Project Proposal Machine Learning:

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1) Problem Statement:

   Our purpose is to build a model for scene labeling taking the restricted set of following 3 scenes:

   

   City
   Beach
   Landscape

   We intend to do this in two levels.

   In level 1, we will try to identify the semantic features or labels such as sky, mountain etc. based on low level features of the image, such as RGB values of pixels. Their spatial location,

   We will be identifying the following 7 semantic features:

   Road
   Ocean (any water body)
   Buildings
   Mountains
   Trees
   Sand
   Sky

   In level 2, we will build a classifier to classify the input images into one of the 3 scenes. We intend to compare the efficiency of 3 types of classifiers here:

   a) One which takes individual semantic features (such as Road, Ocean, sky etc.) only to classify the given scene.
   b) One which takes the scene image and learns which scene it is.
   c) The one which takes both the scene image and the semantic features to predict the scene label.

2) Data Set: We will be using labelled images for the purpose of training and testing our classifiers. The source of the labelled images are:

   i) Image-net (Stanford's labelled image data source)
   ii) MIT Sun Data base

   Other websites with publically available images include:

   http://publicdomainpictures.net/
   http://www.freedigitalphotos.net/
   http://all-free-download.com/

3) Performance Evaluation :

   For performance evaluation we intend to use the percentage misclassification between the test images and the predicted scene labels & corresponding scenes, as the indicator of how accurate each classifier is.

We would be evaluating performance at both the levels. At level one we would be generating accuracy for each label separately.

4) Baseline Algorithm:
   For the individual component(label) classifiers:
   Preprocessing the images we can identify the pixel colors for each component. Also we can calculate the percentage presence of that colored pixel in each image from training set. Using that mean percentage presence of the pixel color, we will hand train a model to classify the image as positive for the particular component.

   Baseline for scene classification:
   We will be classifying all the images as:
   City: if building, road and sky is present
   Beach: if sky, sea and sand is present
   Landscape: if trees, mountain, sky and water body is present.

5) Methods to Build the classifier:
   i) Pre Processing: Converting the labeled images to matrix, where each cell is a feature. Identifying the individual RGB value of pixels for each component. Eg blue's value for sky etc. [By April 4]
   ii) Baseline Algorithm accuracy estimation. Using these pixels as hard coded classification indicators, generate a basic classification result and misclassification rate. [By April 4]
   iii) Feature Extraction: Trying to identify what all features apart from the image matrix can be used for training the data set. Some of the features we intend to add include location of the component, percentage coverage in overall image, shape of the boundary of the component etc. [April 12]
   iv) Dimensionality reduction: is an important part in image segmentation, since several values in the matrix are same and can be represented just by a single feature of that color and a count of number of cells with the value. We are planning to use PCA for this. [April 19]
   v) Building level 1 classifiers, for individual components. Based on our review of the literature we have decided to use SVM and Decision Tree as our classifiers, and we will also compare their accuracy. This will give us the semantic features (Individual components of the scene) for next level of the project. [April 26]
   vi) Building first level 2 classifier, using semantic features to identify the scene by both SVM and Decision Tree classification approach. [April 26]
   vii) Building second level 2 classifier, using the image and hence its low level features to identify the scene by both SVM and Decision Tree classification approach. [May 3]
   viii) Building third level 2 classifier, using semantic features and low level features to identify the scene by both SVM and Decision Tree classification approach. [May 3]
   ix) Compare the efficiency of all these approaches used previously. [May 10]