Gaurav Duggal

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EDUCATION

Virginia Tech, USA, Department of ECE **2021 – present**
- Ph.D. in Electrical Engineering

Indraprastha Institute of Information Technology, Delhi, India **2017 – 2019**
- Masters (M.Tech.) in Communications and Signal Processing Engineering.

Birla Institute of Technology and Sciences, Hyderabad India **2009 – 2013**
- Bachelor (B.E.) in Electrical and Electronics Engineering.

PROFESSIONAL EXPERIENCE

Graduate Intern, *Samsung Research America, Plano, Texas (SMI-lab)* **May 2022 – Aug 2022**
- Worked on an Ultra WideBand (UWB) Radar based product and submitted a patent application for an algorithm that lowered latency.

Engineer, *Qualcomm, India (RF software team)* **Jul 2019 – Aug 2021**
- Worked on software bring-up of Qualcomm modems and resource allocation algorithms.

Graduate Intern, *Hertzwell, Singapore* **Dec 2018 – Feb 2019**
- Developed an end to end automotive MIMO radar signal processing including waveform design, ground clutter modelling, automotive target modelling and receiver effects modelling.

Member of Technical Staff, *Tonbo Imaging, India* **May 2015 – Jun 2016**
- Developed firmware for a thermal imaging camera system used by Defence Forces across the globe.

Embedded Electronics Engineer, *Ducere Technologies, India* **Jul 2013 – Apr 2015**
- Implemented prototypes of Wearable technology based design ideas using basic physics and electronics.

Embedded Electronics Engineer, *Ducere Technologies, India* **Jul 2013 – Apr 2015**
- Made working prototypes of Wearable technology based design ideas using basic physics and electronics.

Research Intern, *Cranfield University, United Kingdom* **May 2012 – Jul 2012**
- Designed an Inertial Navigation System (INS) for an Unmanned Ground Vehicle using an accelerometer, magnetometer and gyroscope mems based sensors.

SELECTED PUBLICATIONS

[3] N. Pandey, G. Duggal, en S. S. Ram, "Database Of Simulated Inverse Synthetic Aperture Radar Images For Short Range Automotive Radar", in **2020 IEEE International Radar Conference** (**RadarConf**), 2020, bll 238–243. [Paper]

[2] G. Duggal, S. Vishwakarma, K. V. Mishra, en S. S. Ram, "Doppler-resilient 802.11 ad-based ultrashort range automotive joint radar-communications system", **IEEE Transactions on Aerospace and Electronic Systems**, vol 56, no 5, bll 4035–4048, 2020. [Paper]

[1] G. Duggal, S. S. Ram, en K. V. Mishra, "Micro-Doppler and micro-range detection via Doppler-resilient 802.11 ad-based vehicle-to-pedestrian radar", in **2019 IEEE Radar Conference** (**RadarConf**), 2019, bll 1–6. [Paper]

COURSEWORK

Multi Channel Communications (MIMO), Information Theory, Software Defined Radios, Stochastic Signals and Systems, Radar Systems, Reinforcement Learning, Data Structures and Algorithms.

TEACHING

Teaching Assistantship

- TA for the Grad course - Radar Systems (ECE 5675) with Prof. Mike J. Ruohoniemi at Virginia Tech. [Fall 2021]
- Wearable Applications, Research, Devices, Interactions (DES 513) with Prof. Aman Parnami at IIIT Delhi. [Monsoon 2018](Aug-Dec)
- Probability And Statistics (MTH 201) with Prof. Sanjit Kaul at IIIT Delhi [Winter 2018](Jan-May)

PROJECTS

MIMO-Course simulations, under Prof. R. Michael Buehrer

- Implemented a narrow-band MIMO channel model based on Clarke's model, various Beamforming algorithms, Transmit and Receive diversity techniques and spatial multiplexing techniques. [Fall 2022]

Wireless localisation in a Joint-Radar communication system in an urban environment, under Prof. R. Michael Buehrer and Prof. Harpreet Dhillon

- Derived Cramer-Rao bounds for wireless localisating using a Joint Radar-Cellular Communication system with the radar doing range/angle measurements in Line of Sight conditions and a ToA system with Non-Line of Sight bias operating in both LoS and NLoS conditions.
- This proposal made it to the North America finals of the Qualcomm Innovation Fellowship, 2022. [Proposal] [Spring 2022]

Business Plan on - A High Quality Wireless Video Streaming Module for Drones, under Prof. J.H Reed

- Identified a business opportunity and proposed an idea for a wireless video streaming product for the Cinematography using Drones industry. [Proposal] [Spring 2022]

Orthogonal Time Frequency Space waveform simulation, under Prof. J.H. Reed.

- Simulated the OTFS waveform which included going from the Delay-Doppler domain to the Time Frequency domain at the transmitter. This was then passed through a channel and then from Time-Frequency domain back to Delay-Doppler domain. [Code] [Spring 2022]

Micro Doppler Radar using HB100 and RCWL-0516, Independent project

- Implemented a Doppler radar in hardware by amplifying the received baseband signals from an RF front end (HB100) and then using an opamp based active amplifier circuit with adjustable gain.
- Sampled the amplified signal using an Arduino ADC and used Serial to send this data to the computer.
- The digitally sampled signals were processed using an Short time Fourier Transform (STFT) algorithm with a hamming window in Python code. We can see micro Doppler features of the target ceiling fan - blades in the spectrogram output [Code], [Video]

ADS-B Receiver and Antenna Design to Track Aircraft, Dr. SS Ram, Assoc Prof, IIITD

- Designed and Constructed a portable Automatic Dependent Surveillance-Broadcast (ADS-B) radio receiver using a Software Defined Radio and an embedded computer to track commercial aircraft
- Implemented a Matched Filter in the preamble detection stage of the ADSB receiver code.
- Implemented 1 bit error correction for the adsb packet.
- Constructed a phased array antenna based on a paper in the Antennas and Propagation journal, for the system to improve aircraft tracking up to the horizon (400km). [Presentation]

Reinforcement Learning Agent for the Atari game Catch, Dr. Sanjit Kaul, Assoc Prof, IIITD

- Implemented Policy Gradient based methods (2018 research papers) and compared it with Deep-Q learning to learn the optimal policy for Atari game Catch. [Code]

AWARDS

- **Qualcomm Innovation Fellowship 2022 - finalist** - Joint radar-communication based wireless localisation **2022**
- Secured a scholarship amounting to 960 UK pounds per month for 3 months for a research internship at **Cranfield University**, United Kingdom. **2012**
- **All India Engineering Entrance Exam** - Top 0.4 percent among 1.2 million candidates. **2009**
- **IIT Joint Entrance Exam** - Top 1 percent among 0.5 million candidates. **2009**
- Won an Individual **Silver** medal (among 77 teams from 11 countries) at the 4th International Young Mathematician's Convention (**IYMC**). **2008**
- **National Cyber Olympiad 2007** - All India Rank 13 **2007**

SKILLS

Languages : C, C++, Python, Matlab

Deep Learning Libraries : Tensorflow (Basic)

Version Management : Git (fluent)