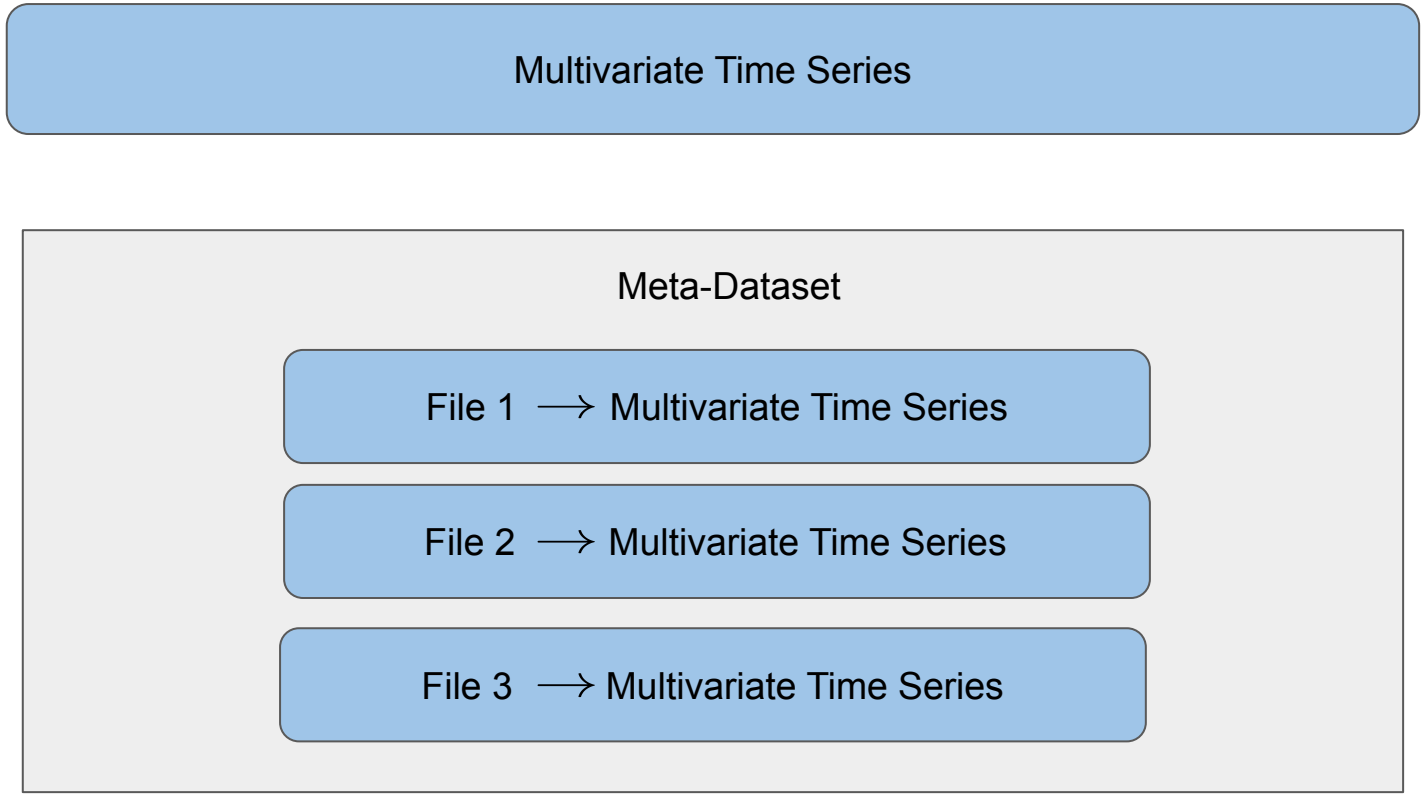
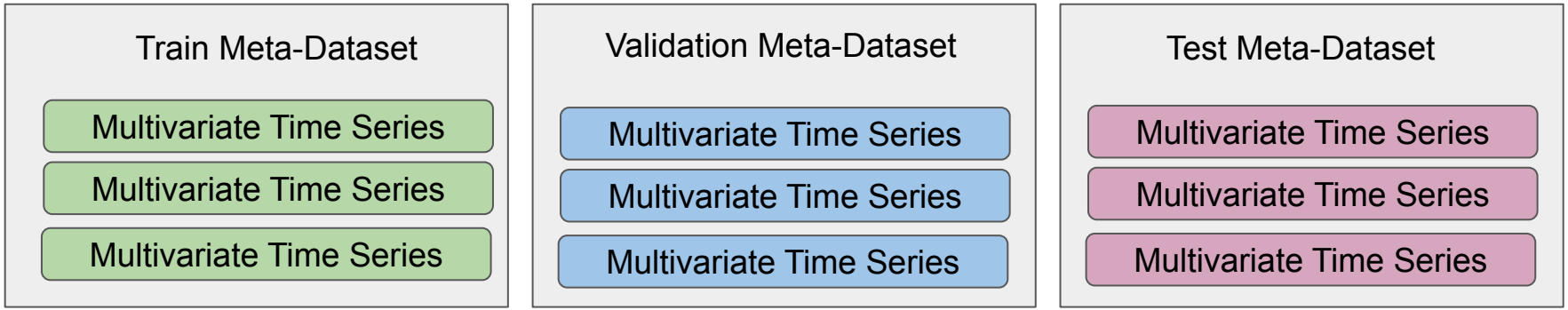
Data splitting and evaluation

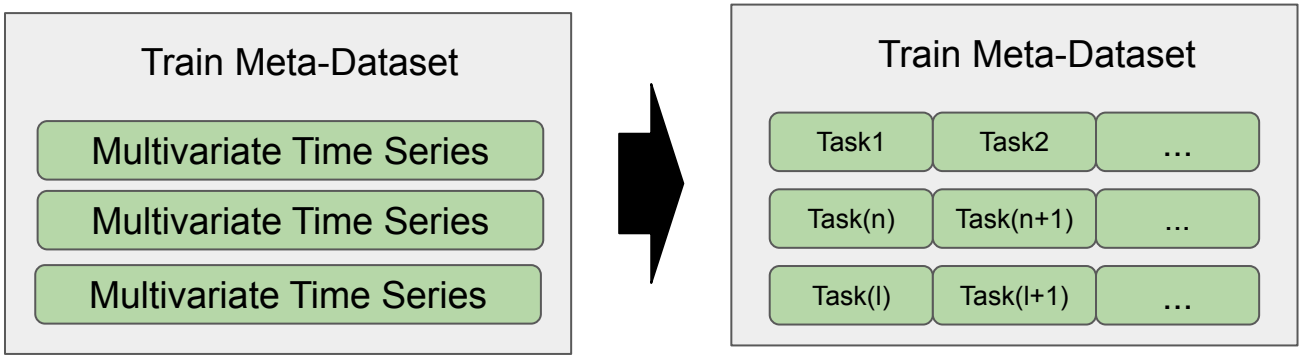
Master thesis

Previously

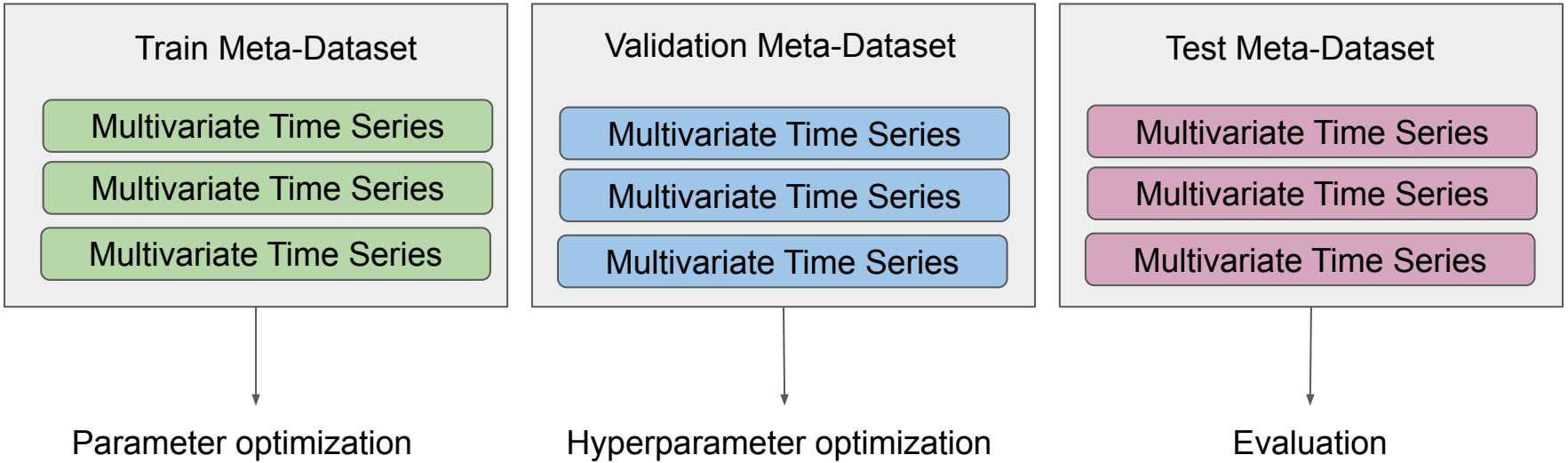
Data splitting


Multivariate Time Series
Meta-Dataset
File 1 ⟶ Multivariate Time Series
File 2 ⟶ Multivariate Time Series
File 3 ⟶ Multivariate Time Series

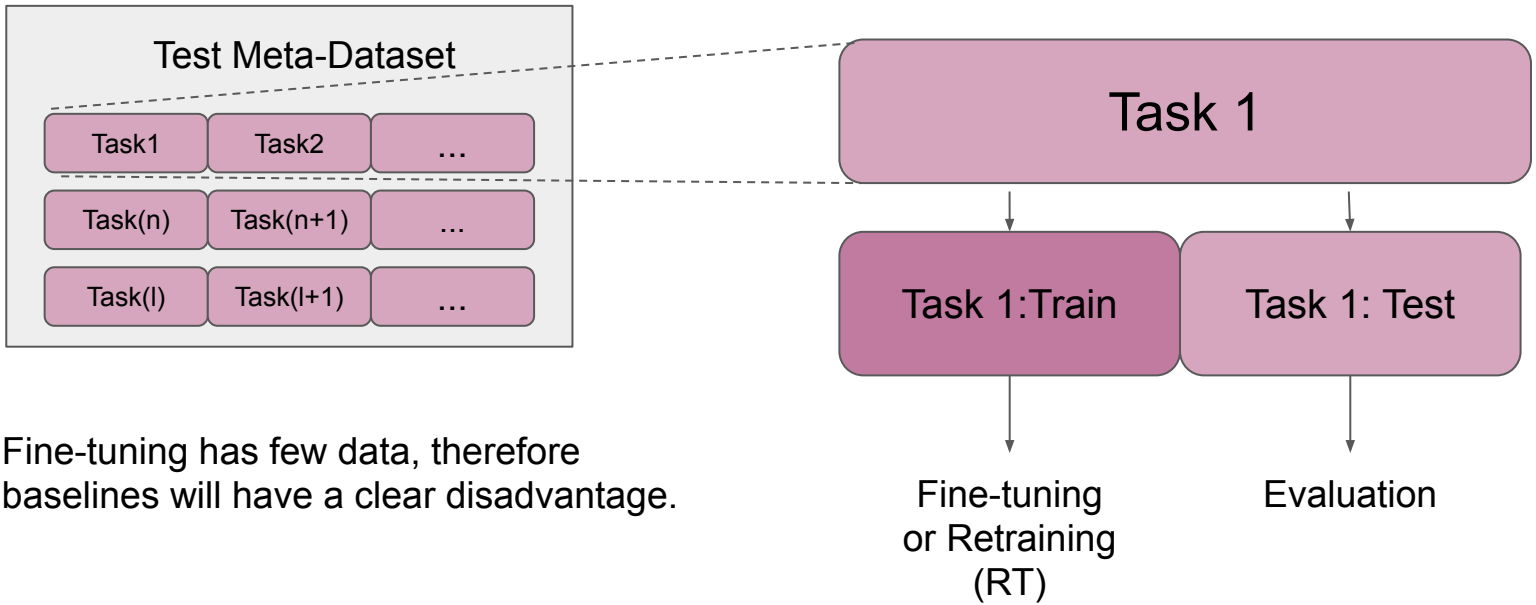

Train Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Validation Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Test Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series


Train Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Train Meta-Dataset
Task1
Task2
...
Task(n)
Task(n+1)
...
Task(l)
Task(l+1)
...

Model evaluation

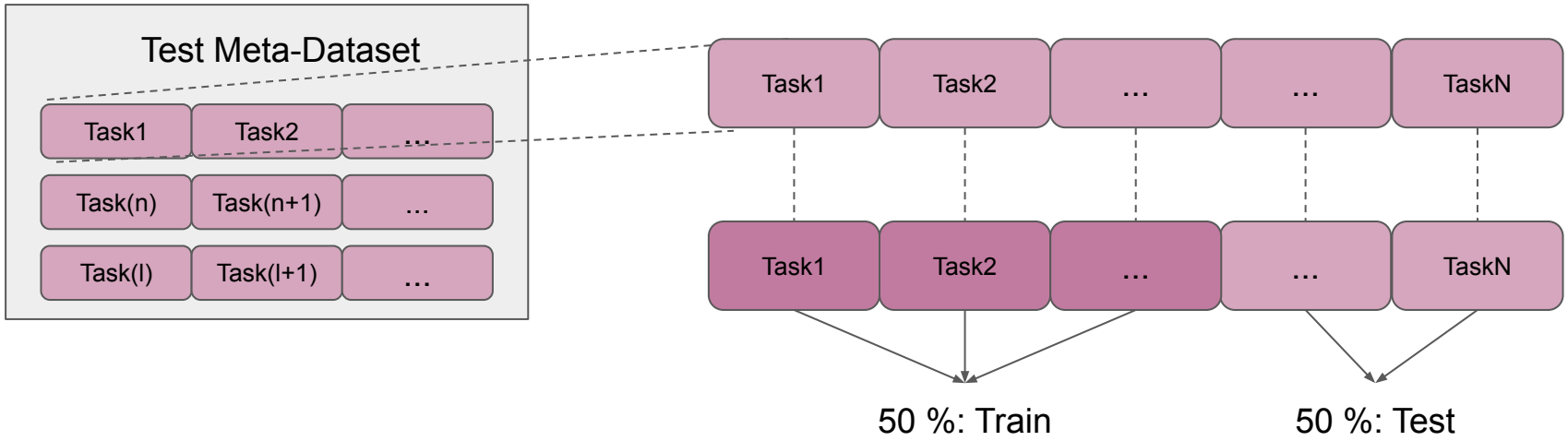

Train Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Validation Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Test Meta-Dataset
Multivariate Time Series
Multivariate Time Series
Multivariate Time Series
Parameter optimization
Hyperparameter optimization
Evaluation

Evaluation in Meta-Learning



Fine-tuning has few data, therefore baselines will have a clear disadvantage.

Other evaluations



Baselines

Baselines

- **kNN -> Gaussian Process (GP)**
- **XG-Boost**
- **Rocket** (Dempster, A., Petitjean, F., & Webb, G. I. (2020). ROCKET: Exceptionally fast and accurate time series classification using random convolutional kernels. *Data Mining and Knowledge Discovery*, 1-42.)
- **FCN** (Fawaz, H. I., Forestier, G., Weber, J., Idoumghar, L., & Muller, P. A. (2019). Deep learning for time series classification: a review. *Data Mining and Knowledge Discovery*, *33*(4), 917-963.)
- **Resnet** (Wei, W. W. S. (2011). Time Series Regression. In *International Encyclopedia of Statistical Science* (pp. 1607–1609). Springer Berlin Heidelberg)

Other comparisons

- MAML
- Transfer learning
- Data augmentation

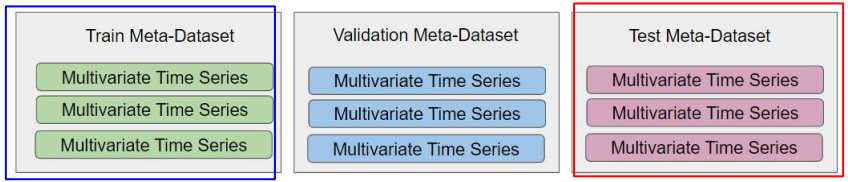
New updates

Done

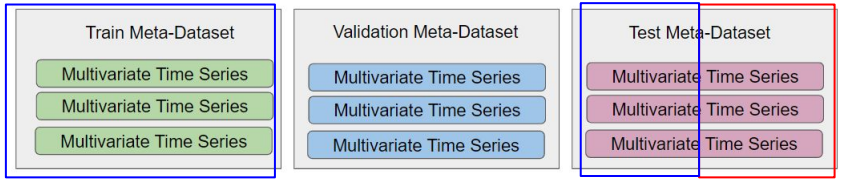
- Preprocessing:
  - Heart rate signals (HR)
  - Five cities pollution data (POLLUTION)
  - Battery signals (BATTERY)
- Evaluation and hyperparameter tuning on:
  - XGBoost
  - GP
  - Resnet (partially)

Evaluation types

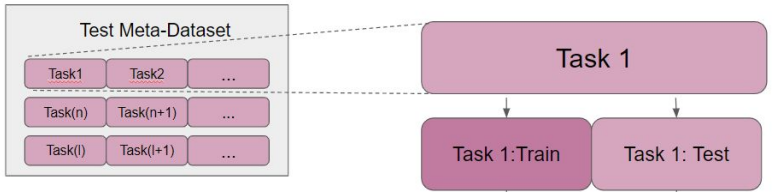
- Without retraining (WORT)



- On 50% (50)



- With retraining (WRT)



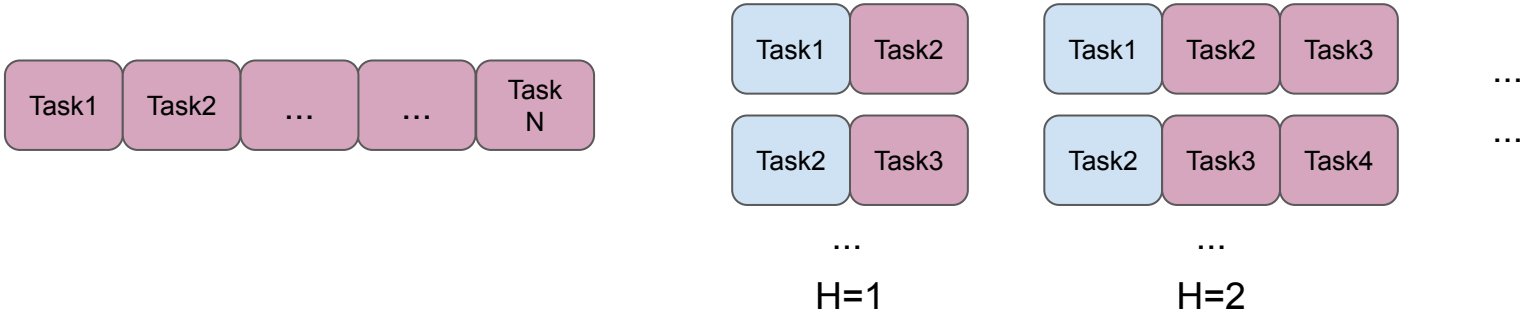
Questions

- Window size?
  - BATTERY: 20. Expert criteria and small cross validation.
  - HR: 32. Dataset reference and data structure.
  - POLLUTION: 5. Literature.
- Task size?
  - Big task size: less tasks, more time consuming meta-learning, more information for fine-tuning.
  - Small task size: less information for fine-tuning, more tasks.

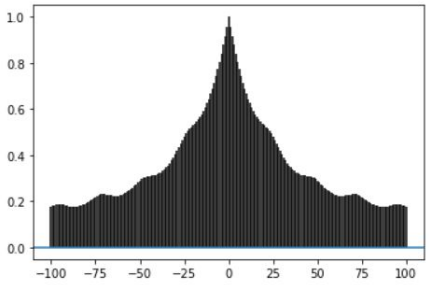
XGBoost and GP results

	XGB - WORT (MAE)	**XGB-50 (MAE)**	**GP- WRT (MAE)**
POLLUTION	0.04284	0.04611	0.04351
HR	0.07725	0.06459	**0.03151**
BATTERY	0.03569	0.02833	**0.00326**

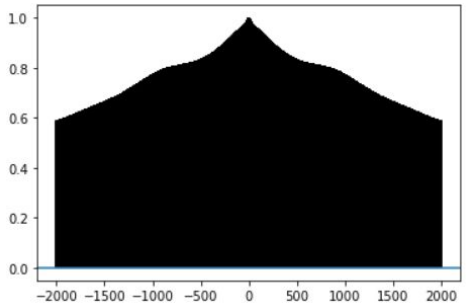
The evaluation horizon problem



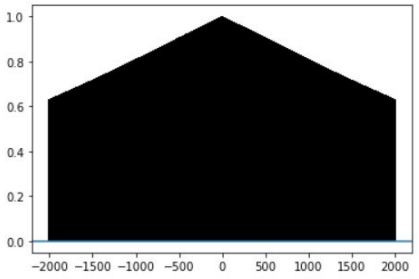
AUTOCORRELATION PLOT OF THE TARGET



POLLUTION

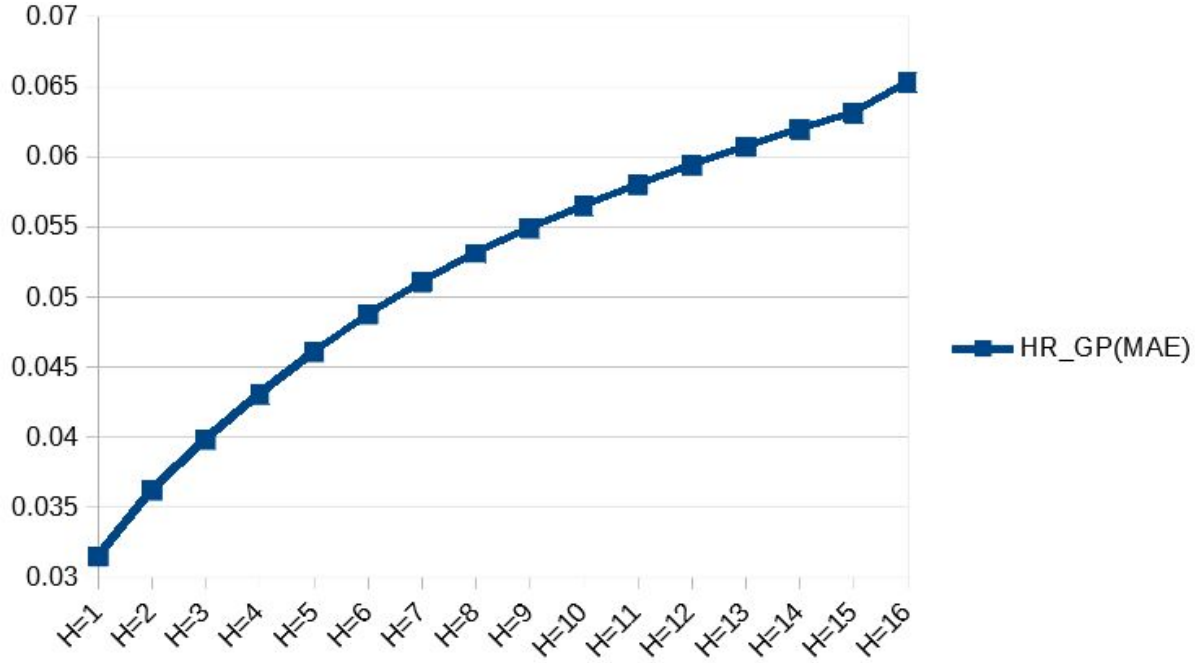


HR



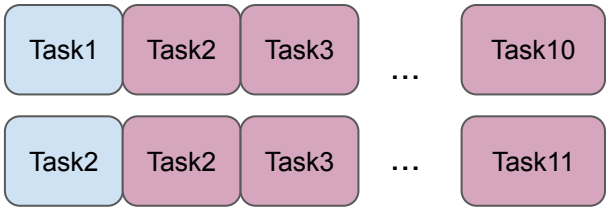
BATTERY

MAE for different horizons



Dealing with evaluation horizon problem

- Using larger horizons for testing allows better **generalization** assessment.



Baseline change

- **kNN**
- **XG-Boost**
- **Rocket** (Dempster, A., Petitjean, F., & Webb, G. I. (2020). ROCKET: Exceptionally fast and accurate time series classification using random convolutional kernels. *Data Mining and Knowledge Discovery*, 1-42.)
- **Resnet** (Wei, W. W. S. (2011). Time Series Regression. In *International Encyclopedia of Statistical Science* (pp. 1607–1609). Springer Berlin Heidelberg).
- **VRADA** (Purushotham, S., Carvalho, W., Nilanon, T., Liu, Y., & Angeles, L. (2017). Variational Recurrent Adversarial Deep Domain Adaptation), (2016), 1–11.)

To do

- Evaluation on Resnet
- Implementation of LSTM
- Implementation of VRADA
- Change task assignment for BATTERY

Other inquiries

- Volkswagen data on cluster?
- Further questions?