IMSM
Institute for Interactive Marketing & Social Media

ANNOUNCEMENT

Bachelor Thesis

KEYWORDS

- Reinforcement Learning
- Real-Time Bidding
- Deep Learning

TOPIC: TOWARDS PERFECTION - LEARNING TO PLAY A GAME WITH INCOMPLETE INFORMATION

Incomplete information is the norm in most aspects of humans' lives. Many card games are popular and very tangible examples of a situations where players need to handle a partly observable state and make the most out of it (winning). The fact that an important part of the environment, which is often represented by the opponents' cards, is not observable forces the players to make assumptions and compute estimates.

In the last years, games of complete information, such as Go, have been solved almost perfectly by applying an optimization approach called Reinforcement Learning (RL). Reinforcement Learning, as a subarea of machine learning, is concerned with choosing optimum actions in an environment by maximizing a cumulative reward signal. Very recently, also games with incomplete information, such as Dota 2, have been tackled using RL.

The goal of this bachelor thesis is to use Reinforcement Learning to teach an agent the Austrian game "Schnapsen". Our industry partner, craftworks GmbH, will provide you with a simulation of the game written in Python and an experienced industry advisor. Your task is to use the simulation to build a Reinforcement Learning agent that masters the game. You are expected to evaluate different approaches to solving it using RL and evaluate the results following best-practices.

While the application in this thesis focuses on a simulation game, the method also holds potential for applications in marketing. For example. Real-Time Bidding Advertising can be framed as a game with incomplete information. What price should an advertiser bid for an ad impression given his private value and the unknown private values of other potential bidders?

Deep math and data analysis skills are required to write this thesis. Thus, math understanding and/or python-programming skills are highly recommended.

LITERATURE:

- **Sutton, R. S., & Barto, A. G. (1998).** Introduction to reinforcement learning (Vol. 135). Cambridge: MIT press.
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- **Silver, D., Schrittwieser, J., Simonyan, K., Antonoglou, I., Huang, A., Guez, A., & Chen, Y. (2017).** Mastering the game of Go without human knowledge. Nature, 550(7676), 354.
- **Bansal, T., Pachocki, J., Sidor, S., Sutskever, I., & Mordatch, I. (2017).** Emergent complexity via multi-agent competition. ICRL 2018.
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- **Wang, J., Zhang, W., & Yuan, S. (2017).** Display advertising with real-time bidding (RTB) and behavioural targeting. Foundations and Trends® in Information Retrieval, 11(4-5), 297-435.

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- DI Christian Hotz-Behofsits www.wu.ac.at/imsm/jobs/team/christian-hotz-behofsits/

Industry Advisor

- craftworks GmbH (www.craftworks.at - Simon Stiebellehner, MSc)

APPLICATION

Applications with CV and transcript of records should be sent to Christian Hotz-Behofsits (christian.hotz-behofsits@wu.ac.at).