Pradipta Ghosh

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Education

2012–2018 **PhD, Electrical and Computer Engineering**, *Minor: Computer Science.*
University of Southern California, Los Angeles, CA, USA
Advisor: Bhaskar Krishnamachari
GPA: 3.97 / 4.00

2008–2012 **Bachelor of Electronics and Tele-Communication Engineering**.
Jadavpur University, Kolkata, India
GPA: 9.25 / 10.00

Experience

2018–Present **Post Doctoral Research Scholar**, *University of Southern California*, Los Angeles, CA.
Working as the lead researcher for ARL Internet of Battlefield Things (IoBT) project under *Prof. Ramesh Govindan* and *Prof. Gaurav Sukhatme*. Designed novel algorithms and systems for public camera localization and multi-camera complex activity detection; these works leverage deep learning, crowdsourcing, and geometric tools. Currently working on novel algorithms for scalable instant IoT network synthesis using constrained optimization techniques and point cloud registration for Infrastructure LiDAR sensing in autonomous driving.

2012–2018 **Research Assistant**, *University of Southern California*, Los Angeles, CA.
Worked under *Prof. Bhaskar Krishnamachari* on novel communication protocols, localization algorithms, robotic controller, and embedded hardware design for wireless robotic networks and the Internet of Things. Other works involved end-to-end system design for dispersed edge computing, Kubernetes based Raspberry PI cluster design, distributed scheduling algorithm design, etc.

2014–2018 **Teaching Assistant**, *University of Southern California*, Los Angeles, CA.
Teaching assistant for three different courses over seven semesters: Introduction to Embedded Systems, Wireless and Mobile Networks Design and Laboratory, and Computer Networks.

summer 2015 **Summer PhD Intern**, *Cisco Systems*, San Jose, CA.
Worked with *Dr. Shyam Kapadia* to design a new system architecture to integrate bare-metal servers with OpenStack for CISCO programmable fabric. This system was converted into a product later on.

summer 2013 **Summer Research Intern**, *General Motors Research & Development*, Warren, MI.
Worked under *Dr. Fan Bai* to investigate the applications of cloud computing and computation offloading in vehicular networks; developed the necessary systems for a proof of concept implementation.

2010–2012 **Undergraduate Student Researcher**, *Jadavpur University & Indian Statistical Institute*, Kolkata, India.
Worked under *Prof. Swagatam Das* and *Prof. Mrinal Kanti Naskar* to develop novel algorithms for evolutionary computations and wireless networks.

summer 2011 **Summer Research Intern**, *Indian Institute of Science*, Bengaluru, India.
Worked under *Prof. Debasish Ghose* on an evolutionary algorithm-based approach for timely deployment of decoys and countermeasures from a ship to avoid an incoming projectile missile.

Research Interests

Internet of Things Wireless sensor networks; Public smart city resources; Ad-hoc networks; Wireless communication; Topology synthesis; Software defined networks; Low power communication; Networking protocols; Publish-subscribe systems; Middlewares; Opensource testbeds

Ubiquitous Computing Edge computing; Cloud computing; Containers; Kubernetes; Dispersed computing; Distributed sensing and computation; Application of constrained optimization in computing

Automation & Robotics Network of robots; Robotic routers; Artificial intelligence; Evolutionary computation; Coordinated robotics; Autonomous vehicles; Infrastructure LiDAR; Point cloud registrations

Networked Systems	Distributed activity detection; Deep learning at the edge; Camera networks; Human-in-the-loop systems; Crowd-sourcing

Selected Courseworks

Graduate Courses	Computer networks; Operating systems; Computer communications; Wireless networks; Wireless communication; Fundamental concepts of analysis; Probabilistic methods in computer systems modeling; Analysis of algorithms; Low power wireless networks; Coordinated Robotics
Online Courses	Introduction to computer vision; Projective geometry; Deep leaning specialization courses in Coursera

Certificates and Workshops

June 2020	**Specialization on Deep Learning**, *Coursera*, Online Course by Prof. Andrew Ng.

Selected Projects

2020–Present	**Infrastructure LiDAR Sensing**. Currently working on novel point cloud registration algorithms for infrastructure LiDARs (with different locations and orientations). Also working on algorithms for fine-grain vehicle tracking using a stitched point cloud to augment autonomous driving. <details>
2018–Present	**Wireless Network Topology Synthesis**. Currently working on developing scalable algorithms for goal-driven, optimal topology synthesis across a set of heterogeneous sensors, actuators, and compute-capable devices. Working with constrained optimizations and parallel processing techniques to attain to the scalability needs *e.g.,* synthesis of a university campus-wide IoT network within minutes. <details>
2018–2020	**Camera Localization**. Worked on public surveillance camera's property estimation (precise location, pose, focal length, etc.) based on limited metadata and available video feed. Developed a system to efficiently combine projective geometry, neural networks, and crowd-sourced annotations from human workers to obtain these properties with reasonable accuracy. <details>
2018–2019	**Multi-Camera Complex Activity Detection**. Developed a novel edge-assisted end-to-end system for near real-time detection of *complex activities* spanning *multiple* (possibly wireless) cameras, a capability applicable to surveillance tasks. Combined rule-based activity detection with Deep Neural Network (DNN) based activity detection, re-identifications, and object detection to define and detect complex activities. <details>
2012–2018	**Wireless Robotic IoT Systems**. Developed two novel embedded robotic platforms along with the necessary controller, and novel localization techniques for indoor operations without any fixed infrastructure. The localization methods use directional antennas for anchor-less operations. Also developed novel lightweight communication protocols for control and sensing in a network of robots. <details>
2016–2018	**Dispersed Mobile Computing for Edge Devices**. Developed necessary software and algorithms for optimal and efficient task distribution from a Directed Acyclic Graph (DAG)-based computational task graph among a distinct set of networked compute nodes that are separated geographically. Also developed novel characterization of communication and compute power availability and a 50 node Raspberry Pi-3 cluster. <details>
2012–2016	**Efficient Low Power Routing for the Internet of Things**. Developed a new energy-efficient protocol for data collection routing without any need for routing tables. Also worked on developing novel methods to detect sensing holes in WSN, and a campus-wide IoT testbed deployment. <details>

Technical Skills

Proficient With:

Languages	C, C++, Python, MATLAB
Hardware	Tmote sky, Openmote, ARM Mbed, Polulu 3π, Arduino, Raspberry Pi, GeForce RTX 2080
Technologies	GIT, SVN, Contiki OS, RIOT OS, RTOS, MBED OS, CPLEX, Z3, Cooja Network Simulator, OPNET, Wireshark

Have Experience With:

Languages	C#, Java, HTML, SQL
Hardware	Android, USRP, Roomba, Nvidia Jetson TX2
Tools	ROS, Gurobi, Android Studio, Circuit Maker Professional Edition, GNU Radio, Eagle, Tensorflow, Keras

Honors and Achievements

Dissertation	**Ming Hsieh Department of Electrical and Computer Engineering Best Dissertation Award (2019)**, **Best Graduating PhD Student Pitch Award at MHI Research Festival (2017)**
Fellowships and Travel Awards	**USC Provost's Ph.D. Fellowship (2012 – 2016)**, **Ming Hsieh Institute Scholar (2016 – 2017),** USC Postdoctoral Scholar Training & Travel Award (2019), NSF and SigMobile Student Travel Grant for Mobicom (2017), NSF Student Travel Grant for IEEE SEC (2017), USC Graduate School Fellows Travel Award (2014), IEEE MASS 2014 Travel Grant (2014)
Others	USC Summer Institute (2014), Grant UGC Infrastructure Grant for Undergraduate Research (2011 – 2012)

Professional Activities

Academic Service	**Technical Program Committee (TPC) member for six conferences/workshops.** ACM Sensys 2020 (Posters and Demo), IEEE INFOCOM Workshops 2020, IEEE INFOCOM Workshops 2019, IEEE INFOCOM Workshops 2018, VTC 2019, IPSN 2016 Shadow PC
Review	**Reviewed more than 25 research articles.** IEEE/ACM ToN, IEEE/RSJ IROS, IEEE GLOBECOM, and IEEE TMC, IEEE JSAC, IEEE TVT, and many more. (See my Publon profile for complete list)
Grant Proposal	**Significantly contributed to more than five funding proposals.** Two of the proposals were approved for funding that is currently funding my postdoctoral research position
Mentorship	**Mentor for twenty directed research students, interns, and PhD students.** Mentored *twenty* students including *seven* undergraduate students and *five* PhD students. One of my undergraduate mentees has received the *best undergraduate poster* recognition at a regional conference
Leadership	**Organizational Activities.** Organized many events at USC including a semester-long educational seminar series called Seminars + Hackathons On Theory and Technology ($SHOT^2$)

Extracurricular Activities

2017–Present	**Balaka (Bengali Association of USC)**, *University of Southern California*, Los Angeles, CA. Founding president and advisory board member of the university cultural, linguistic and ethnic club
2017–2019	**Wireless Networking Club (WNC)**, *University of Southern California*, Los Angeles, CA. Founding board member of the university wireless networking enthusiast group

Selected Publications (Sorted by Year)

[1] Bagchi, S., Abdelzaher, T. F., Govindan, R., Shenoy, P., Atrey, A., **Ghosh, P.**, Xu, R., "New Frontiers in IoT: Networking, Systems, Reliability, and Security Challenges". In: *IEEE Internet of Things Journal (Accepted)* (2020).

[2] **Ghosh, P.**, Bunton, J., Pylorof, D., Vieira, M., Chan, K., Govindan, R., Sukhatme, G., Tabuada, P., Verma, G., "Rapid Top-Down Synthesis of Large-Scale IoT Networks". In: *IEEE TMC (under review). A preliminary version is accepted to be published in IEEE ICCCN 2020* (2020).

[3] **Ghosh, P.**, Liu, X., Qiu, H., Vieira, M. A. M., Sukhatme, G. S., Govindan, R., "On Localizing a Camera from a Single Image". In: *arXiv preprint arXiv:2003.10664* (2020).

[4] **Ghosh, P.**, Tabuada, P., Govindan, R., Sukhatme, G. S., "Persistent Connected Power Constrained Surveillance with Unmanned Aerial Vehicles". In: *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), accepted.* 2020.

[5] **Ghosh, P.**, Gasparri, A., Jin, J., Krishnamachari, B., "Robotic wireless sensor networks". In: *Mission-Oriented Sensor Networks and Systems: Art and Science*. Springer, 2019, pp. 545–595.

[6] **Ghosh, P.**, Nguyen, Q., Krishnamachari, B., "Container Orchestration for Dispersed Computing". In: *Proceedings of the 5th International Workshop on Container Technologies and Container Clouds*. 2019, pp. 19–24.

[7] **Ghosh, P.**, Nguyen, Q., Sakulkar, P. K., Knezevic, A., Tran, J. A., Wang, J., Lin, Z., Krishnamachari, B., Annavaram, M., Avestimehr, S., "Jupiter: A Networked Computing Architecture". In: *arXiv preprint arXiv:1912.10643* (2019).

[8] **Ghosh, P.**, Tran, J. A., Krishnamachari, B., "ARREST: A RSSI Based Approach for Mobile Sensing and Tracking of a Moving Object". In: *IEEE Transactions on Mobile Computing (TMC)* 19.6 (2019), pp. 1260–1273.

[9] Liu, X., **Ghosh, P.**, Ulutan, O., Manjunath, B., Chan, K., Govindan, R., "Caesar: cross-camera complex activity recognition". In: *Proceedings of the 17th Conference on Embedded Networked Sensor Systems (Sensys)*. 2019, pp. 232–244.

[10] Nguyen, Q., **Ghosh, P.**, Krishnamachari, B., "End-to-End Network Performance Monitoring for Dispersed Computing". In: *2018 International Conference on Computing, Networking and Communications (ICNC)*. IEEE. 2018, pp. 707–711.

[11] Sakulkar, P., **Ghosh, P.**, Krishnamachari, B., Avestimehr, S., Annavaram, M., *Wave: A distributed scheduling framework for dispersed computing*. Tech. rep. Technical Report, 2018.

[12] Tran, J. A., **Ghosh, P.**, Gu, Y., Kim, R., D'Souza, D., Ayanian, N., Krishnamachari, B., "Intelligent robotic iot system (iris) testbed". In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2018, pp. 1–9.

[13] **Ghosh, P.**, Jagadeesan, N. A., Sakulkar, P., Krishnamachari, B., "LOCO: A Location Based Communication Scheme." In: *EWSN*. 2017, pp. 311–316.

[14] **Ghosh, P.**, Krishnamachari, B., "Interference power bound analysis of a network of wireless robots". In: *International Conference on Communication Systems and Networks (COMSNETS)*. Springer. 2017, pp. 7–23.

[15] **Ghosh, P.**, Ren, H., Banirazi, R., Krishnamachari, B., Jonckheere, E., "Empirical evaluation of the heat-diffusion collection protocol for wireless sensor networks". In: *Computer Networks* 127 (2017), pp. 217–232.

[16] **Ghosh, P.**, Xie, J., Krishnamachari, B., "miniRadar: A Low Power IEEE 802.15. 4 Transceiver Based Implementation of Bistatic Radar". In: *Proceedings of the 4th ACM Workshop on Hot Topics in Wireless (HotWireless)*. 2017, pp. 25–29.

[17] Knezevic, A., Nguyen, Q., Tran, J. A., **Ghosh, P.**, Sakulkar, P., Krishnamachari, B., Annavaram, M., "CIRCE-a runtime scheduler for DAG-based dispersed computing". In: *Proceedings of the Second ACM/IEEE Symposium on Edge Computing*. 2017, pp. 1–2.

[18] **Ghosh, P.**, Gao, J., Gasparri, A., Krishnamachari, B., "Distributed hole detection algorithms for wireless sensor networks". In: *2014 IEEE 11th International Conference on Mobile Ad Hoc and Sensor Systems (MASS)*. IEEE. 2014, pp. 257–261.

[19] **Ghosh, P.**, Gao, J., Gasparri, A., Krishnamachari, B., "Riverswarm: Topology-aware distributed planning for obstacle encirclement in connected robotic swarms". In: *First Workshop on Robotic Sensor Networks*. Vol. 2014. 2014.

[20] **Ghosh, P.**, Das, S., Zafar, H., "Adaptive-differential-evolution-based design of two-channel quadrature mirror filter banks for sub-band coding and data transmission". In: *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)* 42.6 (2012), pp. 1613–1623.