Abstract

The computational study of anxiety with an algorithm of Artificial Intelligence

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Abstract

Computational algorithms and the use of Artificial Intelligence (AI) are beginning to venture into clinical psychology to explain the computational mechanisms behind mental illness. Anxiety is one of the most prevalent mental disorders worldwide; however, it is relatively recent that computational models use AI to study it. A very important model uses artificial reinforcement learning agents with anxious decision-making to capture how the level of pessimism leads to a range of features of anxious behavior. This model was applied in a new environment to better understand how pessimism and the level of aversion in the environment impact the development of anxious symptomatology. Hence, a reinforcement learning agent was implemented in the environment four_rooms of the Neuro-Nav python package with variations in the environment's size, the level of the aversion state and the levels of pessimism in the agent. We found that the amount of required exploration in an environment is a determining factor for the emergence of anxious symptoms of a non-pessimistic agent when the environment has a high level of aversion. In addition, it was corroborated that a greater level of pessimism generates less cognitive control, higher avoidance, the spread of an erroneous assessment of various states in the environment and the overexploitation of known states. This results also highlights the advantages of using simulations to test and evaluate computational anxiety models without the necessity of doing experiments with humans.

Keywords: anxiety, reinforcement learning, computational psychiatry, artificial intelligence.

Supplementary Materials: The following supporting information can be downloaded at: https://github.com/Alicia-MJ/ansiedad_pesimismo_IA.git, experiment code and results.

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Data Availability Statement: The code and data results are publicly available on https://github.com/Alicia-MJ/ansiedad_pesimismo_IA.git

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Appendix A

Mathematical model of the artificial reinforcement learning agent with anxious decision-making [1]:

$$Q^w(s,a) = r(s,a) + \gamma \sum_{s'} p(s' \mid s,a) \left(w \max_{a'} Q^w(s',a') + (1-w) \min_{a'} Q^w(s',a') \right)$$

Appendix B

The Neuro-Nav python package was implemented to create the environments and artificial agents in the experiment [2].

References

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