Sarthak **Grover**

Networking, Cybersecurity, and Machine Learning Research

Ph: (+91) 79821 30021
Email: sgrover@protonmail.ch
Web: https://sarthakgrover.github.io
https://linkedin.com/in/groversarthak/

Summary

I'm a network analysis and security researcher, and a machine learning enthusiast with 7+ years of experience specializing in home network measurement, IoT security, and Internet performance analysis. An expert at data analysis using python-pandas, SQL, and machine learning toolkits such as scikit-learn and TensorFlow. Currently working as a freelance researcher, I'm interested in measuring and securing the Internet using innovative machine learning solutions.

Education

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

Work Experience

Sugandhaa Co., Ltd.   *New Delhi, INDIA*
Manager   *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.

Freelance Researcher   *Dec. 2018 - Present*

- **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 (IoTs):** 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]
- **Censor Planet:** Developed scripts to analyze censorship data collected throughout the world using TCP SYN-ACK attacks.
- Implemented multiprocessing python code to filter, analyze, and recombine large traces of server responses to TCP packets.
- Used time-series analysis to conclude whether there is server-side blocking, client-side blocking, or no firewall.   [Link]

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)
- **Home network analysis:** Analyzed active and passive network traces from multiple homes to study network availability and reliability in various countries, popular devices and infrastructure 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]

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.

Indian Institute of Technology, Roorkee
Graduate Research Assistant

Roorkee, INDIA
Jul. 2009 – 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.

Internships

Comcast
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.

INRIA
Research Engineer

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 Engineer

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 Associate

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.

University of New South Wales
Practicum Exchange Student

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.

Teaching Experience

PRINCETON UNIVERSITY

     COS 126: Introduction to Computer Science, Graduate Preceptor with Prof. D. Clark   *Spring 2015*
     Coursera MOOC: Fog Networks and IoT, Teaching Assistant with Prof. M. Chiang   *Summer 2015*

GEORGIA INSTITUTE OF TECHNOLOGY

     CS3251: Computer Networking, Teaching Assistant with Prof. P. Traynor   *Fall 2013*

INDIAN INSTITUTE OF TECHNOLOGY

     ECE 102: Fundementals of Electronics, Teaching Assistant with Prof. M.V. Kartikeyan   *Spring 2010*
     ECE 311: Principles of Digital Communication, Teaching Assistant with Prof. A. Patnaik   *Fall 2009*

Awards & Certificates

2019   **Neural Networks and Deep Learning**, Coursera   *INDIA*
2019   **Functional Programming in Scala**, Coursera   *INDIA*
2016   **STEM Chateaubriand Fellowship Award**, Embassy of France   *USA*
2010   **Best Student Paper Award**, IEEE Wireless Networking and Mobile Communication   *CANADA*
2009   **Practicum Exchange Program Scholarship**, University of New South Wales   *AUSTRALIA*
2008   **Best Electronics Project**, Annual Hobbies Club Exhibition - IIT   *INDIA*
2004   **Ranked 14**, National Mathematical Olympiad (Delhi)   *INDIA*

Skills & Coursework

Programming — Python v2.7, v3.3 – v3.7, iPython v7.8, Scala v2.11, Java v12.0, PostgreSQL, C/C++, R, Matlab, Node.js, Vagrant, Openwrt, GNURadio, MATLAB, Octave, Network Simulator NS-2, TinyOS, Xilinx ISE, GPSS

Analytics — Pandas v0.13 – v0.23, Scikit-Learn v0.21, Tensorflow v1.14.0 – v2.0.0, Apache Spark, Numpy, Scipy, Matplotlib, Seaborn, PostgreSQL, Microsoft Excel

Networking — Wireshark/Tshark v2.0, Iperf v2.0 – v3.7, Nmap v7.8, Scapy v2.4, Urllib3, Requests, Beautiful Soup 4, Networkx, LibPCAP, Metasploit

Tools — PyCharm, PyLint, IntelliJ IDEA SBT, Eclipse, Git, Linux, Adobe Photoshop, Corel Draw, MS Office, LaTeX, Sublime Text, Vim, Visual Studio

Coursework — Computer Networks, Network Security, Advanced Operating Systems, Machine Learning, Algorithms, Software Defined Networks, Probability and Stochastic Processes, Advanced Signal Processing, Information & Communication Theory, Coding Theory & Applications.

Languages — English (Native), Hindi (Native)

Selected Publications

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

Extracurricular Activity

IEEE Student Chapter   *Roorkee, INDIA*
Member & Treasurer   *Jun. 2006 - Jun. 2010*
- Organized events for student members to discuss recent research in the field of electronics and communication engineering.

Geek Gazette   *Roorkee, INDIA*
Founder & Chief Designer   *Jun. 2008 - Jun. 2010*
- Founded the campus technical magazine to publish recent influential research by university professors.
- Responsible for reading research papers, summarizing and editing articles, and designing the magazine in Corel Draw.
- Acquired publishing funds from the campus IEEE student chapter.

Watch Out News Agency   *Roorkee, INDIA*
Chief Designer   *Jun. 2005 - Jun. 2008*
- Designer for campus news magazine. Promoted to Chief Designer in third year.
- Responsible for editing and designing magazine in Corel Draw, drawing cartoons in Adobe Photoshop, and hiring new designers.

Hostel Soccer Club   *Roorkee, INDIA*
Regular Member   *Jun. 2005 - Jun. 2010*
- Member of hostel and academic year soccer clubs.
- Regularly played defense and mid-field as part of the team.

References

Available on request.

For further information, please visit https://sarthakgrover.github.io/