

CS 240: Lab 7

Support Vector Machines

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Instructions

- This lab will be **graded**.
- Please read the problem statement and submission guidelines carefully.
- For any doubts or questions, please contact either the TA assigned to your lab group or the TA involved in making the lab.
- The deadline for this lab is **Thursday, 13 March, 5:30 PM**. Submission after that will not be considered.
- The submissions will be checked for plagiarism, and any form of cheating will be penalized.

Problem Statement

The goal of this lab is to classify handwritten digits from the MNIST dataset using Support Vector Machines (SVM). MNIST is a widely used dataset of handwritten digits, containing 60,000 training and 10,000 testing grayscale images of size 28×28 pixels. Each image represents a single digit (0–9). The preprocessed data (flattening and normalization) is given in the template file. Input: Each sample (image) has $28 \times 28 = 784$ float values between 0 and 1 (after normalization) Output: 10 float values, each corresponding to the probability of the input being in a class (used to find the predicted class from 0-9)

- Implement a binary classifier to distinguish the digit '0' from all other digits.
- Extend the approach to train separate one-vs-all classifiers for each digit (0 through 9).
- Evaluate classifier performance using precision, recall, and F1-score to determine which digits are the most difficult to classify.

Tasks to be Completed:

Complete the following tasks in the provided Jupyter Notebook file:

- **Task-1** Implement classifiers for 10 classes, 1 classifier for each digit using SVM.
- **Task-2** Evaluate classifier performance using precision, recall, and F1-score to determine which digits are the most difficult to classify and print the scores for each digit.

Submission

- Submissions should be made on Moodle. Submit the Python file renamed as `rollnumber1.rollnumber2.ipynb` (the "b" in roll number should be in small case).
- Only one person per team should submit their solution.