Syed Muhammad Kazim

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Education

- **Kyung Hee University, Korea**   Sep. 2019 – Feb. 2022
  Master of Science in Electronic Engineering

  Major Courses: Advanced Digital Signal Processing, Machine Learning and Pattern Recognition
  GPA: 4.21/4.30

- **National University of Sciences and Technology, Pakistan**   Sep. 2014 – Jul. 2018
  Bacherlor of Engineering in Electrical Engineering

  Major Courses: Communication Systems, Numerical Methods, Microwave Engineering
  GPA: 3.51/4.00

Work Experience

- **Endress+Hauser, Maulburg, Germany**   Oct. 2021 – Present
  External AI Consultant – Remote

  Project: **Detection and Localization of Defects on Reflective Metal Sensor Casings in Industry**

  Context – 400 images of normal and defective metal casings each, including repetitions of same casings with variable lighting and reflections. Short video recordings to be used in production.

  1. Increased data size by splitting each image and its corresponding annotation into fixed size patches/tiles.
  2. Fine-tuned multiple (pre-trained on ImageNet) feature extractors and selected EfficientNet-B4 based on a complexity/accuracy trade-off.
  3. Tested video frames with empirically derived strategies to achieve a classification accuracy of $\approx 78\%$ (accumulating predictions on multiple frames and basing final prediction on a majority vote scheme can further increase accuracy).
  4. Previous attempts include UNets, transfer learning (along with RISE and GradCam for explanation) without splitting images, and SOTA anomaly detection techniques (Pacthcore and PaDiM).

  Project: **Anomaly Detection using Machine Vision on mm-scale PCBs** (ongoing)

  1. Cleansed the dataset by removing backgrounds, tilts and perspectives from each image.
  2. Used contours of the ROI along with its convex hull to analyze intrusions on the borders of PCBs with a μ-scale resolution.
  3. Implemented two separately trained PaDiM (anomaly detection technique) to detect defects on the arms and critical region of the PCBs, respectively.
  4. Packaged the entire solution, dockerized it, and provided a Streamlit-App demo.

- **Kyung Hee University, Yongin-si, Korea**   Sep. 2019 – Feb. 2022
  Graduate Research Assistant
  Communications and Coding Theory Laboratory

  1. Formulated quantum state estimation as a Bayesian inference problem using the statistical package Stan (Monte Carlo Markov Chain Solver).

2. Developed parallelizable truncated normal distribution based resampling algorithm for particle filters with specialized applications in quantum state generation to reduce computational expense.

3. Developed adaptive quantum state tomography heuristic based on eigenvalue decomposition of states to improve accuracy and rate of state characterization.

4. Trained fully-connected neural networks to reconstruct 4-qubit ground states of 2-local Hamiltonians given noisy data with improved accuracy.

5. Validated proposed simulation based quantum tomography schemes with experiments on IBM's quantum computers using QISKIT.

- **National University of Sciences and Technology, Karachi, Pakistan**　　　　Aug. 2018 – Aug. 2019
Research Officer
Integrated Navigation Terrestrial Electromagnetic (INTEL) Research Lab

  Project: **Optimization Framework of a Novel Collinear Dipole Array Antenna using Moment of Methods**

  1. Applied Moment of Methods on thin wire approximation for numerical analysis of antenna.

  2. Numerically calculated gradient and Hessian matrices to apply optimization algorithms.

  3. Used gradient descent algorithm to approximate parameters to obtain optimal gain of required radiation patterns.

Theses

1. S. M. Kazim, 'Adaptive Learning of Quantum Digits," Master's thesis, Department of Electrical and Information Convergence Engineering, Kyung Hee University, Yongin-si, Korea, Feb. 2022, Thesis Advisor: Professor Hyundong Shin.

2. S. M. Kazim, "Frequency Reconfigurable Patch Antenna using Liquid Crystals," Bachelor's thesis, Department of Electrical Engineering, National University of Sciences and Technology, Islamabad, Pakistan, Jul. 2018, Thesis Advisor: Professor Zubair Ahmed.

Honors and Awards

1. Graduate Student Scholarship, Kyung Hee University, 2019 – 2021

2. Undergraduate Merit Scholarships, National University of Sciences and Technology, 2014 – 2018

Proficiency Exams

1. Graduate Record Examination (General): 327/340, Sep. 2020

2. International English Language Test (Academic): 8.0/9.0, Nov. 2020.

Selected Publications

1. S. M. Kazim, A. Farooq, J. ur Rehman, and H. Shin, "Adaptive quantum state tomography with iterative particle filtering," *Quantum Inf. Process.* Sep. 2021.

2. S. M. Kazim, A. Farooq, J. ur Rehman, and H. Shin, "Applied Bayesian Qubit State Tomography," *Proc. Korea Information and Communications Society (KICS) Summer Conference*, pp. 190-192 Korea, Aug. 2020.