

Gautham Krishna Gudur

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RESEARCH & INDUSTRY EXPERIENCE

Data Scientist III

ERICSSON R&D - GLOBAL AI ACCELERATOR (GAIA)

Feb 2019 – Ongoing Chennai, India

- Incorporating Machine Learning for Network Intelligence in telecom.
- Telco:** Contributed to 3GPP standardization multi-vendor model sharing and *Federated Learning* in 5G, and AI-Native capabilities. Improved *user mobility prediction (UPF-Reselection)* in *Network Data Analytics Function (NWDAF)* using Bayesian Contextual Bandits robust to concept drift.
- Successfully delivered **iSite (Intelligent Site Acceptance)** – a set of tasks for *object detection* of physical infrastructure failures at cell-sites, thereby replacing field technicians; handled detection of blurred images.
- Created **E-LangHub (Ericsson NLP Hub)** with telco-rich data, state-of-the-art models, services. Improved capabilities of **AIB (Automated Intelligent Knowledge Base)** from customer symptoms using *transformer models* and *active learning*; worked on telco-specific *language translation*.
- Created **E-ADF [Ericsson Blog]** – a framework for end-to-end *unsupervised anomaly detection*, along with human-augmented approach recommendation and dynamic threshold optimization. Worked on anomaly detection of IP Multimedia Subsystem (IMS) metrics at scale.

Independent Research

Dec 2018 – Ongoing Chennai, India

- Enabling *calibration* to *aid in sample prioritization* in deep neural networks, thereby accelerating training.
- Currently working on **federated continual learning** on the edge to alleviate *catastrophic forgetting* for audio sensing and HAR tasks.
- Developed a **zero-shot federated learning** framework to handle *new classes with heterogeneous labels and models*.
- Worked on **deep Bayesian active learning** for on-device mobile & audio sensing, and video frame labeling.

Machine Learning Engineer

SMARTCARDIA (EPFL)

May 2018 – Nov 2018 Chennai, India (Remote)

- Developed *gradient-boosted ensembles* and *LSTM models* for regression, classification tasks to provide unique insights into patients' health.
- Engineered features from imbalanced time-series clinical data with **biomarkers** like sleep apnea, troponin, haemoglobin, blood pressure.

Research & Teaching Assistant

SOLARILLION FOUNDATION

Feb 2016 – Jun 2018 Chennai, India

- Led a team of four to develop **HARNet** – a set of deep learning ensemble models for HAR with heterogeneities on resource-constrained devices capable of incremental model updation.
- Led a team of five to design a user-independent **Dynamic Gesture Recognition** system with machine learning approaches by extracting domain-specific features on a low-cost *Raspberry Pi Zero* (\$5).

RESEARCH INTERESTS

Deep Learning Resource-Efficient ML
Limited Supervision Ubiquitous Computing
Federated Learning Active Learning
Bayesian DL Continual Learning
Mobile/Audio Sensing Activity Recognition
Anomaly Detection Telecom

EDUCATION

B.Tech in Information Technology

Anna University [SSN College of Engineering]

Grad. Apr 2017 Chennai, India

Mentors: Prof. Srinivasan R and Bhalaji N.
Thesis: **Intelligent Bus Stop Recognition.**

Coursework

Programming & Data Structures: I & II
Design & Analysis of Algorithms
Artificial Intelligence Signal Processing
Data Analytics Data Mining

HSC (Class XII)

DAV Higher Secondary School, Gill Nagar

Grad. May 2013 Chennai, India

SUMMER SCHOOLS

5th Summer School on Artificial Intelligence (2021)

Aug 2021 IIIT Hyderabad (Virtual)

Computer Vision and Machine Learning.

Eastern European Machine Learning Summer School (EEML 2020 & 2021)

Jul 2020 & 2021 Eastern Europe (Virtual)

Deep Learning and Reinforcement Learning.
Presented *ActiveHARNet* and *Zero-shot federated learning with new classes*.

Oxford Machine Learning Summer School (OxML 2020)

Aug 2020 Oxford, UK (Virtual)

Deep Learning and Healthcare.

- Deployed a **Movie Occupancy Prediction** engine by engineering adaptive behavioral features of the crowd using tree-based ensemble models and branched LSTMs for a *top 3 Indian movie multiplex chain*.
- *Mentored students* to help them develop problem-solving approaches in embedded programming for their assignments and research project.

Undergraduate Student Researcher

SSN COLLEGE OF ENGINEERING

Feb 2015 – Mar 2017

Chennai, India

- Developed a vision-based **Intelligent Bus Stop Recognition System** using CNNs. Used data augmentation and active learning strategies to handle scalability and adaptability to dynamic Indian environments.
- Led a team to work on a funded HCI research project – *Neurocinematics*, to classify real-time cognitive responses of film viewers from EEG.
- Worked on choosing the best-suited mote for two IoT scenarios, by analyzing their RPL performance metrics on a *Contiki test bed*.

PUBLICATIONS

Under Submission/Preprint

- **Gautham Krishna Gudur**, R Raaghul, Adithya A K, Shrihari Vasudevan, "Resource-Efficient Automatic Model Selection with Threshold Optimization for Unsupervised Anomaly Detection" [Under Submission].
- **Gautham Krishna Gudur**, Satheesh Kumar Perepu, "FedNewSense: Zero-Shot Federated Learning for Continuous Heterogeneous Sensing with New Classes and Models" [Under Submission].

Conference/Journal/Workshop

- **Gautham Krishna Gudur**, Satheesh Kumar Perepu, "Zero-Shot Federated Learning with New Classes for Audio Classification", *Interspeech 2021*.
Abridged versions: *ICLR 2021* - Distributed and Private Machine Learning (DPML '21) & Hardware Aware Efficient Training (HAET '21) workshops. Also presented at *EEML 2021*.
- **Gautham Krishna Gudur**, Satheesh Kumar Perepu, "Resource-Constrained Federated Learning with Heterogeneous Labels and Models for Human Activity Recognition", *IJCAI-PRICAI 2020* - 2nd International Workshop on Deep Learning for Human Activity Recognition (DL-HAR '20), Springer.
Abridged version: "Federated Learning with Heterogeneous Labels and Models for Mobile Activity Monitoring", *NeurIPS 2020* - Machine Learning for Mobile Health Workshop (MLMH '20).
- Abhijith Ragav*, **Gautham Krishna Gudur***, "Bayesian Active Learning for Wearable Stress and Affect Detection", *NeurIPS 2020* - Machine Learning for Mobile Health Workshop (MLMH '20).
- **Gautham Krishna Gudur**, Bala Shyamala Balaji, Perepu Satheesh Kumar, "Resource-Constrained Federated Learning with Heterogeneous Labels and Models", *ACM KDD 2020* - 3rd International Workshop on Artificial Intelligence of Things (AIoT '20).
- Sundararaman Venkataramani, Ateendra Ramesh, Sharan Sundar S, Aashish Kumar Jain, **Gautham Krishna Gudur**, Vineeth Vijayaraghavan, "A Dynamically Adaptive Movie Occupancy Forecasting System with Feature Optimization", *IEEE ICDM 2019* - Workshop on Learning and Mining with Industrial Data (LMID '19).
- Raghavan A K, Venkatesh Umaashankar, **Gautham Krishna Gudur**, "Label Frequency Transformation for Multi-Label Multi-Class Text Classification", *KONVENS 2019* (GermEval '19).

*Equal Contribution

HONORS AND AWARDS

- Our project AIB (Automated Intelligent knowledge Base) won **Ericsson's Top Performance Competition 2020**
- **Top 1 percentile in HackerRank** (Algorithms Domain/Problem Solving - Advanced)
- *Full financial registration grant* to attend ICLR 2021, NeurIPS 2020, OXML 2020
- Undergraduate *research grant* of **INR 25,000** from SSN College of Engineering
- **Winner of GermEval Shared Task 1 Challenge** (Subtask (a)), KONVENS 2019 in post-evaluation phase
- Top 10 percentile in 42nd National Mathematics Talent Competitions
- Certification of Merit for Grade A1 in all subjects in AISSE (CBSE 10th boards)
- Completed all 10 levels of UCMAS Mental Arithmetic (Abacus)
- Division-level badminton player (U-19)

SERVICES

- **Program Committee Member/Reviewer**
 - *ICLR 2021* - Distributed and Private Machine Learning Workshop (DPML)
 - *NeurIPS* - Machine Learning for Health Workshop (ML4H 2020, ML4H 2019)
 - *KONVENS 2019* - GermEval '19
- Technical Reviewer of the book titled "Hands-On Meta Learning With Python"
- Event Organizer of "Data Nuggets" - a Data Science event, Invente 2016

SKILLS

Programming

Expert Python C/C++
Intermediate Java SQL HTML/CSS
JavaScript Bash
Basic Android R

Hardware & Software

LaTeX Git Arduino Raspberry Pi

Tools & Frameworks

NumPy Scikit-learn TensorFlow
PyTorch Keras OpenCV Docker
MATLAB PySpark GCP

- **Gautham Krishna Gudur**, Ateendra Ramesh, Srinivasan R, "A Vision-based Deep On-Device Intelligent Bus Stop Recognition System", *ACM UbiComp 2019* - 8th International Workshop on Pervasive Urban Applications (*PURBA '19*).
- **Gautham Krishna Gudur**, Prahalathan Sundaramoorthy, Venkatesh Umaashankar, "ActiveHARNet: Towards On-Device Deep Bayesian Active Learning for Human Activity Recognition", *ACM MobiSys 2019* - 3rd International Workshop on Embedded and Mobile Deep Learning (*EMDL '19*). Also presented at *EEML 2020*.
- Prahalathan Sundaramoorthy, **Gautham Krishna Gudur**, Manav Rajiv Moorthy, R Nidhi Bhandari, Vineeth Vijayaraghavan, "HARNet: Towards On-Device Incremental Learning using Deep Ensembles on Constrained Devices", *ACM MobiSys 2018* - 2nd International Workshop on Embedded and Mobile Deep Learning (*EMDL '18*).
- **Gautham Krishna G**, Karthik Subramanian Nathan, Yogesh Kumar B, Ankith A Prabhu, Ajay Kannan, Vineeth Vijayaraghavan, "A Generic Multi- modal Dynamic Gesture Recognition System Using Machine Learning", IEEE Future for Information and Communication Conference (*FICC 2018*).
- **Gautham Krishna G**, Krishna G, Bhalaji N, "Electroencephalography Based Analysis of Emotions Among Indian Film Viewers", Springer, International Conference on Advanced Informatics for Computing Research (*ICAICR 2017*).
- **G Gautham Krishna**, G Krishna, N Bhalaji, "Analysis of Routing Protocol for Low-power and Lossy Networks in IoT Real Time Applications", *Procedia Computer Science*, Elsevier, *ICRTCS 2016*.

Poster/Extended Abstract

- **Gautham Krishna Gudur**, Satheesh Kumar Perepu "Heterogeneous Zero-Shot Federated Learning with New Classes for On-Device Audio Classification", *MobiUK 2021*.
- **Gautham Krishna Gudur**, Abhijith Ragav, Prahalathan Sundaramoorthy, Venkatesh Umaashankar "Bayesian Active Learning for Wearable and Mobile Health", *NeurIPS Europe* meetup on Bayesian Deep Learning (*BDL 2020*).
- **Gautham Krishna Gudur**, Prahalathan Sundaramoorthy, Venkatesh Umaashankar "Handling Real-time Unlabeled Data in Activity Recognition using Deep Bayesian Active Learning and Data Programming", *MobiUK 2019*, University of Oxford.
- N Bhalaji, G Krishna, **G Gautham Krishna**, "Neurocinematics: The Intelligent Review System.", 3rd International Conference on Cognition, Brain and Computation (*CBC 2015*), Indian Institute of Technology (IIT), Gandhinagar.

PATENTS

- Federated Learning using Heterogeneous Labels, *WO2022013879A1*.
- Distributed Machine Learning with New Labels using Heterogeneous Label Distribution [*Filed*].
- System and Method for Approach Recommendation with Threshold Optimization in Unsupervised Anomaly Detection [*Filed*].

TALKS

- Machine Learning & Ubiquitous Computing [*SSN College of Engineering*]
- Heterogeneous Zero-Shot Federated Learning with New Classes for On-Device Audio Classification [*MobiUK 2021*]
- Resource-Constrained Machine Learning for Ubiquitous Computing Applications [*Flipped by GAIUS*]
- Telecom-Specific Language Translation [*Ericsson/Google Cloud Day*]

MOOCS

- **HackerRank | Problem Solving**
Advanced Intermediate Basic
- **University of Washington | Coursera**
Machine Learning Specialization (4 courses)
A Case Study Approach Regression
Classification Clustering & Retrieval
- **NRU HSE | Coursera**
Bayesian Methods for Machine Learning
- **University of Alberta | Coursera**
Fundamentals of Reinforcement Learning
- **Stanford University | Coursera**
Machine Learning
- **UC San Diego | Coursera**
Algorithmic Toolbox Data Structures
- **John Hopkins University | Coursera**
R Programming
- **Stanford University - CS231n**