Axel **Faes**

Machine Learning Engineer · PostDoctoral Researcher · Scientific Coordinator

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Work & Research Experience

Postdoctoral Researcher: Scientific Coordinator and Artificial Intelligence — *UHasselt*
- Scientific Coordinator of the Flanders AI Research program, Use Case Real World Evidence.
- Technical Machine Learning lead of the Biomedical Data Sciences Group, UHasselt

January 2024 - Current

Postdoctoral Researcher: Brain-Computer Interfacing and Machine Learning — *KU Leuven*
- Project: "Sign Language Alphabet decoding from intracranial brain activity"
- Group: Prof. Marc van Hulle, Computational Neuroscience, Laboratory for Neuro-and Psychophysiology, KU Leuven

May 2023 - January 2024

Web Performance Research Internship — *UHasselt*
- I worked on the iMinds PRO-FLOW project @ Expertise centre for Digital Media (EDM)
- focus on the difference between the http versions (http1.1, https, http2).

Jul. 2016 - Sep. 2016

Summer Research Internship Physical Computing — *UHasselt*
- Interfacing between human entity, a drone and virtual objects @ Expertise centre for Digital Media (EDM).
- (C++, Optitrack motion capture, custom built drone)

Aug. 2015 - Sep. 2015

Educational background

Doctoral Programme in Biomedical Science (PhD) in Computational Neuroscience — *KU Leuven*
- Cognitive and Molecular Neuroscience
- PhD Thesis: Finger Movement Decoding: From Source-Localisation to Tensor Regression Modelling

Sep. 2018 - May 2023

Advanced Master of Science in Engineering (M.Sc.) in Artificial Intelligence — *KU Leuven*
- Engineering and Computer Science (76% - Cum Laude)
- Thesis: An Information Theoretical Approach to EEG Source-Reconstructed Connectivity (on Github)

Sep. 2017 - Jul. 2019

Honoursprogramme of the Faculty of Engineering Science (Research Track) — *KU Leuven*
- Research Assistant: design of type-&-effect system for Eff based on row polymorphism
- Research Assistent: efficient compilation of algebraic effect handlers (in Eff)

Sep. 2016 - Oct. 2018

Master of Science in Engineering (M.Sc.) in Computer Science (Burgelijk Ingenieur - ir.) — *KU Leuven*
- Artificial Intelligence & Theoretical Computer Science (76% - Cum Laude)
- Thesis: Algebraic Subtyping for Algebraic Effects and Handlers (on Github)

Sep. 2016 - Sep. 2018

Business Summer School: United in Manchester (0739) — *The University of Manchester*
- International Business

Jul. 2015 - Aug. 2015

Bachelor of Science (B.Sc.) in Computer Science — *UHasselt*
- Physics and General courses (79% - Magna Cum Laude)
- Thesis: Machine learning techniques for flow-based network intrusion detection systems (on Github)

Sep. 2013 - Jul. 2016

Projects

Cardinal: scripting language — *Lead Developer*
- Written in C (and since 2023, in C++14). High performance (on par with Luajit 2.1 -joff).

Jan. 2015 - Current

Reinforcement Learning Agent in Google Deepmind's StarCraft II Framework — *Developer*
- Implement reinforcement learning algorithms in PySC2 utilising the KU Leuven supercomputer.

Feb. 2018 - Jul. 2018

IoT-platform with pluggable sensors — *Developer*
- Showcase large-scale use of Internet of Things sensors

Feb. 2017 - Jul. 2017

ICAL parser for KU Leuven schedules — *Lead Developer*
- An nodejs application to create an iCalender file for courses at KU Leuven. (>1000 active users)

Aug. 2016 - Current

Search and Recommendation System — *Team Member*
- A search and recommendation system for VoD (Video on Demand) for Androme.
- In production in the Nebula project.

Feb. 2016 - Jul. 2016

Household Survival — *Researcher*
- A tower-defense game written in Unity utilising Optitrack motion capture.
- Combine the virtual world and reality using augmented reality

Sep. 2015 - Dec. 2015

Visual Programming IDE — *Developer*
- A Visual programming IDE (Java)

Feb. 2015 - Jul. 2015

Honors & Awards

Mar. 2018	**Finalist**, Cyber Security Challenge 2018	*Brussels, 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	*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*

Extracurricular Activities

DjangoGirls	**Coach**, Inspire women to fall in love with programming (Python, Django workshops)	*Mar. 2018 - Current*
CoderDojo (UHasselt, PXL)	**Coach**, Teach children programming (Scratch, Python, Minecraft and Lego mindstorm).	*Sep. 2014 - Current*
KU Leuven	**Student Representative**, 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	*Sep. 2017 - Sep. 2018*
StuRa UHasselt	**Student Council Member**, Member of Board of Education, Faculty Council. Board of Student Facilities, Diversity Commission Temporary representative in VVS (Vlaamse Vereniging van Studenten vzw)	*Mar. 2015 - Aug. 2016*
UHasselt	**Student Representative**, Representing students interests in a Computer Science education context. This meant discussing with the university in order to improve teaching, learning, assessment and academic services. Representing Computer Science education for high school students	*Sep. 2013 - Jul. 2016*

Publications

Papers in Preparation

[1] **Valentina Pergher*, Axel Faes*, Yide Li, Marc M. Van Hulle**, "How stimulus type and task structure can affect ERP signatures", .

[2] **Axel Faes, Eva Calvo Merino, Anais Van Hoylandt, Elina Keirse, Tom Theys, Marc M. Van Hulle**, "Finger abduction trajectory prediction from high-density ECoG", Journal of Neural Engineering.

[3] **Axel Faes, Mariana P. Branco, Anais Van Hoylandt, Elina Keirse, Tom Theys, Nick F. Ramsey, Marc M. Van Hulle**, "Decoding Sign Language Finger Movements from high-density ECoG using Graph-Optimized Block Term Tensor Regression", Journal of Neural Engineering.

International Journal Papers

[4] **Eva Calvo Merino, Axel Faes, Marc M. Van Hulle**, "The role of distinct ECoG frequency features in decoding finger movement", Journal of Neural Engineering.

[5] **Axel Faes, Marc M. Van Hulle**, "Finger movement and coactivation predicted from intracranial brain activity using extended Block-Term Tensor Regression", Journal of Neural Engineering.

[6] **Axel Faes, Flavio Camarrone, Marc M. Van Hulle**, "Single finger trajectory prediction from intracranial brain activity using Block-Term Tensor Regression with fast and automatic component extraction", IEEE Transactions on Neural Networks and Learning Systems.

[7] **Axel Faes, Aurelie de Borman, Marc M. Van Hulle**, "Source space reduction for eLORETA", Journal of Neural Engineering.

[8] **Axel Faes, Iris Vantieghem, Marc M. Van Hulle**, "Neural Networks for Directed Connectivity Estimation in Source-Reconstructed EEG Data", Applied Sciences.

Conference Papers

[9] **Robin Marx, Maarten Wijnants, Peter Quax, Axel Faes, Wim Lamotte**, "Web Performance Characteristics of HTTP/2 and comparison to HTTP/1.1", International Conference on Web Information Systems and Technologies, pg 87-114.

[10] **Robin Marx, Peter Quax, Axel Faes, 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.

Thesis

[11] **Axel Faes**, "Finger Movement Decoding: From Source-Localisation to Tensor Regression Modelling", PhD Thesis.

[12] **Axel Faes**, "An Information Theoretical Approach to EEG Source-Reconstructed Connectivity", Advanced Master's Thesis.

[13] **Axel Faes**, "Algebraic Subtyping for Algebraic Effects and Handlers", Master's Thesis.

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

Extended Abstracts

[15] **Qiang Sun, Axel Faes, Marc M. Van Hulle**, "Individual and Coordinated Finger Movements Decoding from High-Density EEG and Its Implication in Hand Exoskeleton Control", European Congress of NeuroRehabilitation 2023.

[16] **Eva Calvo Merino, Axel Faes, Marc M. Van Hulle**, "Modulation of LMPs using the gamma band increases the stability of finger trajectories decoded from ECoG", BCI (Brain-computer interfaces) - Society 2023.

[17] **Axel Faes, Benjamin Wittevrongel, Marc M. Van Hulle**, "Reconstructing single finger trajectories from intracranial brain activity", III International Conference "Volga Neuroscience Meeting 2021".

[18] **Axel Faes, Mansoureh Fahimi Hnazaee, Marc M. Van Hulle**, "Causal Graphical Modelling of Functional Connectivity from Reconstructed EEG Sources", 8th International BCI Meeting (2021).

[19] **Axel Faes, Tom Schrijvers**, "Towards a Core Language with Row-Based Effects for Optimised Compilation", International Conference on Functional Programming 2017 Student Research Competition.

[20] **Kashyap Todi, Brent Berghmans, Axel Faes, 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.

[21] **Kashyap Todi, Donald Degraen, Brent Berghmans, Axel Faes, Matthijs Kaminski, 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.

Posters

[22] **Axel Faes, Tom Schrijvers**, "Towards a Core Language with Row-Based Effects for Optimised Compilation", International Conference on Functional Programming 2017 Student Research Competition.

Other

[23] **Editor**, "Use of Big Data and Artificial Intelligence in Multiple Sclerosis", Frontiers in Immunology.

[24] **Judge**, "Student Research Competition", ICFP (International Conference on Functional Programming).

Other publication

[25] **Matija Pretnar, Amr Hany Shehata Saleh, Axel Faes, Tom Schrijvers**, "Efficient compilation of algebraic effects and handlers", 2017 - CW Reports, CW708, 32 pp. Leuven, Belgium: Department of Computer Science, KU Leuven..

Students

[26] **Qiang Sun**, "Hand exoskeleton dexterity achieved by shared control with a semi-invasive brain-computer interface", Doctoral Program in Biomedical Sciences (daily supervision 2022-2023).

[27] **Eva Calvo Merino**, "Restoring finger dexterity with an exoskeleton controlled by human intracranial recordings", Doctoral Program in Biomedical Sciences (daily supervision 2022-2023).

[28] **Aurélie de Borman**, "Investigating the effect of Source Mixing on Directed Connectivity estimated between Simulated Reconstructed EEG Sources", Internship Student.

[29] **Diogo Sousa Morais**, "Estimating the effectiveness of source localized EEG for BCIs", Internship Student.

[30] **Guilherme de Borras Silva**, "Cluster Permutation Analysis of N-Back related EEG-ERP Data", Internship Student.

[31] **Iris Vantieghem**, "Using Neural Networks to derive Directed Connectivity between Reconstructed EEG Sources", Master of Science in Artificial Intelligence (2020-2021).

[32] **Didier Quintius**, "Neural Network Approach to the Inverse Problem", Master of Science in Artificial Intelligence (2020-2021).

Talks, presentations and other media

Apr. 25, 2023	“Decoding finger movements from invasive recordings in human motor cortex”, Mindseed event Leuven, NeuroTech Leuven.
Oct. 10, 2022	“Coordinated Finger Movements Predicted from Intracranial Brain Activity”, International Congress Humanities vs Sciences & the Knowledge Accelerating in Modern World: Parallels an Interaction,.
May. 11, 2022	“BCI demo - Advanced Engineering, Antwerp Expo”, AI Vlaanderen, Vlaanderen Industrie 4.0.
Mar. 15, 2022	“Finger abduction trajectory prediction from high-density ECoG”, Leuven AI Scientific Workshop.
Nov. 17, 2021	“Decoding single and coordinated finger actions from intracranial brain activity.”, XIV World Scientific Congress - SCIENCE FOR PEACE Modern Science, Global and Regional Theory and Practice.
Aug. 24, 2021	“Reconstructing single finger trajectories from intracranial brain activity”, III International Conference ”Volga Neuroscience Meeting 2021”.
Nov. 28, 2021	“BCI demo - Dag van de Wetenschap”, Technopolis (geannuleerd wegens de covid-19 situatie).
Nov. 07, 2019	“Presentation ”’MINDSPELLER’ Medical Research Project on Brain Computer Interfaces” and concert (with Tigran Maytesian and his Mind Speller Chamber Orchestra)”, Kathedraal van Sint-Michiel en Sint-Goedele, Brussel.
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.