

Project: Image classification using CIFAR-10

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Object Recognition and Image understanding

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

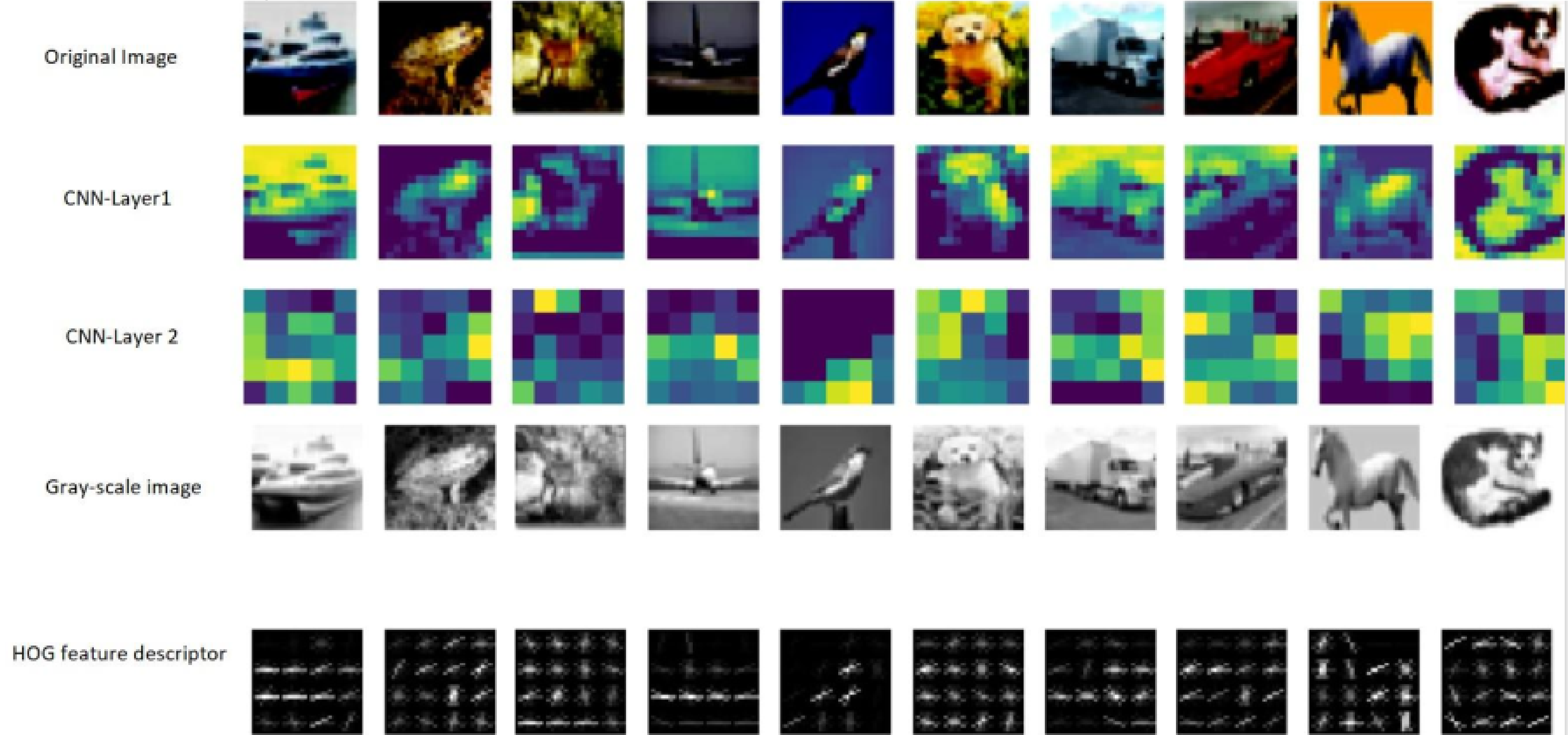
- Labeled subset of the 80 million tiny images dataset
- Contains 60.000 color images of size 32x32
- Images are labeled as one out of 10 classes
- Each class contains 6.000 images
- 50.000 training and 10.000 test images

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 dataset images and their computational 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