

ELEC 474

Machine Vision

Lab 6

Machine Learning for Image Classification

Tuesday November 19th, 2019

This lab aims to enhance your understanding of Machine Learning approaches in computer vision tasks. It includes two main sections:

- 1- Image classification using traditional methods.
- 2- Image classification using neural networks and deep learning methods.

1. Pre-Lab: Image classification using traditional methods

Your task for the pre-lab component is to compare the accuracy of k-means clustering and an SVM classifier when they are used to classify digit images from the MNIST dataset.

Although k-means clustering is used in the context of unsupervised learning, you are asked to use it for classifying digits, which is a supervised task. In unsupervised learning, we try to discover some hidden structures in the data. However, the clusters in this task are already known and k-means will categorize images of each digit in a separate cluster.

- a. Identify the number of clusters in the provided code and run it.
- b. Show the images of different clusters. Report at least one correctly and one wrongly clustered images.
- c. Try different parameters such as the number of iteration and report your best result (in terms of error rate or accuracy). The k-means documentation can be found here:
https://docs.opencv.org/master/d5/d38/group_core_cluster.html#ga9a34dc06c6ec9460e90860f15bcd2f88

Once the accuracy (or error rate) for k-means is obtained, you have to classify digit images of the MNIST dataset using a SVM classifier, which is a well established supervised learner in the Machine Learning world.

- a. Report the number of images in training and test sets, and also dimensions of the images.

- b. Run the provided code for SVM and report the training time and accuracy (or error rate)

2. Lab: Image classification using neural networks and deep learning methods

Your task is to implement a Multilayer Perceptron (MLP) or a Convolutional Neural Network (CNN) on the MNIST digit dataset. To run your code, you have to implement it in the “colab” environment which is a free cloud service. It can be accessed from: <https://colab.research.google.com/>

Marking Scheme:

Prelab:	<u>k-means</u>	<u>2 marks</u>
	<u>SVM</u>	<u>2 marks</u>
Lab:	<u>MLP or CNN</u>	<u>3 marks</u>
TOTAL:		7 marks

Notes:

1. For this lab, the implementation using OpenCV can be in either C++ or Python.
2. The MNIST database is available here: <http://yann.lecun.com/exdb/mnist/>
3. The instructions in Python for the MLP and CNN are included in the lecture slides “ELEC 474: Machine Learning for Visual Recognition”.