

Thariq Shanavas

thariq-shanavas.github.io

University of Colorado
Boulder, Colorado, USA – 80309
thariq.shanavas@colorado.edu

Education

2019 – Present PhD Candidate in Physics, University of Colorado, Boulder, USA

2015 – 2019 Undergraduate, Indian Institute of Technology – Bombay, India
Major in Electrical Engineering, Minor in Physics. *CPI – 9.00/10*

Publications

Farsinezhad, S., **Shanavas, T.**, Mahdi, N., Askar, A. M., Kar, P., Sharma, H., Shankar, K. (2018).
Nanotechnology, *Core-shell titanium dioxide–titanium nitride nanotube arrays with near-infrared plasmon resonances*. <http://doi.org/10.1088/1361-6528/aaad58>

Honors and Fellowships

- **Kishore Vygyanik Protsahan Yojana (KVPY)** 2015
Financial award by the Department of Science and Technology, India, for promotion of basic Sciences among high school students to approx. 1500 students in the country among 40,000 candidates.
- **National Talent Search Examination (NTSE)** 2013
Awarded by the National Council for Educational Research and Training as support for secondary education to approx. 1000 students in the country among 900,000 candidates.
- **Joint Entrance Examination** 2015
Ranked 69 among 1.35 million candidates for admission to IIT Bombay, the premier technical university in India.

Key Research Experience

- **Undergraduate Thesis – IIT Bombay** July 2018 – November 2018
Magnetometry using Nitrogen-Vacancies in Diamond *Advisors: Dr Pradeep Sarin, Dr Kasturi Saha*
 - Involved in designing the experimental setup for sensing weak magnetic fields at micron-scale resolution using nitrogen-vacancy centers in diamond.
 - Using a microwave antenna, provided a uniform RF excitation to the diamond sample for magnetometry using optically detected magnetic resonance.
 - Improvements in the microwave field delivery system led to 57 percent increase in usable nitrogen-vacancies as compared to the setup previously used in the group, corresponding to an expected shot-noise limited sensitivity improvement of 21 percent. [Report](#)
- **Tyndall National Institute, Ireland** May 2018 – July 2018
Demonstration of 20Gbps communication over 10G-class optics enabled by machine learning
Advisors: Dr Cleitus Antony, Dr Paul Townsend
 - Explored the use of neural networks for equalisation at the receiver end and pre-compensation at the transmitter end to compensate non-linear effects of the channel
 - Integrated recurrent, convolutional and decision-feedback neural networks to a simulation testbed and real time experimental setup.
 - Demonstrated 20Gbps data transfer over 10G-class optics using a convolutional neural network at the receiver, within the acceptable error rates for Forward Error Correction. [Report](#)

- KEK, High Energy Accelerator Research Organisation, Japan** Nov 2017 – Dec 2017
 FPGA based controller for self-triggered hybrid pixel detector Advisors: Dr Manobu Tanaka, Dr Tetsuichi Kishishita
 - Developed the FPGA framework for a hybrid pixel detector.
 - Characterised the field response of the analog front end ASIC chip, with test signals using the developed framework.
 - Examined proposed changes to the amplification stages of the ASIC chip, recommended the design with the least equivalent noise charge using Cadence.[Report](#)
- University of Alberta, Canada** May 2017 – July 2017
 Modelling of Photonic nanotubes exhibiting near-infrared plasmon resonance
 Advisor: Dr Karthik Shankar
 - Analytically modelled and numerically simulated the optical properties of titanium dioxide nanotubes coated with Titanium Nitride.
 - Analytical predictions made by modifying Gans theory for a composite nanostructure led to accurate predictions of the plasmon excitation, results agreed with experimental result.
 - Set up and documented a finite element modelling testbed on the University of Alberta Supercomputing cluster using Comsol to support future work on plasmon resonance.

Other Research Experience

- Particle discrimination using machine learning and matched filtering** Mar 2018
Course Project, EE338: Digital Signal Processing
 Prof. V M Gadre, Department of Electrical Engineering, IIT Bombay
 - Used logistic regression and matched filtering to discriminate pions and electrons in the signal from a scintillation detector.
 - Analytically modelled the detector output to compare against incoming signal for matched filtering, used the same model to generate training dataset for the ML classifier.
 - Achieved over 98 percent accuracy for both techniques under reasonable noise conditions.[Poster](#)
- Calibration of readout electronics for Silicon detectors** Jan 2017 – Apr 2017
 Prof. Pradeep Sarin, Department of Physics, IIT Bombay
 - Designed a portable GHz level pulse generator for the purpose of calibrating the electronic readout of Silicon and Diamond particle detectors.
 - Implemented a low noise transconductance amplifier circuit followed by an attenuator block to convert a voltage pulse into a micro ampere current pulse.
- Design of multicycle RISC Processor – Course Project, EE309: Microprocessors** Oct 2017
 Prof. Virendra Singh, Department of Electrical Engineering, IIT Bombay
 - Designed and simulated a multicycle RISC processor optimised for performance.
 - Implemented a Von Neumann architecture, used a shared data and instruction memory.
 - Implemented and verified the design on an FPGA.[Report](#)
- Image classification using Spiking Neural Networks** Nov 2017
 Prof. Udayan Ganguly, Department of Electrical Engineering, IIT Bombay
 - Demonstrated Spike Timing dependent plasticity using a GLM model of probabilistic SNNs.
 - Implemented First-to-Spike decoding rule - the SNN can perform an early classification decision once a spike firing is detected at an output neuron.
 - Observed a massive speed up in training and execution using first to spike decoding as opposed to conventional rate decoding.[Poster](#). [Report](#)

- Matsya, Autonomous Underwater Vehicle | AUV-IITB** Oct 2015-Oct 2016
International RoboSub, AUVSI & US Office of Naval Research
 - Part of a 30 member team aimed at developing unmanned AUVs. The team came second in the world at the international Robosub competition 2016, San Diego, California.
 - Developed the DC-DC boost converter, motor drivers, battery hot-swapping capability and water seepage detection modules.
- Simulation of Spiral RF inductors** Apr 2016 - June 2016
Prof. Dipankar Saha, Department of Electrical Engineering, IIT Bombay
 - Studied and simulated Spiral RF inductors in the micron scale using finite element techniques.
 - Extracted the S-parameters as a function of the frequency of operation.
- Coverage Control of multi-agent robotic systems** Nov 2016 – Feb 2017
Prof. Sukumar Srikant, Systems and Control Engineering, IIT Bombay
 - Proposed a decentralised controller for autonomous mobile robots, drawing inspiration from patterns observed in the seed distribution of a sunflower.
 - Proposed a Lyapunov-type proof for the stability and convergence of the designed controller.
 - Numerical simulations carried out for the proposed controller. Results found to agree very well with coverage objective. [Report](#)

Leadership and Organisation

- Manager, Maths and Physics Club, IIT Bombay** 2017 – 2018
 - As a junior undergraduate, I led a team of six sophomores to foster enthusiasm in mathematics and physics, tending to a community of 400 – 500 in campus.
 - Organised institute-wide quizzes, talks, group discussions and mentoring activities to promote interest in the fundamental sciences.
 - Introduced Scientific Computing Championship to promote interest in Numerical methods for scientific research, first ever conducted to this scale in campus.
 - Oversaw five times improvement in year-to-year participation in Summer of Science initiative, where the club matches senior students to mentor enthusiasts in an area of their interest. [Work Report](#)

Technical Skills

Programming Languages : C++, MATLAB

CAD and Scientific Packages : Eagle, Altium, SolidWorks, Cadence, Comsol, CST Microwave Studio

Other software : Atmel studio, Arduino, HTML, CSS, Latex, gnuradio, VHDL, Xilinx ISE

Extracurricular Activities

- Popular Talks-
 - Control loops and PID algorithm* - Robotics club, IIT Bombay. [Slides](#).
 - Particle Physics: Small detectors, Big questions* - Maths and Physics Club. [Slides](#).
- Completed a year-long course on playing the Keyboard.
- Participated in the Summer of Science initiative under an experienced senior mentor, on Cosmology under the Maths and Physics Club. [Report](#)
- Secured first prize in Electric Jhatka General Championship by the Electronics club, an institute-wide circuit design competition.

References

1. Prof. Juliet Gopinath
Associate Professor
University of Colorado, Boulder
PhD Advisor
+1 (303)-492-5568
juliet.gopinath@colorado.edu
2. Prof. Pradeep Sarin
Associate Professor
Indian Institute of Technology, Bombay
Undergraduate thesis supervisor
+91-22-25767591
pradeepsarin@iitb.ac.in
3. Prof. Karthik Shankar
Professor
University of Alberta, Canada
Internship Supervisor
+1 780 492 1354
kshankar@ualberta.ca
4. Dr. Cleitus Antony
Postdoctoral Researcher
Tyndall National Institute, Ireland
Internship Supervisor
cleitus.antony@tyndall.ie
+353 021 2346827
5. Prof. Manobu Tanaka
Professor
KEK, High Energy Accelerator Research Org. Japan
Internship Supervisor
tanakam@post.kek.jp
+81 298-864-5405