

# Niels Justesen | Curriculum Vitae

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*Ph.D. fellow at the IT University of Copenhagen*

## Education

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### 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/>.

## Current research

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At the IT University of Copenhagen I am investigating how deep learning in combination with online evolutionary planning can be used to play strategy games. My focus so far have been on multi-action adversarial games, such as Hero Academy, and the real-time strategy game StarCraft. I am investigating (1) supervised learning methods, where a neural network learn to predict actions of human players, (2) deep reinforcement learning methods, where a neural network is trained from self-play or against other artificial agents, and (3) online evolutionary planning algorithms that can evolve action sequences in games with large branching factors. My publications are listed in the end of this document.

## Master thesis

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**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

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### Vocational.....

#### 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

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**Danish:** Native

**English:** Professional working proficiency

**German:** Elementary proficiency

## Publications

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### Journal Articles.....

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. Learning macromanagement in StarCraft from replays using deep learning. *IEEE's 2017 Conference on Computational Intelligence in Games*. 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 2017)*. 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. *Computational Intelligence and Games (CIG)*, 2014 IEEE Conference on. IEEE, 2014.

## Press Coverage

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### 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-strategier, 2017

## Invited talks

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"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.

## Reviewer

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I have reviewed for:

- *IEEE Transactions on Computational Intelligence and AI in Games*.
- *GECCO-2018 Complex Systems Track*.

## Teaching & supervision

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### Teaching.....

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

### Supervision.....

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

## Software released

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- **Hero Alcademy:** 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-academy>.
- **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 manag-

ing teams and statistics for the tabletop game Blood Bowl. Released in 2007. Website <https://github.com/nicholasmr/obblm>.