Final Project Description

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Computer Vision: 600.420

October 28, 2011

Team Members

Our team consists of three people and will be a 600.420 team:

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Project Choice

We will be working on **Project 2: Object detection and classification in a video sequence.**

Proposed Approach

Challenges:

- **Quality:** The quality of the traffic.avi file is low; the image resolution is 720x480, contains compression artifacts, and was recorded by a hand-held camera. This last issue is particularly significant, because not only

are objects moving within the frame, but the frame of reference is also changing.

- **Multiple classes:** There are many moving objects within the scene: vehicles (cars, taxis, buses, motorbikes), bicycles, and pedestrians. We need to train on, classify, and search for each of these object types.

- **Occlusion:** There are many instances when one object moves in front of another, partially or completely occluding the other object.

- **Scale, Orientation, and Color:** Objects of the same type - for example, bicyclists - will appear to be different in both size, orientation, and color throughout the video. We need our classifications to be invariant to changes in these attributes.

Proposed Approach:

- We will stabilize the video using 1) SIFT feature detection and 2) Image Rectification to compute a common reference frame.

- We will analyze properties of each frame and compute a model of the background (the part of the video that is static). Next we will detect all the moving objects using the process of background subtraction.

- We will estimate feature vectors for each of the detected objects.

- We will extract all the frames from the beginning of the video to use for training data. We will classify each type of object in each of these frames to generate enough training data. Then we will use the training data to build SVM classifiers for each of these object types.

- Finally, we will use these SVM classifiers to identify the type (car, taxi, pedestrian, etc.) for every element in the set of moving objects and label them appropriately.

- We also hope to implement an extra feature (time permitting): We will let the user click on an object and enter a label. We will then use our classifiers to detect what type of object it is and track it as it moves through the scene. We will also highlight all other objects of that type.

Final Functionality:

- Generate a video with bounding boxes for each detected object superimposed on the video (a unique color for each). We will attempt to classify and detect: vehicles (cars, taxis, buses, motorbikes), bicycles, and pedestrians.

- Time permitting: Build a UI that presents the video to a user. The user can click on an object; automatic detection of the object type will occur and track the object as it moves through the scene. Additionally, all other objects of the same type will be highlighted in the video.

Project Components

The core components our project are:

- Use image rectification to create a stable frame of reference.

- Detect all the moving objects (background subtraction).

- Generate feature vectors that characterize each moving object.

- Generate training data and SVM classifiers.

- Use the classifiers to identify the type of every moving object.

Team Member Assignments

We plan to meet regularly and work on all aspects of the project together.

Rough Project Timeline

11/4	Image Rectification
11/11	Detect moving objects using background subtraction.
11/18	Generate feature vectors for each object.
	Generate training data from video frames.
11/25	Implement SVM classifiers.
	Detect and classify objects automagically.
12/2	Polish and submit.