Vehicle Recognition

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General Idea:

In our project, we will try to detect vehicle[1][2] and recognize[3] the Make, Model, and Year of the car from an input picture (e.g. 2012 BMW M3 coupe). We will combine knowledge from machine learning and visual computing to achieve our goal. For car detection, we will be extracting HOG (Histogram of oriented gradients) using a sliding template through the image and use linear classification[5] to detect the position of the car. We will extract features such as edges (Canny Edge Detection), corners (Harris or Brown Corner Detection), HOG (Histogram of oriented gradients) and DOG (Difference of Gaussian). etc. For the recognition part, we may use decision tree[4] or Neural Network with the features extracted to train our dataset. After we get the trained model, decision tree or neural network, we will evaluate the output by inputting our test dataset and uploading to the evaluation server from the data reference.

Difficulties:

For the difficulties of this project, firstly, it may be difficult to build the detector of the vehicles. Because we will not use any existed vehicle-detection library, and we will establish our own descriptor for the model instead. How to use HOG, Edge Detector, Corner Detection ,and DOG to build up the descriptor is critical. In addition to this, applying knowledge from machine learning is also a difficult point we need to overcome. It will be difficult to treat data and deal with the images simultaneously. We need not only extract features by vision computing but also use these features to train our model, which is the second critical problem.

Scope of work:

1. Extract useful features from images in the dataset.
2. Construct a binary-classifier for vehicle detection.
3. Build up the decision tree or neural network with extracted features.
4. Construct a vehicle detector with the pre-build classifier and feature extracted.
5. Recognize the detected vehicle with the pre-build decision tree or neural network.
6. Visualize the result of the approach and evaluate runtime & correctness of the approach.

Reference:

[1] **3D Object Representations for Fine-Grained Categorization**
- *4th IEEE Workshop on 3D Representation and Recognition, at ICCV 2013* (3dRR-13). Sydney, Australia. Dec. 8, 2013.

[2] **A rapid vehicle recognition and retrieval system**
- The 2014 2nd International Conference on Systems and Informatics (ICSAI 2014)

[3] **Image processing based vehicle detection and tracking method**
- 2014 International Conference on Computer and Information Sciences (ICCOINS)

[4] **Decision Tree**: Make predictions by recursively splitting on different features according to a tree structure.

[5] **Linear Classification**: Predicting a discrete-valued target with data