

## Ricardo Palma Fraga

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### EDUCATION

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- University of Oklahoma**
- 2024 PhD., School of Industrial & Systems Engineering  
Dissertation: *Development of Algorithms to Determine Accurate Parameters for Eye Movement Detection for Visual Scanning Behavior Analysis*  
Advisor: Dr. Ziho Kang
- 2023 Graduate Certificate in Data Science & Analytics, Data Science & Analytics Institute
- 2020 MSc., School of Industrial & Systems Engineering  
Thesis: *Multimodal Neuroergonomic Approaches to Human Behavior & Cognitive Workload in Complex High-Risk Semantically Rich Environments: A Case Study of Local & En-Route Air Traffic Controllers*  
Advisor: Dr. Ziho Kang
- 2018 BSc. with Distinction, School of Industrial & Systems Engineering  
Capstone: *Simulation Analysis of a Thrust Chamber Assembly Area for Redesign and Transport*

### AWARDS & HONORS

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- 2023, 2022 Outstanding Teaching Assistant, voted by the ISE student body
- 2023, 2022 ISE Graduate Director's Scholarship (\$1,000)
- 2023 Henry B. Wilson Engineering Scholarship (\$1,000)
- 2023 Honorable Mention in the Student Paper Competition by the Extended Reality Technical Group at the Human Factors & Ergonomic Society meeting  
Title: *Effect of Machine Learning Cross-validation Algorithms Considering Human Participants and Time-series: Application on Biometric Data Obtained from a Virtual Reality Experiment*
- 2022 Milton J. Gordon Memorial Scholarship (\$1,000)
- 2021 Tomorrow's Engineer Scholarship (\$1,000)
- 2021, 2020, 2018 ISE Advisory Board Scholarship (\$1,000)
- 2021 Wayne T. & LaFawn Biddle Scholarship (\$1,500)
- 2020 PhD. Recruitment Excellence Fellowship (\$5,000)
- 2020 Cleo Cross Scholarship (\$1,000)
- 2020 2<sup>nd</sup> place in the Student Researcher Poster Competition at the FAA Center of Excellence (COE) in Technical Training and Human Performance (TTHP)
- 2020 3<sup>rd</sup> place in the Student Researcher Poster Competition at the FAA COE TTHP
- 2019, 2017 1<sup>st</sup> place in the Student Researcher Poster Competition at the FAA COE TTHP
- 2017 JMA Solutions Scholarship (\$500)
- 2017 Commendation from the Governor of Oklahoma
- 2017 Winning team of Amazon's Alexa Hackathon at the University of Oklahoma  
[Article published in Amazon's Alexa Developers Blog mentioning the Hackathon](#)
- 2015 George T. Gibson Industrial Engineering Scholarship (\$1,000)

## RESEARCH EXPERIENCE

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- 2024 – **Human Factors & Simulation Laboratory**, University of Oklahoma  
Present Postdoctoral Researcher
- Developing supervised machine learning models to predict user gaze on large monitors in real-time using data from multiple eye trackers
  - Designing procedures to calibrate multiple eye trackers simultaneously based on users' anthropometric measurements
- 2020 – (PhD) Graduate Research Assistant  
2024
- Evaluated cross-validation methods to address time dependencies and user characteristics when training machine learning models using biometric data
  - Developed a framework to identify similar visual scanning patterns of air traffic controllers by comparing patterns using multiple string edit distance measures
  - Designed algorithms to determine optimal parameter values used by eye fixation detection algorithms to accurately identify eye fixations and saccades
  - Created multi-user virtual reality applications for studies exploring smart learning methodologies utilizing user biometric data
- 2018 – (MS) Graduate Research Assistant  
2020
- Represented complex eye movement data as directed weighted networks to analyze the visual scanning patterns used by air traffic controllers
  - Evaluated the cognitive workload of air traffic controllers using eye movement and brain activity data
  - Developed a framework to analyze the eye movements of users in near real-time on a simulated air traffic control radar display
- 2017 – Undergraduate Research Assistant  
2018
- Conducted a protocol analysis of interviews with air traffic controllers to identify and classify their conflict mitigation strategies and visual scanning patterns
- 2016 – **Human Memory & Learning Laboratory**, University of Oklahoma  
2017 Undergraduate Research Assistant
- Assisted in collecting data for a study with 642 participants investigating whether the amount of feedback provided while studying improves test performance

## WORK EXPERIENCE

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- Summer **Amazon**  
2022 & User Experience Researcher Intern  
2023
- Built supervised machine learning models utilizing user interaction time-series data to predict user retention
  - Conducted interviews to understand users' trust and privacy concerns regarding generative AI applications that learn from personal data
  - Evaluated website prototypes on computer and cellphone interfaces using Likert scales, task completion times, and error rates
  - Ranked user preferences and unmet needs using MaxDiff surveys to prioritize software development goals

## PUBLICATIONS

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### Journal Articles

- [J1] **Palma Fraga, R.**, Kang, Z., & Crutchfield, J. (2024). Classification framework to identify similar visual scan paths using multiple similarity metrics. *Journal of Eye Movement Research*, 17(3). DOI: <https://doi.org/10.16910/jemr.17.3.4>
- [J2] Naeeri, S. M., Kang, Z., & **Palma Fraga, R.** (2022). Investigation of Pilots' Visual Entropy and Eye Fixations for Simulated Flights Consisted of Multiple Take-Offs and Landings. *Journal of Aviation/Aerospace Education & Research*, 31(2). DOI: <https://doi.org/10.15394/jaaer.2022.1920>
- [J3] **Palma Fraga, R.**, Kang, Z., Crutchfield, J. M., and Mandal, S. (2021). Visual search and conflict mitigation strategies used by expert En Route air traffic controllers. *Aerospace*, 8(7), 170, 1-16. DOI: <https://doi.org/10.3390/aerospace8070170>
- [J4] [Under review] **Palma Fraga, R.** & Kang, Z. (2024). Algorithms to determine accurate eye fixations when expected visual scan path is known vs. unknown. *Journal of Eye Movement Research*
- [J5] [Under review] **Palma Fraga, R.**, Kang, Z., Roberts, Carrie A., & Crutchfield, J. (2024). Identifying accurate visual scan paths of expert air traffic controllers to enhance the training of novice air traffic controllers. *Journal of Aviation/Aerospace Education & Research*
- [J6] [Under review] **Palma Fraga, R.**, Kang, Z. & Crutchfield, J. (2024). Visual search behaviors of expert Tower controllers issuing clear to take off clearances. *International Journal of Aerospace Psychology*

### Conference Papers

- [C1] **Palma Fraga, R.**, Kang, Z., & Axthelm, C. M. (2023). Effect of Machine Learning Cross-validation Algorithms Considering Human Participants and Time-series: Application on Biometric Data Obtained from a Virtual Reality Experiment. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 67(1), (pp. 2162-2167). DOI: <https://doi.org/10.1177/21695067231192258>  
**Received Honorable Mention in the Extended Reality Technical Group's Student Paper competition**
- [C2] Kang, Z., **Palma Fraga, R.**, Izzoteglu, K., Lee, J., Deering, D. D., & Arana, W. X. (2023). Development of a Smart Learning Application in Multi-person Virtual Reality Using Biometric Measures of Neuroimaging, Eye Tracking, and Haptic Interactions. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 67(1), (pp. 2137-2143). DOI: <https://doi.org/10.1177/21695067231196245>
- [C3] Crutchfield, J., Kang, Z., **Palma Fraga, R.**, & Lee, J. (2022). Identification of Expert Tower Controller Visual Scanning Patterns in Support of the Development of Automated Training Tools. In J. Y. C. Chen & G. Fragomeni (Eds.), *Virtual, Augmented, and Mixed Reality: Applications in Education, Aviation and Industry* (pp. 183–195). Springer International Publishing. DOI: [https://doi.org/10.1007/978-3-031-06015-1\\_13](https://doi.org/10.1007/978-3-031-06015-1_13)
- [C4] **Palma Fraga, R.**, Kang, Z., Lee, J., & Crutchfield, J. M. (2021). Real-time eye tracking analysis for training in a dynamic task. In *4th International Conference on Bio-Engineering for Smart Technologies* (BioSMART). DOI: <https://doi.org/10.1109/BioSMART54244.2021.9677680>
- [C5] Crutchfield, J., Kang, Z., **Palma Fraga, R.**, & Mandal, S. (2021). Applying Eye-Tracking Technology to Explore the Visual Scanning Practices of Air Traffic Control Tower Controllers. In *21st International Symposium on Aviation Psychology* (pp. 60-65). DOI: [https://corescholar.libraries.wright.edu/isap\\_2021/11](https://corescholar.libraries.wright.edu/isap_2021/11)
- [C6] Kang, Z., Crutchfield, J., **Palma Fraga, R.**, & Mandal, S. (2021). Spatial-Temporal Cluster Approach to Discover Visual Scanning Behaviors in Virtual Reality. In *21st International Symposium on Aviation Psychology* (pp. 66-71). DOI: [https://corescholar.libraries.wright.edu/isap\\_2021/12](https://corescholar.libraries.wright.edu/isap_2021/12)

- [C7] **Palma Fraga, R.**, Reddy, P., Kang, Z., & Izzetoglu, K. (2020). Multimodal Analysis Using Neuroimaging and Eye Movements to Assess Cognitive Workload. In D. D. Schmorrow & C. M. Fidopiastis (Eds.), *Augmented Cognition. Theoretical and Technological Approaches* (pp. 50–63). Springer International Publishing. DOI: [https://doi.org/10.1007/978-3-030-50353-6\\_4](https://doi.org/10.1007/978-3-030-50353-6_4)

#### **Publications in Edit**

- Palma Fraga, R.** and Kang, Z. (2024). Development of an automated procedure to identify accurate parameters for the I-VT eye fixation detection algorithm. Target journal: *IEEE Access*
- Palma Fraga, R.** and Kang, Z. (2024). Evaluating the accuracy of eye movement detection parameter values on longitudinal eye tracking studies. Target journal: *Journal of Eye Movement Research*

#### **PRESENTATIONS AND POSTERS**

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- [P1] **Palma Fraga, R. (presenter)** & Kang, Z. (2024). Impact of eye fixation classification algorithm thresholds on our ability to accurately interpret the visual scanning patterns of experts: a case study in tower air traffic control. *Human Factors and Ergonomics Society Annual Meeting*, Sept. 9-13, Phoenix, AZ. (Poster exhibition)
- [P2] **Palma Fraga, R. (presenter)** & Kang, Z. (2024). Discovering Eye Movement Metrics to Identify Optimal Gaze Velocity Threshold Values for the I-VT Eye Fixation Detection Algorithm. *Human Factors and Ergonomics Society Annual Meeting*, Sept. 9-13, Phoenix, AZ. (Poster exhibition).
- [P3] **Palma Fraga, R. (presenter)**, Reddy, P., Kang, Z., Izzetoglu, K. (2020). Multimodal analysis using neuroimaging and eye movements to assess cognitive workload: A case study of ATCT local controllers. *Technical Training and Human Performance (TTHP) Meeting*, Federal Aviation Administration Center of Excellence, Virtual Meeting, Nov. 16-17, 2020. (Poster competition)  
**Awarded 2<sup>nd</sup> place in the Student Researcher Poster competition**
- [P4] Kang, Z., Dyer, J. W., West, S. G., **Palma Fraga, R. (presenter)**, Mandal, S., Egwu, U. K., and McClung, S. N. (2020). Characterization of air traffic controllers' visual search patterns and control strategies (extended v2). *Technical Training and Human Performance (TTHP) Meeting*, Federal Aviation Administration Center of Excellence, Virtual Meeting, Nov. 16-17, 2020. (Poster competition)  
**Awarded 3<sup>rd</sup> place in the Student Researcher Poster competition**
- [P5] Kang, Z., Dyer, J. W., West, S. G., **Palma Fraga, R. (presenter)**, Mandal, S., Egwu, U. K., and McClung, S. N. (2019). Characterization of air traffic controllers' visual search patterns and control strategies (extended). *Technical Training and Human Performance (TTHP) Meeting*, Federal Aviation Administration Center of Excellence, Ohio State University, Columbus, OH, Apr. 17, 2019. (Poster competition)  
**Awarded 1<sup>st</sup> place in the Student Researcher Poster competition**
- [P6] Kang, Z., Shehab, R. L., Ding, L., Yaun, H., West, S. G., **Palma Fraga, R. (presenter)**, Plata, M. R., Alhashim, A., Annadi, R. R., Dragoo, M. R., and Yeagle, L. N. (2019). Universal Design for Learning and Multimodal Training (extended). *Technical Training and Human Performance (TTHP) Meeting*, Federal Aviation Administration Center of Excellence, Ohio State University, Columbus, OH, Apr. 17, 2019. (Poster competition)
- [P7] Kang, Z., Dyer, J. W., West, S. G., **Palma Fraga, R. (presenter)**, Mandal, S., Egwu, U. K., and McClung, S. N. (2018). Characterization of air traffic controllers' visual search patterns and control strategies. *Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) Annual Meeting*, Nov. 26-30, Orlando, FL. (Poster exhibition)
- [P8] Kang, Z., Shehab, R. L., Ding, L., Yaun, H., West, S. G., Dragoo, M. R., Yeagle, L. N., **Palma Fraga, R. (presenter)**, and Rippetoe, J. (2018). Adaptive learning pedagogy of Universal Design for Learning (UDL) for multimodal training. *Interservice/Industry Training, Simulation and Education Conference (I/ITSEC) Annual Meeting*, Nov. 26-30, Orlando, FL. (Poster exhibition)

- [P9] Kang, Z., Dyer, J., West, S. G., Mandal, S., **Palma Fraga, R. (presenter)**, McClung, S., and Egwu, U. K. (2017). Characterization of visual scanning patterns and aircraft control strategies for efficient and effective training. *Solutions for Operational Aviation Research (SOAR) Q2 meeting*, Federal Aviation Administration Center of Excellence, Apr. 3-5, Philadelphia, PA. (Poster competition)  
**Awarded 1<sup>st</sup> place in the Student Researcher Poster competition.**
- [P10] Kang, Z., Shehab, R. L., Ding, L., Yaun, H., West, S. G., Dragoo, M. R., Yeagle, L. N., **Palma Fraga, R. (presenter)**, and Rippetoe, J. (2017). Universal Design for Learning and Multimodal Training. *Solutions for Operational Aviation Research (SOAR) Q2 meeting*, Federal Aviation Administration Center of Excellence, Apr. 3-5. Philadelphia, PA. (Poster competition)

## TEACHING EXPERIENCE

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- Fall 2021 & 2023\* **Data-Driven Decision Making II (ISE 4853 & ISE 5853)**  
 Graduate Teaching Assistant, School of Industrial & Systems Engineering  
 Instructor: Dr. Ziho Kang  
 Enrollment (undergraduate and graduate): 56 (Fall 2021) and 43 students (Fall 2023)
- Taught bi-weekly laboratory sessions. Topics included using SAS to conduct parametric and non-parametric analysis, post-hoc comparisons, and build logistic regression models
  - Recorded laboratory lessons uploaded to YouTube
  - Held weekly in-person and virtual office hours
  - Graded midterm and final exams, laboratory reports, course project proposals and final reports
  - Collected student outcome data for ABET reporting
- \* **Awarded Outstanding TA by the ISE student body in 2023**
- Spring 2022\* & 2023\* **Ergonomics in System Design (ISE G4804)**  
 Graduate Teaching Assistant, School of Industrial & Systems Engineering  
 Instructor: Dr. Owen Dodd  
 Enrollment (undergraduate): 57 (Spring 2022) and 38 students (Spring 2023)
- Taught bi-weekly laboratory sessions. Topics included task analysis and cognitive walkthroughs, fault tree analysis, anthropometric measurements, manual material handling, and human-machine system design
  - Turned a laboratory lesson into a competition where students designed ergonomic passenger seats for an aircraft while maximizing the number of seats
  - Held weekly in-person and virtual office hours
  - Graded laboratory reports and end-of-semester poster presentations
- \* **Awarded Outstanding TA by the ISE student body in 2022 and 2023**
- Fall 2019 & 2020 **Systems Analysis Using Simulation (ISE 4663 & ISE 5663)**  
 Graduate Teaching Assistant, School of Industrial & Systems Engineering  
 Instructor: Dr. Ziho Kang  
 Enrollment (undergraduate and graduate): 61 (Fall 2019) and 71 students (Fall 2020)
- Taught bi-weekly laboratory sessions on the use of ARENA to design and analyze systems using simulations
  - Held weekly in-person office hours
  - Graded midterm and final exams, laboratory reports, and course projects
  - Collected student outcome data for ABET reporting

## MENTORING

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### Students

- 2024 **Barrett Ray** – BSc CS student  
Guided Barrett in developing a multi-person virtual reality application using Godot as part of a research project in the Human Factors & Simulation laboratory
- 2023 **Willow Arana** – MSc DSA student (now Analyst at American Airlines)  
Advised Willow in addressing challenges during their DSA final project when training machine learning models using time-series biometric data
- 2022 **Cesar Marquez Rodriguez** – MSc ISE student (now Technology & Risk Consultant at EY)  
Mentored Cesar in conducting a statistical analysis as part of their MS thesis comparing the accuracy of surface flatness measuring tools on aluminum objects. They successfully defended their MS thesis titled: “Comparison of the Measurement Capabilities of CMM and AA-CMM Machines in Flatness Verification”
- 2021 **Junehyung Lee and Jahn timer Dirisina** – MSc ISE students (now PhD ISE students at OU)  
Guided June and Jahn timer in collecting heart rate variability data using smartwatches and self-reported user data for a multi-day study conducted in collaboration with Microsoft

### Classroom Peer-mentor

- 2015 & **Academic Success (UCOL 1002) and Strategies for Success (UCOL 2002)**  
2016 Peer-mentor, University College Gateway program at the University of Oklahoma  
Enrollment (undergraduate): 15 first-semester students in the Academic Success course, and 15 students on academic notice (GPA < 2.0) in the Strategies for Success course
- Connected with students outside of class to discuss effective study habits
  - Conducted tours to introduce students to learning resources on campus
  - Facilitated in-person classroom activities and took class attendance
- Fall **Do You Understand Integrity? (Integrity training seminar)**  
2014 & Peer-mentor, Integrity Council at the University of Oklahoma  
2015, Enrollment (undergraduate): 10 students who committed academic misconduct  
Summer  
2014
  - Met with students weekly to discuss assignments and seminar experience
  - Facilitated in-person classroom activities

## SERVICE

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### Session Chair

- 2020 Human Factors & Ergonomics Society Annual Meeting: Training Session

### Conference Reviewer

- 2024 Human Factors & Ergonomics Society Annual Meeting  
2023 IEEE International Conference on Systems, Man, and Cybernetics  
2021 IISE Annual Conference & Expo: HFE Track

### Invited Presentations

- 2024 **What is UX Research?** OU HFES chapter meeting
- Presented about the role UX Researchers play in addressing the needs of users
- 2023 **Internship opportunities for ISE students**, OU INFORMS / OU IISE chapters meeting
- Participated in a panel discussing internship opportunities for ISE undergraduate and graduate students

### Volunteering

- 2024 **Industrial & Systems Engineering Day**, University of Oklahoma
- Presented to high school students about the role Industrial and Systems Engineers play in improving systems

- Led an interactive session with high school students showcasing applications of virtual reality in human factors research
- 2024 & 2021 **Student Poster Presentations**, School of Industrial & Systems Engineering,
- Guest judge for undergraduate ISE student poster presentations in the Ergonomics in Systems Design course

## LEADERSHIP

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- 2024 **Human Factors & Ergonomics Society**, University of Oklahoma Student Chapter
- 2024 Postdoctoral member
- Leading the initiative to submit a competitive application package for *Bronze level* Outstanding Student Chapter Award
- 2022 Chapter president
- Organized guest speakers from industry to present at monthly meetings
  - Coordinated joint events with other student organizations on campus
  - Led the chapter's participation in the annual campus-wide day of volunteering
- 2021 Chapter vice-president
- Hosted guest speakers from other universities and federal agencies to present at monthly meetings
  - Organized virtual meetings with student chapters at other universities
- 2023 **UX Researcher Intern Community**, Amazon
- Organizer
- Hosted bi-weekly meetings for interns to connect and share research insights
  - Helped other interns prepare for their final presentations
- 2020 **Graduate Council of Excellence**, Gallogly College of Engineering
- President
- Led a team of graduate students to identify opportunities to support underrepresented graduate student minorities in the College of Engineering
  - Proposed potential initiatives to the Dean of the College of Engineering

## PROFESSIONAL AFFILIATIONS

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- 2024 **Human Factors & Ergonomics Society**
- Early-Career Associate
- Member of the Aerospace Systems Technical Group
- Member of the Extended Reality Technical Group