

Final Report

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1 Overview

Since August 2023, I've continued to work under the Time-Series subgroup of Dr. Judy Fox's AI4Science group. While my work in the summer was more focused on understanding Temporal Fusion Transformers and their applications to time-series, my research in the fall was focused on exploring interpretable and explainable AI. This focused more on finding methods to explain the results of a model, primarily through feature sensitivity. As a result, our group has successfully submitted a paper to AAAI 2024.

2 Project: Sensitivity Analysis on Time Series

In order to describe my contributions/tasks I completed, I will describe my tasks in a timeline. My first tasks were to familiarize myself with the different deep learning models and the interpretation models used in the paper and in our repository, linked at: <https://github.com/UVA-MLSys/COVID-19-age-groups/tree/main>. I did this by studying the papers of each of the models listed in our paper, and reading the Captum library documentation for the interpretation models.

Next, I worked on replicating all the experiments, by setting up the environment and running them on the Rivanna servers, in order to gain lab skills and experience. More specifically, I ran replication experiments on each of the Top20, Top100, Top500 and total datasets for each of the six models. Through this, I gained knowledge on using remote servers for high performance machine learning. Once we had all our results, our group began to extend and improve upon the original draft of our paper. My role here was to fully read and understand the draft as well as provide comments for improvement and minor edits. Now, we are currently working on completing the project website to allow interested readers to explore more of our project and how to replicate for themselves.

I reproduced the runs of the five different time series models mentioned in our model, and uploaded the results to our central database. Below are images of the tables for the different deep time series models as well as the different interpretation techniques we used.

Model	MAE	RMSE	RMSLE	R²-score
Autoformer	35.69	189.4	1.918	0.451
FEDformer	30.19	182.2	1.467	0.481
PatchTST	31.17	183.6	1.530	0.469
TimesNet	34.35	191.9	1.604	0.415
Transformer	34.818	192.720	1.601	0.410

Method	Comp. (↑)		Suff. (↓)	
	MAE	MSE	MAE	MSE
Feature Ablation	4.91	8.64	9.53	10.5
Feature Permutation	4.00	7.08	8.00	8.28
Morris Sensitivity	6.23	9.39	5.85	5.46
Feature Occlusion	4.89	8.44	9.49	10.4
Augmented F.O.	4.18	7.66	7.96	8.09
Deep Lift	5.72	9.54	8.90	9.43
Integrated Gradients	5.52	9.09	9.25	10.2
Gradient Shape	4.78	8.17	8.04	8.27

3 Future Planning

At the moment, I am not sure whether I plan to continue to work in this research group. If I do, I plan on continuing to work on the website as well as start exploring the Financial Aid dataset. If I decide not to continue, I am very thankful for being able to work in this research group and be granted this opportunity.