Niels Justesen | Curriculum Vitae

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Ph.D. fellow at the IT University of Copenhagen

Education

IT University of Copenhagen   **Copenhagen, Denmark**

Ph.D., Computer Science   *2016–2019*

Supervised by Sebastian Risi, I am working on deep learning and evolutionary algorithms for strategy game playing.

IT University of Copenhagen   **Copenhagen, Denmark**

Master of Science, Games Technology   *2012–2015*

With courses such as *Modern AI for Games*, *Game Engines*, *Data Mining*, *Game Design* etc.

IT University of Copenhagen   **Copenhagen, Denmark**

Bachelor of Science, Software Development   *2009–2012*

For a complete list of courses passed, please see my LinkedIn profile `https://www.linkedin.com/in/niels-justesen-7b37042a/`.

Research Profile

Games have fascinated me since I was very young and I have been almost obsessed with designing and creating games myself. This led me to start programming and developing video games at an early age. To gain a fundamental understanding of computer science I obtained a bachelor of science in software development at the IT University of Copenhagen (ITU). During my studies, I developed three open source software projects and I worked for four years as a software developer at IT Minds. To pursue my initial dream of developing commercial video games I continued with a master of science in games technology, also at ITU. During this period, a fascination emerged with computer algorithms that express intelligent behaviors. This was primarily due to courses such as *Data Mining* and *Modern AI and Games* that resulted in my thesis called *Artificial Intelligence for Hero Academy* and two conference papers.

The impressive results achieved in the last few years within machine learning and AI sparked an urge in me to learn more about the subject. In 2016 I started as a Ph.D. fellow at the ITU where I am investigating how deep learning methods that can be used to play complex video games. Video games are merely a testbed used to investigate AI. My research is rooted in the deficiencies of current approaches including their inability to learn behaviors in environments with sparse rewards and their inability to adapt to environmental changes.

My research so far has resulted in a total of nine peer-reviewed publications, international media coverage by New Scientist, and the EliteForsk (Elite Research) travel grant. Additionally, I have become a reviewer for a journal and two conferences, and I have organized a conference special session and a machine learning workshop for students and researchers.

Master thesis

Title: *Artificial Intelligence for Hero Academy*

Supervisors: Tobias Mahlmann and Julian Togelius

Description: In this thesis we have focused on how to create an intelligent AI agent for the tactical turn-based game Hero Academy. In this game, players can perform five sequential actions resulting in millions of possible outcomes each turn. We have implemented and compared several AI methods mainly based on Monte Carlo Tree Search (MCTS) and evolutionary algorithms. An online evolutionary algorithm that evolves plans during each turn achieved the best results.

Experience

Vocational

Modl.ai   **Copenhagen, Denmark**
AI Programmer   *2018–*
Researching, programming, and evaluating artificial intelligence methods, game and software engineering, and dealing with internal and external stakeholders.

IT Minds   **Copenhagen, Denmark**
Senior Software Developer   *2012–2016*
My responsibilities as a Senior Software Developer were:
- Development, Architecture, and test of in-house projects.
- Consultancy at customers.
- Project estimation, customer dialogue, and help ensure the best possible solution for our customers.
- Responsible for the quality and delivery of own projects.
- Mentoring, knowledge building and sharing internally Responsibilities.

Tegma ApS   **Jystrup, Denmark**
Web Developer   *2011–2012*
Management, design and development of several web shops and web sites.

Tego Tech Sikkerhedsmateriel ApS   **Jystrup, Denmark**
Web Developer   *2006–2011*
Management, design and development of several web shops and web sites.

Languages

Danish: Native

English: Professional working proficiency

German: Elementary proficiency

Publications

Journal Articles

Niels Justesen, Philip Bontrager, Julian Togelius and Sebastian Risi: Deep Learning for Video Game Playing. *IEEE Transactions on Games (ToG)*. 2019.

Niels Justesen, Tobias Mahlmann, Julian Togelius and Sebastian Risi: Playing multi-action adversarial games: online evolutionary planning versus tree search. *IEEE Transactions on Computational Intelligence and AI in Games (TCIAIG)*. 2017.

Refereed Conference Papers

Niels Justesen and Sebastian Risi. Automated Curriculum Learning by Rewarding Temporally Rare Events. *IEEE Conference on Computational Intelligence in Games (CIG)*. 2018.

Niels Justesen and Sebastian Risi. Learning macromanagement in StarCraft from replays using deep learning. *IEEE Conference on Computational Intelligence in Games (CIG)*. 2017.

Niels Justesen and Sebastian Risi. Continual online evolutionary planning for in-game build order adaptation in StarCraft. *Proceedings of the Conference on Genetic and Evolutionary Computation (GECCO)*. ACM, 2017.

Niels Justesen, Tobias Mahlmann, and Julian Togelius. Online evolution for multi-action adversarial games. *European Conference on the Applications of Evolutionary Computation*. Springer International Publishing, 2016.

Niels Justesen, Bálint Tillman, Julian Togelius, and Sebastian Risi. Script-and cluster-based UCT for StarCraft. *IEEE Conference on Computational Intelligence and Games (CIG)*, 2014.

Refereed Workshop or Short Papers

Niels Justesen, Sebastian Risi and Jean-Baptiste Mouret. MAP-Elites for Noisy Domains by Adaptive Sampling *GECCO: Genetic and Evolutionary Computation Conference*, 2019

Niels Justesen, Ruben Rodriguez Torrado, Philip Bontrager, Ahmed Khalifa, Julian Togelius and Sebastian Risi. Illuminating Generalization in Deep Reinforcement Learning through Procedural Level Generation. *NeurIPS Workshop on Deep Reinforcement Learning, 2018, Montreal, Canada*. 2018.

Niels Justesen, Julian Togelius and Sebastian Risi. Blood Bowl: The Next Board Game Challenge for AI. *Foundations of Digital Games (FDG) 2018: 1st Workshop on Tabletop Games, Malmö, Sweden*. 2018.

Press Coverage

English

New Scientist: DeepMind dojo will train AI to beat human StarCraft players, 2017

Danish

Berlingske: Google-algoritme knækker på tre dage koden til brætspil, det har taget mennesker 2.500 år at udvikle, 2017

P1: Orientering 18. OKT. 2017, 2017

Version2: Version2 vs. ITU's StarCraft AI: Deep learning giver en helt anden spiloplevelse, 2017

Version2: ITU-forsker inviterer til Kulturnatten: Kom og spil StarCraft mod neuralt netværk, 2017

ITWatch: Kunstig intelligens skal udmanøvrere menneskelige Starcraft-strateger, 2017

Invited talks

"Mød årets topforskere. Åbent arrangement for gymnasieelever". **invited talk**. Ministry of Higher Education, Apr. 2nd 2019.

"Deep Learning for Video Game Playing". **Invited talk**, SKAT, Nov. 22nd 2017.

"Learning Macromanagement in StarCraft from Replays using Deep Learning". **Invited talk**, ASYNC: Asynchronous Research on AI & Games, MetaMakers Institute (Online Conference), Oct. 25th 2017.

"Deep Reinforcement Learning". **Invited talk**, Danish Embodied Artificial Intelligence Workshop, Odense, Nov. 10th 2016.

"Online Evolution for Hero Academy and Multi-Action Games". **Invited talk**. nucl.ai Conference in Vienna, July 18th 2016.

Grants and Awards

In 2018, I was awarded the EliteForsk (Elite Research) travel grant of 200,000 DKK (approx. 32,195 USD).

Research Stays

- Visiting Researcher at *INRIA in Nancy* working with Professor Jean-Baptiste Mouret from September to November 2018.
- Visiting Scholar at *the Game Innovation Lab at the NYU School of Engineering* from March to June 2018, working with Professor Julian Togelius and the lab's students and researchers.

Reviewer

I have reviewed for:
- *PeerJ Computer Science*, 2018
- *IEEE Transactions on Computational Intelligence and AI in Games, 2018*.
- *The Genetic and Evolutionary Computation Conference (GECCO), 2018*.
- *Conference on Computational Intelligence and Games (CIG), 2018*.

Organisational Activities

- *Program Committee member of the Conference on Games (CoG) Competitions and Benchmark track, 2019*
- *Program Committee member of the Conference on Computational Intelligence and Games (CIG), 2018*.
- *Track Chair of the special session "Deep Learning in Games" at the Conference on Computational Intelligence and Games (CIG), 2018)*.
- *Organizer of the StarCraft AI Workshop at the IT University of Copenhagen, 2018, with around 60 participants.*.

Teaching Experience

Teaching

- Guest lecturer in *Modern AI for Games*. ITU, Copenhagen, Fall 2016.
- Lecturer in *Modern AI for Games*. ITU, Copenhagen, Fall 2017.

Supervision

- Currently supervising 5 master students working on AI for StarCraft and Blood Bowl.
- Supervised 5 master and bachelor students working on AI for StarCraft.
- Supervised 2 master students and 2 bachelor students.

Software Released

- **FFAI:** The Fantasy Football AI framework is a Python implementation of Blood Bowl and a research platform for deep reinforcement learning. Released in 2019.
  Website: https://github.com/njustesen/ffai.
- **Hero AIcademy:** a Java clone of the video game Hero Academy. The game is optimized for simulations and game AI research. Released in 2015. Website: https://github.com/njustesen/hero-aicademy.
- **JarCraft:** a StarCraft combat simulator based on the SparCraft project, that can be used as a forward model for StarCraft bots. Released in 2014. Website: https://github.com/tbalint/JarCraft.
- **Online Blood Bowl League Manager (OBBLM):** the most widely used way of managing teams and statistics for the tabletop game Blood Bowl. Released in 2007. Website https://github.com/nicholasmr/obblm.