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CSCI 4950

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Reinforcement Learning for Risk (board game)

For my senior project I will be making a Python package that creates a learning environment for the development of reinforcement learning (RL) agents for the board game Risk. Currently learning RL is a tedious task if for no other reason than that the majority of code used to deploy RL is the environment. My package will allow RL developers to easily get right to the heart of their expertise, while working with efficient and easy to use environment and agent creation. The Risk board game will be implemented using various adjustable settings found in the instruction manual (Hasbro). The board game Risk has a myriad of components that stratify the complexity of algorithms that can be used over a wide range of skill (Wolf).

Implementation Objectives

* Instantiation of the environment and agents should be very easy and straight-forward.
* Use object-oriented and pythonic design throughout.
* Allow a human to take the position of a player.
* Contain a basic GUI that allows a human user to play, and aid in visualization.
* Allow GUI and output to console to be disabled for more efficient use of computing power.
* Allow plottable statistics to be collected about a game.
* Allow portions of the game to be played without the entire game (called minigames in RL).
* Use RL algorithms to play the game, such as min-max and Markov models (Robinson).

Technology Needed: Python 3, and a few open source Python packages, TensorFlow

My expectations are that the package will facilitate extremely easy to understand and use environment creation and will allow RL developers to focus on coding only the algorithms they want to use, as opposed to trying to adapt an already built game to RL (Domination or Lux Delux are commonly chosen platforms for this, to which working out of my package would be superior). The end state of my project will be to reduce the entry barrier for many programmers in the fields of AI and RL.

**References**

Hasbro. *Risk Instructions*. Web <https://www.hasbro.com/common/instruct/risk.pdf>

Wolf, Michael. *An Intelligent Artificial Player for the Game of Risk*. Web <http://www.ke.tu-darmstadt.de/lehre/arbeiten/diplom/2005/Wolf_Michael.pdf>

Domination. Yura.net. Web <http://domination.sourceforge.net/makeai.shtml>

Lux Delux. Web <http://sillysoft.net/lux/>

Robinson, Garrett. *The Strategy of Risk*. Web <http://web.mit.edu/sp.268/www/risk.pdf>