Adapting RANSAC-SVM to Detect Outliers for Robust Classification

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We have evaluated our algorithm on the Pascal Voc 2007 dataset. In order to emulate noise, we flipped the labels of 20% of the hardest examples for each of the 20 classes in the dataset. We used distance from the hyperplane as a measure to approximate hardness. The ones closest to the hyperplane are hard in the feature space and are expected to be visually difficult to annotate. We have used linear SVM in all our experiments. To describe each image, we have used responses of the 7th layer of caffe [2] features pre-trained on the Imagenet Large Scale Visual Recognition Challenge 2012 (ILSVRC2012). This gave us a 4096-length feature vector to describe each image. Table shows that using our method we were able to achieve more than 12% improvement over both RANSAC SVM and ordinary SVM.

Our method can also be adapted to identify hard examples in the training data. This is because hard examples are also dissimilar in their feature space as compared to normal examples. Figure 1 shows some of the hard examples identified by our method.

![Figure 1: Few visually hard images of VOC 2007 which were detected as outliers by our method. The classes are: bicycle, bird, boat, car and cat](http://example.com/figure1)

Voc 2007 dataset contains some images labelled as 0 which denote hard positives. We show in table 2 that even after including the 0 labels, we were able to achieve nearly the same performance as normal svm without the 0 labels. Also, our method performed better when 0 labels were not included in both normal svm and our method.

<table>
<thead>
<tr>
<th>Normal SVM</th>
<th>RANSAC-SVM</th>
<th>Our method</th>
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</thead>
<tbody>
<tr>
<td>Normal SVM without 0 labels</td>
<td>41.2</td>
<td>48.6</td>
</tr>
<tr>
<td>Normal SVM with 0 labels</td>
<td>72.7</td>
<td>72.0</td>
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</tbody>
</table>

Table 1: Comparison of mean average precision with 20% noisy labels on the Voc 2007 dataset

Table 2: Mean average precision of Voc 2007 dataset using normal SVM excluding examples labelled as 0, our method in the presence of the 0 labelled examples and our method after removing the 0 labelled examples.

Thus we show how a simple adaptation of RANSAC SVM can be used to achieve robustness to noise. We further show how it can be used to detect hard examples in the training data.

