Muhammad Bilal Shahid

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Summary

PhD researcher in Mechanical Engineering with a minor in Computer Engineering, specializing in dynamical systems, time-series forecasting, and uncertainty-aware machine learning. Developed Predictor-Corrector frameworks using Neural CDE & Modern Hopfield Networks for correction & correction/calibration of learned time-series models, respectively. Skilled in Python, PyTorch, Jax, & HPC workflows.

Education

PhD Mechanical Engineering - **Iowa State University** Jan 2021 – Present

- **Minor**: Computer Engineering **CGPA: 3.67/4.00**

MS Mechanical Engineering - **Incheon National University** Jan 2018 – Feb 2020

BS - **GIK Institute of Engineering Sciences & Technology** Aug 2012 – May 2016

Experience

PhD Researcher in Dynamical Systems and Forecasting - Iowa State University Jan 2021 – Present

- Introduced a Corrector to correct forecasts of the learned time-series models
- Developed an approach to generate calibrated and sharp prediction intervals for forecasting
- Target variable selection for robust car following dynamics modeling via Blackbox models

MS Researcher in ML & Manufacturing - Incheon National University Jan 2018 – Jul 2020

- Worked on integrating Machine learning and Ultrasonic Welding
- Developed a Machine learning based approach to assist with Ultrasonic Weld Horn Design
- Developed a set of weld attributes for sound quality joints via nanoindentation & optical microscopy

Intern - Fauji Fertilizer Company Jan 2018 – Jul 2020

- Worked on the maintenance of boilers, heat exchangers, and cooling towers

Research Projects [github.com/mbelalsh]

Correctors for learned time-series models Paper | Code

- Introduced a Predictor-Corrector framework for learned time-series models
- The Corrector, based on Neural CDE, can correct any learned time-series model
- Obtained state-of-the-art results on forecasting benchmarks

Calibration of Dynamics Models via Pattern Retrieval Paper | Code

- Developed an algorithm to generate calibrated forecasts of system dynamics based on pattern retrieval
- Introduced a Predictor-Corrector framework, where the Corrector was based on Modern Hopfield Networks
- The Corrector corrects the Predictor as well as generates prediction intervals

Robust Car Following Dynamics Modeling Paper | Code

- Focused on target variable selection to train Blackbox models for robust car following dynamics modeling
- The paper concludes with the best choices of the target variable for different types of Blackbox models

Uncertainty-aware Hybrid Crop Model Code

- Developed a Neural–Mechanistic model that generates calibrated prediction intervals for key plant state variables
- The algorithm has applications in sensor placement optimization and precision agriculture.

Skills

Programming: Python, Jax, PyTorch, Numpy, Matplotlib, Github, LaTeX, Linux,

Deep Learning: Supervised Learning, Unsupervised Learning, Uncertainty Quantification, Pattern Retrieval

Time Series: Time Series Forecasting, Dynamics Modeling, Autoregressive Models,