

## Summary

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## Education

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### MA (PhD Incomplete) in Computer Science

Princeton, New Jersey, USA

Princeton University

Apr. 2016

- Received research assistance for work on Network Performance Analysis and Home Network Security.
- Awarded STEM Chateaubriand Fellowship by the Embassy of France for work on the Internet of Things (2016).
- Advisor: Prof. Nick Feamster
- GPA: 3.8/4.0

### BTech and MTech in Electronics and Communication Engineering

Roorkee, INDIA

Indian Institute of Technology, Roorkee

Dec. 2010

- Specialization in Wireless Communication.
- Thesis: Performance Evaluation of Cross-Layer Wireless Body Area Networks.
- GPA: 8.06/10.00

## Skills

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<b>Programming</b>	Python v2.7, v3.3 – v3.7, iPython v7.8, Scala v2.11, Java v12.0, PostgreSQL, C/C++, R, Matlab, Node.js
<b>Analytics</b>	Pandas v0.13 – v0.23, Scikit-Learn v0.21, Tensorflow v1.14.0 – v2.0.0, Apache Spark, Numpy, Scipy, Matplotlib
<b>Networking</b>	Wireshark/Tshark v2.0, Iperf v2.0 – v3.7, Nmap v7.8, Scapy v2.4, Urllib3, Requests, Beautiful Soup 4, NetworkX
<b>Tools</b>	PyCharm, PyLint, IntelliJ IDEA SBT, Eclipse, Git, Linux, Adobe Photoshop, Corel Draw, MS Office, ৳৳

## Work Experience

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### Sugandhaa Co., Ltd.

New Delhi, INDIA

Manager and Freelance Researcher

Apr. 2018 - Present

- Leading a family-owned business. Responsible for inventory, account management, and conducting sales.
- Proficient in interacting directly with customers and managing daily finances to ensure smooth business operations.
- **Network anomaly detection:** Designed and implemented an anomaly detection algorithm for NetFlow records. [Link]
- Used machine learning to extract and transform packet features and detect anomalous behavior in real-time.
- Successfully identified port scans and DoS activity using statistical, information-theoretic, and clustering-based approaches.
- **CDN performance analysis:** Conducted website measurements and tested performance of web page load times. [Link]
- Developed a scalable rule-based CDN estimation algorithm for websites using xcache, whois, parsing, and DNS information.
- Revealed that for some websites, performance can be substantially improved using CDNs offered by their own ASNs.
- **Coursework:** Awarded certificate for Neural Networks and Deep Learning by deeplearning.ai on Coursera. [Link]
- Awarded certificate for Functional Programming Principles in Scala by EPFL on Coursera. [Link]

### Princeton University

Princeton, NJ, USA

Graduate Research Assistant

Jan. 2015 - Sep. 2017

- Advisers: Prof. Nick Feamster (University of Chicago) and Dr. Roya Ensafi (University of Michigan)
- **Identifying Internet of Things (IoT):** Captured and analyzed packets from various IoT devices in the lab. [Link]
- Used machine learning to extract and transform (FFT, PCA, MMT, KDE) volumetric and distribution features from packet headers.
- Used clustering (kmeans, Spectral, MeanShift, DBSCAN) to identify IoTs, and distinguish activity and background traffic.
- Built an IoT behavior monitor and demonstrated that it successfully detects DDoS attack anomalies using DBSCAN. [Link]
- **Real-time IoT query system:** Developed a filtering algorithm to discard non-IoT network traffic using DNS queries. [Link]
- Implemented an exploratory ETL pipeline in PySpark to extract packet header features and cluster IoT network traffic.
- **Internet of Unpatched Things:** Tested multiple IoT devices in the lab and exposed their vulnerabilities. [Link]
- Found that PixStar's digital photo frame was susceptible to eavesdroppers and fails to encrypt photographs, and the Nest thermostat exposed private location information of nearest weather stations to the ISP (now patched).
- **Broadband traffic analysis:** Analyzed usage behavior of customers offered higher speed broadband without their knowledge.
- Found that difference in traffic demand was higher for moderate users as compared to high-volume subscribers. [Link]
- Presented at PAM (Mar 2016), CableLabs (Jul 2016), and FCC (Oct 2016). [Link]
- **Teaching Assistant:** Developed material for Fog Networks and the Internet of Things, Coursera MOOC. [Link]

## Comcast Cable Communications, LLC

### Research Intern

Philadelphia, PA, USA

May. 2016 - Aug. 2016

- Advisers: Jason Livingood (VP, Comcast) and Nirmal Mody (Manager, Comcast)
- Customer Owned and Managed (COAM) Internet of Things (IoT) security: Used DPI to study connectivity, security, and privacy of a subset of Comcast smart homes. Developed a script to search for PII in unencrypted IoT data.
- Used DNS queries to filter smart homes. Identified a misconfigured XBOX for one subscriber by correlating IoT packet captures.

## Georgia Institute of Technology

### Graduate Research Assistant

Atlanta, GA, USA

Aug. 2012 - Dec. 2014

- Advisers: Prof. Nick Feamster (University of Chicago) and Prof. Renata Teixeira (INRIA Paris)
- **Analysis of home network availability, infrastructure, and traffic:** Analyzed active and passive network traces from multiple homes to study network availability in various countries, popular devices in homes, and traffic usage with time. [Link]
- Discovered most home traffic is exchanged to a small number of domains, and home network usage differs based on the device.
- Analyzed prevalence and persistence of traceroutes to a variety of Internet destinations from the perspective of access points.
- **SAZO:** Built and deployed a blacklist based malware identification and notification system on the home router. [Link]
- Used bloom-filters to index malicious IPs and perform quick look-ups on packet headers before redirecting traffic to DPI boxes.
- **Facade:** Built and deployed an HTTP pluggable transport protocol to avoid censorship and detection for Tor. [Link]
- Responsibilities included parallelizing code, implementing framing buffers, and unit testing the system in a team of 6 students.
- **QoS control using SDN:** Identified application and used SDNs to program appropriate rate shaper and control network flow.
- Identified traffic using a DNS classifier and demonstrated ad-block for the whole home using FlowQoS at the access point. [Link]

## INRIA

### Research Intern

Paris, FRANCE

May. 2014 - Sep. 2014

- Advisers: Prof. Renata Teixeira (INRIA Paris) and Dr. Christian Kreibich (ICSI Berkley).
- Browserlab: Home network diagnosis for performance bottleneck detection: Tested uplink and downlink broadband performance between devices, gateways, and online servers to detect if the bottleneck is in the local wireless network or at the edge router.

## LIP6, UPMC

### Research Intern

Paris, FRANCE

Jun. 2013 - Sep. 2013

- Adviser: Prof. Renata Teixeira (INRIA Paris).
- Home network troubleshooting platform using Fathom and BISmark: Programmed active traceroute test on bismark router and analyzed latency and throughput performance from routers.

## North Carolina State University

### Research Scholar

Raleigh, NC, USA

Dec. 2011 - Apr. 2012

- Adviser: Prof. Injong Rhee (VP - IoT, Google).
- Indoor Localization for Samsung Smartphones using Radio: Implemented FM/AM transceiver systems on GNURadio to utilize the time difference in RDS information for performing accurate indoor localization on smart phones.

## Indian Institute of Science

### Junior Research Fellow

Bangalore, INDIA

Apr. 2011 - Dec. 2011

- Adviser: Prof. Anurag Kumar (Director, IISc Bangalore).
- WSNs for Societal Needs and Disaster Management: Prepared work-plan proposal for submission to the Department of Science and Technology (DST), Govt of India.
- Computed closed-formed expressions for network reliability for regular hexagonal network topology.
- Evaluated information-theoretic bounds on network reliability for random hybrid network topology.

## University of New South Wales

### Research Intern

Sydney, AUSTRALIA

May. 2009 - Aug. 2009

- Adviser: Prof. Vijay Sivaraman (UNSW)
- Wireless Body Area Networks for Athlete Monitoring: Analyzed time-series experimental data collected from wireless bio-medical sensors. Developed encounter based model to capture user mobility, and generate synthetic network topologies. [Link]
- Modeled the evolution of connectivity with time, and computed correlation of connectivity using Cholesky decomposition.
- Evaluated the connectivity model using Kolmogorov-Smirnov (K-S) test. Publication awarded Best Paper at WiMob 2010.

## Indian Institute of Technology, Roorkee

### Graduate Research Assistant

Roorkee, INDIA

Jan. 2010 - Dec. 2010

- **Performance Evaluation of a Wireless Body Area Network:** Implemented cross layer protocol to auto-regressively predict PHY parameters and control MAC level queue for mobile nodes in Rayleigh fading environment. Modeled human body channel for intra BAN (on-body network). Comprehensive simulations on NS2 showed improved network throughput and lifetime. [Link]
- **Implementation of a Soft Decision Decoder using Trellis on FPGA:** Implemented a real-time trellis decoder for BCH codes using VHDL on Xilinx ISE and configured it on FPGA.

## Selected Publications

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### CONFERENCE PROCEEDINGS

A Case Study of Traffic Demand Response to Broadband Service-Plan Upgrades

Sarthak Grover, Roya Ensafi, and Nick Feamster

*Proceedings of 17th International Conference on Passive and Active Measurement (PAM)*, 2016, Heraklion, Greece

Facade: High-Throughput, Deniable Censorship Circumvention Using Web Search

Ben Jones, Sam Burnett, Nick Feamster, Sean Donovan, Sarthak Grover, Sathya Gunasekaran, and Karim Habak

*4th USENIX Workshop on Free and Open Communications on the Internet (FOCI)*, 2014, San Diego, CA, USA

FlowQoS: QoS for the Rest of Us

M. Said Seddiki, Muhammad Shahbaz, Sean Donovan, Sarthak Grover, Miseon Park, Nick Feamster, and Ye-Qiong Song

*Proceedings of the Third Workshop on Hot Topics in Software Defined Networking (HoTSDN)*, 2014, Chicago, IL, USA

Peeking Behind the NAT: An Empirical Study of Home Networks

Sarthak Grover, Mi Seon Park, Srikanth Sundaresan, Sam Burnett, Hyojoon Kim, Bharath Ravi, and Nick Feamster

*Proceedings of the ACM Internet Measurement Conference (IMC)*, 2013, Barcelona, Spain

An Experimental Study of Wireless Connectivity and Routing in Ad Hoc Sensor Networks for Real-time Soccer Player Monitoring

Vijay Sivaraman, Ashay Dhamdhere, Hao Chen, Alex Kurusingal, and Sarthak Grover

*Ad Hoc Networking 11.3* (May 2013) pp. 798–817. Elsevier Science Publishers B. V., 2013

Performance Evaluation of Wireless Body Area Network using Cross Layer Approach

Sarthak Grover

*Master's Thesis, Indian Institute of Technology Roorkee* (June 2010). 2010

Experimental study of mobility in the soccer field with application to real-time athlete monitoring

Vijay Sivaraman, Sarthak Grover, Alex Kurusingal, Ashay Dhamdhere, and Allison Burdett

*2010 IEEE 6th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob)*, 2010, Ontario, Canada

A real time face tracking system using rank deficient face detection and motion estimation

Vidit Saxena, Sarthak Grover, and Sachin Joshi

*2008 7th IEEE International Conference on Cybernetic Intelligent Systems (CIS)*, 2008, London, U.K.

## WORKSHOPS AND TALKS

The Internet of Unpatched Things

Sarthak Grover and Nick Feamster

*Proceedings of FTC PrivacyCon*, 2016, Washington, DC, USA

mPaaS: Delivering Mobile Platforms as a Cloud Service

Arpit Gupta and Sarthak Grover

*10th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, 2013, Lombard, IL, USA

End-to-end Routing Behavior in the Internet: A Re-Appraisal from Access Networks

Sarthak Grover and Nick Feamster

*ISMA Workshop on Active Internet Measurements (AIMS)*, 2013, La Jolla, CA, USA

Panoptes: Detecting Malware Activity in Home Networks

Sarthak Grover and Nick Feamster

*HomeSys: Workshop on Design, Technology, Systems and Applications for the Home (UbiComp)*, 2013, Zurich, Switzerland

## Awards & Certificates

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2019 **Neural Networks and Deep Learning**, Coursera

2019 **Functional Programming in Scala**, Coursera

2019 **Machine Learning**, Coursera

2016 **STEM Chateaubriand Fellowship Award**, Embassy of France

2010 **Best Student Paper Award**, IEEE Wireless & Mobile Computing, Networking and Comm. (WiMob)

2008 **Best Electronics Project**, Annual Hobbies Club Exhibition, IIT Roorkee

2004 **Ranked 14**, National Mathematical Olympiad (Delhi)

## Extracurricular Activity

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**PoApper (Developers' Network of POSTECH)**

Core Member & President at 2013

- Reformed the society focusing on software engineering and building network on and off campus.
- Proposed various marketing and network activities to raise awareness.

Pohang, S.Korea

Jun. 2010 - Jun. 2017

**PLUS (Laboratory for UNIX Security in POSTECH)***Pohang, S.Korea***Member***Sep. 2010 - Oct. 2011*

- Gained expertise in hacking & security areas, especially about internal of operating system based on UNIX and several exploit techniques.
- Participated on several hacking competition and won a good award.
- Conducted periodic security checks on overall IT system as a member of POSTECH CERT.
- Conducted penetration testing commissioned by national agency and corporation.