Vahid Ganjalizadeh

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EDUCATION

University of California, Santa Cruz, USA   **2016-present**
Ph.D. in Electrical and Computer Engineering (Bio-photonics and Machine-learning)
University of California, Santa Cruz, USA   **2016-2019**
M.Sc. in Electrical Engineering (Optofluidics and Bio-photonics)
University of Tabriz, IRAN   **2011-2013**
M.Sc. in Electrical Engineering (Analog IC design and Microsystem Technology)
University of Tabriz, IRAN   **2007-2011**
B.Sc. in Electrical Engineering (Digital Electronics)

WORK EXPERIENCE

Applied Optics Group (Professor Holger Schmidt's lab)   **2016-present**
Bio-photonics and ML researcher   *UCSC, USA*

- **Speckle Pattern Analysis using Deep-Learning:** Developing a deep-learning model with multiple CNN layers followed by a regression layer to map speckle patterns seen in scattered light from a waveguide to a 1D array. I'm using Scikit-Image, TensorFlow, and H5py libraries to pre-process, train, and infer and store the image data, respectively (ongoing project).

- **Real-Time Multiplexed Detection on the Edge:** Developed an Edge-TPU classifier using TensorFlow and implemented it on Google Coral Dev Board for real-time multiplexed event detection in optofluidic devices. It utilizes a fast wavelet-based event detector (called PCWA, also developed by me) followed by a quantized DNN model to classify detected events. Due to limited resources available in the edge device, various parallel-processing schemes, including multi-processing, multi-threading, data sharing via queues, etc., were utilized to achieve real-time performance. A Plotly Dash App is also implemented as a browser-based GUI to run on the edge device as a server and let the user monitor real-time data plots plus event detection results. A manuscript is submitted to Scientific Reports and is under review.

- **Fast Wavelet Analysis Technique for Single Molecule Detection and Identification:** Developed a CWT-based event detection algorithm with pattern matching capability in multi-scale and parallel clustering scheme to group local maxima found in each level into a single event localization independently and in parallel. It is implemented in Python and available at my github repository (PCWA).

- **Real-Time Closed-Loop Optofluidic Chip Excitation System:** In this project, I have utilized a single-photon-counting module (SPCM) to read real-time photon counts from the chip and adjust input laser power accordingly. Due to the limitations of the TimeHarp photon counter, I've developed a real-time binning system implemented in Digilent Arty-A7 FPGA board to bin, buffer, and transfer binned photon counts to the PC via Ethernet (UDP socket protocol). A manuscript is under preparation.

- **Photonic Chip Design, Simulation, and Characterization:** Collaborating with Brigham Young University (BYU) on designing, characterizing, and optimizing optofluidic devices for point-of-care applications. I'm experienced with waveguide-based photonic chip simulation with FIMMWAVE/FIMMPROP Photon Design software, especially in creating Python scripts to communicate and run a batch/routine of FIMMWAVE simulations. Also, I'm experienced in building optical setups (imaging, single-molecule fluorescence detection with SPCM, and optofluidic chip handling and running the experiment (a couple of second-author papers).

- **Mode Analyzer:** Application-specific program developed in Python for fluorescent and chip facet waveguide mode image analysis. It has an MMI spot analysis tool that automatically finds and fits N-Gaussian peaks for FWHM and peak-to-valley calculation. (Mode Analyzer).

- **3D Atomic deposition simulation:** Developed a 3D atomic deposition model in Python using PyOpenGL library as the 3D visualization tool. Individual atoms are introduced into the simulation environment, and their dynamics are modeled based on L-J potential. EE216 project (Fall 2017) ([Atomic Deposition](#)).
- **PDMS Optofluidic Chip Design and Fabrication:** Well experienced with PDMS chip design and fabrication from mask to final device. I've done numerous fabrications from scratch: device simulation with FIMMWAVE/FIMMPROP, chrome mask design with AutoCAD, photolithography, testing, and characterizing final chips. A couple of publications are based on these PDMS chips. I developed a Lisp script for AutoCAD to automate design rule check (DRC) publicly available in my github ([PolyHatch](#)).
- Teaching Assistant for EE101 (Fall 2020).
- Teaching Assistant for EE103 (Fall 2018).
- Mentoring undergraduate students for the summer research program.

SAPNA.Co^{TM}   **2015-2016**

R&D Engineer   *Tabriz, IRAN*

- Developed a tabletop CNC machine using Mojo-V3 FPGA and stepper motors as a PMMA engraver for microfluidic application.
- Developed scripts and crontab schedules, mostly in Bash and Python, for RPi to drive 3D holographic displays.

Microfabrication Lab   **2012-2014**

Research Assistant   *University of Tabriz, IRAN*

- Experience in masked and maskless photolithography processes.
- Soft-lithography and replica molding processes in microfluidic and optofluidic devices.
- Free-space optics, imaging systems, and real-time image processing.

Tabriz University Robotic Group (TURG)   **2010-2012**

HWE/SWE   *University of Tabriz, IRAN*

- Developed VHDL/Verilog codes for small-sized league soccer robots' central control unit (Spartan-3A FPGA).
- Implemented ZigBee communication between PC-based strategy AI and robots.
- Developed a C# software to detect and track circles in video frames in real time using OpenCV.

TECHNICAL SKILLS

- **Coding/Programming:** Python, Matlab, C#, C
- **Python:** Data analysis & ML, Software Dev. (multi-processing/threading, socket, instruments) Scipy, TensorFlow, Scikit-Learn, Scikit-Image, Matplotlib, Pandas, H5py, Tk, PySide, OpenCV
- **Finite Elements:** ANSYS APDL, CFX/Fluent, COMSOL Multiphysics
- **CAD/Graphics:** AutoCAD, Inventor/Fusion 360, Blender, Illustrator, GIMP
- **Optics/Photonics:** PhotonDesign (FIMMWAVE & FIMMPROP), Code-V (certified), MEEP (FDTD), TracePro
- **Board and µC:** Coral Dev Board (Edge-TPU), Raspberry Pi, Arduino, Arty A7
- **FPGA (Xilinx):** Vivado, Vitis HLS, MicroBlaze, AXI-4

AWARDS AND HONORS

- ♦ Received EE department fellowship from the University of California, Santa Cruz, Spring   2017
- ♦ Received full scholarship from University of Tabriz for B.S.   2007-2011
- ♦ Top 0.67% ranked among 311,000 participants in the nationwide entrance exam of state universities   2007

PUBLICATIONS

- Ganjalizadeh, Vahid, Gopikrishnan G. Meena, Matthew A. Stott, Aaron R. Hawkins, and Holger Schmidt. "Machine Learning at the Edge for AI-Enabled Multiplexed Pathogen Detection." *Scientific Reports* 13, no. 1 (2023): 4744. https://doi.org/10.1038/s41598-023-31694-6.

- Ganjalizadeh, Vahid, Gopikrishnan G Meena, Thomas A Wall, Matthew A Stott, Aaron R Hawkins, and Holger Schmidt. "Fast Custom Wavelet Analysis Technique for Single Molecule Detection and Identification." *Nature Communications* 13, no. 1 (2022): 1–9. https://doi.org/10.1038/s41467-022-28703-z.
- Meena, GG, AM Stambaugh, V Ganjalizadeh, MA Stott, AR Hawkins, and H Schmidt. "Ultrasensitive Detection of SARS-CoV-2 RNA and Antigen Using Single-Molecule Optofluidic Chip." *Apl Photonics* 6, no. 6 (2021): 066101. https://doi.org/10.1063/5.0049735.
- Amin, Md Nafiz, Vahid Ganjalizadeh, Matt Hamblin, Aaron R Hawkins, and Holger Schmidt. "Free-Space Excitation of Optofluidic Devices for Pattern-Based Single Particle Detection." *IEEE Photonics Technology Letters* 33, no. 16 (2021): 884–87. https://doi.org/10.1109/lpt.2021.3069673.
- Hamilton, Erik S, Vahid Ganjalizadeh, Joel G Wright, Holger Schmidt, and Aaron R Hawkins. "3D Hydrodynamic Focusing in Microscale Optofluidic Channels Formed with a Single Sacrificial Layer." *Micromachines* 11, no. 4 (2020): 349. https://doi.org/10.3390/mi11040349.
- Ganjalizadeh, V, GG Meena, MA Stott, H Schmidt, and AR Hawkins. "Single Particle Detection Enhancement with Wavelet-Based Signal Processing Technique." In *CLEO: Science and Innovations*, STu3H-4, 2019.
- Hamilton, Erik S, Vahid Ganjalizadeh, Joel G Wright, William G Pitt, Holger Schmidt, and Aaron R Hawkins. "3D Hydrodynamic Focusing in Microscale Channels Formed with Two Photoresist Layers." *Microfluidics and Nanofluidics* 23, no. 11 (2019): 1–8. https://doi.org/10.1007/s10404-019-2293-z.
- Black, Jennifer A, Vahid Ganjalizadeh, Joshua W Parks, and Holger Schmidt. "Multi-Channel Velocity Multiplexing of Single Virus Detection on an Optofluidic Chip." *Optics Letters* 43, no. 18 (2018): 4425–28. https://doi.org/10.1364/ol.43.004425.
- Stott, Matthew A, Vahid Ganjalizadeh, Gopikrishnan Meena, Johnny McMurray, Maclain Olsen, Marcos Orfila, Holger Schmidt, and Aaron R Hawkins. "Buried Rib SiO 2 Multimode Interference Waveguides for Optofluidic Multiplexing." *IEEE Photonics Technology Letters* 30, no. 16 (2018): 1487–90. https://doi.org/10.1109/lpt.2018.2858258.
- Stott, Matthew A, Vahid Ganjalizadeh, Maclain H Olsen, Marcos Orfila, Johnny McMurray, Holger Schmidt, and Aaron R Hawkins. "Optimized ARROW-Based MMI Waveguides for High Fidelity Excitation Patterns for Optofluidic Multiplexing." *IEEE Journal of Quantum Electronics* 54, no. 3 (2018): 1–7. https://doi.org/10.1109/jqe.2018.2816120.
- Ganjalizadeh, Vahid, Hadi Veladi, and Reza Yadipour. "A Novel Pressure Sensor Based on Optofluidic Micro-Ring Resonator." In *2014 International Conference on Optical MEMS and Nanophotonics*, 133–34, 2014. https://doi.org/10.1109/omn.2014.6924556.
- Wall, Thomas, Johnny McMurray, Gopikrishnan Meena, Vahid Ganjalizadeh, Holger Schmidt, and Aaron R Hawkins. "Optofluidic Lab-on-a-Chip Fluorescence Sensor Using Integrated Buried ARROW (BARROW) Waveguides." *Micromachines* 8, no. 8 (2017): 252. https://doi.org/10.3390/mi8080252.

And some oral/poster presentations at international conferences.