

# Project: Image classification using CIFAR-10

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23.07.18

# Motivation

- Classify images using HoG features and SVM
- Classify again using CNN and softmax
- Classify again using CNN and SVM
- Compare results

## Dataset: CIFAR-10

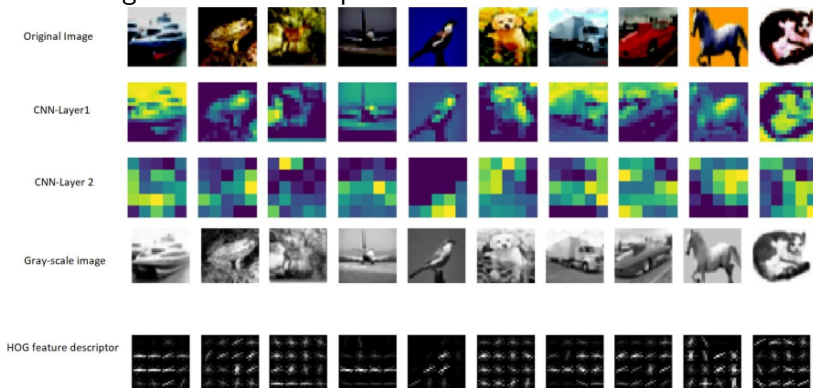
- Labeled subset of the 80 million tiny images dataset
- Contains 60.000 color images of size 32x32
- Images are labeled as one out of 10 classes
- Each class contains 6.000 images
- 50.000 training and 10.000 test images

# Classification method

- HoG and SVM
  - Compute HoG features and let SVM classify them
  - SVM one vs all approach with linear kernel
- CNN with Softmax
  - Let CNN learn the features by itself and use Softmax loss function for classification
- CNN with SVM
  - Let CNN learn the features and use SVM for classification

# Results

## Some images and their computation results



# Results

## Classification example

Actual Class	Ship	Frog	Deer	Plane	Bird	Dog	Truck	Car	Horse	Cat
Predicted class (CNN+SVM)	Car	Frog	Plane	Bird	Bird	Deer	Ship	Ship	Horse	Frog
Predicted class (HOG+SVM)	Car	Frog	Bird	Plane	Bird	Cat	Truck	Dog	Horse	Cat
Predicted class (HOG+Softmax)	Ship	Frog	Bird	Plane	Bird	Dog	Car	Car	Dog	Cat

## Accuracies

Classification	Accuracy
HOG+SVM	45%
CNN+SVM	32%
CNN+Softmax	51%

# Evaluation

- CNN+Softmax was expected to get the highest accuracy since it is a commonly used approach
- CNN+SVM would be expected to get higher accuracy than HoG+SVM
- HoG features seem to be better feature descriptor than simply learning them