

Code documentation for mobile robot simulation environment

1. Running the code

1. For running the code use *Main.m* file.
2. Run all subsections separately using CTRL+ENTER key combination.
3. First, clear all variables and run subsection with the *init.m* file.
4. Depending on the mode chosen in *init.m* one of the scripts will be run and the robot will go through the maze while gathering test data. Simulation can be shown.
5. Run next subsection in order to train the perceptron.
6. In the next subsection choose environment for running the robot with perceptron and run the subsection.
7. In the final section one can see simulation of the robot going through the maze using NN algorithm.

2. Functions and scripts

Following functions are used in the *Main.m* and *Init.m* files:

- *GenerateMaze.m* - generates maze used for simulation, choose filename from the mazeLib folder,
- *Drive.m* - drives the robot for wanted distance with specified wheel speeds,
- *Simulation.m* - shows the simulation of the robot driving through the maze,
- *WallFollow.m* - script running the robot through the maze with a simple wall following algorithm,
- *TunnelDrive.m* - script running the robot through a tunnel (avoiding the walls),
- *StaticRoute.m* - robot performs series of *Drive.m* functions executions with values taken from *distAndVel* cell array in *Init.m* file. This creates a static route of a robot. Variable *j* is used to pick specific route.
- *HistoryUpdate.m* - to be placed after every use of *Drive.m* function, used to update laser, velocity and position histories, used for simulation of the robot (see comments at the beginning of the file),
- *sig* and *sigDer* - sigmoid function and its' derivative,
- *MlpTrain* - function training the neural network with BP algorithm,
- *MlpRun* - returns one set of wheels speed values (vector 2x1) for one set of given input.

All other functions are used within files above and no direct use of those functions is necessary. However, for more information about any function and use examples, type *help FunctionName*.

3. Variables and structures

Essential variables and structures in the *Init.m* file are:

- *robot* - structure of robots' parameters, including: *pose* - starting pose, *param* - wheels separation and wheels radius respectively, *size* - size of the robot, *laserAngles* - angles of the lasers placed on the robot,
- *mlpParam* and *mlpArch* - perceptron parameters (moment, sigmoid function alpha, learning rate eta and number of epochs) and architecture (input size, number of hidden neurons in each layer and output size),
- *wIn1Init*, *w12Init* and *w2OutInit* - initial weight matrices of the perceptron,
- *poseHist* - history of all recorded poses of the robot, used for simulating robots' movement,
- *laserHist* and *velHist* - laser measurements and velocities corresponding to the above,
- *distAndVel* - used in *StaticRoute.m*,
- *collision* - collision flag, used in *Simulation.m*
- *mode* - used for running different methods of gathering training data
- *Ts* - sampling time, used in *Drive.m* and *Simulation.m*