# Andrews George Varghese

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## EDUCATION

**Indian Institute of Technology (IIT) Bombay** — **Mumbai, India**
B.Tech. (Honors) in Electrical Engineering, GPA : 9.65/10, Dept. Rank : 4/150 — **2018 – 2022**
Minor in Computer Science and Engineering

## WORK EXPERIENCE

**NR vRAN Software Engineer** | Samsung Electronics HQ, South Korea — Sep '22 – Present
Developing highly optimized 5G L1 PUSCH algorithms in C++20, leveraging SIMD for superior performance

- *Accolades:* **vRAN Group Best Programmer Award**, Q1 '23, and **Samsung SW Awards**, H1 '23 & H1 '24
- Achieved ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ by leveraging linear algebra, enhancing loop structure, improving memory access patterns, and exploiting instruction-level parallelism
- Coordinated with Intel engineers to adapt the Frequency Equalization module for the new Sapphire Rapids processor and 5GISA (float16) resulting in ▮▮ **performance improvement** along with ▮▮ **power savings**
- Designed, validated **lock-free** PUSCH scheduler to reduce the impact of thread scheduling delays by **90%**
- Redesigned the software and hardware LDPC architectures, increasing parallelism and reducing locks by **50%**, leading to a ▮▮ **speedup** in SW and a ▮▮ **performance improvement** in HW
- Implemented E2E testing framework with support for asynchronous inter-cell communication to simulate real-world scenarios; parallelized long-running tests' framework to reduce runtimes from ▮▮▮▮▮
- Currently collaborating with Intel engineers in integrating ▮▮▮▮▮▮▮▮▮▮ by redesigning our SIMD(vector)-centric code to use **tiled operations**

**Networks Engineer (Intern)** | Samsung Electronics HQ, South Korea — Jun '21 – Jul '21

- Explored SIMD via bitonic sort and obtained **5x speedup** over `std::sort` on vectors of 8-bit integers
- Vectorized gold sequence generator using Galois field theory & Barrett Reduction, obtaining a ▮▮ **speedup**

## RESEARCH EXPERIENCE

**Autonomous Aircraft Control via Reinforcement Learning** — Feb '22 – Sep '22
Airbus Learning to Fly Challenge — Mentor: Prof. Shivaram Kalyanakrishnan

- Addressed the Heading Control Task using the JSBsim flight dynamics model: maintain an Airbus A320's heading and altitude within strict safety margins, with larger random yaw turns executed every 150 seconds
- Designed a control algorithm using **policy search** via hill climbing, trained on a **core sub-task** of flying for 360 seconds with large yaws at both 150s and 300s, ensuring transferability to the original task
- Developed an objective function with a custom lexicographical ordering for improved search efficiency over the policy space; prioritized tighter turns over higher immediate rewards to incentivize valid yaw executions
- Results: Placed **1st** in the competition, with an average flight time of **132 minutes**

**Autonomous Underwater Vehicle (AUV-IITB)** — Oct '18 – Aug '22
RoboSub, AUVSI & US Office of Naval Research — Mentor: Dr. Leena Vachhani
An all-student team working on the development of the AUV Matsya that navigates & performs realistic tasks

- *Accolades:* **Young Researcher Prize**, IEEE OES 2021, Japan | **Finalists (7th) at RoboSub 2022**, Maryland
- Formulated a **Time Difference of Arrival** (TDoA) based algorithm to locate a pinger underwater using 4 hydrophones; supplemented with Taylor-series and Monte Carlo simulations to model error-propagation
- Developed a mission control in ROS to process dependency trees of asynchronous tasks; supported **real-time priority and success probability updates** using sensor fusion of vision, acoustics and localization data
- Calculated optimal positioning of 8 thrusters on Matsya to ensure 6 DoF maneuverability; implemented a 6-PID controller and navigator system that achieves setpoints using minimal time and power under constraints
- Designed the software stack for commercial Remotely Operated Vehicles (ROVs) built in collaboration with Larsen & Toubro and major Indian oil companies in CoE-OGE for defense and pipeline inspection purposes

**Modeling Uncertainty in DNNs**                                                    Spring '21
EE691 RnD Project                                                          Mentor: Prof. Amit Sethi
- Integrated Evidential Deep Learning method into curriculum learning framework for Out-Of-Distribution detection in the Tiny ImageNet Dataset with average **5% increase** in accuracy under label noise and OOD data
- Observed Contrastive Learning with K-means scoring had better OOD data separation than Gausssian scoring

## ACADEMIC PROJECTS

**Hangman on Pt-51 uController:** Simulated Hangman on an LCD; supported randomized start word selection, inputs via UART + keyboard, guess timeouts via interrupts; judged **best submission** of the course

**Right Ventricle Segmentation:** Implemented symmetric UNets to segment cardiac cine MRIs and find right ventricle endocardium and epicardium; trained with dice and focal losses to handle class imbalances

**Fingerprint Matching:** Given database and probe fingerprints, identified matches using Poincaré index based core detection and band-limited phase-only correlation obtained from iDFT of their cross-phase spectrum

**Recommender Systems**: Implemented traditional, deep learning and ensemble music recommender systems

## MENTORSHIP AND LEADERSHIP

**Team Leader** | AUV-IITB, IIT Bombay                                        May '21 – Aug '22
Managed operations, finances (███ budget), knowledge transfer in a 4-tier, **50+ member**, multi-disciplinary team; set vision and strategy while identifying risks and planning contingencies; obtained $30K in sponsorships

**Teaching Assistant** | IIT Bombay                                          Nov '20 – Jul '22
*CH105: Organic Chemistry | PH108: Basics of Electricity & Magnetism | CS101: Computer Programming and Utilization*
Conducted regular tutorials for 100+ students; created problem sets & projects; vetted exam materials; organized help sessions for under-performers in CS101; received the **TAship Excellence Award** for work in CS101

**Institute Student Mentor, Department Academic Mentor** | IIT Bombay          Jul '20 – Aug '22
Mentored **28 first-years** & **14 sophomores** to thrive in college life; guided **16 first-time mentors** in their mentorship journey as their Sub-Group Head; assisted an under-performing senior get back on track and **graduate** under the Academic Rehabilitation Program; received **Special Recognition Award** for exemplary mentorship

## RELEVANT COURSEWORK AND SKILLS

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|---|---|
| **Computer Science** | Advances in Intelligent and Learning Agents (RL), Design and Analysis of Algorithms, Operating Systems, Advanced Topics in ML, Networks |
| **Electrical Engg.** | Processor Design, Computer Architecture for Performance and Security |
| **Mathematics** | Probability and Random Processes, Data Analysis and Interpretation, Complex Analysis, Linear Algebra, Differential Equations, Calculus |
| **Programming** | C/C++, Bash, Python, VHDL, Kotlin, MySQL, Django, LaTeX |
| **Software** | PyTorch, TensorFlow, DPDK, ROS, Intel VTune, Git, MATLAB, Intel PCM |

## SCHOLASTIC ACHIEVEMENTS

- Awarded **3 AP grades** (Advanced Performer) for exceptional performance in Digital Systems, Foundations of VLSI CAD, Organic and Inorganic Chemistry
- Secured **All India Rank 91** in **JEE Advanced 2018** out of over 1.5 million candidates
- **Gold medalist** (one of top 35 out of 56,000 candidates) in the Indian National Chemistry Olympiad (INChO)
- Received the **Best Outgoing Student** Award from Maharishi Vidya Mandir School for all-round achievement
- Recipient of **NTSE Scholarship**, **KVPY Fellowship** (Govt. of India) for being in the nation's top 1500 students
- Received the Quadeye Excellence Scholarship '22 for academic achievements and quantitative reasoning skills

## EXTRACURRICULARS

- Completed **Chartered Financial Analyst Level I** in Feb 2024 and currently a CFA Level II candidate
- Secured **3$^{rd}$ place internationally** in the MaRRS International Spelling Bee Contest in 2014 and 2015
- Placed **2$^{nd}$ nationally** in the SPELLINC competition, 2015, conducted by LINC pens at Kolkata
- Completed **5$^{th}$ grade in piano** from the Associated Board of the Royal Schools of Music (ABRSM), London