

Complex Engineering Problem/Activity

Course Code and Title: EE-439 Introduction to Machine Learning

Semester: 6th (Spring 2025)

Instructor: Kashif Javed

Total Marks: 15

Deadline: 2nd last week of the semester

CLOs and PLOs for Complex Engineering Problem

CLOs		Description	Domains & Levels	PLOs
CLO3	Theory	Analyze different data preparation methods and classifiers for designing a real-time urban sound detection and classification system	4. Analyze	PLO4
CLO4	Theory	Design an end-to-end real-time urban sound detection and classification system using different machine learning algorithms and evaluate each of them to find the optimal solution.	6. Create	PLO3

There can be at most 4 students in each group.

Problem Statement

- **The problem:** to design an automatic urban sound detection and classification system. Each group will collect and annotate the corpus from one of the 5 sound categories. Once you select a category, select at least 3 sound classes from that category. For each class, at least 200 samples should be collected.
 - 1) Animal sounds (dogs, cats, cows etc.)
 - 2) Natural sounds or sounds of nature (rain, sea, birds, lightning etc.)
 - 3) Human sounds (baby crying, footsteps, coughing, breathing etc.)
 - 4) Household or everyday sounds (knocking on the door, typing on the keyboard, alarm clock, breaking glass etc.)
 - 5) Dangerous sounds (police siren, train, engine, airplane, fireworks, gunshots, and other dangerous impulsive sounds etc.)
- **Objectives:** The main objective is that the developed system should work satisfactorily.

- **Deliverables:** A detection and classification system developed on the laptop using Python language and a report written to explain the developed system.
- **Depth of the analysis and design requirements:** The students will have to read different papers, implement, and evaluate those different methodologies through experiments to find the most suitable solution.

Complex Engineering Problem Attributes

WP1: Depth of knowledge WP2: Range of conflicting requirements WP3: Depth of analysis WP4: Familiarity of issues WP5: Extent of applicable codes WP6: Extent of stakeholders WP7: Interdependence	<ul style="list-style-type: none"> • WP1: Depth of Knowledge: Requires knowledge of signals and systems/digital signal processing (WK4) and engagement in research literature (WK8) and engineering design knowledge (WK5). • WP2: Range of conflicting requirements: There can be numerous solutions with different technical and engineering solutions. • WP3: Depth of analysis: In-detail analysis through experimentation will be required for finalizing the solution. 	
	Rubrics	
	Learn how to collect and annotate the data after reading literature (CLO3)	WP1 (5 marks)
	Investigate the existing solutions and highlight the wide range solutions (CLO3)	WP2 (3 marks)
	Perform experiments to test your own solution (CLO4)	WP3 (5 marks)

EA1: Range of resources EA2: Level of interaction EA3: Innovation EA4: Consequences for society and environment EA5: Familiarity	<ul style="list-style-type: none"> • EA1: Range of resources: Design submission in the form of a report 	
	Rubrics	
	Write a report on your design and experiments.	EA1 (2 marks)