Yamini Shankar

PhD Scholar, Dept. of CSE, IIT Madras

Making devices smart, literally!

RESEARCH SUMMARY

- **Doctoral Focus Area: *Wireless Sensing***

Understanding adversarial use cases and network implications of wireless sensing technologies and its potential implications on security/privacy for resource constrained IoT devices.[2 conference publications]

- **Master's thesis**

@JNU involved designing and implementing optimization algorithms for computation offloading and service placement for Edge networks. [1 journal publication]

Research Areas -

1. Leveraging Wi-Fi channel state information for learning physical contexts, e.g., human sensing, object detection etc. My long term goal is to understand the **privacy implications** of such sensing and making wireless networks **resilient to adversarial sensing**. I have set up a SDR based wireless testbed running a fully customizable and open-source 802.11 stack that is able to run simple sensing algorithms in real-time.
2. **Edge-assisted wireless sensing** is increasingly popular, where complex neural network models perform inference tasks on wireless channel state information (CSI) data streamed from IoT devices. However large volumes of CSI data sent across the network for inference can significantly impact network bandwidth and **reduce the Quality of Experience**. We currently are exploring the challenge of optimizing network resource utilization in wireless sensing systems by smartly compressing and subsampling CSI streams.

Publications -

Practical Defense Against Adversarial WiFi Sensing(IEEE ANTS 2024)

Non-intrusive approach of WiFi-based sensing has expanded its market presence. It leverages existing communication infrastructure, extracting Channel State Information (CSI) for area assessment. However, the method's susceptibility to misuse, termed the Integrated Sensing and Communication (ISAC) problem, necessitates robust defenses. Our study introduces a black-box defense against adversarial attacks on CSI, reducing classification model accuracy from 98% to 17% while maintaining strong communication throughput. Additionally, our method preserves a median Signal-to-Noise Ratio (SNR) difference of 1dB for perturbed samples, enhancing overall system reliability.

Improving Network Resource Utilization for Distributed Wireless Sensing Applications (AIoT@MobiHoc2024)

Edge-assisted wireless sensing is increasingly popular, where complex neural network models perform inference tasks on wireless channel state information (CSI) data streamed from IoT devices. However large volumes of CSI data sent across the network for inference can significantly impact network bandwidth and

reduce the Quality of Experience. This work tackles the challenge of optimizing network resource utilization in wireless sensing systems by compressing and subsampling CSI streams. We evaluate methods that quantize and selectively subsample CSI data before transmission to the edge server, which is then fed to the inference models. Such approach reduces bandwidth and computational load, improving data transmission and processing efficiency. Experiments conducted in two real testbeds (indoors as well as outdoors) show how CSI compression preserves sensing information integrity while enhancing system performance in terms of latency, energy efficiency, and throughput. By integrating quantization and subsampling with edge computing, this work enhances wireless sensing systems, making them more scalable and efficient in utilizing network resources.

Teaching Assistant Duties

Foundations of Computer Systems Design:CS2030(Jul-Nov'22, Jul-Nov'23(Best TA Award))

Introduction to Computer Networks:CS3205(Jan-May'23(Best TA Award), Jan-May'24)

Router Architectures and Algorithms:CS6040(Jul-Nov'24)

EDUCATION

- **Indian Institute of Technology, Madras** - *Ph.D (CSE) 2022 – Ongoing (8.35 CGPA)*
- **Jawaharlal Nehru University, New Delhi** - *M.Tech (CS & IT) 2020 – 2022 (87.0%)*
- **Central University of Haryana, Haryana** - *MCA 2017 – 2020 (78.1%)*
- **St. Anthony's College, NEHU, Shillong, Meghalaya** - *B.Sc. (CS) 2014 – 2017 (73.87%)*
- **Class 12th, KV NEHU, Shillong, Meghalaya** - *2014 (74.33%)*
- **Class 10th, KV NEHU, Shillong, Meghalaya** - *2012 (9.2 CGPA)*

EXTRA CURRICULAR

Debating: Awards in *National Youth Parliament* (UNDP-2018), *Red Cross Society* (Narnaul, 2019), *Annual Youth Festival (Kurukshetra*, 2019)
Music: I play the guitar and ukulele and am deeply interested in music.
NPTEL GATE CSE Portal (Subject Matter Expert)
Outreach Program by St. Anthony's College,Shillong (for teaching rural students basic IT skills) - 2015, 2016.