

Rajrup Ghosh

PH.D. CANDIDATE IN COMPUTER SCIENCE

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Interests

Research: Volumetric Video, AR/VR Streaming, 3D Capture and Rendering, Immersive Video Delivery, Systems for ML

Related: 3D Computer Vision, Media Delivery, Edge-Cloud Computing

Education

University of Southern California (USC)

Los Angeles, USA

PH.D. IN COMPUTER SCIENCE

Aug 2019 - May 2026 (Exp.)

- **GPA:** 4.0/4.0
- **Position:** Research Assistant in **Networked Systems Laboratory (NSL)**
- **Advisor:** **Prof. Ramesh Govindan**

Indian Institute of Science (IISc)

Bangalore, India

M.TECH. IN COMPUTATIONAL SCIENCE

Aug 2015 - July 2017

- **GPA:** 6.8/8.0, Gold Medalist

Indian Institute of Engineering Science and Technology (IIEST)

Shibpur, India

B.E. IN COMPUTER SCIENCE AND TECHNOLOGY

July 2011 - Apr 2015

- **GPA:** 9.3/10.0

Projects

Immersive Video Project [NSL]

USC, Los Angeles

LIVE VOLUMETRIC VIDEO STREAMING, CoNEXT 2025 [PAPER]

Jan 2022 - present

- **Gaussian Splat-based:**
 - ▶ Live capture and streaming of photo-realistic representation of participants/scenes for **3D video streaming** application.
 - ▶ Using **Gaussian Splatting** to represent each frame of the volumetric video.
 - ▶ Real-time **GPU-optimized compression** of dynamic Gaussian Splat frames.
 - ▶ On-device rendering of dynamic Gaussian Splats on **mobile devices** such as iPhone and Vision Pro.
 - ▶ **Challenges:** *High bandwidth, Real-time encoding/decoding, Real-time rendering.*
- **Point Cloud-based:**
 - ▶ Enable full-scene **volumetric video conferencing** (represented as point clouds) in six degrees of freedom (6-DoF).
 - ▶ Developed an end-to-end pipeline volumetric video conferencing over the internet at **30 fps** within **300 ms**.
 - ▶ Designed **bandwidth adaptation** for robust conferencing in fluctuating network conditions.
 - ▶ The system leverages popular streaming technologies such as **GStreamer**, **Nvidia Codec SDK**, and **WebRTC**.
 - ▶ **Challenges:** *Real-time encoding/decoding, Bandwidth adaptation, Low latency, Full frame rate.*
- **Applications:** Telepresence, Virtual Classroom, Collaborative Workspace, Telemedicine, AR/VR Multiplayer Gaming.
- This project is a part of **NSF Grant – Multi-perspective Video**.

AR Localization Project [NSL]

USC, Los Angeles

AR LOCALIZATION USING GAUSSIAN SPLATTING, ACM MM 2025 [PAPER]

May 2024 - April 2025

- Proposed a method to perform **AR localization** by representing a map of an outdoor environment using **Gaussian Splatting (GSplat)**.
- **On-device** (iPhone, iPad, Vision Po) implementation of feature matching, GSplat rendering, and localization.
- Online **appearance adaptation** of the outdoor map in GSplat based on the time-of-day.
- The system is implemented in **Swift** using Apple's **Metal** library to replicate **CUDA**-based rasterization.
- **Challenges:** *On-device GSplat rendering, Sparse linear optimization, Fast Gaussian sorting*

Drone Project [NSL]

USC, Los Angeles

LIDAR-BASED FAST 3D RECONSTRUCTION USING DRONE, IMWUT/UbiComp 2023 [PAPER]

June 2021 - Dec 2021

- Capture **3D structures** like buildings, airplanes using a drone-mounted **LIDAR** in the form of **point clouds**.
- Formulated **trajectory planning** as an optimization problem to minimize battery consumption, solved using **Gurobi** Library.
- Offload heavy computation such as localization using **SLAM** and point cloud registration using ICP to the Cloud.
- Implemented efficient point cloud compression using **Draco**, adjusting compression ratios based on available bandwidth.

CONIX Project [NSL]

USC, Los Angeles

ACCELERATING DEEP NEURAL NETWORK INFERENCE

Jan 2020 - May 2021

- **Scrooge**, *ACM SoCC 2021* [[Paper](#)]:
 - A framework for scheduling data-dependent **DNN** workloads on **Cloud Clusters** that satisfy application SLOs, while minimizing VM cost.
- **RIM**, *IoTDI 2021* [[Paper](#)]:
 - A framework for placing **DNN** applications on **Edge Clusters** that satisfy throughput and latency, while achieving high GPU utilization.
- These projects are part of **CONIX Research Center**.

Masters Thesis [DREAM:Lab]

IISc, Bangalore

DISTRIBUTED SCHEDULING OF EVENT ANALYTICS ACROSS EDGE AND CLOUD

Jan 2016 - June 2017

- The thesis focused on efficient static and dynamic **scheduling** of distributed run-time query plans for complex event processing.
- Designed **algorithms** to map user queries on heterogeneous resources such as **Edge devices** (Raspberry Pi) and **Cloud VMs** (Azure).
- **Challenges**: *Compute latency, Network bandwidth, Battery capacity*
- This project was a part of **IISc Smart Campus Project**.

Selected Publications

LiVoGS: Bandwidth-adaptive Streaming of Dynamic Gaussian Splats

In Preparation

R. GHOSH, H. WANG, H. HONG, E. PAVEZ, W. PANG, H. V. MADHYASTHA, A. ORTEGA, R. GOVINDAN

Mar 2026

- On-demand streaming of volumetric video, represented as Gaussian Splats, with bandwidth efficiency and adaptation.

FastPCC: Real-time compression of Point Clouds and Gaussian Splats

In Preparation

R. GHOSH, H. WANG, H. HONG, E. PAVEZ, W. PANG, H. V. MADHYASTHA, A. ORTEGA, R. GOVINDAN

Mar 2026

- GPU-optimized compression of dynamic point clouds and Gaussian Splats for real-time streaming and conferencing in 3D.

LiVo: Toward Bandwidth-adaptive Fully-Immersive Volumetric Video Conferencing

CoNEXT

R. GHOSH, C. SHIN, L. ZHANG, M. YE, T. JIN, H. V. MADHYASTHA, R. NETRAVALI, A. ORTEGA, S. G. RAO, A. ROWE, R.

Dec 2025

GOVINDAN

- PACMNET - Volume 3, Issue CoNEXT4
- CoNEXT 2025 - 21st International Conference on emerging Networking EXperiments and Technologies, [URL: Paper](#)

SplatPose: On-Device Outdoor AR Pose Estimation Using Gaussian Splatting

ACM MM

W. PANG, R. GHOSH, J. YANG, Z. WEI, B. LEONG, Y. WANG, R. GOVINDAN

Oct 2025

- ACM MM 2025 - 33rd ACM International Conference on Multimedia, [URL: Paper](#)

AeroTraj: Trajectory Planning for Fast, and Accurate 3D Reconstruction using a Drone-based LiDAR

IMWUT/UbiComp

F. AHMAD, C. SHIN, R. GHOSH, J. D'AMBROSIO, E. CHAI, K. SUNDARESAN, R. GOVINDAN

Sep 2023

- IMWUT - Vol. 7 Issue 3
- UbiComp 2023 - 25th ACM international joint conference on Pervasive and Ubiquitous Computing, [URL: Paper](#)

Scrooge: A Cost-Effective Deep Learning Inference System

SoCC

Y. HU, R. GHOSH, R. GOVINDAN

Nov 2021

- SoCC 2021 - 12th ACM Symposium on Cloud Computing, [URL: Paper](#)

Rim: Offloading Inference to the Edge

IoTDI

Y. HU, W. PANG, X. LIU, R. GHOSH, B. KO, W. LEE, R. GOVINDAN

May 2021

- IoTDI 2021 - 6th ACM/IEEE Conference on Internet of Things Design and Implementation, [URL: Paper](#)

Adaptive Energy-Aware Scheduling of Dynamic Event Analytics across Edge and Cloud Resources

CCGRID

R. GHOSH, S. P. R. KOMMA, Y. SIMMHAN

May 2018

- CCGRID 2018 - 18th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing, [URL: Paper](#)

Distributed Scheduling of Event Analytics across Edge and Cloud

ACM TCPS

R. GHOSH, Y. SIMMHAN

Sep 2018

- ACM Transactions on Cyber-Physical Systems (TCPS), [URL: Article](#)

Experiences

Networking Research Group, Microsoft Research

Microsoft Research, Redmond

RESEARCH INTERNSHIP - KRISHNA CHINTALAPUDI, NIKUNJ RAGHUVANSHI, RANVEER CHANDRA

May 2022 - Aug 2022

- Developed a **VR Supermarket** application where users can have real-life purchase experiences.
- Supermarket provides personalized experience based on user's profile such as customized layouts, advertisements, and music.
- The system is built in **Unity** using **Oculus XR** and **Triton Audio Spatialization** plugin.

DMX Group, Microsoft Research

Microsoft Research, Redmond

RESEARCH INTERNSHIP - KRISHNA CHINTALAPUDI

June 2020 - Aug 2020

- Greedy layer-by-layer neural network training for tasks such as image classification, detection, and segmentation.
- Developed segmentation-based **person tracking** using body parts-based re-identification.
- Conceptualized automated model training for machine learning systems deployed in production pipelines.

Advanced Technology Lab, Samsung R&D Institute India

Samsung R&D Institute India

LEAD ENGINEER (RESEARCH POSITION)

July 2017 - July 2019

- Built **on-device Neural Network**-based solutions for smartphone keyboard applications like Swipe, Auto-correct, and Emoji Prediction.
- Developed applications over **Blockchain** - User Authentication System for smart building and peer-to-peer payment system.
- Developed an **IoT Query Engine** to perform data fusion on home appliance data stored across different SQL and NoSQL datastores.

Crypto Research Lab, IIT Kharagpur

IIT Kharagpur

SUMMER INTERNSHIP - PROF. DIPANWITA ROY CHOWDHURY

Sum. 2013, Sum. 2014

- Cryptanalysis of a light-weight hash function PHOTON using **fault-based attack** technique similar to Diagonal Faults for AES. A similar technique was applied for a SHA-3 Finalist hash function GROSTL.
- Studied the design and cryptanalysis of SHA-3 standard Keccak Hash Function for reduced round attacks.

Skills

Programming: C, C++, Python, Swift, Android, Java, MATLAB, Golang

Frameworks/Platforms: GStreamer, WebRTC, Open3D, CUDA, Metal, Unity, PyTorch, Point Cloud Library (PCL), Draco, OpenMP, MPI

Development Tools: Visual Studio, Xcode, Android Studio, Eclipse

Databases: Oracle, MySQL, MongoDB

Services

Shadow TPC: CoNEXT 2025

Reviewer: IEEE Vehicular Technology Magazine, Elsevier Computer Communications, Elsevier Computer Networks

Artifact Evaluator: NSDI 2026, JSys 2025, EuroSys 2025, NDSS 2025, JSys 2024, SOSP 2024, NDSS 2024, MLSys 2023, SOSP 2023

Referred Reviewer: NSDI 2024, Mobicom 2023, NSDI 2023, NSDI 2022, Mobicom 2022, SOCC 2021

Achievements

Apr 2022 Nominated for **Outstanding Mentor Award** in the Spring 2022 Viterbi Graduate Mentorship Program.

2019 - Pres. Received **Annenberg Fellowship** for outstanding Ph.D. student joining in Fall 2019.

June 2018 Received **Motorola Gold Medal** for best performance in Master's degree in both academic courses and thesis.

June 2016 **Second** in Microsoft Research IoT Summer School hackathon on innovative IoT applications/projects.

2015 - Pres. Participated in Google APAC 2017 (Best Rank - 412), ACM ICPC 2015.

Jan 2015 Received **INAE (Indian National Academy of Engineering) Fellowship** for performance in internship under an INAE Fellow.

Teaching

CSCI 353: Teaching Assistant for **CSCI 353 - Internetworking** in Fall 2025. *Instructor:* Prof. Ramesh Govindan

EE 689: Guest Lecture for **EE 689 - Computational Intelligence and Neural Learning** in Fall 2024. *Instructor:* Prof. Bart Kosko

EE 689: Guest Lecture for **EE 689 - Computational Intelligence and Neural Learning** in Fall 2023. *Instructor:* Prof. Bart Kosko

CSCI 551/651: Teaching Assistant for **CSCI 551/651 - Advanced Computer Networks** in Spring 2022. *Instructor:* Prof. Ramesh Govindan

COS 598a: Guest Lecture at Princeton University for **COS 598a - Machine Learning-Driven Video Systems** in Spring 2022. *Instructor:* Prof. Ravi Netravali

Courses

Systems: Operating Systems, Computer Networks, Distributed Systems, High-Performance Computing, Parallel Programming

ML: Advanced Computer Vision, Artificial Intelligence, Data Analytics, Data Analysis and Visualization

Basic: Design and Analysis of Algorithms, Probability & Statistics, Numerical Linear Algebra, Numerical Methods

Mentorship

MASTERS

- Amartya Chaudhuri
- Saptarshi Mondal
- Matt Baseheart
- Abhishek Mitra

USC, Los Angeles

May 2021 - present

UNDERGRADUATES

- Yihan Xiong - *CURVE Research Fellow*
- Akshaan Prithvi Ahuja - *SURE Research Fellow*
- Muyang Ye - *CURVE Research Fellow*
- Terry Xia - *CURVE Research Fellow*
- Vikram Agrawal - *Provost Fellow*
- Jonathan Liu - *Viterbi Research Fellow*
- Owen Mech - *Viterbi Research Fellow*
- Emily Kuo - *Undergraduate Thesis*

HIGH SCHOOLERS

- Elvis Amaya - *Viterbi SHINE K-12 Outreach*
- Tanvi Deshpande - *Viterbi SHINE K-12 Outreach*