

Jakub Kowalski

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Research interests

AI Algorithms for Games, General Game Playing, Procedural Content Generation, Evolutionary Computations, Černý conjecture

Work experience

- 2018 – 2019 ADIUNKT (~ASSISTANT PROFESSOR), University of Wrocław, Institute of Computer Science
- 2016 – 2018 RESEARCH ASSISTANT, University of Wrocław, Institute of Computer Science
- 2014 – 2016 COMPUTER SCIENCE TEACHER, 3rd High School in Wrocław

Education

- 2011 – 2016 PHD STUDIES, Computer Science, University of Wrocław, Department of Mathematics and Computer Science
PhD Thesis: *General Game Description Languages*
Supervisor: Prof. Andrzej Kisielewicz
Defended: 09.06.2017
- 2009 – 2011 MASTER STUDIES, Computer Science, University of Wrocław, Department of Mathematics and Computer Science
Master Thesis: *Programming games management system „Meridius”*
Supervisor: Prof. Krzysztof Loryś
- 2006 – 2009 BACHELOR STUDIES, Computer Science, University of Wrocław, Department of Mathematics and Computer Science
Bachelor Project: *AI fight environment „QUAIKE”*

Grants and scholarships

- 2018 – 2021 Investigator in the National Science Centre, Poland, Opus grant number 2017/25/B/ST6/01920: *Classical problems in the theory of finite automata: new approaches, variants, and applications.*
- 2016 – 2019 Investigator in the National Science Centre, Poland, Opus grant number 2015/17/B/ST6/01893: *Algorithmic aspects of synchronization.*

- 2015 – 2018 Principal investigator of the National Science Centre, Poland, Preludium grant number 2014/13/N/ST6/01817: *Languages and Learning in General Game Playing*. 148,200 PLN
- 2013 – 2015 Investigator in the Iuventus Plus grant number IP2012 052272: *Finite automata synchronization - theory, algorithms, tools, and applications*.
- 2012 – 2019 Seven faculty grants for smaller projects from Department of Mathematics and Computer Science, University of Wrocław.

Peer-reviewed publications

All papers are available at jakubkowalski.tech/Publications.

- 2020 J. Kowalski, R. Miernik, M. Mika, W. Pawlik, J. Sutowicz, M. Szykuła, A. Tkaczyk, *Efficient Reasoning in Regular Boardgames*, IEEE Conference on Games, pages 455–462.
- 2020 J. Kowalski, R. Miernik, *Evolutionary Approach to Collectible Card Game Arena Deckbuilding using Active Genes*, IEEE Congress on Evolutionary Computation (to appear).
- 2020 J. Kowalski, M. Szykuła, *Experimental Studies in General Game Playing: An Experience Report*, AAI Workshop on Reproducible AI (RAI).
- 2019 J. Kowalski, M. Mika, J. Sutowicz, M. Szykuła, *Regular Boardgames*, AAI Conference on Artificial Intelligence, Volume 33, Number 1, pages 1699–1706.
- 2018 C. Siwek, J. Kowalski, C. Sironi, M. Winands, *Implementing Propositional Networks on FPGA*, AI 2018: Advances in Artificial Intelligence, Volume 11320 of LNCS, pages 133–145.
- 2018 J. Kowalski, A. Kisielewicz, *Regular Language Inference for Learning Rules of Simplified Boardgames*, IEEE Conference on Computational Intelligence and Games, pages 78–85.
- 2018 J. Kowalski, R. Miernik, P. Pytlik, M. Pawlikowski, K. Piecuch, J. Sękowski *Strategic Features and Terrain Generation for Balanced Heroes of Might and Magic III Maps*, IEEE Conference on Computational Intelligence and Games, pages 86–93.
- 2018 J. Kowalski, A. Liapis, Ł. Żarczyński, *Mapping Chess Aesthetics onto Procedurally Generated Chess-Like Games*, EvoApplications 2018: Applications of Evolutionary Computation, Volume 10784 of LNCS, pages 325–341.
- 2017 B. Kostka, J. Kwiecień, J. Kowalski, P. Rychlikowski, *Text-based Adventures of the Golovin AI Agent*, IEEE Conference on Computational Intelligence and Games (*best paper nominee*), pages 181–188.
- 2017 J. Kowalski, Ł. Żarczyński, A. Kisielewicz, *Evaluating Chess-like Games Using Generated Natural Language Descriptions*, International Conference on Advances in Computer Games, Volume 10664 of LNCS, pages 127–139.
- 2017 J. Kowalski, A. Roman, *A New Evolutionary Algorithm for Synchronization*, EvoApplications 2017: Applications of Evolutionary Computation, Volume 10199 of LNCS, pages 620–635.
- 2016 A. Kisielewicz, J. Kowalski, M. Szykuła, *Experiments with Synchronizing Automata*, Implementation and Application of Automata, Volume 9705 of LNCS, pages 176–188.
- 2016 J. Kowalski, M. Szykuła, *Evolving Chess-like Games Using Relative Algorithm Performance Profiles*, Applications of Evolutionary Computation, Volume 9597 of LNCS, pages 574–589.
- 2016 J. Kowalski, A. Kisielewicz, *Towards a Real-time Game Description Language*, Proceedings of the 8th International Conference on Agents and Artificial Intelligence, Volume 2, pages

494–499.

- 2015 J. Kowalski, A. Kisielewicz, *Game Description Language for Real-time Games*, Proceedings of the IJCAI-15 Workshop on General Game Playing (GIGA'15), pages 23–30.
- 2015 J. Kowalski, A. Kisielewicz, *Testing General Game Players Against a Simplified Boardgames Player Using Temporal-difference Learning*, IEEE Congress on Evolutionary Computation, pages 1466–1473.
- 2015 A. Kisielewicz, J. Kowalski, M. Szykuła, *Computing the shortest reset words of synchronizing automata*, Journal of Combinatorial Optimization, Volume 29, Issue 1, pages 88–124.
- 2014 J.Kowalski, *Embedding a Card Game Language into a General Game Playing Language*, Frontiers in Artificial Intelligence and Applications, Volume 264: STAIRS 2014, pages 161–170
- 2013 J. Kowalski, M. Szykuła, *Game Description Language Compiler Construction*, AI 2013: Advances in Artificial Intelligence, volume 8272 of LNCS, pages 234–245.
- 2013 A. Kisielewicz, J. Kowalski, M. Szykuła, *A Fast Algorithm Finding the Shortest Reset Words*, Computing and Combinatorics, volume 7936 of LNCS, pages 182–196.

PROGRAM COMMITTEES

- 2021 Monte Carlo Search Workshop at IJCAI
- 2020 IEEE Conference on Games
- 2019 IEEE Conference on Games

ORGANIZED COMPETITIONS

- 2020 *Strategy Card Game AI Competition* at IEEE Conference on Games
- 2020 *Strategy Card Game AI Competition* at IEEE Congress on Evolutionary Computation
- 2019 *Strategy Card Game AI Competition* at IEEE Conference on Games
- 2019 *Strategy Card Game AI Competition* at IEEE Congress on Evolutionary Computation

Teaching

INSTITUTE OF COMPUTER SCIENCE, UNIVERSITY OF WROCLAW

- 2020/2021 Artificial Intelligence for Games (lecture; laboratory, 3 groups).
- 2019/2020 Artificial Intelligence (laboratory, 2 groups).
- 2019/2020 Objective Programming (laboratory, 1 group).
- 2019/2020 Algebra (exercises, 1 group).
- 2019/2020 Machine Learning (laboratory, 1 group).
- 2019/2020 Extended Python Course (laboratory, 3 groups)
- 2018/2019 Lua Course (lecture; laboratory, 2 groups).
- 2018/2019 Artificial Intelligence for Games: Advanced Topics (seminar, 1 group).
- 2018/2019 Objective Programming (laboratory, 2 groups).
- 2018/2019 Artificial Intelligence for Games (lecture; laboratory, 1 group).
- 2017/2018 Lua Course (lecture; laboratory, 1 group).
- 2017/2018 Artificial Intelligence for Games: group projects (project, 1 group).
- 2017/2018 Artificial Intelligence for Games (lecture; laboratory, 1 group).

2017/2018 Introduction to Python Programming (laboratory, 2 groups).
 2016/2017 Lua Course (lecture; laboratory, 1 group).
 2016/2017 Artificial Intelligence for Games: group projects (project, 1 group).
 2016/2017 Artificial Intelligence for Games (lecture; laboratory, 2 groups).
 2016/2017 Introduction to Python Programming (laboratory, 2 groups).
 2015/2016 Artificial Intelligence (exercises+laboratory, 1 group).
 2015/2016 Extended Python Course (laboratory, 1 group).
 2015/2016 Introduction to Python Programming (laboratory, 1 group).
 2014/2015 Introduction to Python Programming (laboratory, 2 groups).
 2013/2014 Introduction to Python Programming (laboratory, 1 group).
 2013/2014 Artificial Intelligence (in English) (exercises+laboratory, 1 group).
 2012/2013 Seminar: General Game Playing (seminar, 1 group).
 2012/2013 Introduction to Python Programming (laboratory, 2 groups).
 2011/2012 Creating Interactive Applications in Python (laboratory, 2 groups).
 2011/2012 Introduction to Python Programming (laboratory, 2 groups).

COMPETITION TEAM MANAGEMENT

2020 *CodinGame Fall Challenge*: 1st place in the University ranking, 67/7011 individually.
 2020 *CodinGame Spring Challenge*: 1st place in the University ranking, 118/4955 individually.
 2020 *CodinGame Ocean of Code*: 1st place in the University ranking, 119/2279 individually.

SUPERVISED THESES

All theses are available at jakubkowalski.tech/Supervising.

2020 Cezary Siwek, *Hardware Acceleration for General Game Playing using FPGA*, master thesis
 2020 Marcin Witkowski, Łukasz Klasiński, Wojciech Meller, *Implementation of collectible card Game AI with opponent prediction*, engineer thesis
 2019 Kamila Adamczyk, *Implementacja Gry Programistycznej Roguelike: Proceduralne Generowanie Map Kontra Algorytm Poszukiwacza Przygód* (eng. *Programming Game Implementation: Procedural Map Generation Versus Adventurer AI*), bachelor thesis
 2019 Krzysztof Bednarek, *Procedural Generation Of Geographically Consistent Worlds And Biomes*, bachelor thesis
 2019 Cezary Kosiński, *Generowanie nieskończonych poziomów jaskiń przy użyciu Automatów Komórkowych* (eng. *Generating Infinite Cave Levels using Cellular Automata*), bachelor thesis
 2019 Radosław Miernik, *Evolutionary Algorithms for Strategic Card Games*, engineer thesis
 2018 Łukasz Żarczyński, *Procedural Content Generation for Simplified Boardgames*, master thesis
 2018 Tymoteusz Kaczorowski, *Wykorzystanie sztucznej inteligencji w symulowaniu zachowań biologicznych* (eng. *Utilizing artificial intelligence to model biological behaviours*), engineer thesis
 2017 Tomasz Musiała, Adrian Witek, *Implementacja agenta do Visual Doom AI* (eng. *Implementation of the Visual Doom AI agent*), bachelor thesis/engineer thesis
 2017 Cezary Siwek, *System for autonomous control of a racing car*, engineer thesis

Ongoing:

Radosław Miernik, *Artificial Intelligence for Strategy Card Games: Search and Content Generation*, master thesis

Piotr Pytlik, *Algorithm for Procedural Generation of Balanced Maps for Heroes of Might and Magic III*, master thesis

Dawid Barzyk, *Dynamic Deck-dependent Strategy Adjustment for Collectible Card Game Arena Mode*, bachelor thesis

Jakub Maras, *Knowledge-free Fitness Function for Procedural Generation of Regular Boardgames Rules*, engineer thesis

Kamil Michalak, *Ewolucja mety gry Hearthstone przy użyciu frameworka SabberStone* (eng. *Evolving Hearthstone meta using the SabberStone Framework*), engineer thesis

Dawid Paluszak, *Czynnik ludzki, a statystyki – sztuczna inteligencja do gry Fantasy Premier League* (eng. *The human factor versus statistics – artificial intelligence for the Fantasy Premier League*), engineer thesis

Alicja Danilczuk, Klaudia Osowska, *Implementacja i omówienie algorytmów analizujących dźwięki z perspektywy porównywania utworów* (eng. *Implementation and analysis of audio processing algorithms in recording comparison approach*), engineer thesis

Mikołaj Motak, *Implementacja silnika microRTS na platformę CodinGame* (eng. *Implementation of the microRTS engine for the CodinGame platform*), engineer thesis

3RD HIGH SCHOOL IN WROCŁAW

2015/2016 Computer Science, III year (2 groups).

2014/2015 Computer Science, II year (2 groups).