Kaushik Alaguvadivel Ramya

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Research Interests

Explainable Artificial Intelligence (XAI), Fairness in Machine Learning, Bias Mitigation in AI Systems, Affective Computing, Deep Learning for Physiological Signal Processing, Human Activity Recognition, Computer Vision for Defense Applications, Responsible AI, Data Visualization

Education

New York University | *Master of Science in Computer Science* | GPA: 3.33/4.0 **May 2027**

- *Relevant Coursework:* Algorithms, Big Data, Information Visualization, Machine Learning, Data Science

Thiagarajar College of Engineering | *Bachelor of Technology in Information Technology* | GPA: 3.7/4.0 **May 2025**

- *Relevant Coursework:* Machine Learning, Artificial Intelligence, Data Mining, Data Analytics, Big Data Tools and Visualization, Information Visualization, Algorithm Design, Fuzzy Sets and Clustering, Information Retrieval, Probability and Statistics
- Teaching Assistant for Cloud Computing and Distributed Systems, supporting 200+ students

Publications

Enhanced Drone Classification using Transfer Learning and Optimized RF-Spectrogram **2025**

- *Kaushik A R, U. Annaamalai, and S. Padmavathi*
- *Presented at IEEE Conference, July 2025*
- Developed novel processing pipeline converting RF signals into optimized spectrogram images for drone classification. Analyzed nine CNN architectures and proposed Cross Stage Partial Network achieving 5× reduction in computational complexity with 20× faster inference and 5% accuracy improvement for real-time UAV threat detection.

Enhancing Human Activity Recognition: An Exploration of Machine Learning Models and Explainable AI Approaches for Feature Contribution Analysis **2024**

- *Kaushik A R, K. S. Gurucharan, and S. Padmavathi*
- *2023 International Conference on Energy, Materials and Communication Engineering (ICEMCE), December 14-15, 2023, Published February 21, 2024 — DOI: 10.1109/ICEMCE57940.2023.10434184*
- Applied machine learning models to Activity of Daily Living (ADL) dataset from 30 participants performing six activities using smartphone sensors. Employed LIME and SHAP with game-theoretic frameworks to analyze feature contributions. SHAP-based analysis of 500+ sensor attributes reduced feature redundancy by 30% while maintaining 95%+ classification accuracy.

Performance Analysis of Regression Models in Solar PV Forecasting **2023**

- *Kaushik A R, S. Padmavathi, K. S. Gurucharan, and S. Charles Raja*
- *2023 3rd International conference on Artificial Intelligence and Signal Processing (AISP), March 18-20, 2023, Published June 1, 2023*
- Developed short-term solar photovoltaic power forecasting using Linear Regression, Random Forest Regression, and Decision Tree Regression. Analyzed solar energy yield data including solar irradiance, temperature, humidity, and wind speed. Ensemble approach achieved 99% accuracy for day-ahead PV output prediction.

Ongoing Research

Towards Fair Representation in Affect Recognition: A Performance-optimized GRU Approach

Submitted to IEEE Transactions on Affective Computing | Explainable AI, Fairness in ML, Bias Mitigation

- Investigating bias mitigation in emotion classification using heterogeneous biosignals and demographic features
- Developed GRU-based architecture outperforming LSTM and Transformer models in computational efficiency
- Evaluated three fairness strategies (DIR, Reweighing, LFR) using eleven metrics including SPD, EOD, and Theil Index
- Learning Fair Representations achieved 30% bias reduction while maintaining 95% accuracy

Transparent Affect Recognition through Explainable AI Approaches

In Preparation for Submission | Explainable AI, Affective Computing, Physiological Signal Analysis

- Developed affect recognition using SHAP and LIME to interpret emotions from multimodal physiological signals
- Identified GSR and RSP as primary arousal indicators, and valence-specific EMG patterns in facial muscles
- SHAP analysis revealed ECG and GSR account for 60%+ of arousal classification decisions

Lightweight CNN for UAV Threat Detection **Sept 2022 – May 2025**

Collaboration with Defence Institute of Advanced Technology (DIAT), Pune | Computer Vision, Defense Applications

- Partnered with DIAT to develop lightweight CNN architectures for real-time UAV classification
- Designed Cross Stage Partial Network achieving 5× reduced complexity and 20× faster inference
- Compared nine CNN architectures and achieved 5% accuracy improvement over SOTA models

Research Experience

Machine Learning Research Assistant **Sept 2022 – May 2025**

Thiagarajar College of Engineering | Advisor: Dr. S. Padmavathi (spmcse@tce.edu) | Explainable AI, Deep Learning, Fairness in ML

- First author on 3 published IEEE conference papers and 2 manuscripts under review in AI and Explainable Machine Learning, garnering 10+ citations on Google Scholar
- Collaborated with Defence Institute of Advanced Technology (DIAT) on computer vision and deep learning solutions for UAV classification in defense applications, resulting in deployed lightweight CNN models
- Conducted research in Explainable AI (XAI) applying SHAP (SHapley Additive exPlanations) and LIME (Local Interpretable Model-agnostic Explanations) to interpret deep learning models for emotion recognition and activity classification
- Investigated fairness-aware machine learning techniques including Learning Fair Representations (LFR), Disparate Impact Remover (DIR), and Reweighing algorithms to mitigate demographic bias in affective computing systems
- Developed resource-efficient GRU and LSTM architectures for time-series classification of physiological signals (ECG, EMG, GSR, respiration, BVP) achieving 95% accuracy while reducing computational requirements
- Applied advanced feature engineering and dimensionality reduction techniques to analyze high-dimensional wearable sensor data (500+ features), identifying key physiological markers for emotion and activity recognition
- Presented research findings at international IEEE conferences and contributed to academic discourse in affective computing, explainable AI, and responsible machine learning communities

Teaching Assistant **Aug 2023 – May 2025**

Thiagarajar College of Engineering | Department of Information Technology | Cloud Computing and Distributed Systems

- Supported 200+ undergraduate students across multiple semesters in Cloud Computing and Distributed Systems courses
- Conducted lab sessions, graded assignments and exams, and provided mentorship on cloud technologies including AWS, Docker, and distributed architectures
- Assisted in curriculum development and created supplementary learning materials for complex topics in cloud infrastructure and distributed computing

Technical Skills

- **Programming Languages:** Python, MATLAB, R, C, C++, Java, SQL
- **AI/ML Frameworks:** TensorFlow, PyTorch, Keras, Scikit-learn, XGBoost, LightGBM, SHAP, LIME
- **Deep Learning:** CNNs, RNNs, LSTMs, GRUs, Transformers, Transfer Learning, Model Optimization
- **Data Science:** Pandas, NumPy, SciPy, Matplotlib, Seaborn, Plotly, Statistical Analysis
- **Specialized Areas:** Explainable AI (XAI), Fairness in ML, Bias Mitigation, Signal Processing, Computer Vision
- **Cloud & Tools:** AWS (Certified AI Practitioner, ML Engineer), Google Cloud, Jupyter, Git, Docker
- **Research Tools:** LaTeX, Overleaf, Zotero, Google Scholar, Research Design, Academic Writing

Certifications

AWS Certified Machine Learning Engineer – Associate

AWS Certified AI Practitioner

Honors & Awards

Selected for Demo-Day presentation for Energy Consumption Forecasting project at Thiagarajar College of Engineering

Teaching Assistant recognition for outstanding contributions to Cloud Computing and Distributed Systems courses