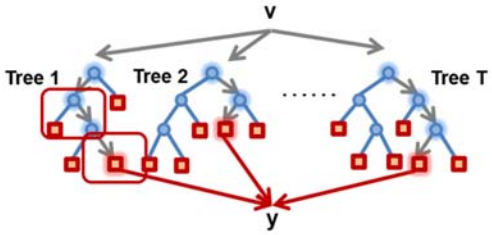
EE462, EE9SO25, EE9CS728

Selected Topics in Computer Vision

Coursework on Randomised Decision Forest [35% mark]



Release on 25 Jan, the report due on 15 Feb (midnight)

The coursework requires computer programming (Matlab or Python). Use the provided Caltech101 image categorisation dataset. In all questions, as you prefer, you can use the provided code set of Random Forest or any existing toolbox/library e.g.

https://github.com/karpathy/Random-Forest-Matlab

http://vision.ucsd.edu/~pdollar/toolbox/doc/

http://code.google.com/p/randomforest-matlab/

http://www.mathworks.co.uk/matlabcentral/fileexchange/31036-random-forest

Submission instructions:

One joint report by each pair

Page limit: 3 A4 pages per report with 10 font size (use the IEEE standard double column paper format, either in MS word or latex).

http://www.pamitc.org/cvpr16/files/egpaper_for_review.pdf

http://www.pamitc.org/cvpr16/files/cvpr2016AuthorKit.zip

Give insights, discussions, and reasons behind your answers on the scope of lectures, and try to visualise interesting observations to support your answers. ***Quality and completeness of discussions within the page limit*** will be marked.

Source codes are not mandatory unless specified: optionally they can go to appendix, which does not count for the page limit.

Submit the report **in pdf** through the Blackboard system. No hard copy is needed. Write your full names and CID numbers on the first page.

If you have questions, please contact

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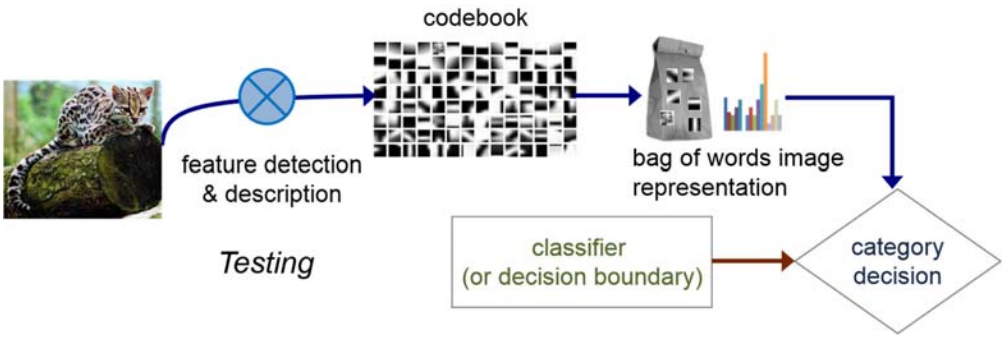
Experiment with Caltech101 dataset for image categorisation



We apply RF to the subset of Caltech101 dataset for image categorisation. Use the provided Caltech101 dataset. We use 10 classes, 15 images per class, randomly selected, for training, and 15 other images per class, for testing. Feature descriptors **d** are given. They are multi-scaled dense SIFT features, and their dimension is 128 (for details of the descriptor, see http://www.vlfeat.org/matlab/vl_phow.html).

Q1. [10] K-means codebook

We randomly select 100k descriptors for K-means clustering for building the visual vocabulary (due to memory issue). Open the main_guideline.m and select/load the dataset.

```
>> [data_train, data_test] = getData('Caltech'); % Select dataset
```

Set 'showImg = 0' in getData.m if you want to stop displaying training and testing images. Complete getData.m by writing your own lines of code to obtain the visual vocabulary and the bag-of-words histograms for both training and testing data. You can use any existing code for K-means (note different codes require different memory and computation time). Show, measure and discuss the followings:

- vocabulary size,
- bag-of-words histograms of example training/testing images,
- vector quantisation process.

Q2. [10] RF classifier

Train and test Random Forest using the training and testing data set in the form of bag-of-words obtained in **Q1**. Change the RF parameters (including the number of trees, the depth of trees, the degree of randomness parameter, the type of weak-learners: e.g. axis-aligned or two-pixel test), and show and discuss the results:

- recognition accuracy, confusion matrix,
- example success/failures,
- time-efficiency of training/testing,

- impact of the vocabulary size on classification accuracy.

Q3. [15] RF codebook

In **Q1**, replace the K-means with the random forest codebook, i.e. applying RF to 128 dimensional descriptor vectors with their image category labels, and using the RF leaves as the visual vocabulary. With the bag-of-words representations of images obtained by the RF codebook, train and test Random Forest classifier similar to **Q2**. Try different parameters of the RF codebook and RF classifier, and show/discuss the results in comparison with the results of **Q2**, including the vector quantisation complexity.