Amr Gomaa

Deputy Head and Researcher in Human-centered AI & Applied ML

Addresses/**Locations**: Saarland, Germany & Cambridge, United Kingdom

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RESEARCH FOCUS

I am broadly interested in research areas related to Human-centered Artificial Intelligence with a focus on machine learning models' evaluation, personalization, and adaptation. My research topics include **Gesture Recognition & Computer Vision**, **NLP & LLMs Evaluation**, **Multimodal Interaction & Interface Design**, **Incremental & Continual Learning**, and **Reinforcement & Imitation Learning**. I have worked in domains such as **Dialogue Systems**, **Surgical Robotics**, and **Well-being** in interdisciplinary academic and industry-oriented projects with partners such as **Carl Zeiss**, **Microsoft Research**, and **BMW**.

SKILLS

Multimodal Gesture Recognition, Computer Vision, NLP, LLMs, RAG, Human Computer Interaction, Artificial Intelligence, Machine Learning, Deep Learning, Reinforcement Learning, Imitation Learning, CNNs, Transformers, Python, PyTorch, TensorFlow, Keras, R, Pytest, Docker, Google Cloud Services, Slurm, FastAPI, Weaviate, Flask, Unity, Unreal Engine, Project Management, Data Analysis.

EXPERIENCE

PhD Visiting Researcher at Cambridge University *August 2024 - ongoing*

Interactive Systems Engineering Group, University of Cambridge, United Kingdom

* My visit research focus is on **feasible ML (specifically LLMs) solutions for HCI design process** and interfaces, enabling designers to make interfaces more controllable using natural language. Additionally, I am working on **contextual LLM agents development, evaluation, and robustness in collaboration with Microsoft Cambridge**.

Deputy Head and Researcher (Ph.D. Candidate) in Human-centered AI & Applied ML *April 2020 - ongoing*

Adaptive Interfaces and Dialogue Group, German Research Center for Artificial Intelligence (DFKI), Germany

* My research topics include **Computer Vision Methods (e.g., Video Understanding, Multimodal Gesture Recognition, Contrastive Learning)**, **Incremental Learning (e.g., for Tabular Data and Sensor Fusion)**, **Reinforcement Learning**, and **LLMs** in **Automotive, Robotics, Health and Well-being, Rehabilitation Interventions, and Geospatial Analysis** domains. Some of the projects I am working/have worked on are: FedWell, CAMELOT, APX-HMI, and TeachTAM.
* I am **responsible for leading a team of researchers of varying size (4 to 6 people at a time) and expertise (psychologists, master students, computer scientists, software engineers, and other PhD students)** in terms of coordination, supervision and technical support to ensure projects goals fulfillment in a timely manner.
* I designed, prototyped, and implemented several frameworks **utilizing ML and AI spanning adaptable interfaces, gesture recognition, LLM personas, LLM negotiation agents, imitation learning for surgical robots, reinforcement learning techniques for personalization, adapting rehabilitation exercises, mental workload estimation and autonomous driving (GitHub).**
* I am responsible for supporting junior researchers and other PhD students technically and organizationally, **as well as writing papers and grant proposals (totaling around two million Euros)** to ensure successful project completion, help them acquire funds, and finish their PhD degree successfully.
* I am supervising several master's and bachelor's students in finishing their thesis projects and successfully obtaining their degrees with the highest grades. I was able to guide several master's students to publish their thesis work at highly reputable conferences.
* I have published several papers in top-tier human-computer interaction, machine learning, and robotics conferences and workshops. I won several awards for best workshop paper and blue sky visionary work.
* **Skills: Computer Vision, Robotics, NLP, LLMs, Reinforcement Learning, Imitation Learning, Project Management, Conflict Resolution, Software Engineering, Technical Writing of Academic Papers, Virtual Reality, Unity, Unreal Engine, C#, Python, Pytorch, REST, docker, FastAPI, Flask, Distributed Training, Pytorch Geometric, AutoML, Google Cloud Services, Pytest, Pylint, Matplotlib**

Project Manager/Lead, TeachTAM and SisWiss Projects *April 2022 - Ongoing*

German Research Center for Artificial Intelligence (DFKI), Germany

* Multiple Research foci on **Reinforcement Learning, Imitation Learning, and Curriculum Learning for Surgical Robotics and Secure Knowledge Management with LLMs**.
* I created a project idea and established its desired goals, outcomes, and milestones, as well as **acquired research funding from the German Federal Ministry of Education and Research (BMBF)**.
* I was responsible for **leading a force task of researchers** to ensure project goals were fulfilled in a timely manner and successfully published the work at top-tier robotics conferences, specifically IROS (TeachTAM project).
* I **coordinated and reported the results to project stakeholders** (e.g. industry partners and the BMBF).
* **Skills: Project Management, Conflict Resolution, Software Engineering, Technical Writing of Academic Papers, Robotics, NLP for Robotics, Reinforcement Learning, Imitation Learning, Unity, Unreal Engine, C#, Python, Pytorch, REST**

Junior Researcher *April 2019 - April 2020*

German Research Center for Artificial Intelligence (DFKI), Germany

* I was responsible for creating and deploying end-to-end machine learning (ML) systems for multimodal adaptive interfaces, computer vision tasks, and sensor data, including collections, preprocessing, model training, and evaluations.
* **Skills: Python (Pandas, Numpy, Pytest), ML (Scikit-learn), Deep Learning (Pytorch, TensorFlow), SQL**

Research Assistant *November 2017 - April 2019*

Human-Computer Interaction Group, Saarland University, Germany Advised by Prof. Dr. Jürgen Steimle

* I worked on wearable devices, including prototyping and novel circuit design, printed electronics, on-skin circuits and micro-controller programming, creating tactile feedback with ultra-thin electrons. This work was published in top HCI conferences such as UIST.
* Acknowledgements:
  "Tacttoo: A Thin and Feel-Through Tattoo for On-Skin Tactile Output Output", Withana et al.
  "Tactlets: Adding Tactile Feedback to 3D Objects Using Custom Printed Controls", Groeger et al.

Senior Radio Frequency (RF) Optimization Engineer - Project Manager *May 2016 - September 2017*

Vodafone Egypt

* I was responsible for the RF design, development, optimization, and RF engineering services of Alexandria (the second-largest city in Egypt and a fifth of Egypt's Entire Cellular Network). Also responsible for network design, development, roll-out, integration and implementation of 2G/3G/4G wireless network systems.
* I worked with systems and IC designers to optimize power optimization for all RF circuitry in the cellular system. I was the project manager for several multi-functional teams targeted at optimizing RF dependencies to enhance Key Radio Features.

Vodafone's Discover Graduate Program for Outstanding Academics *October 2013 - April 2016*

Vodafone Egypt

* I have successfully joined a highly selective program to jump-start my career and fill a senior engineer position in a record time of only one year, where I have worked with two highly experienced teams (RF Planning/Optimization & RAN Optimization). While being accepted immediately after graduation, program officially started in March 2015 after Mandatory Military Service.

EDUCATION

Ph.D. in Computer Science *September 2020 - August 2025*

German Research Center for Artificial Intelligence (DFKI) and Saarland University, Germany
Advisors: Dr.-Ing Michael Feld and Prof. Dr. Antonio Krüger

M.Sc. in Computer Science *October 2017 - April 2020*

Saarland University, Germany
GPA: 1.4/1.0 (Thesis GPA: 1.3)
Advisors: Dr.-Ing Michael Feld and Prof. Dr. Antonio Krüger

B.Sc. in Telecommunications and Electronics Engineering *September 2008 - July 2013*

Ain Shams University, Egypt

Miscellaneous

Udacity Deep Reinforcement Learning Nanodegree, 2023
Google Data Analytics Certification, 2022
Sixth Summer School on Computational Interaction (CIXSchool), 2022
First Inria-DFKI European Summer School on AI (IDESSAI), 2021

Successful Grants and Personal Awards

- **Secured a Research Grant of 427,500 Euros** (1,800,000 Euros total for the Consortium) on Secure Language Models for Knowledge Management from the German Federal Ministry of Research (BMBF, now BMFTR), 2025
- Awarded Best Paper at HITLAML Workshop, 2023
- Awarded Third Place for Blue Sky Papers at ICMI, 2023
- **Secured a Research Grant of 100,000 Euros** on **Hybrid Reinforcement Learning and Imitation Learning** from the German Federal Ministry of Research (BMBF, now BMFTR), 2022
- Granted Saarland University scholarship for international students (DAAD STIBET III scholarship grant), 2019

Selected Academic Publications (In collaboration with Industrial partners)

[1] **Amr Gomaa***, Sahar Abdelnabi*, Eugene Bagdasarian, Per Ola Kristensson, and Reza Shokri. "Firewalls to Secure Dynamic LLM Agentic Networks". In: *arXiv preprint arXiv:2502.01822* (2025). *: Equal contribution.

[2] Sahar Abdelnabi, **Amr Gomaa**, Sarath Sivaprasad, Lea Schönherr, and Mario Fritz. "Cooperation, Competition, and Maliciousness: LLM-Stakeholders Interactive Negotiation". In: **NeurIPS**. 2024.

[3] **Amr Gomaa**, Bilal Mahdy, Niko Kleer, and Antonio Krüger. "Toward a Surgeon-in-the-Loop Ophthalmic Robotic Apprentice using Reinforcement and Imitation Learning". In: **IROS**. 2024.

[4] Niko Kleer, Martin Feick, **Amr Gomaa**; Michael Feld, and Antonio Krüger. "Bridging the Gap to Natural Language-based Grasp Predictions through Semantic Information Extraction". In: **IROS**. 2024.

[5] Niko Kleer, Ole Keil, Martin Feick, **Amr Gomaa**, Tim Schwartz, and Michael Feld. "Incorporation of the Intended Task into a Vision-based Grasp Type Predictor for Multi-fingered Robotic Grasping". In: **RO-MAN**. 2024.

[6] **Amr Gomaa**, Guillermo Reyes, Michael Feld, and Antonio Krüger. "Looking for a better fit? An Incremental Learning Multimodal Object Referencing Framework adapting to Individual Drivers". In: **IUI**. 2024.

[7] **Amr Gomaa** and Michael Feld. "Towards Adaptive User-Centered Neuro-Symbolic Learning for Multimodal Interaction with Autonomous Systems". In: **AI & HCI Workshop at ICML and ICMI**. **Won Third Place for Blue Sky Papers**. 2023.

[8] **Amr Gomaa**, Bilal Mahdy, Niko Kleer, Michael Feld, Frank Kirchner, and Antonio Krüger. "Teach Me How to Learn: A Perspective Review towards User-centered Neuro-symbolic Learning for Robotic Surgical Systems". In: *arXiv preprint arXiv:2307.03853* (2023).

[9] **Amr Gomaa** and Bilal Mahdy. "Unveiling the Role of Expert Guidance: A Comparative Analysis of User-centered Imitation Learning and Traditional Reinforcement Learning". In: **HITLAML Workshop**. **Best Paper Award**. 2023.

[10] **Amr Gomaa**, Robin Zitt, and Guillermo Reyes. "SynthoGestures: A Novel Framework for Synthetic Dynamic Hand Gesture Generation for Driving Scenarios". In: **Adjunct Proceedings of UIST**. 2023.

[11] **Amr Gomaa***, Guillermo Reyes*, and Michael Feld. "It's all about you: Personalized in-Vehicle Gesture Recognition with a Time-of-Flight Camera". In: **AutomotiveUI**. *: Equal contribution. 2023.

[12] **Amr Gomaa**, Guillermo Reyes, and Michael Feld. "ML-PersRef: A Machine Learning-Based Personalized Multimodal Fusion Approach for Referencing Outside Objects From a Moving Vehicle". In: **ICMI**. 2021.

Additional Industrial Projects (not Published due to NDA)

1. LLM-based In-context Learning for Personalized Cross-domain Recommender Systems, 2025.

2. Geospatial Data Analysis using Foundational Models for Emergency Relief and Crisis Aversion, 2024.

3. Feet Pressure Points and Landmarks ML-based Prediction during Walking and Standing for Pain Relief with Personalized Medical Shoe Insoles, 2024.

4. Adaptive Grasp Prediction for Anthropomorphic Robotic Hand using Imitation and Reinforcement Learning, 2023.

Teaching and Supervision

Student Theses Mentor and Co-Superviser
2020 - ongoing

– Bilal Mahdy, Master Thesis Title: Imitation Interactive Incremental Learning for Robotics in Cataract Surgery
– Kiran Gani, Master Thesis Title: Personalisation of Modalities using Reinforcement Learning for Object Referencing
– Simon Engel, Master Thesis Title: Adaptive User Interface Approach for Efficient Transfer of Control in Conditionally Automated Vehicles
– Michael Sargious, Bachelor Thesis Title: An Adaptive Incremental End-to-End ML Framework with Automated Feature Engineering
– Hassan Kanso, Bachelor Thesis Title: Multi-person Multi-camera tracking for Industry 4.0

Lecturer & Teaching Assistant
2019 - ongoing

Saarland University, Germany
Selected Classes: Speech-based Adaptation of Personalized User Interfaces Seminar, AI for HCI Seminar, Adaptive Human Machine Interfaces for Autonomous Systems Seminar, Hybrid Machine Learning Approaches and Applications Seminar, Automotive User Interfaces Seminar, and Machine Learning School

Tutor
2017 - 2019

Saarland University, Germany
Classes: Human Computer Interaction and Neural Networks: Implementation and Application

Academic Activities

Reviewing

AC (Associate Chair) at AutomotiveUI 2024 & 2023, PC (Program Committee) at HITLAML Workshop 2023, IMWUT 2023, CHI (Special Recognition for Outstanding Review all years) 2024 & 2023, IEEE VR 2023, NordiCHI 2022, AutomotiveUI (Special Recognition for Outstanding Review all years) 2023 & 2022 & 2021, CHI PLAY 2021, ICMI 2021, and IEEE AIVR 2021.

Talks

Teach Me How to Learn: An Outlook on User-centered Neuro-Symbolic Learning for Robotic Surgical Systems
Medical & Environmental Computing (MEC-Lab) at TU Darmstadt, 2022

TeachTAM: Machine Teaching with Hybrid Neuro-symbolic Reinforcement Learning
Software Campus Summit at DATEV IT-Campus Nürnberg, 2022

Languages

English (Bilingual)
German (Intermediate/CEFR Level B1)
Arabic/Colloquial Egyptian (Mother Tongue)

Referees

Prof. Dr. Antonio Krüger
CEO, German Research Center for Artificial Intelligence (DFKI). Professor and Media Informatics Chair, Saarland University
✉ antonio.krueger@dfki.de

Dr. Michael Feld
Senior Researcher and Team Lead, German Research Center for Artificial Intelligence (DFKI)
✉ michael.feld@dfki.de

Prof. Dr. Per Ola Kristensson
Professor in Interactive Systems Engineering in the Department of Engineering, University of Cambridge. Leading the Intelligent Interactive Systems Group.
✉ pok21@cam.ac.uk

Prof. Dr. Anna Maria Feit
Professor in Computer Science Department, Saarland University. Leading the Computational Interaction Group.
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