Machine Learning — Programming Assignment

February 2026

1 Problem definition and data

As part of their autonomous driving system, a company needs to implement a module for the recognition of road signs. They already have a detection module that analyzes images taken from a camera on the vehicle and outputs a close-up of any visible road sign. The close-up is a color image of 200×200 pixels. The quality of the images is variable, therefore road signs are not always clearly recognizable.

For a preliminary version of their system, the company selected 20 types of signs. The following picture shows one exemplar of each type:

For training and test, a small number of samples (1088 in total) has been collected. They have been organized in directories: one for each type of sign, with `train` and `test` subdirectories.

2 Assignment

We want to build a classifier that is able to identify each kind of road sign. For the programming assignment you are expected to:

1. analyze and comment the data;

2. design and implement a suitable data pre-processing procedure;

3. implement, train and evaluate one or more classification models;

4. use suitable data processing and visualization techniques to analyze the behavior of the trained models.

As an additional request, you are asked to compare the accuracy that can be obtained by using gray-level and color images.

All the above should be implemented as scripts in the Python programming language. Any machine learning library (included `pvml`) can be used. Data and code used during the course can be used for the assignment if needed.

3 Report

Prepare a report of three to five pages documenting all your work. Provide detailed instructions on how to reproduce the results. The report must be in the PDF format. Include your name in the report and conclude the document with the following statement: "I affirm that this report is the result of my own work and that I did not share any part of it with anyone else except the teacher."

Make a ZIP archive with the report and the Python notebook (converted to PDF, with visible outputs), and submit it from the course web page.