before adding. **Display the average as a single collage image (not a plot full of subplots).**The order of the classes is not important. **[20 points]**



2. Collect and display the following statistics about the data (you could collect it while doing the previous part too, but display it separately) **[10 points]**
    a. The maximum number of images in a class
    b. The minimum number of images in a class
    c. The maximum and minimum height of an image
    d. The maximum and minimum width of an image

3. Train an SVM classifier using the HOG features of all the images of the airplane class as positive samples, and HOG features of images from the top three largest classes other than the airplane class as the negative samples (largest class = class with most images. This can be found while calculating the previous answer). Now pass all images other than the training images through the classifier and display any 25 that get a positive response (i.e., the classifier says they're airplanes). **[20 points]**

4. **Ungraded**: try to read as many of the papers uploaded to Moodle as you can.