intelligent systems
TU Graz

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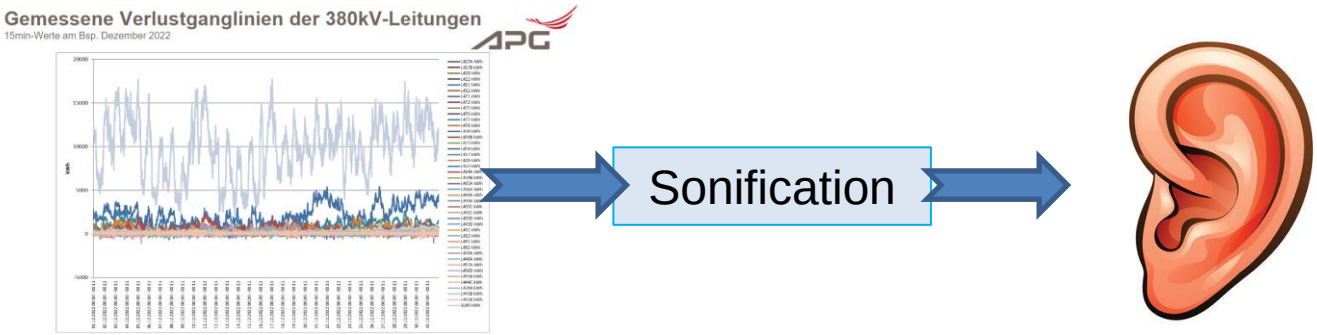
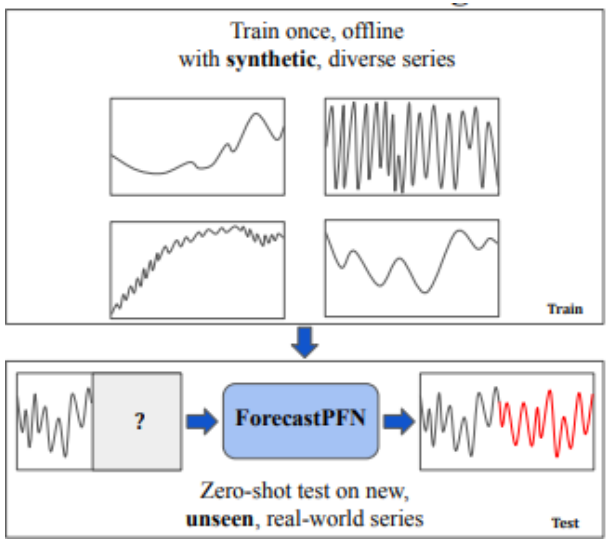
Bachelor/Master/TI Projects & Master Theses 2024

Potential Topics

- Sonification of time-series data of the Austrian power grid; Anomaly detection in sequential data



- Time-series prediction of energy loss using the Austrian power grid data (ForecastPFN)



- Please ask for details and more options: pernkopf@tugraz.at

Bachelor/Master/TI Projects & Master Theses 2024

Potential Topics

- Invertible Neural Network (or Normalizing flow) for modeling of steel production processes & multi-target regression

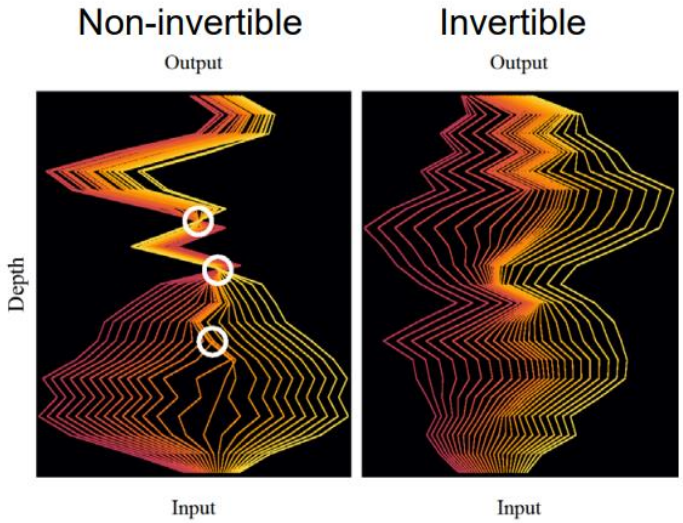
Lynton Ardizzone, Jakob Kruse, Sebastian J. Wirkert, Daniel Rahner, Eric W. Pellegrini, Ralf S. Klessen, Lena Maier-Hein, Carsten Rother and Ullrich Köthe, Analyzing Inverse Problems with Invertible Neural Networks, ICLR 2018

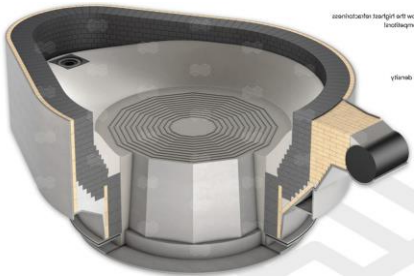
Invertible Neural Networks (INNs) are bijective function approximators which have a **forward mapping**

$$F_\theta : \mathbb{R}^d \to \mathbb{R}^d$$
$$x \mapsto z$$

and an **inverse mapping**

$$F_\theta^{-1} : \mathbb{R}^d \to \mathbb{R}^d$$
$$z \mapsto x$$





voestalpine
ONE STEP AHEAD.

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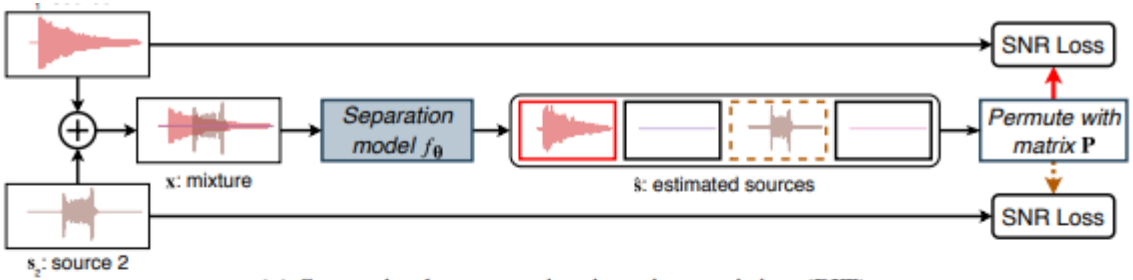
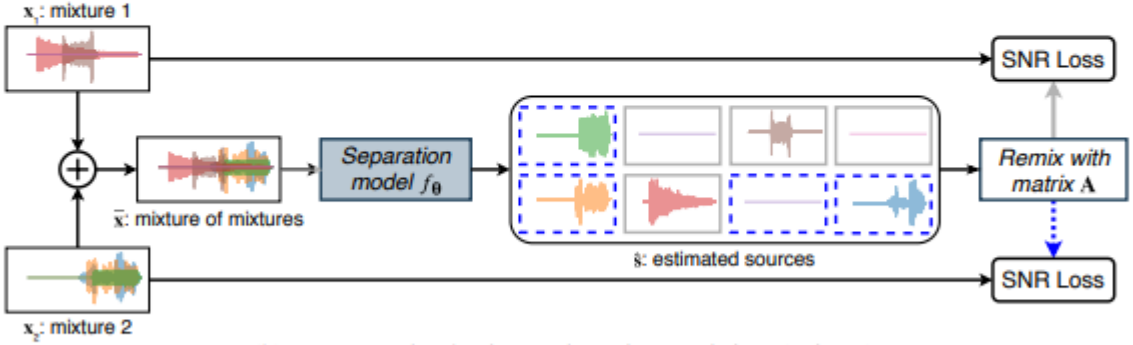
Bachelor/Master/TI Projects & Master Theses 2024

Potential Topics

- Unsupervized single channel source separation (SCSS) (Master Thesis)



(a) Supervised permutation invariant training (PIT).



(b) Unsupervised mixture invariant training (MixIT).

Figure 1: Schematic comparing (a) PIT separating a two source mixture into up to four constituent sources to (b) MixIT separating a MoM into up to eight constituent sources. Arrow color indicates the best match between estimated sources and the ground-truth.

Scott Wisdom, Efthymios Tzinis, Hakan Erdogan, Ron J. Weiss, Kevin Wilson, John R. Hershey, Unsupervised Sound Separation Using Mixture Invariant Training, NeurIPS, 2020

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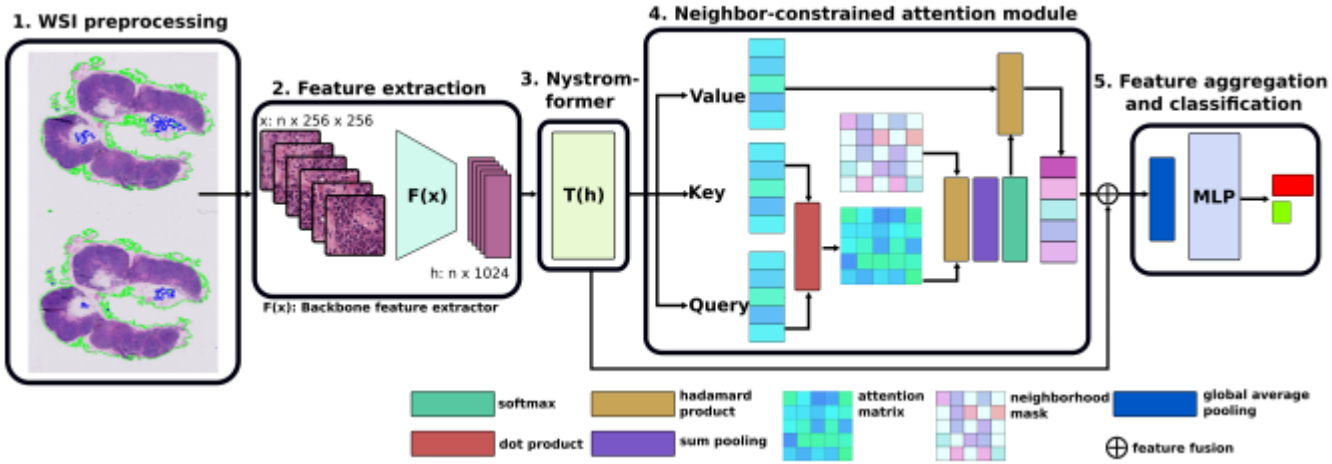
Potential Topics

- Estimating the reception quality of mobile radio and power line communication for smart meters (Master Thesis, funded)

- Context-aware multiple instance learning (reimplementation + application to point cloud data or refractory wear data)



Olga Fourkioti, Matt De Vries, Chris Bakal, CAMIL: Context-Aware Multiple Instance Learning for Cancer Detection and Subtyping in Whole Slide Images, ICLR, 2024

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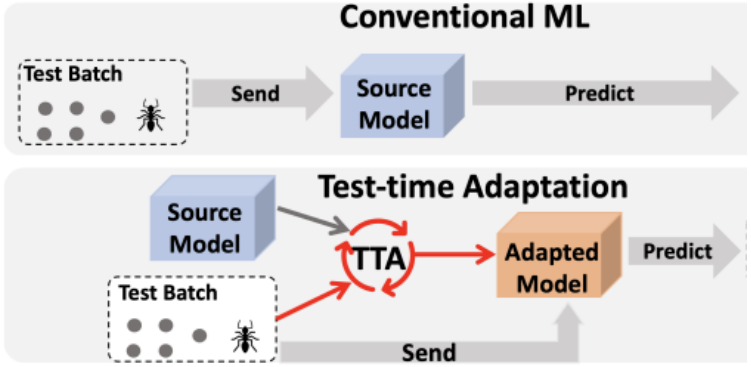
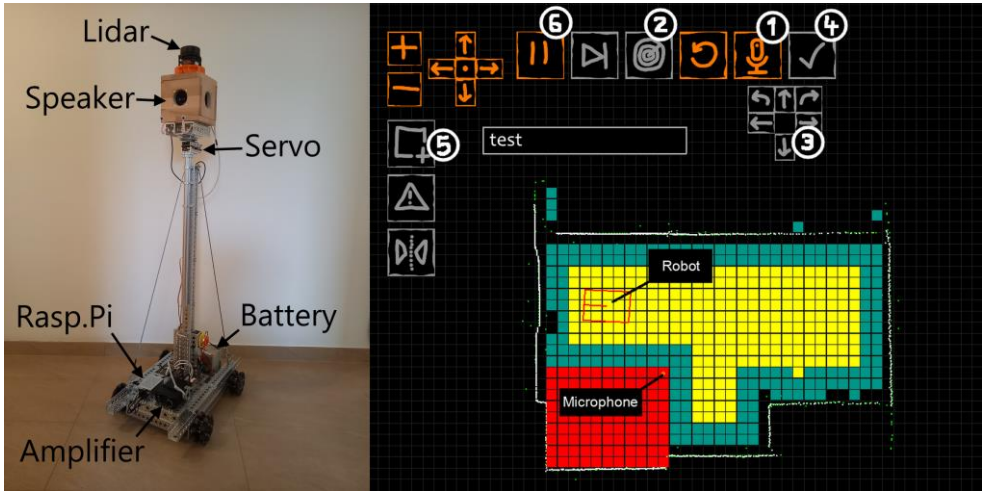
Potential Topics

- Test-time adaptation for optical character recognition



- Measuring room-impulse-response using our robot



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How to start **your** project

- Select research area/topic which correlates with your interests!
- Approach me/my colleagues which will provide a specific topic (you can also suggest your own topic)
- Regular meetings on the progress of the topic

Research Areas & Applications

Probabilistic Graphical Models

- Analysis of Belief Propagation
- Causality

Deep Learning

- Uncertainty Modelling in DNNs
- Physics-Informed Neural Networks
- Explainable AI (XAI)
- Robustness & Domain Adaptation
- Resource-efficient Deep Models

Speech Processing

- Source Separation & Dereverberation
- Keyword Spotting
- Acoustic Scene Classification

Medical Data Processing

- Lung Sound Classification
- Acoustic Covid Detection
- Event-Detection in Heart Sounds

Industrial Applications

- Condition Monitoring
- Radar Interference Mitigation
- Time-series Forecast

Research Challenges in Machine Learning