

Girish G Hegde

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Research Statement

Aspiring researcher in machine learning and data science with a strong theoretical and implementation-oriented foundation. My academic interests lie in deep learning architectures, generative modeling, and computational approaches to structured reasoning. I am particularly interested in principled models that integrate representation learning, attention mechanisms, and algorithmic structure for scientific and societal applications.

Education

Indian Institute of Science Education and Research (IISER), Thiruvananthapuram

2022–Present

Integrated BS–MS in Data Science

Relevant Coursework: Machine Learning, Deep Learning, Artificial Intelligence, Scientific Computing, Algorithms, Operating Systems

CGPA: 7.5 / 10.0

Seshadripuram Composite PU College, Bengaluru

2018–2020

Science Stream (Physics, Chemistry, Mathematics, Biology)

Aggregate: 86%

BP Indian Public School, Bengaluru

2008–2018

Aggregate: 81%

Research Experience

Frequency Aware Deep Learning for Facial Deepfake Detection

2024–Present

Supervisor: Dr. Alwin Poulose, IISER Thiruvananthapuram

Investigated frequency-domain representations for robust deepfake detection, focusing on GAN- and diffusion-generated facial images. Explored Fourier- and Discrete Cosine Transform-based feature extraction integrated with convolutional neural networks and Vision Transformers. Analyzed cross-domain generalization and sensitivity to spectral artifacts introduced by generative models.

Other Research Projects

Generative Image Modeling using Variational Autoencoders and PixelCNNs

Conducted research on probabilistic generative models for image synthesis, with emphasis on latent space expressivity, reconstruction fidelity, and architectural efficiency. Explored attention-enhanced decoding strategies for improved sample quality under compact representations.

Neural Network Architectures and Sequence Models from First Principles

Implemented feedforward networks, recurrent neural networks, and LSTM architectures entirely from scratch, including explicit derivations of backpropagation and gradient-based optimization.

Studied convergence behavior, temporal dependency modeling, and optimization failure modes in controlled experimental settings.

Transformer Models in JAX with Transfer Learning

Designed and implemented Transformer architectures using JAX, incorporating multi-head self-attention, positional encodings, and efficient training pipelines. Performed transfer learning on domain-specific literary corpora to analyze representational drift and stylistic generalization.

Neural Machine Translation with Custom Transformers

Developed sequence-to-sequence Transformer models for English–French and English–Kannada translation. Investigated tokenization strategies, positional representations, and training stability in multilingual learning regimes.

Symbolic–Neural Legal Reasoning Framework (Lexi Lawyers)

Constructed a hybrid reasoning system encoding Indian Penal Code statutes into structured symbolic representations using YAML and semantic graphs. Implemented a forward-chaining inference engine with an interactive interface for structured legal query analysis.

Temporal Modeling of Financial Time Series using LSTM and GRU Networks

Developed recurrent architectures for modeling sequential financial data streams. Conducted exploratory backtesting to analyze temporal dependencies, predictive uncertainty, and regime sensitivity in market signals.

Neural Reasoning and Entity Interaction with Attention Mechanisms

Built an experimental reasoning agent combining pretrained embeddings, syntactic parsing, and MLP-based attention to infer relational structure from natural language. Visualized entity interactions using graph-based representations to study interpretability and emergent reasoning behavior.

Parallel Crowd Simulation and Swarm Dynamics

Implemented a C-based parallel simulator to model crowd and swarm movement in constrained environments, with Python-based visualization of density heatmaps, emergent flow patterns, and anomaly detection.

Media Bias Detection using Classical and Deep NLP Models

Designed text classification pipelines employing TF-IDF, CNNs, and BERT-based encoders to detect ideological bias in news media. Applied interpretability techniques to identify salient linguistic features influencing model predictions.

Technical Proficiency

Programming Languages: Python, R, Julia, C, C++

Machine Learning Frameworks: PyTorch, TensorFlow, Keras

Scientific Tools: Git, Jupyter, LaTeX, VS Code

Core Expertise: Deep Learning, Generative Modeling, Attention Mechanisms, Reinforcement Learning, Scientific Computing, Data Visualization

Academic Service and Leadership

- Student Coordinator, Placement Cell — IISER Thiruvananthapuram (2023–2026)
- Member, Events and Content Team — CSIT Club, IISER Thiruvananthapuram (2022–Present)
- Health and Hygiene Representative — Student Mess Council (2022–2023)

Research and Laboratory Skills

Scientific and technical writing, experimental design and evaluation of machine learning models, visualization of high-dimensional data, basic cell culture techniques, collaborative research

Languages

English (Fluent), Kannada (Fluent), Hindi (Intermediate)

Extracurricular Interests

Table tennis, trekking, cycling, endurance running, outdoor exploration