Universidade do Minho
Departamento de Informática

Intelligent Systems
Soft Computing
4º/1º Year, 2º Semester
2019/2020 Edition

Practical Work nº 2

Theme

Deep Reinforcement Learning applied to Agents

Learning Objectives

With the realization of this practical work, it is intended that groups learn the following procedures:

- Preparation of a Deep Q-Learning Model;
- Analysis and validation of the Reinforcement Learning model performance;
- Optimization mechanisms applied in the Reinforcement Learning model;

Problem Statement

This practical work intends to be the starting point for the development of a Deep Reinforcement Learning (DRL) algorithm using the Python development environment together with Tensorflow, Keras and ViZDoom libraries. For this, it will be necessary to develop a solution to the following problem:

"Preparation of a DRL algorithm capable of learning to play the famous game: Doom"

In this project, it is intended to apply the knowledge taught during the curricular unit of Soft Computing for the creation of an agent capable of learning to play (and win) one specific scenario of the game Doom, through the implementation of DRL algorithms. For this, each group will use the ViZDoom library in order to have access into the respective game environment. The respective ViZDoom tutorial and documentation are available at ViZDoom main website.

The environment scenario to be used in this project is the "basic" scenario. In this scenario, the player is spawned along the in the center of the map, where a red circular monster is spawned randomly somewhere along the opposite side of the map. For this, the player can only do the following actions: [left, right, shoot], where one hit is enough to kill the monster. The episode ends when the monster is killed or on timeout.

Considering the project objectives, the work can be divided into two main phases:

(1) A first phase dedicated to the training of a prototype model, where the agent will train and validate a Deep Q-Network. This model will receive as input a sequence of pre-processed frames of the current state of the game (state), and output the predicted Q-values for each action;
(2) A second phase dedicated to the testing, validation and optimization of the Q-Learning network and hyperparameters.

The practical work includes the delivery of the developed code and corresponding digital report, describing all the procedures applied and respective justification for its use, based on the demonstration of the results obtained.

Additionally, each group can use any open-source libraries that are considered useful for solving the problem at hand (considering the defined development environments).

Delivery	The code resulting from this practical work and respective report (in digital format - PDF) must be sent via elearning platform to the respective evaluation item (found in: **Conteúdo – Instrumentos de Avaliação – Practical Work nº 2**), in compressed file (ZIP format), **until 1st of June 2020 – 09:00h**. The file must be identified in the form "**[CN:F2GXX]**", in which **[GXX]** designates the identification number of the group. The presentation session of the practical work will take place on 1st of June 2020, in a format to be announced in due course.
Bibliographic References	Zai, A., & Brown, B. (2020). Deep Reinforcement Learning in Action. Manning Publications. Sewak, M. (2019). Deep Reinforcement Learning. Springer Singapore. http://vizdoom.cs.put.edu.pl/