Learning and Planning

Questions in the homework are related to the recent two topics you covered in the class, namely, learning and planning.

Some of the questions are also put in the learning part so you can do a little bit research about the topics yourself.

There is no coding question.

Problem 1 - Planning

Create an example **novel** (that is, not one of the problems in your lecture slides such as
blocks world, spare tire, shoe etc...) problem. Your problem may be easy so you can solve
it with less amount of steps. Represent this problem with one of the problem description
languages you see in the lecture (STRIPS, ADL...), then choose **one of the following**:

1. Solve this problem by applying Partial Order Planning (POP) by hand, your solution
   must backtrack at least once before finding the solution, and you must show each
   step of the planning clearly.

2. Create a planning graph for the problem **with at least two state levels, excluding
   start state level, and your final state level must contain 3 different (negations
   does not count) literals**. Indicate all mutex relations and their types (inconsistent
   effects, competing needs...) clearly. You do not need to find the solution.

Problem 2 - Learning

Answer the following questions:

1. Explain meaning of the terms *overfit* and *underfit*.

2. What is *online learning* and *offline learning* in the context of machine learning?

3. Explain why it is advised to split your data into train set and test set.

4. You are given a problem of robot navigation. You have a mobile robot (with wheels) and you just need it to be able to move around without colliding into walls or obstacles. Your robot has a bump sensor and a 2D laser scan sensor (360 degrees) that shows the distance to the closest obstacle in each 360 direction. Your robot can move forward, move backward, turn left and turn right.

   - If you would model this as a supervised learning problem, what your output would be, how would you collect the training data, what are the labels of your data would be, how would you perform the training process and an give an example supervised learning algorithm to use.

   - If you would model this problem as a reinforcement learning problem, what your output would be, how would you perform the training process and give an example reinforcement learning algorithm to use.

Problem 3 - Neural Networks

Answer the following questions:

1. What is a *loss function* in the context of neural networks.

2. What is an *activation function* in the context of neural networks.

3. Currently there are different neural network architectures being used. For both "convolutional neural networks" and "recurrent neural networks", give an example domain/problem where these architectures are used and explain briefly why these specific architectures are preferred in this specific domain/problem.

4. Draw a simple fully-connected neural network that takes 4 input features as input, has 1 hidden layer between input and output layers and is able to classify between 3 different classes. Give an example loss function for this task and explain how output of your neural network is used to determine the class of your input (How is the numerical value you obtained in the last layer used for classification?).

Submission

Submit your homework files through Ninova. Please upload your report file using filename
BLG435E_HW_3_STUDENTID.pdf. You are going to submit:

1. A pdf file containing answers of the questions.

In case of any questions, feel free to send an e-mail to unlut@itu.edu.tr.