

AIBirds 2019 - Orpheus: Team Description

Mihai Polceanu is currently Lecturer in Games Technology and AI at the University of Greenwich, London, UK. His work in the context of the AIBirds competition focuses on applying human-inspired mental simulation to computational decision making in virtual agents. His research interests include Artificial Intelligence, Machine Learning, Virtual Reality, Multiagent Systems, Computer Vision and Games.

The Orpheus agent incorporates the idea of simulation-based reasoning from former work by Mihai Polceanu, with a long term goal of obtaining an agent capable of emulating its own environment in order to support decision making and creative problem solving.

The previous version of the agent (full code available at [1]) consists in an improvement to object recognition over the Naive Agent provided by the organizers, such that game objects (positions and orientations) are more accurately identified (including the newly introduced hollow blocks and triangles). Based on the information provided by the perception module, the agent creates what we refer to as an “Imaginary World” in which “mental simulations” can be performed. The model which makes up the imaginary world consists in the perceived scene structure (objects, birds, pigs, scenery) and physical laws that govern the objects' motion. Mental simulations represent independent executions of this functional model and lead to a future state of the environment which can be evaluated – it acts as a multi-step forward prediction model. Our agent is able to perform multiple parallel simulations to test different courses of actions, and chooses the one that best suits its goals to apply in the real game. Although the model does not perfectly reflect the reality of the game, and errors are bound to build up during each simulation, the agent's performance is not drastically decreased; caution must be taken however to ensure that the perception data is as complete as possible (hence the improvements made to the Naive Agent) in order to obtain satisfactory results.

The 2019 version of our agent features improved decision time, the ability to abandon a game at an early stage by predicting failure (the agent restarts the level or chooses another one to play, which saves a considerable amount of time), and changes to shooting behavior to gain time.

The main limitations of our agent are the errors caused by the lower level of simulation detail. Work is in progress to integrate machine learning for obtaining an adaptive environment model, based on recent developments [2] in Deep Learning. More information about the theoretical framework behind Orpheus can be found in [3].

References

- [1] Agent code: <https://bitbucket.org/polceanum/ihsev-aibirds>
- [2] David Ha, Jürgen Schmidhuber, “Recurrent World Models Facilitate Policy Evolution”, Neural Information Processing Systems, 2018, <https://papers.nips.cc/paper/7512-recurrent-world-models-facilitate-policy-evolution.pdf> .
- [3] Mihai Polceanu, Cedric Bueche, “Towards A Theory-Of-Mind-Inspired Generic Decision-Making Framework”, IJCAI Symposium on AI in Angry Birds, 2013, <http://arxiv.org/abs/1405.5048> .