

Supervised Learning Lab Assignment

In this assignment, you will work with a dataset of concrete surface images, where each image shows either **cracked** or **non-cracked** concrete surfaces. You will design, train, and evaluate two image classification models to detect cracks in concrete:

1. **A classical machine learning classifier using Support Vector Machine (SVM) (10 points)**
2. **A deep learning model using a Convolutional Neural Network (CNN) (10 points)**

Dataset Link: <https://data.mendeley.com/datasets/5y9wdsg2zt/1>

Task 1: -----

Goal: Train an SVM to classify images as “cracked” or “non-cracked”.

Instructions:

1. **Preprocessing**
 - Normalize the images.
 - Separate the images into a training/test split.
2. **Feature Extraction**
 - Choose at least one method to represent each image as a feature vector or extract handcrafted features (e.g., HOG, LBP, SIFT, or raw pixel intensities).
 - You may test alternatives and justify your choice.
3. **Model Training**
 - Train an **SVM** classifier, for example linear, RBF, or polynomial kernels.

Evaluation

1. Report accuracy, precision, and the confusion matrix. (5 pts.)
2. Discuss the strengths and limitations of SVM for this dataset. (5 pts.)

Task 2: -----

Goal: Train CNN to classify images as “cracked” or “non-cracked”.

Instructions:

1. **Data Preparation**
 - Normalize images and optionally apply data augmentation (rotation, brightness, flipping).
 - Separate the images into a training/test split.
2. **Model Design**

- Design a CNN from scratch **or** fine-tune a pre-trained network (e.g., AlexNet, VGG16, ResNet).
 - Clearly specify architecture, activation functions, and regularization.
3. **Training**
- Choose an appropriate optimizer, loss function, and batch size.
 - Track training/validation loss and accuracy.

Evaluation

1. Visualize training curves and discuss overfitting/underfitting. (5 pts.)
2. Evaluate the test set and compare SVM results. (5 pts.)