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 networks* 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* in 2020,
Zero-shot Federated Learning with New Classes in 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) *[Oral Presentation]*.
- **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 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)
- 29th 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***). 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 Multi-modal 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***) *[Oral Presentation]*.
- **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*** *[Oral Presentation]*.

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