

Spring 2025 Call for Applications

IEM Undergraduate Research Assistant (URA)

Overview

- The goal of this program is to support IEM undergraduate students to work with IEM faculty to conduct publishable research.
- All IEM undergraduate students can apply.
- Selected URAs are paid \$15/hour, up to 100 hours over ten weeks.
- There will be an IEM student research symposium with poster competition and cash prizes in April 2025.

Research Projects

	Faculty Contact	Project Title
#1	Dr. Katie Jurewicz <katie.jurewicz@okstate.edu>	Quantifying the Interaction Between Human Operators and AI-Enabled Automation in Aerospace Applications
#2	Dr. Mohammad Fili <mohammad.fili@okstate.edu>	Personalized learning system for cognition enhancement
#3	Dr. Guiping Hu <guiping.hu@okstate.edu>	Identification of cognitive trajectories using blood and brain biomarkers
#4	Dr. Guiping Hu <guiping.hu@okstate.edu> and Dr. Mohammad Fili <mohammad.fili@okstate.edu>	Technological advances used in dairy farm management
#5	Dr. Lizhi Wang <lizhi.wang@okstate.edu>	Data Analysis for Dairy Cattle Milk Productivity

More details about these projects can be found below.

Application Process

- Read the project descriptions (below) carefully before applying.
- Application should be an email to the faculty contact of the project that you are interested in working on. In the email, please briefly introduce yourself and explain why you are interested in the project.
- One student may apply for multiple projects, and one faculty may receive multiple applications. Faculty can make their selection decisions any time before the deadline of **Friday 01/24/2025**, so please apply early and leave enough time for you and faculty to get to know each other and potentially schedule for an interview.

Expectations and Deliverables for Selected URAs

- Participation of a kick-off meeting and a mid-point meeting
- Participation in poster competition in the student research symposium
- Individual projects may have additional requirements on expectations and deliverables

Timeline

- **01/13/2025:** Application is open.
- **01/24/2025:** Faculty will have selected the URA to work with. Staff will initiate the paperwork for URAs.
- **Week of 01/27/2025:** Kickoff meeting. Exact location, date, and time TBD.
 - 01/27: week 1
 - 02/03: week 2
 - 02/10: week 3
 - 02/17: week 4
 - 02/24: week 5
- **Week of 02/24/2025:** Mid-point meeting. Collect feedback and provide more details for the poster competition. Exact location, date, and time TBD.
 - 03/03: week 6
 - 03/10: week 7
 - 03/17: spring break
 - 03/24: week 8
 - 03/31: week 9
 - 04/07: week 10
- **04/17/2025:** IEM Student Research Symposium

Project #1

- **Project title:** Quantifying the Interaction Between Human Operators and AI-Enabled Automation in Aerospace Applications
- **Faculty and email:** Dr. Katie Jurewicz <katie.jurewicz@okstate.edu>
- **Project description:** Artificial intelligence (AI), AI-enabled decision aids, and other forms of automation are prevalent in modern complex systems (e.g., military, aerospace, healthcare, manufacturing). The introduction of automation and AI-enabled automation in complex systems require interaction with a human operator, and it has been shown that the use of fully automated systems negatively impacts both Situation Awareness (SA), user performance, and overall system performance. Conversely, manual systems, when employed for prolonged tasks, increase SA but negatively affect both workload and performance. Therefore, there is a need to identify the most appropriate level of automation for human operators that would enhance SA, reduce workload, and ultimately improve performance during human-automation interaction. The purpose of this study is to investigate the factors that contribute to users' preferred level of automation in an automated system and to assess the influence of the reliability of AI assistance on performance during human-AI interaction. Ultimately, we aim to develop a mathematical model that quantifies human behavior of transitioning to a preferred automation level. An experimental study in a flight environment will be conducted, and participants will be asked to perform tasks that are typical for pilots during flight. These tasks include regulating fuel level in a set of primary tanks, responding to call signal at intervals, monitoring the system for malfunction, and controlling the movement of a target around the computer screen with the use of a joystick (tracking task). A secondary screen will simulate an AI agent that provides information about the current level of automation for the tasks being performed on the primary screen. The primary variables of interest to collect are cognitive workload, trust in automation, and task performance. Results from this study will inform how engineers can better design human-AI systems that allow the automation to adapt to the human operator and the contextual environment.
- **Requirements for URA applicants:** The URA is expected to be highly motivated to perform research, available to support data collection, and have a strong math background. There are no course requirements for this position – students with math/stat courses on their resumes are preferred but not required.
- **Expected research outcome and deliverables:** The student is expected to formally disseminate results in the form of a research poster.

Project #2

- **Project title:** Personalized learning system for cognition enhancement
- **Faculty and email:** Dr. Mohammad Fili <mohammad.fili@okstate.edu>
- **Project description:** The URA will analyze relevant research papers, focusing on established cognitive enhancement systems and identifying best practices. This step will provide valuable insights to guide the design of an improved system, incorporating a personalized component. The goal of this system is to enhance cognitive performance in adults at risk for Alzheimer's Disease (AD).
- **Requirements for URA applicants:**
 - Currently enrolled as an IEM undergraduate student.
 - Interest in research.
 - Having a collaborative and team-oriented mindset.
 - Commitment and time management.
 - Ability to present research findings in a clear and organized manner.
 - Proactive attitude and willingness to contribute to research objectives.
 - Understanding of ethical considerations in research.
 - No background knowledge of the problem context is required for these projects.
- **Expected research outcome and deliverables:**
 - Compile a poster by the semester's end to effectively communicate the outcomes and findings of the research efforts undertaken by the URA.
 - Depending on the performance of URA and the contribution, they may be credited as co-authors in the subsequent publications.

Project #3

- **Project title:** Identification of cognitive trajectories using blood and brain biomarkers
- **Faculty and email:** Dr. Guiping Hu <guiping.hu@okstate.edu>
- **Project description:** The URA will analyze cognition and biomarker data to identify relationships between specific biomarkers and cognitive performance. This role involves applying data analytics skills to uncover patterns in the data. Basic programming knowledge in R or Python is required for tasks such as data preprocessing and modeling.
- **Requirements for URA applicants:**
 - Currently enrolled as an IEM undergraduate student.
 - Interest in research.
 - Having a collaborative and team-oriented mindset.
 - Commitment and time management.
 - Ability to present research findings in a clear and organized manner.
 - Proactive attitude and willingness to contribute to research objectives.
 - Understanding of ethical considerations in research.
 - No background knowledge of the problem context is required for these projects.
- **Expected research outcome and deliverables:**
 - Compile a poster by the semester's end to effectively communicate the outcomes and findings of the research efforts undertaken by the URA.
 - Depending on the performance of URA and the contribution, they may be credited as co-authors in the subsequent publications.

Project #4

- **Project title:** Technological advances used in dairy farm management
- **Faculty and email:** Dr. Guiping Hu <guiping.hu@okstate.edu> and Dr. Mohammad Fili <mohammad.fili@okstate.edu>
- **Project description:** The URA will analyze research papers that focus on technologies and sensors implemented by dairy farms to optimize resource management. Students will identify and extract relevant technologies from these publications and contribute to the preparation of a comprehensive review paper.
- **Requirements for URA applicants:**
 - Currently enrolled as an IEM undergraduate student.
 - Interest in research.
 - Having a collaborative and team-oriented mindset.
 - Commitment and time management.
 - Ability to present research findings in a clear and organized manner.
 - Proactive attitude and willingness to contribute to research objectives.
 - Understanding of ethical considerations in research.
 - No background knowledge of the problem context is required for these projects.
- **Expected research outcome and deliverables:**
 - Compile a poster by the semester's end to effectively communicate the outcomes and findings of the research efforts undertaken by the URA.
 - Depending on the performance of URA and the contribution, they may be credited as co-authors in the subsequent publications.

Project #5

- **Project title:** Data Analysis for Dairy Cattle Milk Productivity
- **Faculty and email:** Dr. Lizhi Wang <lizhi.wang@okstate.edu>
- **Project description:** In the past couple of decades, “[t]he U.S. dairy sector has undergone substantial structural change characterized by a shift to larger and fewer dairy operations concentrated in fewer States” [1]. In the meantime, productivity in the U.S. dairy sector grew at an annual rate of 2.99% for large farms with more than 1,000 milk cows, which was four times faster than small operations [1]. The structural change, coupled with climate change and ever improving labor-saving technology, made dairy production increasingly sensitive to environmental conditions and management practices [1]. Data analytics offers a promising approach to understanding lactation biology and physiology from systemic and holistic perspectives [2, 3]. This project will prepare systematically integrated data sets from dairy cow farms in order to identify the environmental and management factors that affect the health and productivity of dairy cows.

[1] Njuki, Eric. "US dairy productivity increased faster in large farms and across southwestern states." *Amber Waves: The Economics of Food, Farming, Natural Resources, and Rural America 2022* (2022).

[2] Giordano, J. O., et al. "Symposium review: Use of multiple biological, management, and performance data for the design of targeted reproductive management strategies for dairy cows." *Journal of Dairy Science* 105.5 (2022): 4669-4678.

[3] Bouallegue, Mahdi, and Naceur M'Hamdi. "Mathematical modeling of lactation curves: A review of parametric models." *Lactation in farm animals-biology, physiological basis, nutritional requirements, and modelization* 1 (2020): 1-20.

- **Requirements for URA applicants:** Interest in learning to analyze, visualize, and draw insights from data.
- **Expected research outcome and deliverables:** Poster presentation at research symposium