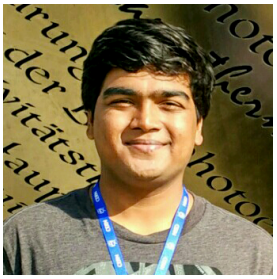
AMITABH YADAV



Electronics & Computer Engineer

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SUMMARY[1]

I'm an Electronics and Computer Engineer currently working as a Fellow at CERN - a cheerful nerd who loves Vim, Linux, Mathematics, Physics and Problem solving. I'm experienced in designing complex computing systems in experimental physics, space systems and safety-critical electronics. Briefly, I have also worked on topics in Theoretical CS where I devised an algorithm for pattern matching for the High-Energy Physics use-case.
My research interests lie in **Digital IC/ASIC Design**, **Computer Architecture** and **AL/ML accelerator Hardware/Software Co-design**.
When on a break, I enjoy traveling, playing tennis, running, swimming and photography.

EDUCATION

University of California, Berkeley, U.S.A. *November 2019 - December 2021*
Affiliate at Department of Physics

- Courses: CS61C Machine Structures, EE290-2 Hardware for Machine Learning, EECS151 Digital Design and Integrated Circuits, EECS252 Advanced Computer Architecture.

Delft University of Technology, the Netherlands *September 2017 - August 2019*
Master of Science (M.Sc.) in Computer Engineering (Quantum Computing) CGPA: 8.2/10.0

- Master Thesis on 'CC-Spin: A Micro-architecture design for scalable control of Spin-Qubit Quantum Processor' conducted at QuTech, TU Delft. Grade: 9/10.
- **Research Assistant**: Quantum & Computer Engineering Lab, QuTech/TU Delft (6 months)
- **Teaching Assistant**:
  (i) 'The Building Blocks of a Quantum Computer' MOOC on edx.org (12+ weeks).
  (ii) 'EE1D11 Digital Systems and Programming in C' Spring 2019 Undergraduate Course (8 weeks).

ETH Zurich, Switzerland *11-14 September 2018*
Summer School in Quantum Information at Theoretical Physics department (D-PHYS).

University of Petroleum and Energy Studies, India *August 2013 - June 2017*
Bachelor of Technology (B.Tech.) in Electronics Engineering/EE Dept. CGPA: 3.1/4.0

- Thesis: 'Design and Simulation of 16-bit Microcontroller in VHDL/Xilinx ISE'. (8 months)
- 3^{rd} Year Project: 'Embedded Audio Morse-Code Encoder and Decoder' (4 months)

PROFESSIONAL EXPERIENCE

CERN (European Organization for Nuclear Research) *October 2020 - present*
Electronics Engineer / Fellow *Geneva, Switzerland*

- Lead developer and SoC Design Engineer for CERN's RadiatiOn Monitoring Electronics (CROME) running on Zynq Ultrascale+ MPSoC.
- Development of TCP/IP C networking library ROMULUSlib (published), Cosimulation framework development CROME-CoSim based on QEMU and UVM (publication pending).
- CERN guide for SM-18 LHC Superconducting magnet facility and ATLAS Experiment Cavern.

[1] please visit `amitabhyadav.com/links` for the list of hyperlinks mentioned in the CV.

SyncMindAI (syncmind.org) *January 2021 - present*
Co-founder and CEO *Geneva, Switzerland*

- Chief in-charge of implementing deep learning hardware optimizations and IP design for training and real-time inference on FPGA. (presentation video)
- Designed the online developer toolchain, using Gitlab and Grafana, for visualizing and running algorithms on ECoG Neural Data.

LBNL (Lawrence Berkeley National Laboratory) *November 2019 - December 2020*
Research Associate - HEP.QPR (under H. Gray (PI), P. Calafiura) *Berkeley, California*

- Developed the 'Quantum Hough Transform (QHT)' algorithm for Charged-Particle Track Reconstruction and identifying multi-parameter defined tracks in CERN's TrackML particle dataset.
- Leveraging quantum superposition phenomena on input parameters and implementing Grover-Long subroutine, QHT algorithm is developed to study track- and vertex- fitting efficiency.

QuTech/Intel Quantum Computing Lab *September 2018 - August 2019*
Master Thesis Research (under N. Khammassi (Intel, Oregon), K. Bertels (QuTech)) *Delft, Netherlands*

- Implemented the CC-Spin Micro-architecture on Cyclone-V SoC using Verilog, C and Tcl.
- Central Controller (CC-Spin) is connected to FPGA-controlled Direct Digital Synthesis (DDS) units via LVDS links for multi-channel synchronous waveform generation (I/Q and DC Pulses).
- Designed: Quantum Instruction Pipeline, Microcode Unit, 8b/10b Encoder-Decoder, SERDES, Timing Control Unit and SPI Master (DDS controller) to perform Qubit control with precise timing.
- Proposed a scalable micro-architecture for NISQ-era Hybrid Quantum-Classical Algorithms (QAOA).

DARE (Delft Aerospace Rocket Engineering) - Stratos-III *October 2017 - July 2018*
Electronics/Firmware Engineer - Core Team Member *Delft, Netherlands*

- Avionics Hardware development on ARM Cortex-M3/LPC1768 MCU. [blog post]
- PCB Design using Altium Designer 18 for Stratos-III Sounding Rocket electronics.

CERN (European Organization for Nuclear Research) *June 2017 - August 2017*
Summer Intern - ATLAS Pixel Group/EP-ADE-ID (under C. Solans, A. Sharma) *Geneva, Switzerland*

- Developed front-end DAQ firmware components for FEI-4 Silicon Pixel readout on Xilinx KC705.
- Integrated IPBus (UDP/IP) (front-end monitoring) with 8b/10b encoded Rx/Tx Core to communicate with back-end Gigabit TRx (GBT) protocol and developed the data_routing entity 'E_Link Bank'.

Lockheed Martin Corp. *August 2015 - May 2017*
Electronics Team Lead, Roll-on/Roll-off University Design Challenge *New Delhi & Dehradun*

- Developed the detailed technical designs for Aerial Surveillance System, Payload Control and Communication System for payload specification on Lockheed Martin C-130J Super-Hercules Aircraft.

BARC (Bhabha Atomic Research Center) *June 2016 - July 2016*
Summer Intern - Data Acquisition & Processing Systems Group *Mumbai, India*

- Developed Compression and De-Noising libraries for A, B and C Scan Ultrasonic Scan Data for application in NDT of Materials. (Report)
- Achieved loss-less compression up to 75.37% in C-Scan data using information coding algorithms.
- Analyzed compression ratio & noise in Lossy compression for DCT, DFT and Wavelet Transform.

AWARDS

- Featured in LBNL News, Physics@Berkeley News, CERN Alumni News .
- SyncMindAI, an EdgeAI startup co-founded by my colleague and I, is selected among top-10 Swiss Deep-Tech Ventures for AIT – Academia to Industry transition training. (2021)
- Honorific address at UPES Undergraduate Convocation. (2017)
- Ranked 1st at University Best Research Award 2017 for developing an IoT and Wireless Sensor Network based system for Landslide Forecasting in the Himalayan Regions, funded by UPES's Research Initiative for Students of Engineering (RISE). (2017)
- International Rank 1st at CanSat Competition 2017 held in Texas, USA. (2017)
- National Rank 1st and secured a research grant of USD 40,000 by Lockheed Martin Corp. in Critical Design Phase of C130-J Super Hercules Aircraft Roll-On/Roll-Off Design Challenge. (2016)
- International Rank 4th (1st in Eurasia) at CanSat Competition 2016 held in Texas, USA. (2016)
- Ranked 8th at University Best Research Award 2015 for developing a Wireless Sensor Network for Heath Monitoring and Indoor Location Tracking, funded by RISE. (2015)

ACADEMIC PROJECTS

- Running Shor's Algorithm on IBM Quantum Experience using IBM-Q QISKit. GitHub
- BICMOS5 Fabrication & Measurement of IC parameters in EKL Cleanroom, TU Delft. (16 hours)
- OpenCL implementation of Smith-Waterman Algorithm for Protein/DNA Sequencing. (GPU)
- Performance improvement of Plasma processor (opencores.org) in VHDL. (Processor Design Project)
- Parallel Poisson Solver on Distributed Memory HPC cluster using MPI. (HPC)
- Design & Jitter Analysis of Quad-Phase By-6 frequency divider in Cadence. (Digital IC Design)
- Development of Classic Snake Game using Software Design Patterns in Java. (ATHENS 2017)
- University-Funded research projects (INR 45,000) on Wireless Sensor Network system
  (i) Landslide Forecasting for Himalayan Range [UPES Research Award 2017: Rank #1st]
  (ii)Patient Monitoring and Tracking System. [UPES Research Award 2016: Rank #8th]
- Project Geo-Rover: Robot Navigation and Camera Interfacing for Digital mapping of a geographical area using a Land rover.

TECHNICAL STRENGTHS

Programming Languages	C (incl. POSIX and Linux Kernel), C++, Python (SciPy, NumPy, MatPlotLib, Seaborn, Pandas, Pytorch, Qiskit, Pennylane), MATLAB, Verilog and VHDL (expert).
Software & Tools	Cadence Genus, Virtuoso and Innovus, Xilinx Vivado and Vitis, Altium Designer, LaTeX, Anaconda, QuestaSim, Git, CI/CD, Docker, Tcl, Bash
OS	Linux(Ubuntu, CentOS, Petalinux)
Laboratory	EKL (Class-10 IC Cleanroom), Embedded Hardware and Robotics Lab

INTERNATIONAL ACHIEVEMENTS

Intercollegiate Rocket Engineering Competition (IREC) 2017 *August 2016 - May 2017*
Chief Electronics and Payload System Engineer *Spaceport America, New Mexico, USA*

- Developed the avionics and telemetry systems in the Sounding Rocket, Kalam.
- Developed electronics payload - a custom-built Hexacopter, for Multi-Terrain landing.

Cansat Competition (U.S. Naval Research Lab, NASA, JPL) *August 2014 - June 2017*
Technical Advisor 2017, Team Leader (Electronics) 2016, Team Member 2015 *Texas, USA*

CANSAT 2017 (Advisor)	International Rank#1 (96.32%) out of 96 teams. Developed *'Venus Glider'*, a helical gliding payload weighing under 500g with real-time video feed at ground. **(Report)** **"Indian students grab first position in global aerospace competition in Texas."** (India Today)
CANSAT 2016 (Leader)	Lead the development & integration of Sensor Subsystem, Telemetry System and real-time decent monitoring system by Ground Station for the mission payload, *'Mars Glider'* (500g). International Rank of 4th out of 72 teams. (**Report**) **"Indian Students present epic CanSat System at Global Aerospace Competition in Texas, & left NASA absolutely stunned."** (BusinessInsider)
CANSAT 2015 (Member)	Developed the Sensor Subsystem (Arduino MCU) and Ground Control Station (MATLAB based GUI) for the Mission Payload, *Auto-Gyro Recovery Imager* (500g). (**Video**)

SUMMER SCHOOLS, WORKSHOPS & EXTRA-CURRICULAR

- 'Hardware-Efficient Machine Learning across the Circuit-Architecture-Scheduling Stack' at **IMEC**.
- 'The Quantum Wave in Computing 2020' at **Simons Institute for Theory of Computing**.
- 'Quantum Computing for High Energy Physics' meet (November 2018) at **CERN, Geneva**.
- 'Quantum Computing Meetup' on Quantum Algorithms at **IBM Watson tower**, Munich.
- 'BigCompute20' Conference held Feb 11 - Feb 12, 2020, organized by **Rescale Inc. in San Francisco**.
- Nature conference on 'Technologies for Neuroscience' Online
- "Venture Lab: Business Creation ENGINEERING" workshop in EPFL Lausanne, Switzerland.
- 'TechCrunch: Robotics + AI Conference' held March 3, 2020 in Berkeley, California.
- 'TUD15 Software Design Patterns' 2018 at ATHENS Programme
- Introduction to Swarm Robotics at IIT Bombay.
- Network Security and Ethical Hacking Workshop 2015 (Nettech Pvt. Ltd.)
- Life-saving volunteer certified by CERN Medical Service.
- Cross Country Cycling - Around Lac Leman (185km), Vlaadingen to Delft (115 km) etc.
- Industry/Professional Courses: Expert VHDL (by Doulos, London) - 2021; Embedded Linux (by Doulos, London) - 2021; Cadence Static Timing Analysis (2022); Cadence RTL-to-GDSII Flow, Cadence (2022).
- Certified MOOCs: Particle Physics: An Introduction (University of Geneva, Coursera) - 2017;
  Quantum Cryptography (TU Delft & Caltech, EDX) - 2018;
  Quantum Machine Learning (University of Toronto, EDX) - 2019;

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LIST OF PUBLICATIONS (Google Scholar)

1. **A. Yadav**, H. Boukabasche, N. Gerber, K. Ceesay-Seitz, D. Perrin, "ROMULUSlib: An autonomous, TCP/IP-based, multi-architecture C networking library for D.A.Q. and Control applications ", International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS) Conference, Shanghai Advanced Research Institute, China (October 2021).
2. H. Gray, J. Wonho, V. R. Pascuzzi, R. Sawada, K. Terashi, **A. Yadav** "Quantum Pattern Recognition for Tracking in High Energy Physics ", SnowMass 2021.
3. K. Bertels, A. Sarkar, T. Hubregtsen, M. Serrao, A. A. Mouedenne, **A. Yadav**, A. Krol, I. Ashraf "Quantum Computer Architecture Toward Full-Stack Quantum Accelerators ," in IEEE Transactions on Quantum Engineering, vol. 1, pp. 1-17, 2020, doi: 10.1109/TQE.2020.2981074.
4. **Amitabh Yadav**, Vivek Kaundal, Abhishek Sharma et. al. (2017) *"Wireless Sensor Network Based Patient Health Monitoring and Tracking System"* In Proceeding of International Conference on Intelligent Communication, Control and Devices (pp. 903-917). Springer, Singapore.

Preprint:

5. **Amitabh Yadav**, Nader Khammassi, Koen Bertels, *"CC-Spin: A scalable Microarchitecture design for Control of Spin-Qubit Quantum Accelerator"* (2020).
6. **Amitabh Yadav**, Carlos Solans Sanchez, Abhishek Sharma (2017) *"FE-I4 Firmware Development and Integration with FELIX for the Pixel Detector"* . CERN Document Server, Meyrin, Switzerland.

Thesis:

7. Master Thesis: *"CC-Spin: A Micro-architecture design for scalable control of Spin-Qubit Quantum Processor"* , August 2019 (presentation)

PATENT

1. **Amitabh Yadav**, Vivek Kaundal, Abhishek Sharma et. al. (2016) *"WSN based Patient Health Monitoring and Tracking System"*. (Indian Patent No. 201611039333)

CONFERENCE PRESENTATIONS/POSTER

1. Invited talk on "ROMULUSlib: A TCP/IP based, multi-architecture C networking library for DAQ and Control" at the International Conference on Accelerator and Large Experimental Physics Control Systems, at Shanghai Advanced Research Institute (SARI), China. (2021) (PDF | Video)
2. Invited Talk on *"CC-Spin: A Micro-architecture design for scalable control of Quantum Processors"*. at Advanced Quantum Testbed (AQT) Meeting, Lawrence Berkeley National Laboratory/University of California, Berkeley. (PDF | April 2, 2020)
3. Poster on *"Quantum Pattern Recognition for High Energy Physics (HEP)"*. (March 9, 2020) HEP.QPR (W. Bhimji, W. Lavrijsen, P. Calafiura, H. Gray, E. Rohm, A. Yadav) at US Department of Energy, Review Meeting. (Poster)
4. Invited Talk *"Quantum Hough Transform for Charged-Particle Track Reconstruction"*. (Jan 7, 2020) at Annual ATLAS LBNL Meeting 2020, Lawrence Berkeley National Laboratory. (PDF)
5. Invited Participant at *'Quantum Algorithms' Seminar* (Feb 25 - Feb 28, 2020) Simons Institute for the Theory of Computing, University of California, Berkeley.

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