

# Project # 4: Object Detection Part 2: Classification

## CSC 391: Introduction to Computer Vision

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*due date: Thursday, April 18th*

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## 1 Image Features

In Project #3: Object Detection Part 1, you experimented with the characterization of images in terms of representative features extracted using a variety of global (e.g., HOG) and local (e.g., SIFT) descriptors. The main idea was to develop intuition as to what types of features could best encode information for your selected detection problem and be advantageous for subsequent classification.

## 2 Classification

For Project #4: Object Detection Part 2, we will focus on developing and testing classification approaches that use the image features you studied in Project #3 to solve the recognition problem you chose. You can test a variety of off-the-shelf unsupervised and supervised classification methods implemented in existing Python packages.

For example, the scikit-learn package (<https://scikit-learn.org/stable/>), provides methods and sample codes for methods such as support nearest neighbors classification, vector machine (SVM), and random forests. You have also seen several examples of classifiers from code that I shared with you, such as:

- the Kullback-Leibler divergence measure used in the LBP example,
- the random forest classification technique used with Haar-like features, and
- k-means clustering and SVM classification in bag of visual words.

In addition, we have also

- seen an example of data splitting into training and testing datasets (Haar-like classification example) that can be used for training and then prediction, (see also [https://scikit-learn.org/stable/modules/cross\\_validation.html#cross-validation](https://scikit-learn.org/stable/modules/cross_validation.html#cross-validation)),
- seen an example of computing the area under a ROC curve (Haar-like classification example) to estimate performance of a classifier, and
- discussed in detail the use of HOG features and SVMs for classification (HOG for human detection).

Feel free to use the above methods or any other methods you find for classification.

## 3 Report

Similar to previous reports you have done, your report for Project #4 should summarize the classification work you have done. I am primarily looking for analysis of the work you are conducting. It doesn't matter so much how much or how little code you write. I am interested in

1. your thinking in terms of experiments you are conducting and why (e.g., testing the performance of a linear SVM for various parameter choices of HOG, or testing the performance of linear vs kernel SVM for a fixed choice of HOG features, etc.), and
2. your analysis of the results you obtain.

Finally, please include relevant parts of your Project #3 report to make it easier for the reader to get a full picture of your work. I intend to share the reports with Prof. Miles Silman, Director of the Center for Energy, Environment, and Sustainability.