

# Machine Learning for Sequential Decision Making

Preliminary Meeting (IN2107, IN4872)

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# Team

- ▶ Dr. Patrick Rockenschaub (Senior Research Scientist)
- ▶ Tom Haider (Research Scientist/PhD Student)

This is a seminar for **Master** students!

Main prerequisite: Machine Learning (IN2064)

Optional: Machine-Learning for Graphs and Sequential Data (IN2323)

Website:

[https://www.cs.cit.tum.de/daml/lehre/wintersemester-2023-24/  
seminar-machine-learning-for-sequential-decision-making/](https://www.cs.cit.tum.de/daml/lehre/wintersemester-2023-24/seminar-machine-learning-for-sequential-decision-making/)

Kontakt:

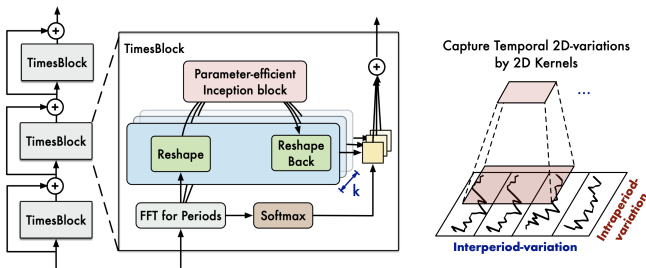
[patrick.rockenschaub@iks.fraunhofer.de](mailto:patrick.rockenschaub@iks.fraunhofer.de)

# Why attend this Seminar?

1. Explore **state-of-the-art** research in ML for **decision making**
2. **Analyze and criticize** recent publications or **dive deep** into a method and investigate extensions/improvements
3. Improve your **scientific writing**
4. Participate in a **review process** akin to international conferences
5. Improve your **presentation skills**

# Topics I: Predicting

- ▶ Time Series Prediction and Representation Learning
  - ▶ Traditional approaches in time series modelling
  - ▶ Recent advances in discrete-time modelling
  - ▶ Recent advances in continuous-time modelling



**Figure:** Architecture of the discrete-time TimesNet (Wu et al., 2023)

# Topics II: Deciding

- ▶ Reinforcement Learning and its Variants
  - ▶ Model-based vs. model-free
  - ▶ Off-policy vs. on-policy
- ▶ Estimation of Causal Effects
  - ▶ Theory of Causality and Identifiability
  - ▶ ML for Estimation of Dynamic Treatment Regimens

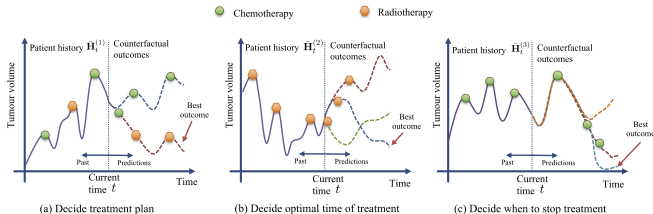
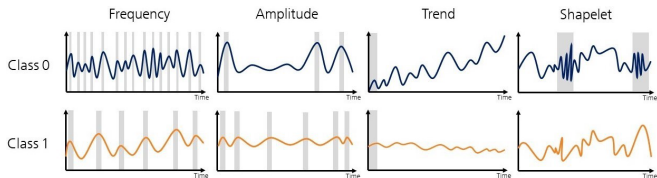


Figure: Counterfactual Recurrent Networks (Bica et al., 2020)

# Topics III: Robustifying

- ▶ Out-of-Distribution and Anomaly Detection
- ▶ Domain Adaption and Generalisation
- ▶ Missing Data
- ▶ Explainability and Interpretability



**Figure:** Interpretation of saliency maps for time series (Schröder et al., 2023)

# What will you do?

1. Read **seed research papers** (provided by us)
2. **Choose** either
  - ▶ **Snowball research:** identify and read additional papers related to the seed papers (via references to/from these papers, relevant keywords)
  - ▶ **Deep dive:** Experiment with the code released with the paper; extend/improve the method/code, run experiments, and analyze the results
3. Summarize your findings, criticism, and research ideas in a **short paper** (4 pages, double column)
4. Write **reviews** of other students work
5. **Present** your work in final talk + discussion round with your peers

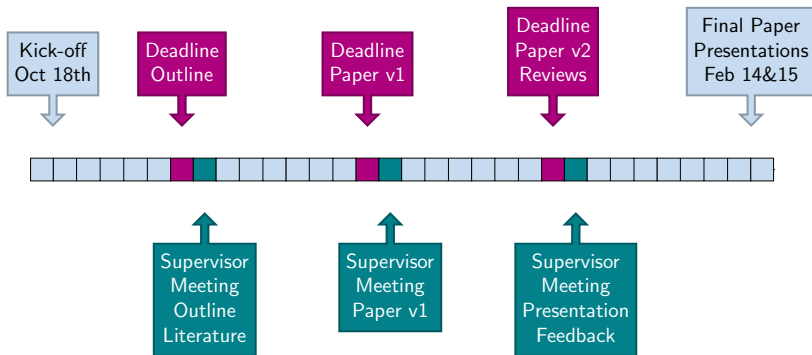
Grade will be based on **all** parts: Paper, reviews, talk and overall participation

# Requirements

- ▶ Strong knowledge of machine learning and mathematics
- ▶ Passed relevant courses (the more, the better)
  - ▶ Machine Learning (hard requirement)
  - ▶ Machine Learning for Graphs and Sequential Data (formerly Mining Massive Datasets)
  - ▶ Machine Learning Lab
- ▶ Motivation
- ▶ Additional selection criteria
  - ▶ relevant experience (projects in companies, experience as a HiWi)  
⇒ you can send an overview of your experience to us (see end of slides)



# Schedule



# Registration

## Registration via the **matching system!**

<https://matching.in.tum.de/>

Machine Learning for Sequential Decision Making (IN2107, IN4872)

## + **Fill out the application form!**

<https://forms.gle/PQxDYZAUEb1zqCrR7>

**Deadline July 19, 2023**

## Application

- ▶ Which course (lab/seminar) are you applying for?
- ▶ List of ML-related lectures you attended
- ▶ **Concise** overview of your resume (bullet list, not a complete CV)
- ▶ Brief motivation statement
- ▶ Any additional relevant experience (research, HiWi positions, etc.)