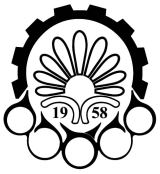
Homework 1
Computation Intelligence and its Applications in Mechatronics
Amirkabir University of Technology

Submission deadline: **February 22, 12:00 AM**



Amirkabir University of Technology
(Tehran Polytechnic)

1 Task 1: Implementing Perceptron Using Scikit-Learn

1. Load the **Iris dataset** from Scikit-Learn.
2. Select only the Setosa and Versicolor classes.
3. Use the `Perceptron` class from `sklearn` to train a model on this dataset.
4. Evaluate and visualize the decision boundary of the Perceptron for the 2D combination of all features.
5. Report the accuracy and discuss the results.

2 Task 2: Implementing a Custom Perceptron Class

1. Implement a Perceptron model from scratch using only NumPy.
2. Train your custom Perceptron on the same Iris dataset as in Task 1.
3. Compare the results of your implementation with the Scikit-Learn implementation.
4. Plot the convergence of weights during training.
5. Provide accuracy comparison, and analysis.

3 Task 3: Exploring Non-Linearly Separable Data

1. Modify the Iris dataset to only include Versicolor and Virginica classes.
2. Train a Perceptron (using both Scikit-Learn and your custom implementation) on this dataset.
3. Visualize the decision boundaries and discuss whether the model correctly classifies the data.

Submission Guidelines

- Homeworks must be completed in **groups of four**.
- Each group must submit a single file containing a **PDF report**, including answers to discussion questions, visualizations, and code explanations, and a **Jupyter Notebook**, containing all code and results.