# Yuvraj Singh Malhi


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## Education

### Birla Institute of Technology & Science, Pilani (BITS Pilani) — *Pilani, India*

Bachelor of Engineering (Electronics and Instrumentation): *GPA – 8.36/10 GRE – 331/340* — *2018 - Present*

**Interests** Network security, System security, Software Security, Machine Learning, Deep Learning
**Positions** Teaching assistantship (**01**), Undergraduate research assistantships (**05**), Industry internships (**02**)
**Languages** **Proficient –** C, C++, Python, MATLAB, HTML, LaTeX. **Basics –** Java, Assembly language, Spice
**Courses** Network security, Computer programming, Network programming, Data structures, Cloud computing, Ethical hacking
**Tools** Metasploit, WireShark, Tensorflow, Scikit-Learn Git, GitHub, VScode, Jupyter

### Central Board of Secondary Education — *Bangalore, India*

**Senior Secondary** Class Rank: **3**. JEE percentile: **99.38%**. SAT Mathematics: **800/800** — *2018*
**Secondary** Class Rank: **1**. Grade Point: **10/10**. Received **Certificate of Merit**

## Research

### Research Experience & Formal Projects

#### IIT Kanpur, c3i Cybersecurity Division — *Kanpur, India*

Research Intern — *May 2021 - July 2021*

- Among **top 5** students from India selected to be a part of the **Intrusion Detection Team** of IIT's cybersecurity division. Learnt about IDS roles, applications, working mechanisms, limitations, and future prospects.
- Surveyed and categorized IDS solutions for **non-encrypted and encrypted traffic analysis** based on application and detection mechanism.

#### Undergraduate Research Assistant, BITS Pilani — *Pilani, India*

Project with Professor Virendra Shekhawat on **Security Problems in Blockchain Technology** - *In Progress* — *Spring 2022*

- Aim to survey and categorize vulnerabilities in blockchain ledgers and transaction methodology by analysing recent frauds in cryptocurrencies.

Project with Professor Virendra Shekhawat on **Intrusion Detection Systems for IoT using ML** - *10/10* — *Spring 2021*

- Designed and implemented **network IDS for IoT devices** to overcome design flaws of existing intrusion detection systems. This IDS can detect 22 types of attacks with help of three ML based modules using **Random Forest, ANN, Decision Tree, and XGBoost** algorithms.
- Central Module used for attack detection & classification with F1 Score **94.41%**. One among two edge modules used for only attack detection at IoT edge with F1 scores of **99.98%** and **99.87%**.

Project with Professor Hari Babu on **Mitigating DoS/DDoS attacks in SDN Data Planes** - *10/10* — *Spring 2021*

- Surveyed and analyzed methods used to **detect and mitigate** Denial-of-Service (**DoS**) and Distributed Denial-of-Service (**DDoS**) attacks at **Data Plane** level in Software Defined Networks (SDN) using P4 language.
- Identified **limitations of P4** for attack detection and mitigation such as: No support for loops and for complex functions, and minimal support for mathematical analysis. This project is further being used by students to develop a defense solution at data plane level.

Project with Professor Rahul Singhal on **Novel Optimization technique of Low Loss Antenna** - *10/10* — *Fall 2020*

- Designed a simple and efficient **regression optimization** technique for designing antennas with low return loss (< -15 dB).
- Used the designed technique on **MATLAB** to optimized a 2.4 GHz Patch antenna **4X faster** .

Project with Professor Navneet Gupta on **Comparison of ANN Soft Computing Techniques for Antenna Design** - *10/10* — *Spring 2020*

- Worked on soft-computing, artificial neural network, and their combined use for **low cost calculations**.
- Compared performance of **22** combinations of networks and optimization algorithms for designing a rectangular patch of a Microstrip antenna. This test was carried out for different use-case frequencies of **WiFi** (5 GHz), **Bluetooth** (2.48 GHz) & **3G** (1.8 GHz).
- Achieved highest accuracy of **99.938%** with Reduced Radial Basis Network and quickest training time of **0.001s** with Generalized Regression.

### Papers & Publications

**Two-Level Machine Learning Driven Intrusion Detection Model for IoT Environments** — *Switzerland | Read Paper*
*Y.S. Malhi, V.S. Shekhawat,* International Journal of Information and Computer Security (IJICS) — *Jan 2022*

***Accepted* - Comparison of ANN based Soft Computing Techniques for Electromagnetic Modeling of a Microstrip Patch Antenna** — *India | Read Pre-print*
*Y.S. Malhi, N. Gupta,* 6th International Conference on Soft Computing: Theories and Applications (2021) — *Dec 2021*

**A Comparative Study on Industrial Multiphase Flow Measurement Techniques** *India | Read Paper*

*P. Grover, Y.S. Malhi, R.N. Ponnalagu,* 8th International and 47th National Conference on Fluid Mechanics and Fluid Power (2020) *Dec 2020*

# Work Experience

### Samsung Research & Development Institute
*Bangalore, India*

Network and Systems Intern *July 2021 - Dec 2021*

- Working on **ML-based log analysis** for **system fault detection** and post-mortem **root cause analysis**.
- Working on **anomaly detection** by monitoring system background information in order to take preventive action before hard failure occurs.

### ioT-ioT
*Pune, India | See Project*

Linux Automation Intern *Dec 2019 - Jan 2020*

- **Automated** the process of notifying user on occurrence of a specific event.
- Created an **SMTP client** with CLI in **C++** to send TLS encrypted emails using **cURL** library.

### Larsen & Tourbo Chiyoda
*Gujarat, India | Read Paper*

Summer Intern *May 2020 - July 2020*

- Identified and documented state-of-the-art instrumentation techniques and devices used in **complex multiphase flow measurement**.
- Published 'A Comparative Study on Industrial Multiphase Flow Measurement Techniques' in FMFP 2020.

### Student's Society of Mess Services (SSMS)
*Pilani, India*

Mess Secretary, SSMS Governing Council Member *Aug 2018 - July 2019*

- Part of a 13 member governing council responsible managing day-to-day mess activities, quality assurance, infrastructure development, renewing tenders, and resource allocation of over **200 employees** and having annual budget of more than **Rs 2 Crore**.

# Additional Projects

### Ultra Fast Trace-route
*See Project*

- A concurrent server runs traceroute on multiple domains and give results within **3 sec**, which is up to **10X faster** than standard traceroute.
- A TCP client runs on a separate window to find the **longest common routing path** among given set of domains.

### Linux shell with added functionality
*See Project*

- A clean and verbose **command shell** built in **C** that can support output redirection and almost all **CLI commands** like ls, cat, grep etc.
- Additionally, this shell includes two new commands: `double pipe ||` and `triple pipe |||`.

### Concurrent TFTP Servers
*See Projects |*

- Created a TFTP single process server to handle multiple clients concurrently using `listen` call on multiple client FDs. Speed: **~25 Mbps**.
- Created a TFTP **multi process server** to handle multiple clients by creating a new child server for each client. Speed: **~50 Mbps**.
- These servers are incorporated with unresponsive client **timeouts** and can run in `verbose` mode.

### Ultra-fast URL Port Scanner
*See Project*

- Scans URL open ports upto **10X faster** than traditional scanners by using upto 100 of child scanners **concurrently**.
- The scanner also **lists all IPv4 and IPv6 addresses** allotted to each URL.

### Simple Hadoop Implementation

- Replicated a simpler version of **Google File Storage** by creating client, data server and meta-data server. Client uploads files in chunks and **distributed data servers** store 3 separate copies of each chunk to ensure **availability** in case any data server crashes.
- All IPC (Inter process communication) for download, upload, permission, and **security** of files is facilitated by the **meta-data server**.

# Teaching

### Teaching Assistant, BITS Pilani
*Pilani, India*

TA of Professor Hari Babu for the course **'IS F462 Network Programming'** *July 2021 - Present*

- Selected as teaching assistant for a **graduate level course** to conduct **networking programming labs** and doubt clearing sessions.
- Responsible for correcting **lab assignments** and providing inputs for lesson plans.

### Manzil (NGO)
*Delhi, India*

Teacher *Aug 2020 - Present*

- Part-time volunteer teacher of **English** and **C++** classes conducted for under privileged children.

# Interests and Achievements

**Sports** Hockey (**University team**), Athletics, Swimming

**Extracurricular** Reading, Hiking, Cycling, College Cultural Activities

**Honors & Awards** Best **all-rounder** award (2018), School **Pupil Leader** (2018), **1st** in National Astronomy Olympiad (2017)

**Scholarships** Class 12 outstanding performance (2018), FIITJEE Scholarship (2017), AFSH Class 10 outstanding performance (2016)