UPMC/LIP6 at ImageCLEFannotation 2009: Large Scale Visual Concept Detection and Annotation

Ali Fakeri-Tabrizi, Sabrina Tollari, Ludovic Denoyer, Patrick Gallinari
Université Pierre et Marie Curie - Paris 6, UMR CNRS 7606-LIP6, France, firstname.lastname@lip6.fr

1 Annotation Models in the Case of Imbalanced Classes

Some classes have much more examples than the others and there will be the dominating effect of the majority classes. We try two strategies for solving this problem:

1. Removing the examples from the majority set
2. Choose a convenient loss function for the classifier

1.1 SVM with a Convenient Lost Function

We train a SVM classifier using a linear kernel. As proposed in [1], we use a ROC area as the loss function to solve the imbalanced data problem. It can be computed from the number of swapped pairs:

$$SwappedPaires = \|\{ (i,j) : (y_i > y_j) and (w^T x_i < w^T x_j)\}\|$$

$$1 - ROCarea = \frac{SwappedPaires}{\#pos.\#neg}$$

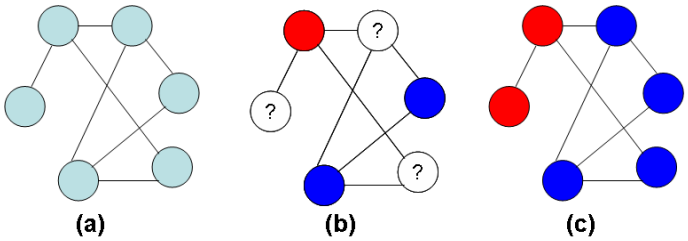
1-ROCarea is the value of misclassification in the loss function for each iteration.

1.2 Annotation by Graph Classification

Each node represents an image (annotated or not). Each edge is weighted by the similarity value between the pair of images:

$Sim(X,Y) = e^{-D(X,Y)}$ in which D represents the euclidean distance.

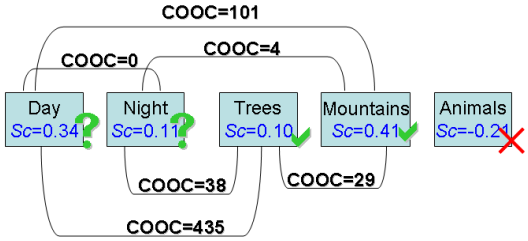
As in [2], we propagate the labels through the graph. The propagation through an edge with a high value will be stronger than one with a low value.



2 Relations between concepts

a) Detect and use the exclusive concepts

We create a co-occurrence matrix $COOC$. For each pair of concepts X and Y, if $COOC(X,Y) < \epsilon$ then X and Y are exclusives.



For a given image:

1. If a concept obtains a negative score, then the image will not be annotated by the concept.
2. If two concepts are exclusives, the image will be annotated only by the concept with stronger predicted value Sc and the other will be eliminated.

b) Filter the classification scores using an optimism rate

An optimism rate (OR) signifies an acceptation degree of negative values. First, concepts are sorted according to their scores (Step2). Second, if two concepts are exclusives then the lowest score is decreased (Step4). We reiterate the process until having the scores greater than OR. See the table (OR=-0.1).

Step1	Spring -0.08	Night 0.01	Animals -0.21	Trees 0.19	Mountains 0.41	Day 0.34
Step2	Mountains 0.41	Day 0.34	Trees 0.19	Night 0.01	Spring -0.08	Animals -0.21
Step3	**Mountains 0.41**	Day 0.34	Trees 0.19	Night 0.01	Spring -0.08	Animals -0.21
Step4	**Mountains 0.41**	**Day 0.34**	Trees 0.19	Spring -0.08	Night -0.19	Animals -0.21
Step5	**Mountains 0.41**	**Day 0.34**	**Trees 0.19**	Spring -0.08	Night -0.19	Animals -0.21
Step6	**Mountains 0.41**	**Day 0.34**	**Trees 0.19**	**Spring -0.08**	Night -0.19	Animals -0.21
Step7	**Mountains 0.41**	**Day 0.34**	**Trees 0.19**	**Spring -0.08**	Night -0.19	Animals -0.21

3 Experiments and Results

The corpus is composed of 5000 training images and 13000 testing images. There are 53 concepts.

Each image is segmented into 3 horizontal regions with the same sizes. For each region, we compute a HSV histogram. We believe that these visual descriptors are particularly interesting for general concepts (not objects).

Official Results

Run	EER	AUC
SVM	0.372	0.673
SVM+Hierarchy:OR=-0.1	0.384	0.651
SVM+Hierarchy:OR=-0.15	0.407	0.630
SVM+Hierarchy:OR=-0.2	0.410	0.623
GraphClassifier+Hierarchy:OR=-0.1	0.498	0.192
Random	0.500	0.499

[1] Thorsten Joachims. A support vector method for multivariate performance measures. In ICML, 2005.
[2] Huang J., Zhou D. and Schlkopf B. Learning from labeled and unlabeled data on a directed graph. In ICML, 2005.

In addition...

We are part of the AVEIR consortium, which proposed the fusion of four french labs' runs. We also submit to ImageCLEFphoto2009.

Acknowledgment: This work is supported by the French National Agency of Research (ANR-06-MDCA-002 AVEIR project).