

# AIBirds 2018 -Team IHSEV: Description

Mihai Polceanu is a currently a post-doc at the National Engineering School of Brest, member of the IHSEV team of Lab-STICC. His work 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 and Computer Vision.

Cedric Buche is a Professor (HDR, CNU 27) at the National Engineering School of Brest, member of the IHSEV team of the Lab-STICC Labs UMR 6285 - CNRS. His research interests include Artificial Intelligence, Virtual Reality, Adaptive Behaviors and Multiagent Systems.

The AIBirds agent developed by the IHSEV team 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 solutions to problems.

The previous version of the agent (full code available at [1]) consists in an improvement in object recognition over the Naive Agent provided by the organizers, such that game objects are more robustly 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 2018 version of our agent features improved decision time (~2x faster), 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 in Deep Learning. More information about the theoretical framework behind our agent's implementation can be found in our paper [2].

[1] Agent code: <https://bitbucket.org/polceanum/ihsev-aibirds>

[2] Polceanu M., Buche C., “Towards A Theory-Of-Mind-Inspired Generic Decision-Making Framework”, IJCAI Symposium on AI in Angry Birds, 2013, <http://arxiv.org/abs/1405.5048> .