

# Assignment 1 (20 marks)

## Soft Computing (7168) & Soft Computing PG (7197)

### Semester 2- 2024

#### Task Description

We monitored an interesting behaviour demonstrated by a group of robots. The robots are placed in a large, closed room that contains exactly four small candles. We noticed that initially, most robots wander around searching for a candle. Overtime, more robots seem to find a candle and move towards it. A sample of the robots' behaviour can be viewed in the file RobotVideo.avi. We watched the robots doing the same behaviours several times and collected data about these behaviours. Each row of the dataset represents data about a single robot at a given point of time. The dataset contains 14 columns as follows:

1. X\_robot: the x-coordinate of the position of the robot
2. Y\_robot: the y-coordinate of the position of the robot
3. Orientation\_robot: the heading of the robot
4. Collision: '1' if the robot suffered collision in the previous time step, '0' otherwise
5. X\_candle1: the x-coordinate of the position of the 1<sup>st</sup> candle
6. Y\_candle1: the y-coordinate of the position of the 1<sup>st</sup> candle
7. X\_candle2: the x-coordinate of the position of the 2<sup>nd</sup> candle
8. Y\_candle2: the y-coordinate of the position of the 2<sup>nd</sup> candle
9. X\_candle3: the x-coordinate of the position of the 3<sup>rd</sup> candle
10. Y\_candle3: the y-coordinate of the position of the 3<sup>rd</sup> candle
11. X\_candle4: the x-coordinate of the position of the 4<sup>th</sup> candle
12. Y\_candle4: the y-coordinate of the position of the 4<sup>th</sup> candle
13. X\_speed: the motor speed the robot will apply along the x-axis
14. Y\_speed: the motor speed the robot will apply along the y-axis

A sample of the data we collected can be found in RobotData.csv. Your task is to use one of the function approximation models we studied to predict X\_speed and Y\_speed. You are expected to run several experiments to help you decide on the best hyperparameters and features for your final model. Your final model will be tested on another part of the data that will not be made available to students. PG students will have a more challenging test set than UG students.

#### Notes

This assessment needs to be done individually. GenAI or opensource code can only be used to assist with secondary tasks (e.g., reading file, logging & saving output) and need to be referenced as mentioned in Lecture 1.

#### Deliverables & Submission

This assignment needs to be submitted by the deadline indicated on Canvas. You need to:

- Upload a zipped file **lastname\_firstname\_assignment1.7z** (where lastname & firstname should be replaced by your own names) which contains the following:
  - o the source code of your final model. File name must be "FinalModel.py" or

“FinalModel.ipynb”.

- the source code of other 3 diverse models you tried as part of your experiments. These models can have different architecture, hyperparameters, and/or features. File names must be “OtherModel\_i.py” or “OtherModel\_i.ipynb” where i is the model number (1,2, or 3).
- the trained final model “Final.model” which is saved using the pickle package.
- a 2-page report describing the features used, any data processing, data split, validation, and the methods used to select the final model. Reports with more than 2 pages will be penalised.