Adding an NN component to a PC game implementation

1 Description

Computer games are one of the most promising applications for ML algorithms [1] (`http://gameaibook.org/book.pdf`). NNs can be used as part of a computer game in different ways. NN classifiers can be used to add intelligent features to the game enviroment, to extract and exploit information about the user behavior, etc. This project can be developed using a previous implementation. It can be a previous course project implemented by the student, an open source game implementation, or a Final Degree Project (PFG) from another student that did not include a machine learning component. The sophistication of the environment, graphics, etc., are not relevant, what counts is to what extent the goal of the project is accomplished (see below for details).

2 Objectives

The goal of the project is to insert a Neural Network component as part of a computer game and show that this added component improves or enhances the game experience in anyway. The NN component can be used in ANY form, i.e., for implementing supervised learning algorithm (regression or classification) or for any unsupervised learning task (e.g, clustering, dimensionality reduction, outlier detection, etc).

The student should: 1) Propose the NN component to insert within the game. 2) Implement the NN application. 3) Explore and/or evaluate the behavior of the component, and discuss the results of the exploration/evaluation. 4) Answer to the following questions in the report:

- What class of problems can be solved with the NN? (e.g., supervised vs unsupervised problems)
- What is the network architecture? (e.g., type and number of layers, parameters, connectivity, etc.).
- What is the rationale behind the conception of the NN?
- How is inference implemented? (e.g., How is the information extracted from the network?). Type of prediction or type of inference process.
- What are the learning methods used to learn the network ? Algorithms used for learning the network.

As in other projects, a report should describe the characteristics of the design, implementation, and results. Exceptionally, the game implementation can be implemented in another programming language, but the NN component should be coded in Python. Also exceptionally, if it is not possible to run the game from the Jupyter notebook, the students can include in the report the description of the different ways to demonstrate the effectiveness of the introduced NN component by running the game implementation (with its ML component) independently.

3 Suggestions

- For ideas about how to use NN for games, check the excellent book by Yannanakis and Togelius freely available from `http://gameaibook.org/book.pdf`.
- Implementations can use any Python library.
- We encourage to use games implemented in Python to ease the project evaluation.

References

[1] G. Yannakakis and J. Togelius. *Artificial Intelligence and Games*. 2017.