Tanmaey Gupta

Pre-doctoral Research Fellow
Microsoft Research India

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EDUCATION

Indian Institute of Technology Gandhinagar *2017 - 2021*
B.Tech. in Electrical Engineering with Minor in Computer Science and Engineering
GPA: 8.84/10

RESEARCH EXPERIENCE

Microsoft Research India *2023-Present*
Research Fellow
Advisor: Dr. Ramachandran Ramjee

- **Distributed DNN training failure recovery:** Designed and implemented an efficient fault recovery mechanism for large-scale DNN training tasks which alleviates the need for periodic checkpointing and utilizes replica states to resume training in case of a failure. Devised a solution which is compatible with a wide set of ML models, frameworks and parallelisation strategies, and requires minimal code changes. The proposed approach reduces wasted GPU hours by up to 30x, ultimately saving cost and time required for training large models. This work has been **accepted at EuroSys'24**.

Microsoft Research India *2021-2023*
SCAI Research Fellow
Advisor: Dr. Akshay Nambi

- **Generating reliable IoT sensor data:** Developed Verified Telemetry, a robust and scalable end-to-end hardware-fingerprint based fault detection system to enhance IoT sensor data quality. Devised the solution to be capable of running on resource-constrained devices with plug-and-play operation for a wide range of RTOS and MCU, including automatic calibration for different sensors. This work was **accepted at IoTDI'23** and is being used by multiple partners in **real-world IoT deployments across 1000s of devices**.

- **Modelling pressure signals for water disaggregation:** Designed and developed a novel solution to efficiently generate fine-grained water-usage insights in large residential and commercial buildings. Devised a method comprising of classifying pressure waves using Transfer learning to calculate per-floor water usage and later solving for fixture level events using combinatorial optimization. This work was **accepted at BALANCES, BuildSys'23 and CCAI, NeurIPS'23**.

IRACS Lab, IIT Gandhinagar *2020 - 2021*
Research Assistant
Advisor: Prof. Uttama Lahiri

- **Real-time Exercise and Rehabilitation Guidance Platform:** Researched on developing an interactive, real time exercise guidance and rehabilitation platform based on pose estimation, which accurately records and matches body joints for trainer and patient movements, without being affected by position, rotation and size of the subjects relative to the camera.

PUBLICATIONS

1. **Just-In-Time Checkpointing: Low Cost Error Recovery from Deep Learning Training Failures**
Tanmaey Gupta, Sanjeev Krishnan, Rituraj Kumar, Abhishek Vijeev, Bhargav Gulavani, Nipun Kwatra, Ramachandran Ramjee, Muthian Sivathanu
*accepted at 19th ACM SIGOPS **EuroSys**, 2023.*

2. **PressureML: Modelling Pressure Waves to Generate Large-Scale Water-Usage Insights in Buildings**
Tanmaey Gupta, Anupam Sobti, Akshay Nambi
*accepted at 3rd ACM BALANCES Workshop, **BuildSys**, 2023.*
*also accepted at Tackling Climate Change with Machine Learning Workshop, **NeurIPS**, 2023 (poster).*

3. **Verified Telemetry: A General, Easy to use, Scalable and Robust Fault Detection SDK for IoT Sensors**
Tanmaey Gupta, Shubhankar Handa, Akshay Nambi
*accepted at 8th ACM/IEEE Conference on Internet of Things Design and Implementation (**IoTDI**), 2023.*

Software

1. **Just-in-time Checkpointing : Low-cost DNN training fault recovery***
   Tanmaey Gupta, Sanjeev Krishnan, Nipun Kwatra, Ramachandran Ramjee.
   Microsoft Research India, 2023 - present.
   ∗official Microsoft code-release under progress.

2. **Verified Telemetry : Fault Detection for IoT Sensors**
   Sumukh Marathe, Nishant Shrivastava, Ryan Winter, Akshay Nambi, **Tanmaey Gupta**, Shubhankar Handa.
   Microsoft Research India, 2021 - 2022.

3. **FlexFlow**
   Developing runtime backend on Legion programming system.
   Open source contribution, 2023 - present.

Work Experience

ITC India *April - June 2020*
Technology track KITES Intern

- **Energy Efficient Industry:** Researched on existing inefficiencies in energy consumption of 3 flour plants across India by analyzing 2 year logged data using statistical methods and collaborating with domain experts on process mechanisms study. Proposed 3 key factors of improvement and designed sensor aided automation system which could improve energy efficiency by 3%. The deployment of design was not possible due to COVID restrictions.

Detect Technologies, IIT Madras Research Park *May - July 2019*
Firmware Developer

- **Drone Telemetry:** Developed firmware on STM32 MCU to enable real-time data stream and feedback of custom sensor mounted on drone to the controlling base station using a proprietary RF communication protocol.

Invent@IITGn (Invention Factory, USA), IIT Gandhinagar *May - July 2018*
Inventor

- **Invent for Road Safety:** Developed a novel collision shock absorption system and under-run prevention assembly for high rise vehicles. Collaborated with domain experts (ARAI India), built simulation models and prototype and filed a provisional patent for the same.

Undergraduate Projects

1. **LSTM based 3D-motion Text and Gesture Recognition**
   Used LSTM models for text recognition using accelerometer data of an IMU sensor to enable air-writing.

2. **Git from scratch in C++**
   Implemented Git version control system in C++ from scratch, using content addressable file system and SHA1 hashing.

3. **Linux Shell in C**
   Implemented Linux Shell in C from scratch using system calls.

4. **Multi-threaded Tries**
   Implemented thread-safe Tries in C with Single, Reader-Writer and Hand over Hand locking.

5. **FPGA based Two Level Morse Code Encoder-Decoder**
   Developed a two tier encryption-decryption machine on Basys 3 FPGA board with I/O using Morse code and Base 64.

6. **Sea navigation and collision-avoidance system for fishermen**
   Designed and developed a prototype of a low-cost device to avoid ship collisions in low-visibility situations. Experimented with various standards like IEEE 802.11, 802.15.4, 802.15.1. Project came 7/21 IITs at Inter-IIT Tech Meet.

Selected Awards and Honors

- Awarded travel grant by CCAI to attend NeurIPS 2023 *2023*
- Winner of Microsoft Global Hackathon, 2021(Future Of Edge Computing Track) *2021*
- Selected for Inter- IIT Tech Meet (IIT Madras, IIT Bombay) *2017, 2018*
- Enlisted in Dean's List for Academic Excellence at IIT *2017, 2018*
- Among top 0.15% of 1.2 million candidates in IIT-JEE Examination *2017*

Professional Responsibilities

- *Mentor:* Peer-Assisted-Learning, IIT Gandhinagar *2021*
- *Undergraduate Teaching Assistantship* - ES102 Computing course, CSE, IIT Gandhinagar *2020*