

Alexander Dockhorn | Curriculum Vitae

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Education

Otto von Guericke University <i>PhD, Final Grade: Summa Cum Laude</i>	Magdeburg 2016–2020
Otto von Guericke University <i>M.Sc. Computer Science, Final Grade: 1.0</i>	Magdeburg 2014–2015
University of Abertay <i>Semester abroad</i>	Dundee 2012–2013
Otto von Guericke University <i>B.Sc. Computer Science, Final Grade: 1.2</i>	Magdeburg 2010–2014

Research and Notable Projects

Thesis Topic: *Forward Model Learning*

Part of my PhD project focuses on developing a process of modelling environment dynamics by observation. This would enable the application of statistical forward planning methods, which proved to be successful in a wide range of game playing scenarios. While my previous studies focused on the applications to general game learning similar methods could be used in the context of robotics and optimisation.

Thesis Topic: *Predictive State Determinisation*

In the second part of my PhD project I analyse how statistical forward planning methods can be applied to partial information games. New techniques for inducing the current state are analysed and compared to the state-of-the-art. Applications such as collectable card games present a natural benchmark and lead me to the creation of an international research competition on Hearthstone AI.

International Research Competition: *'Hearthstone AI'*

I am the organiser of the international research competition on Hearthstone AI, which was part of the IEEE Conference on Computational Intelligence and Games 2018. The competition focuses on the development of autonomous Hearthstone agents and tested the agent's skill on multiple game playing tasks. It attracted a total of 50 submissions and was the largest competition of the conference. Due to numerous requests, it will be held again at the IEEE Conference on Games 2019.

Research Project in Cooperation with University Bremen and Salzgitter AG: 'Energieoptimale Regelung eines brennstoffgeführten Kraftwerks unter schnell variierenden Randbedingungen'

In the context of complex industrial processes, coupling gases, which are a byproduct of the production process, can be used to avoid voltage peaks and ensure a reduction in total energy costs. The power plants task is the maximum possible utilisation of the coupling gas, the minimum use of external fuels, the provision of process steam in line with demand and the capping of electrical power peaks by burning leftover coupling gas. The mentioned goals are contradictory and can only be achieved to a certain extent with the help of manual control interventions. In particular, the inaccurate prognosis of consumer behaviour often leads to increased use of foreign fuels. The project's objective is the development of an automatic control system, which will ensure that the power plant is robust and reliable despite rapidly varying boundary conditions.

Publications

Bookchapters.....

Dockhorn, A., Saxton, C., & Kruse, R. (to be published). Association Rule Mining for Unknown Video Games. In Christophe Marsala and Marie-Jeanne Lesot (Ed.), *A fuzzy dictionary of fuzzy modelling. Common concepts and perspectives*.

Journal Papers.....

Dockhorn, A., & Kruse, R. (to be published). Predicting Cards Using a Fuzzy Multiset Clustering of Decks. *International Journal of Computational Intelligence Systems*.

Apeldoorn, D., & **Dockhorn, A.** (to be published). Exception-Tolerant Hierarchical Knowledge Bases for Forward Model Learning. *IEEE Transactions on Games*. 10.1109/TG.2020.3008002

Held, P., **Dockhorn, A.**, & Kruse, R. (2015). On Merging and Dividing Social Graphs. *Journal of Artificial Intelligence and Soft Computing Research*, 5(1), 23–49. <https://doi.org/10.1515/jaiscr-2015-0017>

Reviewed Conference Papers.....

Dockhorn, A., & Kruse, R. (to be published). Forward Model Learning for Motion Control Tasks. *Proceedings of the IEEE Intelligent Systems IS'20*. IEEE.

Dockhorn, A., & Lucas, S. (to be published). Local Forward Model Learning for GVGAI Games. In: *Proceedings of the 2020 IEEE Conference on Games*. IEEE.

Dockhorn, A., Lucas, S. M., Volz, V., Bravi, I., Gaina, R. D., & Perez-Liebana, D. (2019). Learning Local Forward Models on Unforgiving Games. In: *Proceedings of the 2019 IEEE Conference on Games* (pp. 1–4). IEEE.

Dockhorn, A., & Mostaghim, S. (2019). Introducing the Hearthstone-AI Competition, 1–4. Retrieved from <http://arxiv.org/abs/1906.04238>

Dockhorn, A., Schwensfeier, T., & Kruse, R. (2019). Fuzzy Multiset Clustering for Metagame Analysis. In *Proceedings of the 2019 Conference of the International Fuzzy Systems Association and the European Society for Fuzzy Logic and Technology (EUSFLAT 2019)*. Paris, France: Atlantis Press.

Dockhorn, A., Tippelt, T., & Kruse, R. (2018). Model Decomposition for Forward Model Approximation. In *2018 IEEE Symposium Series on Computational Intelligence* (pp. 1751–1757). IEEE.

Dockhorn, A., & Apeldoorn, D. (2018). Forward Model Approximation for General Video Game Learning. In

Proceedings of the 2018 IEEE Conference on Computational Intelligence and Games (pp. 425–432). IEEE.

Dockhorn, A., Frick, M., Akkaya, Ü., & Kruse, R. (2018). Predicting Opponent Moves for Improving Hearthstone AI. In *17th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems*, IPMU 2018 (pp. 621–632). Springer International Publishing.

Sabsch, T., Braune, C., **Dockhorn, A.**, & Kruse, R. (2017). Using a Multiobjective Genetic Algorithm for Curve Approximation. In *2017 IEEE Symposium Series on Computational Intelligence*. IEEE.

Dockhorn, A., & Kruse, R. (2017). Combining cooperative and adversarial coevolution in the context of pac-man. In *2017 IEEE Conference on Computational Intelligence and Games*, CIG 2017 (pp. 60–67). IEEE.

Dockhorn, A., Doell, C., Hewelt, M., & Kruse, R. (2017). A decision heuristic for Monte Carlo tree search doppelkopf agents. In *2017 IEEE Symposium Series on Computational Intelligence* (pp. 1–8). IEEE.

Dockhorn, A., Braune, C., & Kruse, R. (2016). Variable density based clustering. In *2016 IEEE Symposium Series on Computational Intelligence* (pp. 1–8). IEEE.

Dockhorn, A., Braune, C., & Kruse, R. (2015). An Alternating Optimization Approach based on Hierarchical Adaptations of DBSCAN. In *2015 IEEE Symposium Series on Computational Intelligence* (pp. 749–755). IEEE.

Held, P., **Dockhorn, A.**, Krause, B., & Kruse, R. (2015). Clustering Social Networks Using Competing Ant Hives. In *2015 Second European Network Intelligence Conference* (pp. 67–74). IEEE.

Held, P., **Dockhorn, A.**, & Kruse, R. (2014). On Merging and Dividing of Barabasi-Albert-graphs. In *2014 IEEE Symposium on Evolving and Autonomous Learning Systems* (Vol. 444, pp. 17–24).

Held, P., **Dockhorn, A.**, & Kruse, R. (2014). Generating Events for Dynamic Social Network Simulations. *15th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems*, IPMU 2014.

Workshop Papers.....

Dockhorn, A., & Kruse, R. (2018). Detecting Sensor Dependencies for Building Complementary Model Ensembles. In *Proceedings. 28. Workshop Computational Intelligence*, Dortmund, 29.-30. November 2018 (pp. 217–234).

Talks and Presentations

Fuzzy Multiset Clustering for Metagame Analysis	Prague
11th Conference of the European Society for Fuzzy Logic and Technology (EUSFLAT)	2019

Learning Local Forward Models on Unforgiving Games	London
2019 IEEE Conference on Games (CoG)	2019

Generalisation of Simulation-Based Search for Autonomous Gameplaying	QMUL London
Invited Talk - Game AI Research Group	2019

Generalisation of Simulation-Based Search for Autonomous Gameplaying	OVGU Magdeburg
Doktorandentag der Fakultät für Informatik	2019

Detecting Sensor Dependencies for Building Complementary Model Ensembles	Dortmund
28. Workshop Computational Intelligence	2018

Forward Model Approximation for General Video Game Learning Conference on Computational Intelligence and Games (CIG)	Maastricht 2018
Predicting Opponent Moves for Improving Hearthstone AI International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems (IPMU)	Cádiz 2018
A decision heuristic for Monte Carlo tree search doppelkopf agents 2016 IEEE Symposium Series on Computational Intelligence (SSCI)	Hawaii 2017
Using a Multiobjective Genetic Algorithm for Curve Approximation 2016 IEEE Symposium Series on Computational Intelligence (SSCI)	Hawaii 2017
Combining cooperative and adversarial coevolution in the context of pac-man Conference on Computational Intelligence and Games (CIG)	New York 2017
Variable density based clustering 2016 IEEE Symposium Series on Computational Intelligence (SSCI)	Athen 2016
An Alternating Optimization Approach based on Hierarchical Adaptations of DBSCAN 2015 IEEE Symposium Series on Computational Intelligence (SSCI)	Cape Town 2015
Generating Events for Dynamic Social Network Simulations 2014 International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems (IPMU)	Montpellier 2015

Awards and Honours

- **Distinguished Student Paper** at the EUSFLAT 2019 for the paper
"Fuzzy Multiset Clustering for Metagame Analysis"
- **Best Presentation Award** Doctoral Symposium in WS 2018/2019 at the OVGU
- **Best Computer Science Master Graduate** in 2015/2016
- **Student Teaching Award "Held der Lehre"** from the department of computer science at the OVGU
- **Nominee for the Teaching Award 2018** at the OVGU

Commitment

Otto von Guericke University, School for Computer Science <i>Member of the Research Commission</i>	2016-2019
Student Game Developer Club - Acagamics e.V. <i>Head of Teaching</i> <i>Head of Industry</i>	2017-2018 2016-2017
Faculty Student Council, Otto von Guericke University, School for Computer Science <i>Organiser of several events</i>	2013-2015

Teaching Activities

Appointed Lecturer of the <i>Computational Intelligence</i> working group	
<i>Computational Intelligence in Games</i>	SS 2018
Teaching Assistant of the <i>Computational Intelligence</i> working group	
<i>Fuzzy Systems</i>	SS 2019
<i>Bayes Networks</i>	WS 2019/2020 WS 2018/19 WS 2017/2018 WS 2015/2016
<i>Computational Intelligence in Games</i>	SS 2019 SS 2017
<i>Neural Networks</i>	SS 2018 SS 2015
<i>Seminar Classification Algorithms</i>	WS 2017/2018
<i>Intelligente Systeme</i>	WS 2015/2016 WS 2014/2015
<i>Einführung in die Informatik</i>	WS 2011/2012

Supervised Theses

2020.....	
Neural Network-based Adaption of Rapidly Exploring Random Trees for Motion Planning	Master Thesis
<i>Maximilian Kühn</i>	2020
2019.....	
DeePolation: AI-based interpolation on multi-dimensional spherical sensors	Master Thesis
<i>Martin Zettwitz</i>	2019
Clustering of Longitudinal Disease Progression Data	Master Thesis
<i>Aditya Nemali</i>	2019
Evolutionäre Agenten-Generierung für HearthStone	Bachelor Thesis
<i>Bastian Heinrich</i>	2019
Schaffung von Modellierungsansätzen zur Interaktionsvorhersage unbekannter Spiele	Master Thesis
<i>Tim Tippelt</i>	2019
Multivariate Time Series Sensor Data Clustering	Master Thesis
<i>Sourabh Dandage</i>	2019
Prediction of Player Moves in Collectible Card Games	Master Thesis
<i>Tony Schwensfeier</i>	2019

2018.....

Multikriterielle Wegfindung für Agentengruppen <i>Maurice Hoffmeister</i>	Bachelor Thesis 2018
Classification of Differently Trained Larvae based on Changes in their Trajectories using Artificial Neural Networks, <i>Jonathan Spiegel</i>	Bachelor Thesis 2018
Robust and Transferable Reflectance Reconstruction Using Deep Neural Networks, <i>Cornelius Styp von Rekowski</i>	Master Thesis 2018
Regression Analysis for Power Consumption of a Production Plant <i>Sujan Adhikari</i>	Master Thesis 2018
Ermitteln der Siegbedingung unbekannter Spiele durch Assoziationsanalyse <i>Chris Saxton</i>	Bachelor Thesis 2018
Optimising All-Shortest-Path Dictionaries using Machine Learning <i>Jannis Becke</i>	Master Thesis 2018
Designing an Interface between Data System and Root Cause Evaluation to enhance analysis strategy utilizing a larger Database for Tire Design, Manufacturing and Evaluation Process, <i>Pankaj Narula</i>	Master Thesis 2018

2017.....

Entscheidungsheuristische Erweiterung des UCT-Algorithmus für Doppelkopf, <i>Matthias Hewelt</i>	Master Thesis 2017
Kursverlaufvorhersage von Wertpapieren mit Hilfe von Ensemble Classification, <i>Leopold Ryll</i>	Bachelor Thesis 2017