

# Umang Garg

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📍 U.C. Santa Barbara, CA

## TECHNICAL SKILLS

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**Languages:** Python, C/ C++, MATLAB, Verilog/ Systemverilog, Assembly, HTML, RTL

**Developer Tools/ Frameworks:** Pytorch, IBM CPLEX, Noxim++, Numpy, Pandas, Linux, Vivado Tool Suites, Cadence Virtuoso, DRC, LVS, Simulink, Labview, GIT, Ansys HFSS, Zynq library, FPGAs.

## PROJECTS

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**Optimal Compiler Design for SDNN mapping** 🔗 | [Swarm Opt](#), [PyCARL](#), [Noxim++](#) Feb '21 - Ongoing

- Investigating efficient graph-cut algos (KL) to map SNNs to least-interacting tiles: saving NoC hops, BW.
- A multi-variate (energy, accuracy, latency, throughput) space search using PSO, Tabu, hill-climb techniques.

**Rational AI multi-agent design for PACMAN** 🔗 | [Python](#), [DSA](#), [Heuristics](#) Feb '21 - March '21

- Designed multi-adversary-aware intelligent Pacman AI agent: reflex-based, Minimax, Expectimax models.
- Goal-tailored heuristic modelling. Implemented greedy search,  $\alpha$ - $\beta$  pruning, iterative deepening to time-limit.

**Unsupervised SNN Learning for Digit Recognition** 🔗 | [SNNtorch](#) | [Verilog](#) Jan 2021

- Implemented end-to-end neural network in digital RTL-logic with in-situ **online STDP learning** support.
- New local unsupervised learning mechanisms Inter-synaptic traces mechanisms tested. Lateral inhibition etc.

**Parallel time-domain Compute-in-memory (CIM) Spiking NN** | [Pytorch](#), [Virtuoso](#) Sept - Dec '21

- Collaborated and developed time-domain parallel spiking paradigm: **83x EDP improvement** over SOTA.
- Reimagined dataflow for better weight reuse. Tested on Fashion-MNIST, NMNIST, CIFAR-10 datasets.

**Developing 'TETRIS' firmware on Xilinx FPGA** 🔗 | [Embedded C](#), [QPNano](#), [Vivado](#) Sept - Dec '21

- Used QPNano **Hierarchical FSM** for designing game states on Xilinx Artix-A7 board on Vivado.
- Interfaced SPI LCDs and push buttons for interactive gameplay; ensured correct **interrupt handling**.

**Hyperspectral Aerial-Vehicle Anomaly detection at Edge** 🔗 | [MATLAB](#), [Virtuoso](#) May '19 - Aug '19

- Worked on hyperspectral aerial anomaly detection techniques and multi-band flexible-grain filter design.
- Co-integrated anomaly detection unit with hyperspectral imager for system-constrained perception.

## INDUSTRY EXPERIENCE

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**QpiAI Technologies** 🔗 | [Design Engineer](#) Dec '20 – Jul '21 | [Bangalore, India](#)

- Developed “Auxiliary Pulse Cancellation” code, boosting qubit fidelity times by 10x. **2 US patents**.
- Filed **US patent** proposing an extensively scalable in-silco solution for magnetic field control for qubits.
- Designed a rail-to-rail cryogenic Variable gain amplifier: deployed as **standalone IP** for qubit control.

## EDUCATION

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**University of California, Santa Barbara (UCSB)** Sept 2021 – Present  
*M.S. in Computer Engineering, Dept. of ECE; GPA: 3.90* Santa Barbara, CA

**Birla Institute of Science and Technology, Pilani** Aug 2016 – May 2020  
*B.E. in Electronics and Instrumentation; GPA - 8.4* Pilani, India

## RELEVANT COURSEWORK

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**Graduate:** Data Structures and Algorithms, Artificial Intelligence, Deep Neural Networks, NP-hard Optimizations, Software-HW Co-Design, Embedded Systems, Neuromorphic Computing, Probabilistic Computing

**UnderGraduate:** Analog and Digital VLSI Design, Computer Architecture, RF Microelectronics

## PATENTS and PUBLICATIONS

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Publication [1]. Time-domain Parallel Compute-in-memory Spiking Neural Network Architecture and acceleration  
Patent [2]. Method and System for designing hybrid quantum-classical architecture (Q-arc) in quantum computers for individual qubit control in distributed fashion. (*3 additional major-Conference publications and 2 more patents*)