MEHUL MITTAL

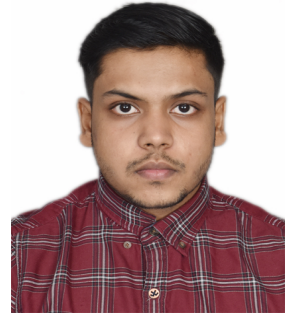AI Researcher | Machine Learning & Neural Signal Processing

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Portfolio: mehulai27.github.io/portfolio/

Fürth, Bavaria, Germany (Open to relocation)

Research Interests

I've worked on machine learning problems across healthcare, natural language processing, and computer vision, always focused on the practical challenge of getting models to actually generalize. My recent research tackled questions like why a model that works perfectly on one dataset completely fails on another, and what we can do about it. I believe good research comes from rigorous experiments, diving deep into literature, and systematically testing what works (and honestly reporting what doesn't). I've built everything from deep learning systems for biosignals to LLM applications, taking ideas from initial experiments all the way to production. I'm open to working on interesting research problems across different domains and applications.

Education

M.Sc. in Artificial Intelligence

Friedrich Alexander University Erlangen-Nuremberg (FAU) | Apr 2023 – Dec 2025

GPA: Excellent | Thesis Grade: Expected Excellent

Awarded FAU Graduation Scholarship (December 2025) for outstanding academic achievement and research excellence

Thesis: Transfer Learning for Biomedical Signal Processing

Supervisor: *Dr. Emmanuelle Salin, Arijana Bohr M.Sc., Prof. Dr. Bjoern Eskofier*, Machine Learning and Data Analytics Lab

Research Focus: Systematically evaluated domain adaptation and transfer learning approaches (contrastive learning, adversarial training) for cross-subject EEG decoding across four cognitive tasks. Demonstrated fundamental limitations of current deep learning methods in handling subject-specific variance, providing insights for future research directions in neural signal processing.

Relevant Coursework: Deep Learning, Machine Learning, Pattern Recognition, Statistical Machine Learning, Biomedical Signal Processing, Reinforcement Learning, Computer Vision, Natural Language Processing, Probabilistic Graphical Models

B.Tech in Information Technology

Guru Gobind Singh Indraprastha University | Aug 2018 – Jun 2022

First Division | Dean's List Recognition

Final Year Project: Team Lead for Distributed Machine Learning System Implementation

Research Experience

AI Research Engineer (Working Student)

Robert Bosch GmbH | Mar 2025 – Sep 2025 | Abstatt, Germany

- Developed LLM-based solution using prompt engineering and fine-tuning techniques to automatically standardize technical engineering diagrams, exploring how language models can understand and generate structured visual representations
- Conducted research on optimal prompting strategies and model selection for domain-specific technical tasks, systematically evaluating different architectures and training approaches
- Implemented and deployed the research prototype into production systems, bridging the gap between experimental research and practical engineering applications

- Built reproducible research infrastructure with automated experiment tracking enabling systematic evaluation of different model configurations and training strategies

Research Assistant

Machine Learning and Data Analytics Lab, FAU | Mar 2024 – Apr 2025 | Erlangen, Germany

Supervisor: Hamid Moradi, M. Sc.

- Conducted research on machine learning methods for detecting Freeze of Gait (FoG) episodes in Parkinson's Disease patients using wearable inertial measurement units, contributing to ongoing clinical studies
- Developed deep learning models for real-time classification of movement patterns from multimodal sensor data, exploring temporal convolutional networks and recurrent architectures for sequential prediction
- Applied signal processing techniques to extract meaningful features from accelerometer and gyroscope data, investigating the trade-offs between hand-crafted features and learned representations
- Investigated patient-specific versus population-level models, analyzing how inter-patient variability affects model performance and exploring personalization strategies
- Co-authored peer-reviewed conference paper analyzing subjective motor activity perception in Parkinson's Disease, presented at IEEE-EMBS BHI 2025
- Collaborated with clinicians and neuroscientists to ensure research relevance and translational potential for real-world clinical applications

Lead Machine Learning Engineer

Concentrix | Oct 2021 – Feb 2023 | Gurgaon, India

- Led team developing predictive models for workforce optimization, exploring time-series forecasting and optimization techniques at scale
- Researched and implemented ensemble learning approaches combining multiple model architectures to improve prediction robustness
- Built end-to-end machine learning pipelines from data collection through model deployment, establishing best practices for production ML systems
- Mentored junior researchers on experimental design, model evaluation, and scientific methodology in applied ML contexts

Machine Learning Research Intern

Mirrag AI | Sep 2021 – Nov 2021 | Mumbai, India

- Explored machine learning approaches for startup product development, gaining early experience in rapid prototyping and experimental iteration
- Implemented classification and clustering algorithms for customer analytics, learning to balance model sophistication with practical constraints
- Established reproducible research workflows with version control and documentation practices

Publications

[1] Slim, S., Küderle, A., Moradi, H., **Mittal, M.**, Salin, E., Winkler, J., & Eskofier, B. (2025). *Investigating Subjective Motor Activity Perception and Gait in Parkinson's Disease.* IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI 2025).

Master's Thesis

Transfer Learning for Biomedical Signal Processing

Machine Learning and Data Analytics Lab, FAU | May 2024 – Nov 2025

Supervisor: Dr. Emmanuelle Salin, Arijana Bohr M.Sc., Prof. Dr. Bjoern Eskofier

Research Overview:

- Investigated why deep learning models trained on one person's brain signals fail catastrophically when applied to another person, despite solving the same cognitive task
- Systematically evaluated whether domain adaptation and transfer learning techniques could enable cross-subject generalization in EEG-based brain-computer interfaces
- Tested multiple neural architectures and training strategies across four different cognitive tasks to understand what factors influence transferability

What I Found:
- Current domain adaptation methods completely fail for this problem. Models trained on other subjects perform no better than random chance, even when everything is implemented correctly
- The models appear to learn idiosyncratic patterns specific to each individual rather than task-relevant features, suggesting fundamental limitations in how we approach this problem
- These results are scientifically valuable, they tell us that we need fundamentally different approaches, not just better hyperparameters

Technical Approach:
- Built robust experimental pipeline processing over 1 million EEG samples with careful quality control and preprocessing
- Implemented multiple state-of-the-art architectures and trained hundreds of models with systematic ablation studies to ensure findings weren't artifacts of implementation choices
- Used proper research infrastructure (MLflow for tracking, DVC for versioning) to ensure reproducibility and enable future researchers to build on this work

Additional Research Projects

Healthcare Analytics with Large Language Models

Academic Capstone Project | Oct 2024 – Apr 2025

- Investigated applications of large language models for medical text processing and clinical decision support systems
- Developed retrieval-augmented generation (RAG) architecture integrating medical knowledge bases with LLMs for context-aware query responses
- Explored prompt engineering strategies and few-shot learning approaches for domain-specific language model adaptation
- Analyzed model reliability, hallucination detection, and safety considerations for deploying LLMs in healthcare settings

Technical Skills

Programming & Scientific Computing: Python (Expert: NumPy, Pandas, SciPy, Scikit-learn), R, MATLAB, Julia (Basic), C++ (Intermediate), Git/GitHub, LaTeX

Deep Learning Frameworks: PyTorch, TensorFlow, Keras, PyTorch Lightning, Hugging Face Transformers, JAX (Intermediate)

Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Transfer Learning, Domain Adaptation, Meta-Learning, Self-Supervised Learning, Contrastive Learning, Few-Shot Learning

Neural Network Architectures: CNNs, RNNs, LSTMs, GRUs, Transformers, Attention Mechanisms, Graph Neural Networks, Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs)

Signal Processing & Neuroscience: EEG Signal Processing, Time-Series Analysis, Wavelet Transforms, Spectral Analysis, Feature Extraction, Biosignal Processing, Brain-Computer Interfaces (BCI)

Statistical Methods: Hypothesis Testing, Bayesian Inference, Causal Inference, Experimental Design, Statistical Modeling, Multivariate Analysis, Time-Series Forecasting

Research Tools: MLflow, Weights & Biases, DVC, Jupyter Notebooks, Conda, Docker, Slurm (HPC), Ray Tune, Optuna (Hyperparameter Optimization)

Data Visualization: Matplotlib, Seaborn, Plotly, TensorBoard, Scientific Figure Preparation for Publications

Cloud & HPC: AWS, Azure, Google Cloud Platform, High-Performance Computing Clusters, Distributed Training, GPU Computing (CUDA)

Teaching & Mentoring Experience

- Mentored junior researchers and students on machine learning methodologies, experimental design, and scientific writing
- Led team of 5 engineers in previous industry roles, teaching ML best practices and research methodologies
- Delivered technical presentations at lab meetings on deep learning techniques and research progress

Academic Achievements & Awards

- **FAU Graduation Scholarship (December 2025) for outstanding academic performance and research excellence**
- Dean's List Recognition during undergraduate studies for academic achievement
- Published author in IEEE-EMBS conference proceedings

Professional Skills

- Scientific Writing & Communication: Experienced in writing research papers, technical reports, and grant proposals. Strong presentation skills for academic and industry audiences.
- Interdisciplinary Collaboration: Proven track record working with researchers from diverse backgrounds including neuroscience, medicine, engineering, and computer science.
- Project Management: Experience leading research projects from conception through completion, managing timelines, and delivering results under deadline pressure.
- Critical Thinking & Problem Solving: Strong analytical skills with ability to identify research gaps, formulate hypotheses, and design rigorous experiments.

Languages

English (Fluent - Academic & Professional) | German (Elementary - A2) | Hindi (Native)

References

Available upon request