# Axel **Faes**

COMPUTER ENGINEER · ARTIFICIAL INTELLIGENCE EXPERT

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## Abstract

I am a Msc. Artificial Intelligence and Msc. Computer Science Engineering student at KU Leuven. My main interests include program optimization, numerical linear algebra, artificial intelligence, virtual reality, neural computing and brain-computer interfaces. I am participating in the Honoursprogramme of the Faculty of Engineering Science (research track) at KU Leuven. I am also a big supporter of Open Source Software.

## Research Interests

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|---|---|
| **Programming Language Theory** | Algebraic Effect Handlers, Type Systems and Program Optimization |
| **Artifical Intelligence** | Machine Learning, Reinforcement Learning and Virtual Reality |
| **Neuroscience** | Neural Computing and Brain Computer Interfaces |

## Educational background

**Doctoral Programme of Biomedical Science in Computational Neuroscience** — *Leuven, Belgium*

KU LEUVEN — *Sep. 2018 - Sep. 2022*

Graph theory and brain-computer interfaces

**Advanced Master of Science in Engineering (M.Sc.) in Artificial Intelligence** — *Leuven, Belgium*

KU LEUVEN — *Sep. 2017 - Jul. 2018*

Engineering and Computer Science

**Master of Science in Engineering (M.Sc.) in Computer Science (Burgelijk Ingenieur - ir.)** — *Leuven, Belgium*

KU LEUVEN — *Sep. 2016 - Jul. 2018*

Artificial Intelligence & Theoretical Computer Science

**Bachelor of Science (B.Sc.) in Computer Science (79% - Magna Cum Laude)** — *Hasselt, Belgium*

UHASSELT — *Sep. 2013 - Jul. 2016*

Physics and General courses

**Business Summer School: United in Manchester (0739)** — *Manchester, UK*

THE UNIVERSITY OF MANCHESTER — *Jul. 2015 - Aug. 2015*

International Business

## Honors & Awards

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|---|---|---|
| Oct. 2017 | **Honoursprogramme,** of the Faculty of Engineering Science | *KU Leuven, Belgium* |
| Sep. 2017 | **3rd place,** ICFP 2017 Student Research Competition | *Oxford, UK* |
| Jul. 2016 | **Bachelor Award,** in Computer Science | *UHasselt, Belgium* |
| May. 2016 | **3rd place,** ACM CHI 2016 Student Design Competition (Interaction Design and User Experience.) | *San Jose, CA, USA* |
| Feb. 2016 | **2nd place,** BeGDC (Belgian Game Development Championship) | *Brussel, Belgium* |
| Jan. 2016 | **IELTS,** Academic Module (8.0/9.0) | *Brussel, Belgium* |

## Work & Research Experience

**Research Internship: Quasi-Monte Carlo points on collections of triangles** — *Leuven, Belgium*

KU LEUVEN — *Sep. 2017 - Current*

- Faculty of Engineering Science: Computer Science
- Research group: NINES

### Student Job: Creating System Identification course

*Leuven, Belgium*

KU Leuven

*Sep. 2017 - Current*

- Faculty of Engineering Science: ESAT (Electrical Engineering)
- Research group: STADIUS

### Research Assistant: design of type-&-effect system for Eff based on row polymorphism

*Leuven, Belgium*

KU Leuven

*Apr. 2017 - Oct. 2017*

- Faculty of Engineering Science: Computer Science
- Research group: DTAI
- Part of the Honoursprogramme of the Faculty of Engineering Science (research track).
- Topic: Development of an row-based type-&-effect system for the Eff programming language

### Research Assistent: efficient compilation of algebraic effect handlers

*Leuven, Belgium*

KU Leuven

*Sep. 2016 - Apr. 2017*

- Faculty of Engineering Science: Computer Science
- Research group: DTAI
- Part of the Honoursprogramme of the Faculty of Engineering Science (research track). My project is part of the C1 project: Algebraic Effect Handlers: Harnessing the Fundamental Power of Effects. Eff is a functional programming language that uses handlers to handle all kinds of effects. These effects could be I/O, exceptions, user-defined, etc. My task is to design, implement, benchmark and formally proof new optimisations in the Eff compiler. The compiler is written in OCaml.

### Web performance research intern

*Hasselt, Belgium*

Expertise centre for Digital Media (EDM), UHasselt

*Jul. 2016 - Sep. 2016*

- I worked on the iMinds PRO-FLOW project.
- My work involved creating multiple usecases to measure website performance. The main focus is on the difference between the http versions (http1.1, https, http2).
- During the project, I had to utilise multiple servers, maintain and extend the nodejs framework used to measure website performance, and manually optimize commercial websites using PHP, JS, HTML and CSS.

### Summer Internship Physical Computing

*Hasselt, Belgium*

Expertise centre for Digital Media (EDM), UHasselt

*Aug. 2015 - Sep. 2015*

- Work on a project which focuses on the interaction between a human entity and a drone, aswell as interaction between the drone and virtual objects. This project is written in C++, used the Optitrack motion capture and a custom created drone.

## Extracurricular Activities

### KU Leuven

*Leuven, Belgium*

Student Representative

*Sep. 2017 - Current*

- POC of Master Computer Science Engineering
- POC of Advanced Master Artificial Intelligence
- Member of Departmental council of Computer Science
- Member of Department board of Computer Science
- Member of Faculty council of Engineering Science

### CoderDojo Belgium

*Uasselt, PXL*

Coach

*Sep. 2014 - Current*

- Teach children how to program utilising Scratch, Python, Minecraft and Lego mindstorm.

### Student Council

*UHasselt*

Member

*Aug. 2015 - Aug. 2016*

- Member of Board of Education
- Member of Faculty Council
- Member of Board of Student Facilities
- Member of Diversity Commission
- Temporary representative in VVS (Vlaamse Vereniging van Studenten vzw)

### Student Council

*UHasselt*

Member

*Mar. 2015 - Aug. 2015*

- Member of Board of Education
- Member of Faculty Council
- Member of Board of Student Facilities

## Natural Languages

| English | Fluent (IELTS: 8.0/9.0) |
| --- | --- |
| **Dutch** | Mothertongue |
| **French** | Basic Knowledge |

# Projects

### ICAL parser for KU Leuven schedules
LEAD DEVELOPER

*Leuven, Belgium*

*Aug. 2016 - Current*

- An nodejs application to create an iCalender file for courses at KU Leuven. Allows the creation of a schedule containing courses from different masters and the option to ignore events.

### Machine learning techniques for flow-based network intrusion detection systems
BACHELOR'S THESIS

*Hasselt, Belgium*

*Feb. 2016 - Jul. 2016*

- The thesis gives an overview of how machine learning algorithms could be used for intrusion detection using only IP Flows. The system has been used to detect intrusions in Cegeka Hasselt Datacenter network.

### Software engineering: Search and Recommendation System
TEAM MEMBER

*Hasselt, Belgium*

*Feb. 2016 - Jul. 2016*

- A search and recommendation system for VoD (Video on Demand) for Androme. The system is currently being used in production in the Nebula project. Both Content-Based Recommendations and Collaborative filtering techniques were implemented. Made in a team of 5 (Pieter Teunen, Luuk Raaijmakers, Brent Berghmans, Axel Faes, Matthijs Kaminski, Wouter Bollaert) utilising Java and the Spring framework.

### TTUI: Household Survival
RESEARCHER

*Hasselt, Belgium*

*Sep. 2015 - Dec. 2015*

- Project made for the class 'Technologies and Tools for User Interfaces'.
- A tower-defense style game written in Unity utilising Optitrack motion capture. The game combines the virtual world and reality, by allowing users to interact with the virtual world using real-world objects. Made by Brent Berghmans, Axel Faes and Matthijs Kaminski.

### Cardinal: scripting language
LEAD DEVELOPER

*Hasselt, Belgium*

*Jan. 2015 - Sep. 2015*

- Cardinal is a small, fast, class-based, Object Oriented scripting language written in C. It is built upon the skeleton of an existing scripting language and shows how I can modify and improve existing software, as well as design new components to this software.
- New components include a debugger, an embedding API, multiple inheritance and a new module system.

### United in Manchester
TEAM LEADER

*Manchester, UK*

*Jul. 2015 - Aug. 2015*

- A summer school which focuses on teamwork in cross-cultural and multidisciplinary teams, global product development and entrepreneurship. Our team developed a start-up idea on Food Management/Delivery system. Product pitch took place at the end of the course for feedbacks from professionals and for potential commercialisation. Our team consisted of Axel Faes, Linh Chi Evelyn Phan, Reinaert Van de Cruys and Maria Barouh.

### PSOPV: Visual Programming IDE
DEVELOPER

*Hasselt, Belgium*

*Feb. 2015 - Jul. 2015*

- A Visual programming IDE created by Axel Faes & Matthijs Kaminski for a course of Hasselt University. The purpose of the IDE is to create 'black boxes' which can send events (signals packed with data) to eachother. We take the idea of using drag-able blocks in a visual IDE and expand on it.

# Publications

## CONFERENCE PAPERS

[1] **Robin Marx, Peter Quax, Axel Faes and Wim Lamotte**, "Concatenation, embedding and sharding: Do HTTP/1 performance best practices make sense in HTTP/2?", WEBIST 2017 - Proceedings of the 13th International Conference on Web Information Systems and Technologies.

## EXTENDED ABSTRACTS

[2] **Axel Faes and Tom Schrijvers**, "Towards a core language with row-based effects for optimised compilation", International Conference on Functional Programming 2017 Student Research Competition.

[3] **Kashyap Todi, Brent Berghmans, Axel Faes and Matthijs Kaminski**, "Purpose-Centric Appropriation of Everyday Objects as Game Controllers", CHI EA '16: Extended Abstracts of the SIGCHI Conference on Human Factors in Computing Systems. Late Breaking Work.

[4] **Kashyap Todi, Donald Degraen, Brent Berghmans, Axel Faes, Matthijs Kaminski and Kris Luyten**, "Household Survival: Immersive Room-Sized Gaming Using Everyday Objects as Weapons", CHI EA '16: Extended Abstracts of the SIGCHI Conference on Human Factors in Computing Systems. Student Game Competition.

## THESIS

[5] **Axel Faes**, "Machine learning techniques for flow-based network intrusion detection systems", Bachelor's thesis 2016.

## POSTERS

[6] **Axel Faes and Tom Schrijvers**, "Towards a core language with row-based effects for optimised compilation", International Conference on Functional Programming 2017 Student Research Competition.

## TALKS, PRESENTATIONS AND OTHER MEDIA

Sep. 19, 2017     "Honours student Axel Faes wins bronze medal in ACM SIGPLAN", KU Leuven, Department of Computer Science.

Sep. 19, 2017     "Student Axel Faes wins bronze medal in the ACM SIGPLAN Student Research Competition in ICFP conference", KU Leuven, Department of Computer Science, DTAI.