Gandhimathi (Mathi) Padmanaban

University of Michigan-Dearborn
Industrial and Manufacturing Systems Engineering
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GitHub - LinkedIn - Personal Website

Research interests

Development of machine learning and human factors methodologies for transportation safety.

Design and implementation of data-driven behavioral prediction models.

Application of scientific machine learning in computational behavioral modeling and prediction.

Development of human-centered design frameworks for intelligent autonomous systems.

Methods: Traditional and scientific machine learning, deep learning, computer vision, behavioral data analytics, scientific computing, computational modeling, applied statistics, human factors, human-centered computing, human-computer interaction

Applications: Driver behavior analysis & modeling, transportation safety, decision-making in complex systems, human computational modeling and development of intelligent systems

Education

Ph.D., **Industrial and Systems Engineering**, *Expected: May 2025*
University of Michigan-Rackham Graduate School (University of Michigan-Dearborn), USA
Dissertation: "Enhancing Transportation Safety: Research on Driver Behaviors Using Machine Learning and Data Analytics"
Advisor: Dr. Fred Feng

M.S., **Human Centered Design and Engineering**, 2021
University of Michigan-Dearborn, USA
Thesis: "Computational Human Performance Modeling using Queuing Network in an Open-Source Platform"
Advisor: Dr. Fred Feng

B.E., **Computer Science and Engineering**, 2013
Anna University, India
Thesis: "Automated Detection of Modifications in Software Requirement Traceability Links"
Advisor: Prof. Ramachandran Alagarsamy

Certifications
Rackham Professional Development Diversity, Equity, and Inclusion Certificate, *Apr 2025*
University of Michigan-Rackham Graduate School, USA

Post Graduate Diploma in Computer Applications, 2011
Computer Software Research Institution, India

Publications

Refereed Conference Proceedings

1. Gandhimathi Padmanaban, Nathaniel P. Jachim, Hala Shandi, Lilit Avetisyan, Garrett Smith, Howrah Hammoud, and Feng Zhou. "An Autonomous Driving System - Dedicated Vehicle for People with ASD and their Caregivers". *AutomotiveUI '21 Adjunct: 13th International Conference on Automotive User Interfaces and Interactive Vehicular Applications*. Association for Computing Machinery, 2021, pp. 142–147. doi: https://doi.org/10.1145/3473682.3480282.

Papers Under Review

1. Gandhimathi Padmanaban, Fred Feng, Edward Dai, Ankit Saini, Guopeng Hu, and Yanan Zhao. "A Machine Learning Approach to Identify Aggressive Driving Patterns based on Vehicle Longitudinal Jerk" (2024).
2. Gandhimathi Padmanaban, Fred Feng, Edward Dai, Ankit Saini, Guopeng Hu, and Yanan Zhao. "A Comparative Analysis of Acceleration and Deceleration Profiles for Aggressive Driving Styles and Fuel Economy Test Cycles" (2024).

Working Papers

1. Rayane Moustafa, Fred Feng, and Gandhimathi Padmanaban. "Using High-Resolution Lidar to Study Cycling Safety - Automatic Distance Estimation of Passing Vehicles via Machine Learning" (2024).
2. Gandhimathi Padmanaban and Yi Lu Murphey. "Intelligent Vehicle Lane Change System using Temporal Convolutional Networks: A Foundational Approach with Open-source Implementation". 2024.
3. Gandhimathi Padmanaban, Hala Shandi, Garrett, and Feng Zhou. "Mixed Methods Study on Data Privacy in Messenger Applications: A Comparison between WhatsApp and Signal". 2024.

Open-source Projects

- DigitwiML - Open-Source Project to model Digital Twin of C.elegans in Space (Software repository)

Research Experience

Graduate Student Research Assistant, Jan 2022 - Present

University of Michigan-Dearborn, USA

Utilizing computer vision and machine learning models to enhance transportation safety through analysis of driver-bicyclist interactions, particularly during overtaking maneuvers directly contributing to understanding and improving vulnerable road user safety.

Engineered custom machine learning frameworks for predicting driver behaviors, achieving significant improvements in predictive accuracy while establishing connections between driving patterns and fuel economy.

Leading multiple research initiatives resulting in high-impact peer-reviewed publications on driver behavior analysis and transportation safety.

Research / Project Assistant, Oct 2011 – Feb 2013

Anna University, India

Led the development of multiple university management systems, including exam cell software and leave management systems.

Directed user research, prototyping, design, development, and deployment phases, resulting in highly efficient and user-friendly systems.

Teaching Experience

Guest lecturer

- IMSE 501 Human Factors & Ergonomics, UM-Dearborn, F2021

Workshops & tutorials

- "Software Carpentry Workshop - CZI Foundation Accelerate Precision Health", The Carpentries, Nov 2024 (Instructor)
- "UM Software Carpentry Workshop - Python", The Carpentries at the University of Michigan, Mar 2024 (Instructor)
- "Workshop on Machine learning and talk on experience in NASA SpaceApps 2023", [WOC] Code - University of Michigan, Ann Arbor, Feb 2024
- "UM Software Carpentry Workshop - Python pilot", The Carpentries at the University of Michigan, Dec 2023 (Helper)
- "[WOC] Code Summer 2023 Boot Camp", [WOC] Code - University of Michigan, Ann Arbor, May 2023 (workshop content), (schedule)

Scholarships and Awards

- Irma M. Wyman Scholar, F2020, *Center for the Education of Women (CEW+), University of Michigan*
- Non-Resident Graduate Student Scholar , S2020, F2020, W2021, *University of Michigan-Dearborn*

- Global Finalist in NASA Space Apps Challenge, 2023
- Nominated for India's premier JS conference, JSFoo, by Has Geek, *Deloitte's 2017 Hackathon*
- Second place in Hackathon, 2015, *Syncfusion, India*

Professional Experience

Deloitte (Offices of the US) – Bangalore, India

Development Lead/Consultant, *Jan 2017 – May 2018*

Designed and developed UI modules for Coca-Cola's beverage dispenser machines using React.

Created an interactive online gaming platform for a UK-based company, enhancing user engagement.

Contributed to R&D projects for VR gaming and data science, mentoring development teams and enhancing application management strategies.

Cognizant – Chennai, India

Programmer Analyst, *Dec 2015 – Dec 2016*

Played a key role in designing and developing interactive e-learning applications for Pearson Education, supporting both web and mobile platforms.

Facilitated design discussions, requirement gathering, and prototyping, ensuring comprehensive application development and deployment.

Syncfusion – Chennai, India

Software Engineer – Level II, *Aug 2013 – Dec 2015*

Developed and tested web applications for a US medical billing organization using .NET MVC and web application frameworks.

Created custom tools for event space reservation and internal company web portals, enhancing operational efficiency.

Skills

Expertise

- Applied Machine Learning, Deep Learning, Scientific Computing, Data Analytics
- Human-Centered Computing, Human Factors Engineering
- Human computational modeling, Complex and Intelligent Systems

Data Analysis Skills

- Statistical Analysis: Python, R for large-scale data processing

- Machine Learning: TensorFlow, PyTorch for behavioral modeling
- Scientific Computing: MATLAB, ROS for experimental analysis
- Data Visualization: Advanced techniques for complex data presentation

Research Methods

- Experimental design
- Human subject studies
- Behavioral data analysis

More Programming

- C#, SQL, CPLEX
- HTML/CSS/JavaScript
- Version Control (Git), Jupyter Notebooks, LaTeX

Research & Scholarly Skills

- Experimental Design, Data Collection, Statistical Analysis, Data Visualization
- Qualitative and Quantitative Research Methods, User Study Design and Execution
- Literature Review, Scientific Writing and Publication, Proposal Development
- Academic Presentation and Public Speaking, Mentoring and Teaching, Peer Review Process, Workshop Organization and Facilitation, and Interdisciplinary Collaboration

Professional Skills

- Industry-Academia Collaboration, Design Thinking Facilitation, Technical Documentation
- Project Management, Team Leadership, Workshop Organization and Execution

Professional services

Honorary Societies

- Upsilon Pi Epsilon (UPE) - *President of Michigan Beta Chapter*

Professional membership

- Human Factors & Ergonomic Society (HFES) - UM-Dearborn Student Chapter
- Association for Computing Machinery (ACM) - UM-Dearborn Student Chapter
- Society of Women Engineers (SWE) - UM-Dearborn Student Chapter
- Doctoral Student Association (DSA) - UM-Dearborn

Reviewer

- International ACM Conference on Automotive User Interfaces 2024 (AutoUI)
- 2024 Conference on Human Factors in Computing Systems
- 2024 Americas Conference on Information Systems
- International ACM Conversational User Interfaces conference 2024
- ACM International Conference on Interactive Media Experiences (IMX)
- ACM Conference on Designing Interactive Systems (DIS) 2024

Volunteer service

- Organizer, CECS Career Panel, Nov 2024
- Instructor/Mentor, WocCode - University of Michigan, May 2023 - Present
- Judge, NASA SpaceApps Challenge - Pittsburgh, 2024
- Judge, MHacks, 2024
- Student Volunteer, U-M Annual Data Science & AI Summit, 2023
- Panelist, CECS Open Lab Day, F2023
- Website Design & Developer, BSE Human-Centered Engineering Design Planning Team, 2021
- Tutor, Middle and high school students in mathematics, physics, chemistry, and computer science
- Organizer, 2-Day International Conference for Software Professionals, ASPRO'12, UCEP - Anna University, India

Last updated: December 1, 2024