Shruti Lall

PhD Candidate
Electrical and Computer Engineering
Georgia Institute of Technology

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Research Interests

Edge Computing, Predictive Caching, Machine Learning, Wireless Communications and Networking, Multimedia Systems, Mobile Computing, Data Mining, Data-driven User Behavior Modelling.

Education

PhD, Electrical and Computer Engineering Aug'16 - Present
Georgia Institute of Technology, Atlanta, USA

- Advisor: Prof. Raghupathy Sivakumar
- Dissertation Topic: Time-shifted Prefetching & Edge Caching of Video Content - Insights, Algorithms & Solutions

MEng, Electronic Engineering Jan'15 - Dec'15
University of Pretoria, Pretoria, South Africa

- Advisor: Prof. Sunil Maharaj & Prof. Attahiru Alfa
- Thesis Topic: Optimal Placement and Power Allocation for Jammers in Wireless Mesh Networks
- Graduated Summa Cum Laude

BEng(Hons), Electronic Engineering Jan'14 - Dec'14
University of Pretoria, Pretoria, South Africa

- Graduated Cum Laude

BEng, Computer Engineering Jan'10 - Dec'13
University of Pretoria, Pretoria, South Africa

- Graduated Cum Laude and with Gold Merit Award

Awards and Achievements

- **Fulbright Scholar**, awarded for PhD studies in the U.S., 2016
- Awarded **N2Women/Student Travel Grant** for ACM MobiCom, Los Cabos, Mexico, 2019
- **Semi-Finalist** of Qualcomm Innovation Fellowship 2018, USA
- **S2A3 Medal**, awarded for most outstanding research student in a scientific subject graduating at the Masters level at a South African University, 2015
- **South African Women in Science Award** for outstanding academic and research abilities in the Masters category, 2015
- **Gold Merit Award** for top student in Computer Engineering at University of Pretoria, 2011
- **Dean's List of Merit**, appeared in the Dean's List for outstanding academic achievement at University of Pretoria, 2010-2013
- Member of **Golden Key International Honour Society** for academic achievement at the University of Pretoria, 2010-2015
- **IEB Commendable Achiever** for being ranked in top 5% in 5 subjects in the National Senior Certificate Examinations, South Africa, 2009

- **Dux Scholar**, awarded to top student at St Mary's DSG Pretoria, 2009

Internships

Verizon Media Summer'20

- Worked with the content delivery network research team
- Performed large-scale cache modeling and investigated the inter-dependencies between customers and caching policies
- Developed and evaluated a model for predicting cache churn age for edge servers

IBM Research T.J. Watson Summer'17

- Worked with the IBM Quantum Algorithms group
- Developed and implemented a cognitive Q/A system for IBM's cloud quantum computing offering

IBM Research South Africa Spring'16, Summer'16

- Involved with the Smarter Urban Ecosystems thematic area
- Developed an artificial neural networks based system for wildfire prediction and prevention
- Implemented a user interface and associated dashboard for wildfire risk prediction for the City of Cape Town

Sentech South Africa January'12

- Assisted in the development of the National Wireless Broadband Network Project
- Researched methods for the deployment of wireless networks at a national scale

Research Experience

Predictive Edge Caching of Video Content May'17 - Present

Advisor: Prof. Raghupathy Sivakumar, Georgia Institute of Technology

- Collected and performed an in-depth analysis of real-world datasets of YouTube and Netflix usage and provided substantiated directions for solutions based on obtained insights in the general domains of networking and communication.
- Designed and developed data-driven machine learning and deep learning algorithms for predicting future video consumption behavior
- Developed and implemented prototypes for prefetching algorithms on mobile devices.

Access Point Mobility on Indoor WiFi Communication Jan'17 - Apr'17

Advisor: Prof. Raghupathy Sivakumar, Georgia Institute of Technology

- Investigated the effects that mobility of wireless access points (APs) have on small-scale fading and network throughput
- A linear XYZ actuator mounted with a wireless AP was used to perform multiple experiments to study the effect of AP mobility on single-client and multi-client scenarios

Physical-layer Security Methods for V2X Communication Aug'16 - Dec'16

Advisor: Prof. Geoffery Li, Georgia Institute of Technology

- Studied the application of physical-layer based security techniques for V2X communication in vehicular ad hoc networks
- Investigated using multi-path components to fingerprint channel

Location Optimization and Power Allocation of Jammers Jan'15 - Dec'15
Advisor: Prof. Attahiru Alfa, University of Manitoba, Canada and Prof. Sunil Maharaj, University of Pretoria, South Africa

- Developed a novel physical-layer based technique for prevention of eavesdropping in wireless mesh networks using protective jammers
- Formulated the placement and power allocation of the jammers as a minimization mixed integer non-linear problem
- Performance is evaluated on the OmNet++ platform and using IBM ILOG CPLEX solver

Null-frequency Jamming of a Proactive Routing Protocol Jan'13 - Dec'13
Advisor: Prof. Sunil Maharaj, University of Pretoria, South Africa

- Developed a novel periodic jamming technique for proactive routing protocols in wireless mesh networks
- Evaluated using OmNet++ platform

Publications

S. Lall and R. Sivakumar, "Will They or Won't They?: Toward Effective Prediction of Watch Behavior for Time-Shifted Edge-Caching of Netflix Series Videos", *ACM/IEEE SEC*, 2021.

S. Lall and R. Sivakumar, "A Real-world Dataset of Netflix Videos and User Watch-Behavior: Analysis and Insights", *IEEE ICC*, 2021.

S. Lall and R. Sivakumar, "Are Netflix Videos Edge-Cacheable? Exploration of a Deep Learning based Prefetching Strategy using a Real-World Dataset", *HotEdge*, 2020.

S. Lall, U. Moravapalle and R. Sivakumar, "MANTIS: Time-Shifted Prefetching of YouTube Videos to Reduce Peak-time Cellular Data Usage", *ACM MMSys*, 2020.

S. Lall, M. Agarwal and R. Sivakumar, "A YouTube Dataset with User-level Usage Data: Baseline Characteristics and Key Insights", *IEEE ICC*, 2020.

S. Lall, U. Moravapalle and R. Sivakumar, "Poster: While You Were Sleeping– Time-Shifted Prefetching of YouTube Videos to Reduce Peak-time Cellular Data Usage", *ACM MobiCom*, 2019 (**Awarded Best Poster at ACM S3 Workshop**).

Y. Jian, **S. Lall** and R. Sivakumar, "Toward a Self-Positioning Access Point for WiFi Networks", *ACM MobiWac* 2018.

Y. Jian, **S. Lall** and R. Sivakumar,"Twirl: On the Benefits of Adapting Orientation of a WiFi Access-Point", *ACM MobiSys*, 2017.

S. Lall and B. Mathibela, "The Application of Artificial Neural Networks for Wildfire Risk Prediction", *IEEE RAHA*, 2016.

A. S. Alfa, B. T. Maharaj, **S. Lall** and S. Pal, "Mixed-Integer Programming Based Techniques for Resource Allocation in Underlay Cognitive Radio Networks: A Survey", *Journal of Communications and Networks*, vol. 18, no. 5, pp. 1-18.

S. Lall, A. S. Alfa and B. T. Maharaj, "The Role of Queueing Theory in the Design and Analysis of Wireless Sensor Networks: An Insight", *IEEE INDIN*, 2016.

S. Lall, B. T. Maharaj and P. A. Jansen van Vuuren, "Null-Frequency Jamming of a Proactive Routing Protocol in Wireless Mesh Networks", *Journal of Network and Computer Applications*, vol. 61, pp. 133-141.

S. Lall, A. S. Alfa and B. T. Maharaj, "Optimal Placement and Power Allocation of Jammers in Wireless Mesh Networks", *IEEE VTC*, 2015.

Provisional Patents

S. Lall and R. Sivakumar. Systems and methods for Time-Shifted Prefetching of Predicted Content for Wireless Users. US Provisional Patent Application 17/317,581. 2021.

Technical Skills

Python, SQL, Scikit-learn, Tensorflow, C/C++, Java, MATLAB, Assembly, VHDL, OmNet++, IBM ILOG CPLEX, Wireshark, LaTeX, Web (HTML/CSS/d3/js/PHP)

Certifications

Machine Learning by Stanford (2021), Cisco CCNP: Building Scalable Internetworks Cisco Networking Academy (2013), Cisco CCNA Exploration Cisco Networking Academy (2011)

Coursework Highlights

Telecom	Digital Communications, Coding Theory, Dependable Distributed Systems, Computer Networks, Data Compression & Modeling, Personal & Mobile Communications, Spatial Array Processing, DSP Programming & Applications
Computer Science	Intelligent Systems, Data Structures and Algorithms, Ubiquitous Computing, Introduction to Cognitive Science, Netcentric Computer Systems

Professional Service

- Reviewer for *IEEE Transactions on Mobile Computing*
- Co-authored 2 NSF grants: (i) *Action-based Predictive Content Access- A New Prefetching Paradigm for the Next Generation Wireless Internet*; (ii) *Next-Generation Anticipatory Mobile and Wireless Networks*
- Student volunteer at ACM MobiCom'19

Talks

- Verizon Media, 2020: Large-Scale Cache Modeling for the CDN
- IBM Research T.J. Watson, 2017: Cognitive Q/A for IBM's Quantum Experience
- IBM Research South Africa, 2016: The Application of Artificial Neural Networks for Wildfire Risk Prediction
- Invited talk at IEEE South Africa Chapter on Communications Colloquium at Wits University, 2015: Optimal Placement and Power Allocation for Jammers in Wireless Mesh Networks
- Invited speaker for The Girl Learner Programme at Sci-Bono Discovery Center, Johannesburg, 2014 : Encouraging Learners to Follow Careers in Engineering

Professional Affiliations

- IEEE Member
- ACM Student Member
- IEEE Communication Society Member
- IEEE Women in Engineering Member

Languages

- English (Native)
- Hindi (Fluent)
- Afrikaans (Fluent)