

# 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 resulting in multiple publications, patents, and deployed products [Mentors: Dr. Shrihari Vasudevan and M J Prasath (Director)].
- Telecom:** Contributed to 3GPP standardization for *multi-vendor model sharing* and **Federated Learning**; positioned Ericsson's AI-Native design principles. Created *temporal unsupervised graph NNs* for predicting indoor building connectivity in 5G using drones (< 5% error); improved *mobility prediction* of user devices in Network Data Analytics Function (NWDAF) using *Bayesian Contextual Bandits* robust to concept drift.
- Created **E-ADF** [Ericsson Blog] – an end-to-end *unsupervised anomaly detection* framework, along with simultaneous *data-efficient Bayesian model selection* and *dynamic threshold optimization*. Worked on anomaly detection of IP Multimedia Subsystem (IMS) metrics at scale.
- 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*.

### Independent Research

Dec 2018 – Ongoing   Chennai, India

- Analyzing the *effect of calibration on sample prioritization* in deep neural networks, thereby *accelerating training* [Mentored by Prof. Emtiyaz Khan].
- Leveraging *explainable components* of deep neural networks to aid in *curriculum learning* and *subset selection*.
- Currently working on *federated continual learning* on the edge to alleviate *catastrophic forgetting* for audio sensing and HAR tasks.
- Developed *zero-shot federated learning* frameworks to handle new heterogeneous classes and models for mobile and audio sensing tasks.
- Worked on *deep Bayesian active learning* for on-device mobile sensing, video frame labeling; currently incorporating *adaptive acquisition*.

### Machine Learning Engineer

#### SMARTCARDIA (EPFL) [Mentor: Dr. Srinivasan Murali]

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 [Mentor: Vineeth Vijayaraghavan]

Feb 2016 – Jun 2018   Chennai, India

- Led a team of four to develop **HARNet** – a set of *deep learning ensemble models* for HAR on edge devices capable of incremental model updation.
- Led a team of five to design user-independent ML approaches for *dynamic gesture recognition* on a low-cost Raspberry Pi Zero (\$5).

## RESEARCH INTERESTS

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

## EDUCATION

### B.Tech in Information Technology

#### Anna University [SSN College of Engineering]

Grad. Apr 2017   Chennai, India

Cum. GPA: 7.41/10 - First Class

Mentors: Prof. Srinivasan R and Bhalaji N

Thesis: Intelligent Bus Stop Recognition

#### Core 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

Scored an overall of 94.25%.

## 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* at EEML 2020, *Zero-shot Federated Learning with New Classes* at EEML 2021.

### 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 over 17 students* in embedded programming and machine learning for their assignments and research project.

## Undergraduate Student Researcher

**SSN COLLEGE OF ENGINEERING** [Advisors: Dr. Bhalaji N and Dr. Srinivasan R]

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

### Conference/Journal/Workshop

- Tata Ganesh\*, **Gautham Krishna Gudur\***, Gopinath Chennupati, Mohammad Emtiyaz Khan, *Can Calibration Improve Sample Prioritization?*, **NeurIPS 2022** - Human in the Loop Learning (HILL '22) & Has It Trained Yet? (HITY '22) workshops.
- **Gautham Krishna Gudur**, Raaghul R, Adithya KA, Shrihari Vasudevan, *Data-Efficient Automatic Model Selection in Unsupervised Anomaly Detection*, **IEEE ICMLA 2022** [Oral Presentation].
- **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** - Workshop on Deep Learning for Human Activity Recognition (DL-HAR '20) [Oral Presentation]. Abridged version: **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) [Oral Presentation].
- Raghavan A K, Venkatesh Umaashankar, **Gautham Krishna Gudur**, *Label Frequency Transformation for Multi-Label Multi-Class Text Classification*, **KONVENS 2019** (GermEval '19).
- **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) [Oral Presentation].

\*Equal Contribution

## HONORS AND AWARDS

- Our project AIB (Automated Intelligent knowledge Base) won **Ericsson's Top Performance Competition 2020** in Operational Excellence category
- **Top 1 percentile in HackerRank** (Algorithms Domain/Problem Solving - Advanced)
- *Full financial registration grants* 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 42<sup>nd</sup> 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)
- 29<sup>th</sup> Rank overall in Grade 3 Keyboard

## PATENTS

- *Federated Learning using Heterogeneous Labels*, WO2022013879A1.
- *Distributed Machine Learning with New Labels using Heterogeneous Label Distribution*, WO2022162677A1.
- *System and Method for Approach Recommendation with Threshold Optimization in Unsupervised Anomaly Detection* [Filed].
- *System and Method for Secure Federated Learning* [To Be Filed].
- *System and Method for Predicting Coverage and Connectivity of Indoor Buildings using Drones* [To Be Filed].

## 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
- Mentor at IEEE B. Tech. Student Branch – *Python Programming for Underrepresented*
- Member at National Service Scheme (NSS)

- **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**) [Oral Presentation]. 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**) [Oral Presentation].
- **Gautham Krishna G**, Karthik Subramanian Nathan, Yogesh Kumar B, Ankith A Prabhu, Ajay Kannan, Vineeth Vijayaraghavan, *A Generic Multimodal Dynamic Gesture Recognition System Using Machine Learning*, IEEE Future for Information and Communication Conference (**FICC 2018**) [Oral Presentation].
- **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, **ICRTCSE 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.

## To Be Submitted/Research Under Progress

- *Can Explanations Improve Curriculum Learning and Subset Selection?* [Research Under Progress].
- *Federated Active Learning with Adaptive Acquisition* [To be Submitted].
- *FedNewSense: Zero-Shot Federated Learning for Continuous Heterogeneous Sensing* [To Be Submitted].

## TALKS

- *Machine Learning and Ubiquitous Computing* [June 2022, SSN College of Engineering]
- *Heterogeneous Zero-Shot Federated Learning with New Classes for On-Device Audio Classification* [July 2021, MobiUK 2021]
- *Telecom-Specific Language Translation using GCP* [May 2021, Ericsson/Google Cloud Day]
- *Resource-Constrained Machine Learning for Ubiquitous Computing Applications* [Sept 2020, Flipped by GAIUS]

## 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

## 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
- **Stanford University | Coursera**  
 Machine Learning
- **UC San Diego | Coursera**  
 Algorithmic Toolbox Data Structures
- **John Hopkins University | Coursera**  
 R Programming
- **Stanford University - CS231n**