

Afonso Fontes

AI Engineer: machine learning lifecycle, model validation and production systems. Based in Gothenburg, Sweden (resident since 2020). EU citizen.

Profile

AI/ML engineer with 11 years of applied AI/ML experience and 5+ years of end-to-end production ML ownership. Holds an MSc in Computer Science and a Licentiate (PhD track, University of Gothenburg) centred on AI evaluation methodology: designing quality metrics, benchmarking approaches against baselines, and validating model robustness across scenarios.

He has taken machine learning solutions through the full lifecycle: data collection and preparation (sensor and simulation data for autonomous-driving perception), model development and training, and rigorous validation, including search-based test generation techniques that combine classical ML, reinforcement learning and LLM-driven approaches, benchmarked against the state of the art.

Since 2021 he has owned the complete ML/AI stack for a live production platform (13,700 users, 3,200 paying subscribers): training, serving, CI/CD, monitoring and retraining, with every change gated by a defined evaluation criterion before it reaches users.

Technical skills

- Languages: Python (primary, 8+ years); JavaScript/TypeScript; SQL for evaluation and verification queries.
- ML and data: TensorFlow, Keras, PyTorch, scikit-learn; model training, evaluation and serving; data collection and preprocessing from APIs, databases and sensor sources; statistics and probability foundations from a BSc in Control and Automation Engineering.
- Validation and evaluation: search-based test generation combining classical ML, reinforcement learning and LLM-driven techniques; benchmark design; robustness testing across scenarios; regression evaluation; structured failure-case triage (the core of his PhD research).
- Production and MLOps: Docker, CI/CD pipelines, REST API development, service deployment and monitoring, model retraining workflows, cloud-native tooling.
- Engineering practices: Git (branching strategy, mandatory code review before any merge), automated testing, structured failure triage, agile cross-functional collaboration.

Experience

Founder and Lead ML/AI Engineer, Next Action Guides (SaaS). Jun 2021 to present

- Next Action Guides builds in-game add-ons and tools that help World of Warcraft players optimise their performance.

- Founder and owner, directing a team of 4 developers. Sets the AI/ML architecture and evaluation strategy and owns technical decisions end to end across a live platform (13,700 users, 3,200 paying subscribers), from business need through model design, training, evaluation, deployment and production monitoring.
- Production ML infrastructure: Python backend, REST API layer, Dockerised deployment, CI/CD pipeline, automated validation gates, service monitoring. Every change is validated before reaching users; failures are triaged into product-defect, model-issue and environment-issue categories.
- Evaluation-driven development: no ML/AI change ships without a defined quality metric and a benchmark pass, a discipline kept for four years in a paid-subscriber environment.

Independent AI/ML Consultant, own practice (enskild firma)

Available for new software consulting engagements in applied AI/ML and agentic systems.

Client engagement: EggAI Technologies (Munich), Sep to Oct 2026.

- Shipped production agent infrastructure (configurable-agent-python): native transport integration with the client's agent bus, multi-modal input handling (file, image, PDF), tool-call history support, and a bus architecture assessment with the client's system designer.
- Built and evaluated a GenAI multiclass classifier (severity and ownership axes): designed the evaluation harness, fixed token accounting, added a typed multi-label output schema, and shipped a before/after demo.
- Delivered infrastructure for two further client projects (environment provisioning, access control, audit trail) and contributed to a Trusted Research Environment (TRE) specification and a K8TRE compliance audit.
- Worked directly within the client's engineering team, including daily stand-ups and an in-person company meeting in Frankfurt.

PhD Candidate and Researcher, University of Gothenburg. Sep 2020 to Aug 2025

- Core research: search-based software test generation, applying classical ML, reinforcement learning and LLM-driven techniques to automatically generate and evaluate test cases: designing evaluation pipelines, defining quality and coverage metrics, and benchmarking against the state of the art.
- Applied this methodology across several domains, including a case study on autonomous-driving perception: search-based test generation for pedestrian-detection robustness on the Baidu Apollo stack (SVL simulator), generating and curating scenario datasets under varied real-world conditions.
- Focus: enhancing automated software test case generation by integrating machine learning; search-based test generation and multi-objective optimisation to improve code coverage and fault detection.
- 17 published papers, including systematic reviews on ML evaluation methodology.
- Licentiate thesis: "Search-based Software Testing: Infusing Context into Automatic Unit Test Case Generation".

Assistant Professor, AI, Robotics and Autonomous Systems, UNIFOR. May 2017 to Aug 2020

- Taught AI, Computer Vision and Autonomous Systems at MSc level. Led research groups developing and evaluating applied ML/RL systems: reinforcement-learning-based locomotion, behavioral-cloning networks, SLAM, and lidar-based autonomous navigation.

- Courses taught: Algorithms, Object-Oriented Programming, Robotics, Autonomous Systems, Principles of Control and Digital Control.
- Member of the Computer Systems research group of the PhD program in Applied Informatics; led undergraduate research groups in Computer Vision, Artificial Intelligence, Industrial Robotics and Mobile Robotics, with tools such as Unity3D, Arduino, OpenCV, ROS, TensorFlow, Keras and OpenAI.
- Mentoring and knowledge-sharing across a cross-functional team of students and researchers.

Business Partner and Head of Development, taskOne (Autonomous Systems). Dec 2018 to Aug 2020

- Led applied AI and autonomous-systems R&D for drone/UAV solutions: perception, control integration and reliability testing. Moved ML-driven perception from prototype to field deployment in a fast-moving, resource-constrained environment.
- Projects included 3D mapping and geolocation of large open areas, real-time surveillance and intruder detection, counting and monitoring manatee groups, water pipe inspection and leak detection, and power line following and inspection.

Founder and CEO, SkyRobotics. Dec 2014 to Aug 2020

- Founded a company offering practical courses in microcontrollers and general electronics, and lectured there; under his management it grew from two courses to more than ten courses per semester.

Earlier career (2005 to 2017)

- Product Marketing Engineer, APC by Schneider Electric (May 2014 to Jun 2017): product offer lifecycle and pricing; trained and enabled APC distributors and resellers.
- Technical Support Specialist, Hexing Group (Dec 2013 to May 2014): energy meter offer manager in the measurement automation division; product lifecycle and key accounts.
- Control and Automation Engineer, Nexo Automação (May 2013 to Nov 2013): team leader designing and installing building automation and fire detection systems.
- Sales Consultant, HomeTech Premium (Sep 2012 to Feb 2013) and Habitat Automação (Jun 2011 to Sep 2012).
- Developer, home automation control systems, StudioVip (Mar 2011 to Jul 2011).
- General Manager, Swedish Taste Imp e Exp LTDA (Jul 2009 to Mar 2011): plant management over sales, purchasing and maintenance.
- Trainee, INACE (Indústria Naval do Ceará) (Feb 2009 to Jul 2009).
- Sales team leader, Red Fish (Aug 2005 to Nov 2008): local market sales; also administrative assistant and buyer.

Education

- Licentiate (PhD track), Software Engineering, University of Gothenburg, 2020 to 2025.
- MSc, Computer Science (thesis: SLAM from a single RGB-D camera), UECE, Brazil, 2015 to 2016.
- BSc, Control and Automation Engineering, University of Fortaleza (UNIFOR), Brazil, 2008 to 2012.

Publications

Google Scholar (October 2026): 328 citations, h-index 7, i10-index 5, 17 publications. Research interests listed there: Autonomous Systems, Robotics, Computer Vision, Software Engineering, Software Testing.

- 2025: Exploring the Interaction of Code Coverage and Non-Coverage Objectives in Search-Based Test Generation. *Software Testing, Verification and Reliability* 35 (6-7). With G. Gay and R. Feldt.
- 2025: Context-Infused Automated Software Test Generation. Licentiate thesis, Chalmers University of Technology.
- 2023: The Integration of Machine Learning into Automated Test Generation: A Systematic Mapping Study. *arXiv* 2206.10210. With G. Gay. 45 citations.
- 2023: Automated Support for Unit Test Generation. Book chapter in *Optimising the Software Development Process with Artificial Intelligence*. With G. Gay, F. G. de Oliveira Neto and R. Feldt. 9 citations.
- 2022: AI-empowered data offloading in MEC-enabled IoV networks. *arXiv* 2204.10282. 7 citations.
- 2022: Visual Odometry for RGB-D Cameras. *arXiv* 2203.15119. With J. E. B. Maia. 6 citations.
- 2022: Development of a robotic manipulator: applying interdisciplinarity in Computer Assisted Project, Microcontrollers and Industrial Robotics. *arXiv* 2203.16924. 1 citation.
- 2022: Applying PBL in the Development and Modeling of Kinematics for Robotic Manipulators with Interdisciplinarity between Computer-Assisted Project, Robotics, and Microcontrollers. *arXiv* 2203.16927. 1 citation.
- 2022: Criação e aplicação de ferramenta para auxiliar no ensino de algoritmos e programação de computadores (a tool for teaching algorithms and programming). *arXiv* 2204.01468.
- 2022: Desenvolvimento de ferramenta de simulação para auxílio no ensino da disciplina de robótica industrial (a simulation tool for teaching industrial robotics). *arXiv* 2203.16920.
- 2022: Aplicação de ROS como ferramenta de ensino a robótica (using ROS as a robotics teaching tool). *arXiv* 2203.16923.
- 2021: Emerging drone trends for blockchain-based 5G networks: open issues and future perspectives. *IEEE Network* 35 (1). 54 citations.
- 2021: Efficient and effective generation of test cases for pedestrian detection: search-based software testing of Baidu Apollo in SVL. *IEEE International Conference on Artificial Intelligence Testing (AITest) 2021*. 43 citations.
- 2021: Using machine learning to generate test oracles: a systematic literature review. *1st International Workshop on Test Oracles*. With G. Gay. 36 citations.
- 2021: Automated support for unit test generation: a tutorial book chapter. *arXiv* 2110.13575. 6 citations.
- 2020: Industrial internet-of-things security enhanced with deep learning approaches for smart cities. *IEEE Internet of Things Journal* 8 (8). 116 citations (his most cited paper).
- 2019: PBL in the development and stability control of a UAV with interdisciplinarity between digital control and computer-assisted design. *International Journal of Advanced Engineering Research and Science*. 4 citations.

Languages

English (fluent), Portuguese (native), Swedish (intermediate).