Nelly F. Almaktoum

Computer Science Student | Machine Learning & AI Research

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PROFILE

Computer Science student at King Abdulaziz University on the Waed Distinctive Excellence track, preparing for Ph.D. study and an academic research career in machine learning and AI. My work applies reproducible, interpretable ML to environmental and infrastructure problems: modeling urban heat in Wahaj, sensor-based leak detection in Maeen, and IoT prototyping in the patented Aykah smart bin. I was the youngest of seven UNCCD Young Researchers Award winners at COP16, selected from 209 researchers across 36 countries.

Research interests: Neural networks and deep learning; representation learning; trustworthy and explainable AI; model evaluation and generalization; AI for environmental sustainability and resilient infrastructure.

EDUCATION

King Abdulaziz University, Jeddah *2025 – Expected 2030*

B.S. Computer Science, Faculty of Computing and Information Technology

- Waed Distinctive Excellence track for gifted students (Waed Scholar).
- Academic Excellence Award 2025–2026 for a GPA of 4.5 or higher across two consecutive semesters.

Dar Al Fikr International Schools, Jeddah *2022 – 2025*

American High School Diploma

- Mawhiba alumna: advanced STEM coursework through the King Abdulaziz & His Companions Foundation for Giftedness & Creativity (2022–2025).
- Graduation project: Aykah, taken from Sustainable Development Goal research to a working prototype and a business concept.

RESEARCH EXPERIENCE & SELECTED PROJECTS

Maeen (مَعين): Real-Time Pipeline Leak & Water-Quality Detection *Aug – Oct 2026*

Technical lead and developer, five-person team github.com/nelmkt/maeen

- Developed a reproducible ML pipeline for multivariate in-pipe sensor streams (pressure, flow, pH, EC, acoustics and vibration), from physics-aware feature engineering to fault classification, localization and evidence-based alerts.
- Physics-aware features with gradient boosting reach 94.1% fault-type accuracy across 6 classes on unseen scenarios, against 78.5% for classic threshold rules, with 0.06 false alarms per day.
- Locates faults to the right pair of devices 99.9% of the time, within about 110 m on a 5 km line, with a 5-minute median detection delay for leaks.
- Built a working prototype with a FastAPI service, bilingual evidence-based dashboard, model registry, drift monitoring and CI quality gate (Docker, GitHub Actions, pytest).

Wahaj Framework: Urban Greening and Energy Trade-offs *Jun – Oct 2026*

Researcher and developer DOI 10.5281/zenodo.23168529

- Developed a reproducible Python and Google Earth Engine research framework to study urban greening, surface temperature and desalination energy trade-offs, using Jeddah as a case study.
- XGBoost land surface temperature model on Landsat 8: spatial cross-validation R^2 0.795 on 19,650 cells, benchmarked against random forest, gradient boosting and linear regression.
- Matched-contrast benchmark of −1.18 °C per greened pixel outside the built-up area, with counterfactual gates and robustness tests, plus a NEGI index and a water–energy ledger (about 2.9–5.3 MWh/yr of desalination energy per degree of cooling).

Aykah (آيكة): Solar-Powered IoT Smart Bin *Oct 2024 – Mar 2025*

Inventor and project lead - patented github.com/nelmkt/Smart-Bin-Aykah

- Designed, built and prototyped a low-cost smart bin end to end: Raspberry Pi, ultrasonic fill sensing, LCD interface, LED status indicators, air filtration and solar power.
- Grounded in a community survey of 222 participants on waste habits and acceptance of smart waste technology, and developed into a business concept with its own identity.
- Won the UNCCD Young Researchers Award at COP16, protected by a patent, and featured in the Saudi Gazette.

RESEARCH OUTPUTS & PATENT

- **Patent:** Aykah smart waste management system (inventor).
- **Research paper:** 2nd Conference on Sustainability and Quality of Life, King Abdulaziz University. *2026*
- **Software release:** Wahaj Framework, Zenodo, DOI 10.5281/zenodo.23168529. *2026*

AWARDS & HONORS

UNCCD Young Researchers Award, COP16 *Dec 2024*

Award winner, Modern Technologies category (United Nations Convention to Combat Desertification)

- Youngest of the seven winners among 209 researchers and professors from 36 countries, received at age 16.
- Also recognized nationally by the Ministry of Environment, Water and Agriculture (MEWA) and the National Center for Meteorology (NCM).

IEEE Ideation Competition (3rd Place), 22nd International Learning & Technology Conference *Jan 2025*
Presenter and team lead, Effat University

- Won 3rd place for best technological innovation; presented our paper at the Human Machine Fusion (HMF) exhibition to a committee of technology professors and innovators, and led a team of five.

25th Annual Graduation Research Seminar & Exhibition *2025*
Exhibitor, Dar Al Fikr International Schools

- Showcased a renewable green-energy prototype and organized research booths, leading visitor engagement and presenting to guests and industry professionals.

- **Bronze Medal, International Invention, Innovation & Entrepreneurship Idea Competition 2026 (i3EC'26)**, representing King Abdulaziz University with Aykah; recognized by the Malaysia Innovation, Invention & Creativity Association (MIICA) *Nov 2026*
- **Poster Finalist, Saudi HPC/AI Conference 2026**, KAUST, student poster session: "When an Accurate Urban Heat Model Cannot Forecast Greening Effects in Jeddah" *Nov 2026*
- **Academic Excellence Award 2025–2026**, King Abdulaziz University *Jun 2026*
- **Certificate of Appreciation**, KAU, for distinguished participation in local and international competitions *Sep 2026*
- **Hackathon winner**, multiple local hackathons
- **National Mathematics Olympiad**, final stage, representing the Western Region *Feb 2022*

LEADERSHIP & EXTRACURRICULAR ACTIVITIES

- **Technical Team Lead**, Waed Students Community, King Abdulaziz University *Sep 2026 – Present*
- **Project Coordinator, Talks X**, Engineering Day 2027, KAU *Sep 2026 – Present*
- **Layout & Design Specialist**, Engineering Day 2027 Planning Department *Aug 2026 – Present*
- **Webmaster**, IEEE KAU SB (Female) Research Community (2027 term) *Nov 2026 – Present*
- **Technical Department Member**, IEEE (2027 term) *Oct 2026 – Present*
- **Tech Department Vice Leader**, Programming Club (2027 term) *Oct 2026 – Present*
- **Tech Department Vice Leader**, Microsoft Learn Student Ambassadors Club (LSAC), KAU *Oct 2026 – Present*
- **CM Experience Member**, Google Developer Groups, KAU *Oct 2026 – Present*
- **Organizer & Event Coordinator**, English Language Olympiad (ELO), KAU *Oct 2026*
- **Coordinator**, Annual Waed Workshop & Introductory Meeting 2027 *Aug – Sep 2026*
- **Member**, Scientific Research Club, KAU *Sep 2026 – Present*
- **Member**, Intellectual & Electronics Sports Club, KAU *Oct 2025 – Jun 2026*

CONFERENCES, COMPETITIONS & EVENTS

- **Miyahthon 2027**, Saudi Water Authority *2027*
- **2nd Conference on Sustainability and Quality of Life**, King Abdulaziz University (research paper) *2026*
- **Hackathon Al Hareeq**, Ministry of Environment, Water & Agriculture *Dec 2025*
- **Aramco Consulting Championship**, participant *Dec 2025*
- **The 2nd Scientific Forum**, King Abdulaziz University *Nov 2025*

SUBMISSIONS & APPLICATIONS

- **Seoul International Invention Fair (SIIF) 2026, COEX, Seoul**, nominated by King Abdulaziz University to exhibit Wahaj *Dec 2026*
- **Global Sustainability Challenge 2026–27 (Stanford Doerr School of Sustainability and partner universities)**, submitted (team 1330) *Oct 2026*
- **KAUST Academy Artificial Intelligence Specialization 2026/27**, application submitted, under review *Oct 2026*
- **2nd International Online Conference on Environments (IOCE 2027), MDPI**, abstract submitted (Sciforum-215772) *Oct 2026*
- **WAW 2026**, manuscript submitted *Oct 2026*
- **Wilkes Climate Innovation Prize 2027, Wilkes Center for Climate Science & Policy, University of Utah**, submitted *Oct 2026*
- **International Grand Invention, Innovation and Design Expo (IGIIDeation 2027), IIUM**, abstract and paper submitted *Oct 2026*

SKILLS

- **Programming:** Python, TypeScript, JavaScript, Rust, Ruby; working knowledge of SQL, C++, C# and Java.
- **Machine learning & AI:** PyTorch, XGBoost, scikit-learn, pandas, NumPy, Matplotlib; feature engineering, model training and benchmarking, explainable AI, cross-validation, counterfactual testing, reproducible pipelines, MLOps (model registry, drift monitoring).
- **Web & tools:** React, Next.js, Tailwind CSS, HTML/CSS, Node.js, FastAPI REST APIs, WebSockets, Pydantic, SQLite, Pyodide; Git, Docker, GitHub Actions, GitHub Pages, pytest, MATLAB.
- **Hardware & IoT:** Raspberry Pi, embedded systems, ultrasonic sensors, LCD/LED interfaces, solar power, IoT prototyping.
- **Leadership & communication:** Committee leadership, event coordination, team leadership, scientific presentation to expert panels, layout and visual design.
- **Languages:** Arabic (native), English (fluent).
- **Interests:** Design and painting.