

AI4Science - Fall 2023 Final Report

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1. Overview

After working with Professor Fox during the summer of 2023 regarding building an interactive project website and polished the presentation slide, I decided to continue my study under Professor Fox's guidance and joined another ongoing project, "Interpreting Time Series Transformer Models and Sensitivity Analysis of Population Age Groups to COVID-19 Infections" for the AI4Science project. I spent part of my semester on adding more Sensitivity Analysis methods such as feature ablation and integrated gradients and training more models such as DLinear and PatchTST for benchmarking purposes based on the existing progress. And most of the semester was spent on the submission of a research statement titled Evaluation of Interpretability Methods for Time-Series Deep Learning with Sensitivity Analysis to the AAAI'24 Undergraduate Consortium under Professor Fox's guidance. My detailed work and performance are documented in this report below.

2. Rivanna environment and reproduced results

Throughout the project, I became increasingly familiar with Slurm script, Rivanna OpenOnDemand GUI, and SSH command line arguments thanks to the guidance of Khairul and Professor Fox. Initially I always use file upload and use the Rivanna terminal on OpenOnDemand, but now I use SSH via VSCode to streamline the process. Now I am very familiar with conda and linux commands and proficient in composing and adjusting Slurm script. Now I feel comfortable training Deep Learning Models using GPU on Rivanna. In the following tables, I document a subset of my reproduced results, particularly focusing on "Interpret FEDformer model without ground truth" and "Interpret FEDformer model with ground truth using Morris Sensitivity"

- DLinear Model Results

	mae	rmse	rmsle	r2
DLinear	29.525	174.950	1.425	0.524

- Interpret FEDformer model without ground truth: Feature Ablation

	metric	area	comp	suff
0	mae	0.05	6.185393	11.879540
1	mae	0.10	8.278957	10.926261
2	mse	0.05	10.244110	17.771105
3	mse	0.10	14.800696	14.778280

- Interpret FEDformer model without ground truth: Feature Occlusion

	metric	area	comp	suff
0	mae	0.05	6.148119	11.983938
1	mae	0.10	8.218288	10.990644
2	mse	0.05	10.051311	18.178113
3	mse	0.10	14.489111	15.107386

- Interpret FEDformer model without ground truth: Augmented Feature Occlusion

	metric	area	comp	suff
0	mae	0.05	4.014695	13.281469
1	mae	0.10	5.221146	12.000462
2	mse	0.05	7.325848	23.154757
3	mse	0.10	9.430358	18.905275

- Interpret FEDformer model without ground truth: Feature Permutation

	metric	area	comp	suff
0	mae	0.05	3.853141	13.163686
1	mae	0.10	4.989805	11.914339
2	mse	0.05	7.023798	22.678165
3	mse	0.10	8.899339	18.697967

- Interpret FEDformer model with ground truth: Morris Sensitivity

	age_group	cases	attr	cases_rank	attr_rank
0	UNDER5	3.568745	5.806866	7.0	8.0
1	AGE517	14.482830	14.636159	4.0	3.0
2	AGE1829	24.589799	18.241373	1.0	1.0
3	AGE3039	19.326818	14.607036	2.0	4.0
4	AGE4049	14.099899	13.185573	5.0	5.0
5	AGE5064	15.889536	17.342780	3.0	2.0
6	AGE6574	5.066949	9.824253	6.0	6.0
7	AGE75PLUS	2.97542	6.355960	8.0	7.0

Evaluating local ranks

Rank mae: 0.09375, rmse: 0.125, ndcg: 0.97828

Normalized mae: 0.030364, rmse: 0.035932, ndcg: 0.98898

3. Paper Reading Session

On 2023/9/22, I was the first undergraduate student to lead a paper reading. The paper name is “Domain Adaptive Multi-Modality Neural Attention Network for Financial Forecasting”. After days of reading and digestion, I formed a clear way to navigate my peers through the paper in a both detailed and understandable way. To better convey the ideas and walk my peers through the paper, I composed presentation slides. I used my first several slides to introduce the main contributions of the paper and then explained why I chose this paper. After that, I annotated this paper part by part on Notability using Ipad, highlighting main points and important techniques the author used. After the paper-reading session, I produced a new slide deck of my presentation and my understanding toward the paper for Professor Fox’s talk at the UVA Psychology Department.

4. Personal Research Statement:

One of the most defining moments for me in this AI4Science project is the research statement submission to the AAAI’24 Undergraduate Consortium. Based on my summer and fall participation in Time Series Deep Learning and Interpretation, I develop my own research interest in robustness of post-hoc perturbation-based Sensitivity Analysis methods and their applications. Under the guidance of Professor Fox, I have submitted a two-page research statement titled

Evaluation of Interpretability Methods for Time-Series Deep Learning with Sensitivity Analysis and an associated two-page personal statement. This statement is submitted on 2023/11/6.

5. Group commitment

Throughout the semester, I treated every group meeting seriously. I attended every Monday and Friday group meeting punctually, always prioritizing the commitments over other stuff. Besides, I always chose to meet in person, as I believe face to face interaction is always better and more efficient. During other students' presentations or reports, I always pay special attention to their speech and raise questions or give comments. Other than group meetings, I also actively participated in talks that professor Fox gave to graduate students. Furthermore, I pulled my weight in our poster submission, trying to refine the original rejected paper into a 2-page poster.