Abdulrahman AlRabah

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Professional Profile

Ph.D. CS researcher specializing in NLP, LLMs, and multimodal AI. Builds multi-agent systems, reinforcement learning pipelines, and large-scale evaluation and benchmarking tools. Distinguished Paper Award recipient (SDIoTSec 2024).

Education

- **Doctor of Philosophy in Computer Science**, *University of Illinois Urbana-Champaign* **Aug 2025 – Present**
- **Masters of Science in Computer Science**, *University of Illinois Urbana-Champaign* **Dec 2024**
- **Bachelor of Science in Mechanical Engineering**, *California State University Northridge* **May 2013**

Skills

Programming	Python, Java, Matlab, R
Web Development	HTML, CSS, JavaScript, Docker
Data Analysis	SQL, PowerBI, Tableau,
Frameworks	TensorFlow, PyTorch
Data Management	SQL, Neo4j, MongoDB
Cloud Computing	AWS, GCP
Other Skills	Machine Learning, Data Analysis, pandas, NumPy, sklearn, Product Management, SolidWorks, Git, GitHub
Spoken Languages	English(Native), Arabic(Native), French(Basic)

Publications

- AlRabah, A., Kargupta, P., Han, J., & Alawini, A. (2026). *Instructor-Aligned Knowledge Graphs for Personalized Learning*. Under review at *KDD 2026*
- Kasprova, V., Parulekar, A., AlRabah, A., Agaram, K., Garg, R., Jha, S., Bozdag, N. B., & Hakkani-Tür, D. (2026). *Too Polite to Disagree: Understanding Sycophancy Propagation in Multi-Agent Systems*. Submitted January 5, 2026 to *COLM26 Under Review)*
- Zhou, W., AlRabah, A., Dunham, D., & Alawini, A. (2026). *AI-Powered Knowledge Graph System for Personalized SQL Learning and Adaptive Feedback in Database Systems Education*. Work in progress paper submitted to the *2026 ASEE Annual Conference & Exposition*, Charlotte, NC, June 21–24, 2026
- Gao, X., AlRabah, A., Kozlowski, T., Koloutsou-Vakakis, S., Kindratenko, V., & Alawini, A. (2026). *Integrating Generative AI Chatbots to Foster the Entrepreneurial Mindset in Engineering Education*. Submitted to the *2026 ASEE Annual Conference & Exposition*, Charlotte, NC, June 21–24, 2026
- AlRabah, A., Blumthal, M., Koloutsou-Vakakis, S., Kindratenko, V., & Alawini, A. (2025). Data-Driven Insights into AI-Powered Learning: Analyzing Student Interactions with Chatbot in Engineering Education. *2025 ASEE Annual Conference & Exposition*
- AlRabah, A., & Alawini, A. (2025). CodeLens: A Generative AI Framework for Automated Feedback on SQL Assignments. *DataEd 2025*
- AlRabah, A., Yang, S., & Alawini, A. (2024, June). Optimizing Database Query Learning: A Generative AI Approach for Semantic Error Feedback. Paper presented at the *2024 ASEE Annual Conference & Exposition*, Portland, OR. https://doi.org/10.18260/1-2–47819
- Mangar, R., Qian, J., Zegeye, W., AlRabah, A., Civjan, B., Sundram, S., …& Kotz, D. (2024, February). Designing and Evaluating a Testbed for the Matter Protocol: Insights into User Experience. In *Workshop on Security and Privacy in Standardized IoT (SDIoTSec)*

Research Experience

University of Illinois Urbana-Champaign (UIUC) **Aug 2025 – Present**
Graduate Research Assistant | Siebel School Fellow Urbana, IL

- Building a multimodal knowledge graph pipeline for large-scale retrieval and concept extraction, processing unstructured documents using multi-LLM inference (Llama 3B/8B, Qwen 14B) scaled across H200/A100 GPUs via vLLM, with human-in-the-loop evaluation benchmarks.
- Designing an agent-based task-oriented dialogue system for contextual risk intervention, using belief state tracking, structured databases, and reinforcement learning–based policy learning for action selection.
- Building large-scale embodied AI agents by extending PARTNR (Habitat 3.0) with inter-agent dialogue for decentralized task planning, training multi-agent coordination policies via SFT and GRPO reinforcement learning on Llama 3.1-8B.
- Developing a generative AI diagnosis pipeline that classifies semantic errors against extracted knowledge graph concepts, evaluating accuracy against expert human judgments.

University of Illinois Urbana-Champaign (UIUC) **Jan 2025 — Aug 2025**
Volunteer Researcher Urbana, IL

- Contributed to an early-stage AI-driven education analytics tool by organizing course interaction data and summarizing usage patterns for instructors
- Developed a prototype for a knowledge-graph structure to link student activity signals to learning concepts and prerequisite relationships

University of Illinois Urbana-Champaign (UIUC) **May 2023 — Dec 2024**
Graduate Research Assistant Urbana, IL

- My research focuses on advancing database education by addressing a critical gap in the feedback systems for Structured Query Language (SQL) learning. While much of the existing work in the field has concentrated on detecting syntax errors, my research explores the under-investigated area of semantic errors—logical flaws in SQL queries that are syntactically correct but produce unintended results. This work contributes to the broader field of AI-enhanced education, aiming to improve learning outcomes through intelligent feedback systems
- I developed *CodeLens*, an AI-powered SQL assistant that provides targeted feedback to students struggling with semantic errors. Utilizing a Chat Completion API and fine-tuning techniques, *CodeLens* delivers personalized, context-sensitive messages, helping students understand the logical structure of their queries and guiding them toward correcting mistakes. This tool addresses the gap left by traditional feedback systems, which typically focus only on syntax errors
- The fine-tuning process involved using real-world datasets of student SQL submissions, allowing the GPT models to learn the nuances of both correct and incorrect SQL query structures. By embedding AI-driven feedback directly into the learning process, we sought to provide more sophisticated educational support that enhances student problem-solving skills
- Our work has demonstrated the potential of AI to transform educational practices in database systems. Students who used *CodeLens* showed improvements in their understanding of SQL semantics, allowing for deeper learning and better problem-solving capabilities. These results highlight the broader impact of AI-driven feedback systems in improving educational outcomes, and they lay the foundation for future research into the application of AI in various educational domains
- We are planning further studies to scale the use of *CodeLens* in different courses, with an emphasis on evaluating its long-term impact on student learning. Additionally, future work will involve enhancing the AI models to provide even more nuanced feedback and expanding the tool to cover other types of programming languages beyond SQL

University of Illinois Urbana-Champaign (UIUC) **August 2023 — December 2023**
Researcher – CS 598: Security and Privacy for IoT in Homes Urbana, IL

- Participated in a research project exploring the use of the Matter protocol to address heterogeneity and interoperability challenges in smart homes, contributing to the development of a testbed for academic use
- Designed and developed a user interface for the testbed, enabling students to interact with a network utility device that sniffs network traffic and provides a wireless access point within IoT networks
- The project aimed to enhance the integration of smart devices in homes by evaluating the effectiveness of the Matter protocol in creating a unified and interoperable smart home environment
- The research project was presented as part of the course and provided valuable insights into the practical applications of IoT security and privacy in academic and real-world settings

Technical Experience

Cadence Design Systems **May 2026 — Present**
ChipStack AI Super Agent Team San Jose, CA

- Developing LLM-based agents for automated RTL design and optimization workflows
- Building benchmarking and evaluation pipelines to measure agent performance on PPA objectives

Gonuts Cronuts LLC. **Jan 2016 — Aug 2021**
Founder & CEO West Abu Fatira, Kuwait

- Spearheaded financial and operational strategies, enhancing business performance with data analytics-driven solutions
- Implemented cost optimization using ODOO, reducing costs by 5% through data-driven financial analysis
- Managed supply chain analytics and strategic data-driven decision-making for 70+ outlets

Baker Hughes Drilling Fluids **Jun 2014 — Dec 2015**
Field Engineer Ahmadi, Kuwait

- Analyzed operational data to optimize drilling fluid properties, enhancing process efficiency and minimizing fluid loss
- Utilized geological data analysis to formulate solutions meeting targeted well objectives
- Conducted regular lab tests and project reporting, validating market opportunities and technical requirements

Alkout Industrial Project **Dec 2013 — Jun 2014**
Plant Engineer Shuaiba, Kuwait

- Performed periodic inspections on plant machinery and systems, guiding products throughout the execution cycle
- Coordinated scheduled shutdowns and improved machinery runtime, demonstrating ability to manage competing priorities
- Reduced nonproductive time significantly by enhancing chemical input processes, driving adoption of technical solutions

Project Highlights

CS 546 Advanced NLP (UIUC) **Aug 2025 — Dec 2025**
Multi Agent Development (Team Project - ARR Submission) Urbana, IL

- Investigated how sycophancy LLM agreement with incorrect user stances—spreads in multi-agent discussions and how peer-awareness can mitigate it.
- Designed a six-agent framework across MMLU tasks where models iteratively update responses after observing peers' answers and sycophancy scores.
- Introduced three peer-credibility scoring methods—Base (BSS), Discussion-Based (DBSS), and Dynamic (DSS)—to quantify and reduce sycophancy during debate.
- Conducted experiments with six open-source LLMs; peer-awareness improved majority accuracy by 8.6% and reduced error cascades and post-discussion sycophancy.

CS 543 Computer Vision (UIUC) **Aug 2024 — Dec 2024**
(Team Project) Urbana, IL

- Re-implemented the CVPR 2024 paper *"Shadows Don't Lie and Lines Can't Bend!"* and extended it for detecting synthetic images using geometric and frequency-domain cues
- Built an end-to-end pipeline combining DeepLSD (line segments), PerspectiveFields (vanishing-point consistency), Detectron2 (shadow segmentation), and Fourier/DCT features to capture spectral artifacts
- Added two extensions: a vision model classifier for real vs. generated images and an autoencoder-based anomaly detector for reconstruction-based fake detection
- Evaluated on Kandinsky, PixArt, SDXL, and DeepFloyd; geometric+frequency cues achieved strong generalization and $>$97% accuracy on easier subsets

CS 444 Deep Learning for Computer Vision (UIUC) **Jan 2024 — May 2025**
ViT implementation + training/infrastructure lead (Team Project) Urbana, IL

- Conducted an empirical study of Vision Transformer (ViT) and MobileViT across CIFAR-10, Fashion-MNIST, and MNIST under controlled, comparable training settings
- Implemented and evaluated ViT baselines plus two optimizations: a convolutional stem (stacked 3×3 convs replacing patchify) and an improved positional encoding scheme
- Compared ViT, ViT+ConvStem, ViT+PosEnc, and MobileViT; the convolutional-stem variant delivered the best accuracy/stability, while MobileViT converged faster with competitive accuracy for edge settings

CS 511 Database Systems (UIUC) **Jan 2024 — May 2025**
(Team Project) Urbana, IL

- Benchmarked MySQL vs. MongoDB on the Amazon Reviews dataset (GCP + MongoDB Atlas) to compare transactional performance vs. high-throughput writes under mixed workloads
- Designed a hybrid architecture with a buffered streaming layer to optimize inserts/queries, reducing I/O contention and improving isolation
- Showed MySQL excelled on complex transactions, MongoDB on heavy writes, and the hybrid achieved a lower-latency middle ground with stronger integrity + scalability trade-offs

CS 465 User-Interface Design (UIUC) **Aug 2023 – Dec 2023**
UI/UX Designer (Team Project) Urbana, IL

- Designed *Biped Ground Station (BGS)*, a UI that streamlines tuning and monitoring for a two-wheeled self-balancing robot used in embedded systems labs
- Enabled controller parameter tuning and real-time performance visualization, replacing a tedious firmware-flashing workflow
- Incorporated feedback from educators, researchers, and engineers to improve efficiency, clarity, and error-free iteration

CS 424 Real-time and Cyber-physical & Systems (UIUC) **Aug 2023 – Dec 2023**
(Team Project) Urbana, IL

- Surveyed 21 papers on smart-home authentication/access control, comparing auth methods, RBAC/ABAC/context-aware policies, and privacy practices
- Identified key deployment gaps (interoperability, policy scalability, observability) and promising directions (adaptive auth/anomaly detection, hybrid RBAC+ABAC, user-centered controls)
- Simulated AV camera perception with the Waymo Open Dataset and designed bounding-box–priority scheduling (area/depth) to reduce response time
- Deployed YOLOv8 on an NVIDIA Jetson Nano and improved real-time efficiency via scheduling, cross-frame de-duplication, and spatial hashing ($>$30% reduction vs. baseline)

Department of Computer Science (UIUC) **Jun 2023 – Aug 2023**
Web Application Developer (Team Project) Urbana, IL

- Designed and developed a demo booking website using Google Cloud as the database host
- Implemented features such as user authentication and booking management using Python Flask
- Worked on both frontend (HTML, CSS, JavaScript) and backend (Python Flask) development
- Managed data storage and retrieval processes on Google Cloud

Activities & Achievements

- **Distinguished Paper Award at SDIoTSec 2024**: Exceptional IoT security research **Spring 2024**
- **Fostering the Entrepreneurial Mindset, Babson Global Inc.**: 1st place for initiative **Fall 2016**
- **SME's Entrepreneurship Diploma, The National Fund**: 1st place in business innovation **Fall 2016**