Tutorial 5, 23.06.22 **Bioinspired Learning SS 2022**

Goal:
The goal of this tutorial is to apply a reinforcement learning (RL) method to penalty kicks in robot soccer games. For this purpose, read the paper [1], and see the supplementary material.

[1]: T. Hester, M. Quinlan, P. Stone: "Generalized Model Learning for Reinforcement Learning on a Humanoid Robot", IEEE International Conference on Robotics and Automation (ICRA), pp. 2369-2374, 2010.

Tasks:

1) Implement the RL algorithm described in paper [1]. For this purpose, use the info given in the document "Reinforcement Learning Examples" to obtain the transition model $Pr(s' \mid s, a)$.

2) Demonstrate the RL algorithm on the NAO robot scoring goals in a penalty kick scenario with consideration of the following constraints:
   - Fixed ball location and distance to the goal.
   - The goal keeper can have color markers if needed.
   - The goal keeper can be at different positions. Hint: Test your algorithm with one fixed goal keeper position, then try different goal keeper positions.
   - Use a decision trees for your transition and reward function implementations. If you have difficulties with DT for the transition function, use a different probability distribution model instead. The reward function is still expected to be a DT implementation

3) Plot the cumulative reward. Comment your results.

You can optionally use the goals provided in the NAO lab. They have a size of ca. 127 x 107 x 66 cm (50 inches).

Additional information on robot soccer (including penalty point distance etc.) can be found at:
http://www.informatik.uni-bremen.de/spl/bin/view/Website/WebHome

Results to submit:

1) All relevant code implementing the RL algorithm (task 1)) and integrating it into the existing framework. Source code!! (no binaries, etc.)

2) The plot of the cumulative reward and your comments (task 3)).

Don't forget to make a demo video.

Compress all the required results into a .zip or .tar.gz file (naming convention as in tutorial 2). Submit that file to: **bilhr-lecture.ics@ei.tum.de**

After submission, you will have to demonstrate this task on the robot.
Deadline: **20.07.2022, 23:59**