Abdulaziz Alharbi

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Education

Stanford University Sep 2023 – Mar 2025
Master of Science in Electrical Engineering (Machine Learning and Optimization) *Stanford, USA*

King Saud University Sep 2015 – Aug 2020
Bachelor of Science in Electrical Engineering (Signal Processing - GPA: 3.96 / 4.0) *Riyadh, Saudi Arabia*

Experience

Center for Complex Engineering Systems at KACST and MIT Dec 2020 – Sep 2023
Research Specialist *Cambridge, USA*

- Conducted and led research projects and proposed solutions involving machine learning, deep learning, geospatial data science, optimization, image processing, computational modeling, and parallel processing.
- Tackled multidisciplinary research problems in energy, healthcare, agriculture, and transportation.
- Developed APIs and front-ends, and assisted in integrating them with the stakeholder infrastructure.
- Mentored and supervised +8 interns in the fields of machine learning and optimization.
- Communicated and presented solutions to high-ranking stakeholders in Saudi Arabia.

Projects

Road Segmentation from Satellite Imagery
- Developed a novel loss function leveraging noisy OpenStreetMap (OSM) data for efficient U-Net model training, achieving performance on par with supervised models that use manually obtained pixel-wise labels.
- Enhanced applicability by developing a fine-tuning pipeline to adapt the model to regions with limited OSM data.
- Implemented the U-Net model in PyTorch and optimized hyperparameters using the Optuna framework.

Palm Tree Detection from Satellite Imagery
- Designed a palm tree detection pipeline utilizing convolutional neural networks, spectral indices, peak detection algorithms, and linear filters, surpassing the performance of end-to-end deep learning methods.
- Developed a memory-efficient implementation using Ray for processing +300 GB WorldView-3 satellite imagery.

Urban 3D Reconstruction from Multi-view Satellite Imagery
- Utilized mathematical morphology and Mask R-CNN to accurately outline buildings.
- Minimized reconstruction noise using a regularized optimization approach solved by genetic algorithms.
- Developed an interactive visualization platform using ArcGIS Pro to showcase the model's results.

Optimization for Automating Renewable Energy Deployment
- Proposed a graph-theoretic mixed-integer optimization formulation using Pyomo to automate the design of rooftop solar systems, reducing the average design time from 72 hours to a few minutes.
- Integrated the model with the NREL NSRDB weather API and the SunPower panel manufacturer database.
- Developed an interactive front-end using Streamlit and deployed it to an AWS EC2 instance.

Reinforcement Learning for Optimizing Robo-taxi Operations
- Developed a hierarchical environment for simulating high and low-level decisions in Robo-taxi operations.
- Optimized system operations using a combination of proximal policy optimization (PPO) and model predictive control (MPC), resulting in a 7% increase in operator revenue.

Algorithmic Trading in the Saudi Stock Exchange
- Developed an API for parsing and sentiment analysis of news outlets' RSS feeds using FastAPI and ChatGPT.
- Utilized the news sentiment and stock price information in the Prophet time-series prediction model
- Implemented a constrained optimization model in Pyomo for optimal portfolio allocation.

Technical Skills

Programming Languages: Python, Julia, R, Javascript, HTML/CSS, C/C++.
Libraries: Pandas, NumPy, Scipy, Matplotlib, Sklearn, Statsmodels, Skimage, OpenCV, Pytorch, Tensorflow, Optuna, Pyomo, CVXPY, GurobiPy, Streamlit, OpenAI, FastAPI.
Software: MATLAB, ArcGIS Pro, QGIS, CloudCompare, Blender, and LaTeX.
Developer Tools: Git, Docker, VS Code, AWS, Linux.