Philip Wolfe

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Experience

Beam Tech, Inc. - Robotics Systems Architect *2 years*
- Designing & Implementing many things including but not limited to PCB design, firmware, motion control, edge computing, network architecture, signal processing, backend + frontend web dev, devops, database design/management (timescaledb, mongodb, mysql) + connection to grafana container, gimbal design, and more. Balancing scaling up for production & continuing rapid prototyping to test new features

Georgia Tech Research Institute - Research Engineer *5 years*
- AI/ML Embedded Edge Computing: designed, implemented, & maintained GTRI-wide Custom Deepstream SDK codebase + managed support team as the use-case grew across multiple contracts. This product allowed users to tailor a custom video streaming machine learning architecture in the field at scale to include various features and easily tweak desired settings. Quick list of some things I've done with Deepstream SDK:
    - wrote gstreamer appsrc driver to publish GigE camera data as a source into Deepstream
    - enabled parallel ML/tracker & video streaming pipelines streaming at different resolutions and framerates
    - adding timestamp synchronization scripts to sync streams and recordings across multiple devices
    - publish bounding box data to server in a container to forward them as ROS messages
    - integrating custom yolov4 into tensorrt/deepstream pipeline alongside out of box models
    - containerized on x86 and ARM with GPU pass-through
  Projects I've used this for include: real-time video analytics for security & surveillance, aerial & ground based precision pointing systems
- FPGA: Demonstrated proof of concept for dynamically reconfigurable ALU using partial reconfiguration on Xilinx Kintex Ultrascale, laying groundwork for dynamic ML accelerator to adapt to changing needs
- Gimbal: both ground and aerial based gimbal work at various precisions for tracking various targets on both COTS gimbals and custom. developed firmware control system for high precision gimbal with direct drive BLDC's (space vector modulation, field oriented control, velocity control, position reference curve shaping)
- Embedded: Pixhawk custom firmware for point and shoot GPS finder, custom gimbal firmware, debug people's radio/RF problems, debug people's networking problems, review board designs
- Leadership/Project Management: wrote proposal, got funded, designed tests, led team, successfully executed, and published remotely-operated underwater welding robotics imagery study

Clapping Pattern Detection/Rejection using Artix-7 FPGA on Basys3 board *4 months*
- Developed a real-time clapping pattern detector using VHDL on a Xilinx Artix-7 FPGA and a microphone
- Normalized over-time to detect pattern regardless of clapping rate

Emotion Recognition from Speech *4 months*
- Classified emotion from human speech as happy, sad, angry, or neutral using Python (Tensorflow & Keras)
- Pre-Processed data for neural-net training on a dataset from USC of labeled emotions from an acted scene
- Used scikit-learn to do random forest classification and ended up with better results than the neural net approach

Analog Synthesizer using Field Programmable Analog Array *4 months*
- Our team developed an analog music synthesizer on a Field Programmable Analog Array for 1/3 market price, powered off USB.
- Developed audio plugin compatible with most digital audio workstations with modern-looking GUI that parsed incoming MIDI, mapped notes to control messages sent over serial to a microcontroller controlling the FPAA.
- Parsed messages, clamped the voltage range for FPAA inputs, and controlled ring oscillator's frequency, waveform shape, & volume.

Autonomous Robot Path Navigation & Wireless Communication using Altera DE2 FPGA *4 months*
- Added extra assembly instruction that interfaces with a UART to a simple computer ISA configured on an FPGA with VHDL.
- Designed buffer system to queue incoming bytes from UART, received via Wifi.
- Translated data into interpretable coordinates for a wireless pick-up drop-off robot delivery system & implemented successful path algorithm for minimal error during traversal to coordinates.

Machine Learning for Trading *4 months*
- Trained BAG learner (bootstrap aggregation) to improve accuracy of a model with high bias (decision trees)
- Evaluated boosting to improve accuracy, specifically AdaBoost (adaptive boost) which is an ensemble method that weighs poorer performing individual learners of the ensemble
- Built a AI trader that chose when to buy, hold, or sell Apple stocks using reinforcement learning: Q-learning, and Dyna-Q (Q-learning with hallucination)

ConvexMind Inc. - Co-Founder *1.5 years*
- Co-founded startup that makes games for children age 2-6 with games to help them learn, and provides parents with data analytics to give them more insight on what their children are interested/how to help improve their rate of learning
- Implemented mechanics to create a product that dynamically adapts to the child based on their choices using Unity game engine deployed on Android

Skills

Software:
- C/C++/Assembly: Unit and functional testing, Development on a variety of embedded processors/microcontrollers, Multithreading, Scheduling, MIPS & ARM Assembly
- Python: machine learning, web socket servers, automated firmware testing, data analysis, computer vision, audio processing
- Networking: configuring subnets, dhcp servers, scripts to automate testing between common configurations across multiple OSes, DNS
- MATLAB: control system simulation, filter design, image/audio processing, GUI development, animation, data visualization

Lab Skills: Debugging techniques, multimeter, soldering, oscilloscope, logic analyzer, function generator, datasheet interpretation

Controls: Linear state space, digital controls, optimal controls; nonlinear controls

Other: Linux, Vim, C#/.NET, Keil, LTSpice, Multisim, ModelSim, SolidWorks, Onshape, Cadence Virtuoso, KiCAD, Verilog, VHDL

Education

GEORGIA INSTITUTE OF TECHNOLOGY, School of Electrical and Computer Engineering

Masters of Science in Electrical and Computer Engineering	*2 years*
Bachelor of Science in Computer Engineering with High Honors	*4 years*

Publications

[1] Francesco Amato, Chris M. Beaulieu, Aneneth T. Haile, Jingyuan Liang, Kevin M. Mairena, Hiba Murali, George O. Udochukwu, Ikenna C. Uzoije, Philip J. Wolfe and Gregory D. Durgin, "5.8 GHz Energy Harvesting of Space Based Solar Power using Inkjet Printed Circuits on a Transparent Substrate" in 2015 IEEE International Conference on Wireless for Space and Extreme Environments, Orlando, FL, 2015 [link]

[2] Amir Yazdanbakhsh, Hajar Falahati, Philip J. Wolfe, Kambiz Samadi, Nam Sung Kim, Hadi Esmaeilzadeh, "GANAX: A Unified MIMD-SIMD Acceleration for Generative Adversarial Networks" in 45th International Symposium on Computer Architecture (ISCA), 2018 [link]