# Object recognition using SVM models

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**Abstract.** The following paper raises the subject of usage SVM model for object recognition. The tests were carried out on dataset from Columbia University Image Library COIL-20 that consist of 20 sets of images, each for one test object. Results shows, that ....

## 1 Introduction

Topic of object recognition opens up many interesting possibilities today. Right now [4] it is widely used in areas such as image retrieval, security and surveillance, automated vehicle parking systems and machine inspection and many more. For all these applications, image recognition is the core. Despite the fact that this area is dynamically developing, there is still a lot of room for improvement. This paper focuses on use of pattern recognition technique to the object recognition problem using SVMs.

## 2 Experiment

### 2.1 Dataset

Dataset used in experiment comes from Columbia University Image Library and is called COIL-20 [2]. This dataset consists of 20 objects, hence naming. Each object in the collection appears in the form of 72 photos from different angles. In each picture, the object is rotated 5 degrees in relation to its previous photo. 72 photos, each rotated 5 degrees gives a full 360 degrees perspective on given object.

In experiment we decided to also test bigger dataset from the same source - COIL-100 [3].

### 2.2 Simulation

Next step is to divide our dataset into the training set and the test set. In this case we divided given set of pictures randomly in half. This division was used

for each object in COIL-20 dataset. After reading the set of images, we need to process (extract) them in order to build dataset for classification. For this purpose, Canny's filter was used. Its working principle is that it searches for edge of picture and marks them white. After applying Canny's filter next step was to calculate Hu's Geometric Moments Invariants which remain the same independently from image scale, rotation or translation. These were needed as a source for SVM classifier to learn. With such prepared data it was possible to start the process of learning for classifier and then testing stage.

To sum up. Experiments scenario consisted of three steps:

- Objects' images loading and preprocessing.
- Training stage - half of each image pictures were used
- Testing stage - done by performing multiple comparisons of two various objects' images

Results of test are presented in the next section.

## 3 Results and analysis

Within created computer software we performed an experiment, where we compared 20 (10 for 50 images case) objects' images to every else remaining in dataset. The accuracy comparison was made using the predict function from scikit-learn python library.

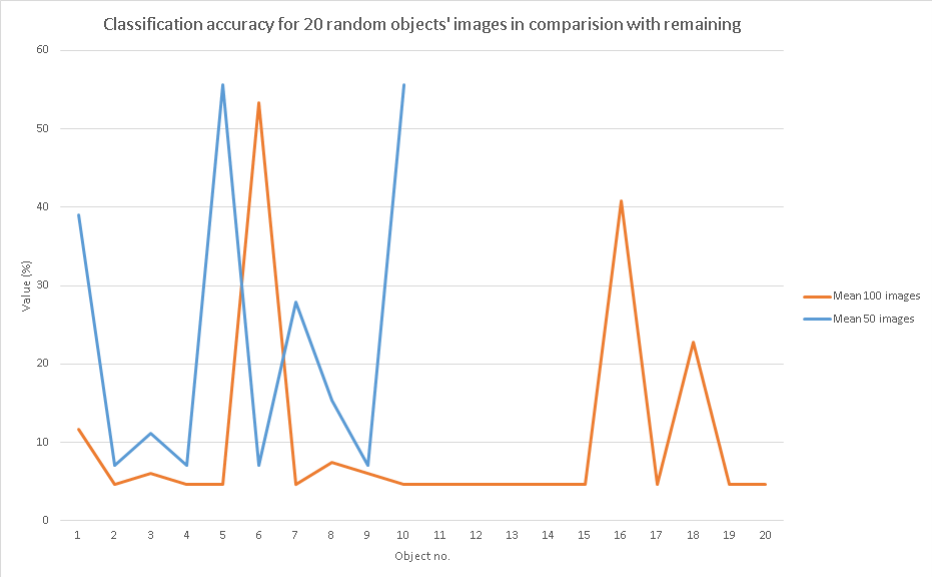


**Fig. 1.** Mean values of classification accuracy for 100 and 50 images.

## 4 Summary

Analysis of received in experiment data leads to the following conclusions:

- Not every picture was recognized well in comparison to others - it may be an effect of not sufficient feature extraction. Improvement could be possible for better filter setup or better selected dataset.
- By decreasing dataset size to 50 objects classification accuracy improved in every case.
- Trial with skipping feature extraction resulted in worsening results.
- Training set for classifier was only 36 pictures for one object. Better results could be probably obtained for larger group of training images.

## References


1. Object Recognition using SVM-KNN based on Geometric Moment Invariant, Chandramouli Chandrasekar, Muralidharan R in International Journal of Emerging Trends Technology in Computer Science 1(3):215 - 220· September 2011
2. Columbia University Image Library (COIL-20). Access on 05.06.2020 https://www.cs.columbia.edu/CAVE/software/softlib/coil-20.php
3. Columbia University Image Library (COIL-100). Access on 05.06.2020 https://www1.cs.columbia.edu/CAVE/software/softlib/coil-100.php
4. Object recognition techniques in real applications, Fernandez Robles, Laura. University of Groningen, 2016

| Object no. | Object ID | Object ID in COIL | Mean value of classification (100 images) | Standard deviation value (100 images) | Mean (50 images) | standard deviation (50 images) |
|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 11,64 | 10,99 | 38,97 | 13,66 |
| 2 | 7 | 8 | 4,69 | 10,99 | 7,03 | 13,66 |
| 3 | 15 | 16 | 6,08 | 10,99 | 11,2 | 13,66 |
| 4 | 21 | 22 | 4,69 | 10,99 | 7,03 | 13,66 |
| 5 | 56 | 57 | 4,69 | 10,99 | | |
| 6 | 34 | 35 | 53,3 | 10,99 | 55,64 | 13,66 |
| 7 | 27 | 28 | 4,69 | 10,99 | 7,03 | 13,66 |
| 8 | 46 | 47 | 7,47 | 10,99 | 27,86 | 13,66 |
| 9 | 49 | 50 | 6,08 | 10,99 | 15,36 | 13,66 |
| 10 | 76 | 77 | 4,69 | 10,99 | | |
| 11 | 77 | 78 | 4,69 | 10,99 | | |
| 12 | 98 | 99 | 4,69 | 10,99 | | |
| 13 | 84 | 85 | 4,69 | 10,99 | | |
| 14 | 51 | 52 | 4,69 | 10,99 | | |
| 15 | 18 | 19 | 4,69 | 10,99 | 7,03 | 13,66 |
| 16 | 33 | 34 | 40,8 | 10,99 | 55,64 | 13,66 |
| 17 | 61 | 62 | 4,69 | 10,99 | | |
| 18 | 72 | 73 | 22,75 | 10,99 | | |
| 19 | 85 | 86 | 4,69 | 10,99 | | |
| 20 | 90 | 91 | 4,69 | 10,99 | | |

**Fig. 2.** Table