Muhammad Hamdan Authorized to work in the U.S

Email : mhamdan.usa@gmail.com
Address : 1311 MAYFIELD DR. IA, US 50014
Mobile : +1 (269)-501-8462
Linkedin: https://linkedin.com/in/mhamdan91
Website: https://mhamdan91.github.io/
Github: www.github.com/mhamdan91

Career Profile

- An accomplished research engineer with solid electrical and computer engineering background.
- In-depth knowledge of designing deep learning architectures.
- In-depth knowledge of designing algorithms to solve supervised and semi-supervised learning problems.
- Hands-on experience in designing hardware accelerators on FPGAs.
- Solid Background with hands-on experience in automation and control systems (SCADA).
- Excellent programming skills in languages like C, Python and LabVIEW.
- Steep learning curve with the ability to handle tasks responsibly and efficiently with minimum supervision.

Education

Iowa State University — Ames, Iowa
- PhD Candidate in Electrical and Computer Engineering - GPA 3.89 — 2018 – Present

Thesis: Vision based mass flow estimation using deep learning techniques and semi-supervised learning

Iowa State University — Ames, Iowa
- Masters in Electrical and Computer Engineering - GPA 3.94 — May 2018

Thesis: VHDL auto-generation tool for optimized hardware acceleration of convolutional neural networks on FPGA

North Dakota State University and IUG — Fargo, North Dakota - Gaza
- Bachelor of Science in Electrical Engineering - GPA 3.5 — May 2015

Senior Design Project: Security and real time monitoring system

Experience

- **Bicentenary Research Farm** — Ames, Iowa
  Deep Learning Researcher and Algorithm Design Engineer — Aug 2018 - Present
  - Developed semi-supervised algorithm that predicts and quantifies mass of material from images.
  - Implemented a VAE to process image data in an unsupervised fashion to characterize image content.
  - Designed a dynamic algorithm that handles gradient computation in batches to account for memory limitations.
  - Designed a complete scheme for background subtraction to process image data.
  - Developed a smoothing technique to smooth predictions for a regression problem.
  - Developed custom design and application centric DNN architectures.
  - Processed and analyzed image-based and tabular datasets.

  Big Data Management

  - Managed big data of $\approx$ 0.5PB, performed data transformations, feature engineering, and data fusion.
  - Automatically fused and analyzed multiple reference ground-truth sheets into a single one without redundancy.
  - Extracted data from encoded files and parsed these files in an automated fashion to fill up missing data points in the ground-truth sheets (e.g. identifying crop type through image analysis.)

- **BioCentury Research Farm** — Ames, Iowa
  Instrumentation and Automation Engineer — Jan 2017 - Dec 2018
  - Designed and implemented NI-DAQ systems to acquire/log large volumes of data ($\approx$42MB/s).
  - Designed and implemented LabVIEW based user friendly graphical user interfaces.
  - Designed and instrumented automation systems, which incorporated various sensors (Acoustics, Accelerometers, Laser, Temp and Ultrasonic-CAN based, Pressure, Contamination-RS485 based, Speed, Thermocouples).
  - Implemented different communication schemes (wired, wireless).
  - Designed and implemented cellular and email-based alert and reporting system as well as system handler to perform automatic system update, data transformation, and reporting at certain time daily.
  - Wrote Matlab and python scripts for data manipulation, transfer and cold storage.

Programming Skills

- **Programming Languages**: Python, LabVIEW, MATLAB, C, Java, Veri/VHDL, C++, C#, Arduino.
- **Tools**: Matlab, Visual studio, Pycharm, Netbean, Ecllipse.
- **Software**: Microsoft office (Word, Excel, Power Point, Visio, and MS Project), JMP, Tableau, Camtasia, Acoustica-Mixcraft, Prezi, P.S, SolidWorks Electrical.
- **EDA Tools**: Vivado, ModelSim, Xilinx ISE.
- **Simulation and Design**: EAGLE, Circuit-maker, Altium design, MasterCam & Simulink.
- **Special Controllers**: KUKA (LBR_iiwa_14_R820), PLCs, NI-CDAQ, NI-CRIO, Micro-controllers in general, Keyence Laser, Controllino Mega, Radar controllers.

Computer Vision and Deep Learning Frameworks

- **Deep Learning Frameworks**: TensorFlow, Keras, PyTorch
- **Computer Vision Libraries**: OpenCV, dlib, Sikit-image.

Selected Projects

- **Mass Estimation From Images of Sparsely Labeled Data** [1]:
  Designed and implemented a lightweight DNN architecture that works in a semi-supervised fashion to capture mass of flowing material. The algorithm achieved inference average error of 4.5% with a run-time speed of 348FPS when running on GTX 1080-Ti GPU for a batch size of 8. Inference speed is proportional to batch size and constrained by I/O and memory bounds. **(Python, Keras, TensorFlow)**
- **Object Tracking Using FPGA**:
  Implemented an object tracking system on the Zedboard. The tracking algorithm was written in C. Images processing was performed on the FPGA and control of a USB missile launcher was performed using the on-board CPU. The system track targets and when a target is locked down, the system issues a command to fire a missile. **(C, VHDL, FPGA)**
- **Corn Ear Counting**:
  Developed a process flow to perform background subtraction then apply object detection (to be applied to corn ears) to count the number of corn ears present in an image. **(Python, OpenCV)**
- **A DynoStand to Detect Motor Bearing Failure Using Prognostic Analysis**:
  Designed, instrumented and implemented a data acquisition system that handles over 42MB/s of sensor data from various sensors with different sampling time. **(NI-cDAQ, LabVIEW, Matlab)**
- **VHDL Generator for A High Performance Convolutional Neural Network FPGA-Based Accelerator** [2]:
  Designed and implemented user friendly Java based tool that generates an optimized VHDL code for constitutional neural networks. The tool offers a GUI that allows users to easily configure CNNs and generate a VHDL implementation for it. The generated code for AlexNet achieved 611.52 GOP/s and 414 FPS. **(VHDL, Java, FPGA, Xilinx Vivado, ISE).**
- **Biogas and Composting Units**:
  Designed and implemented a supervisory and data acquisition system (SCADA) that controls and monitors bio-gas and composting units. A set of pumps and solenoid valves are controlled using a PLC. VFDs were used to control AC motors in the system. Various sensors were utilized to monitor the state of the system which includes temperature, pressure, motor speed, water level, gas leakage, and ph level measurements. **(PLC, ladder, LabVIEW, OPC).**
- **Wireless Station for Geothermal Mapping**:
  Designed and implemented several ground-temperature mapping stations located within a radius of 30 miles. The stations communicated data using WiMax technology. A Central station was used to receive remote sensor data and forward it to an Ethernet based PLC that handled processing and storing the data. a LabVIEW based GUI was used to monitor the state of the system. **(Ladder, PLC, LabVIEW, OPC, WiMax).**

Selected Coursework

- **Hardware**: Reconfigurable computing, Computer architecture, Embedded systems design, Real-Time systems.
- **Software**: Computational perception, Autonomous vehicles specializations-perception (coursera), Image and video processing, Convolutional Neural Networks for visual recognition, and Introduction to machine learning .

Selected Publications

- Hamdan, Muhammad K A, Rover, Diane T., Darr, Matthew J., and John Just, **"Mass Estimation from Images using Deep Neural Network and Sparse Ground Truth."**, To appear in the 18th IEEE International Conference on Machine Learning and Applications (ICMLA), IEEE, 2019
- Hamdan, Muhammad K., and Diane T. Rover, **"Vhdl generator for a high performance convolutional neural network fpga-based accelerator."**, In 2017 International Conference on ReConFigurable Computing and FPGAs (ReConFig), pp. 1-6. IEEE, 2017.