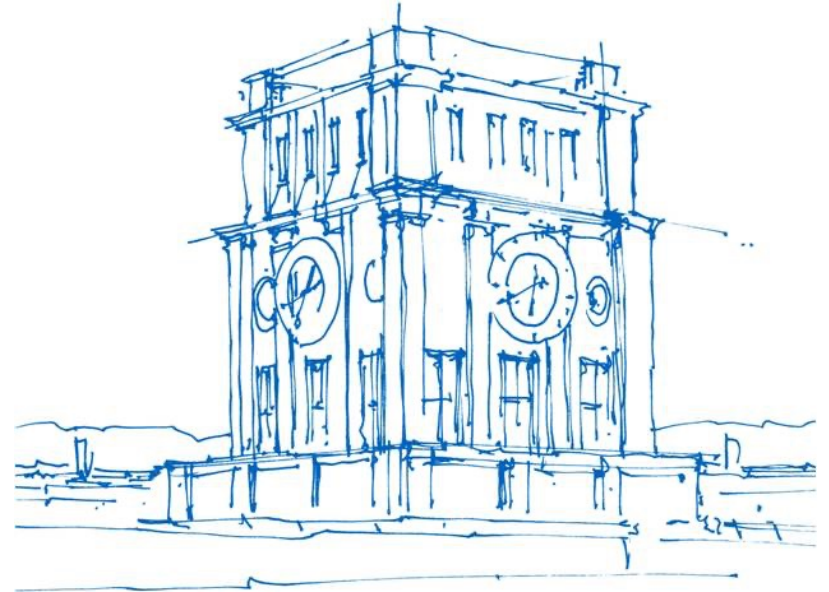


# First Update – Connectome Informed Attention

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Munich, November 2022



*Uhrenturm der TUM*

# First Update – Connectome Informed Attention



# Overview

## 1. Progress and Findings

- Diagnosis Classification
- Tau Progression Prediction
- Visualization of Tau Density in the Brain
- Dataset Generation for Tau Progression

## 2. Next steps

- Focus on Tau Progression Prediction
- Incorporate Connectivity Information

# 1. Progress and Findings

- Diagnosis Classification
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- Visualization of Tau Density in the Brain
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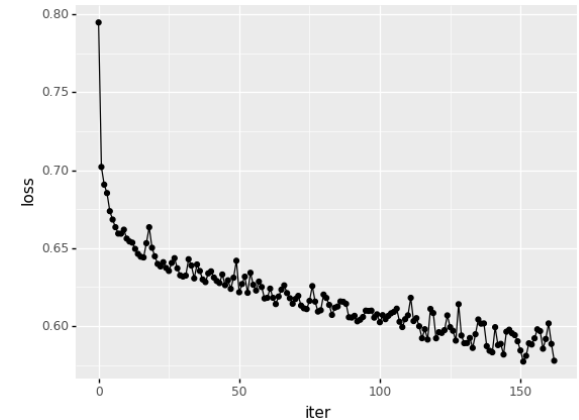
# 1. Progress and Findings

- **Diagnosis Classification**
- Tau Progression Prediction
- Visualization of Tau Density in the Brain
- Dataset Generation for Tau Progression

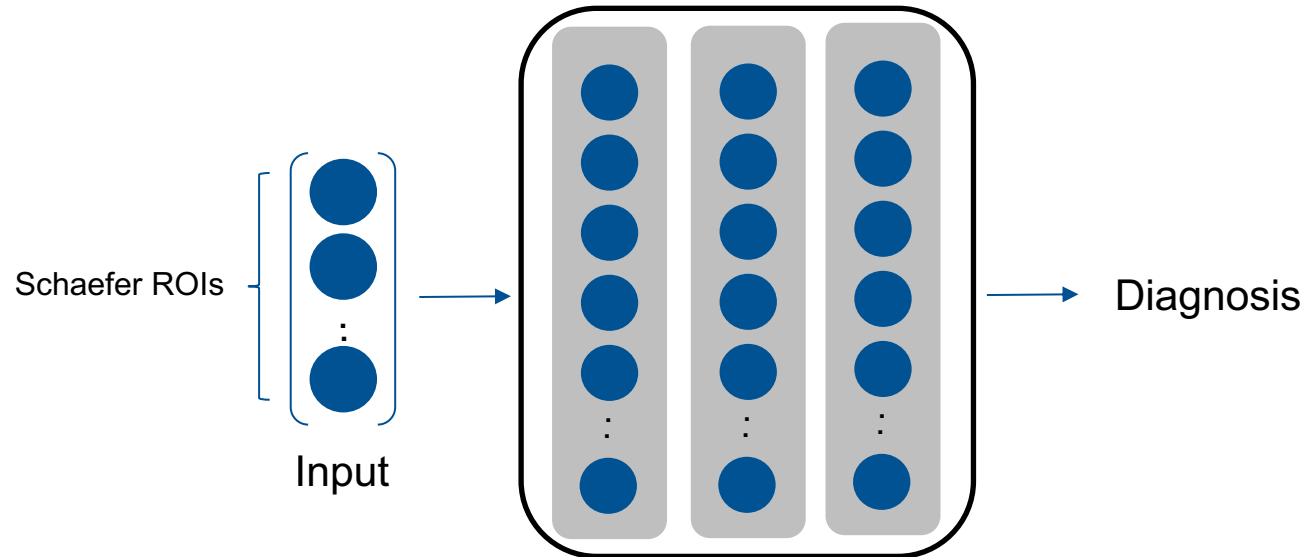
# Diagnosis Classification: Binary Models

- Data split by subjects maintaining diagnosis ratio (55% CN, 45% MCI, 10% Dementia)
- Here: Binarization into *CN vs. MCI / Dementia*
- Linear Regression with  $r^2 = 0.32$

Model	Linear	MLP
Accuracy	0.63	0.66
F1	0.51	0.58

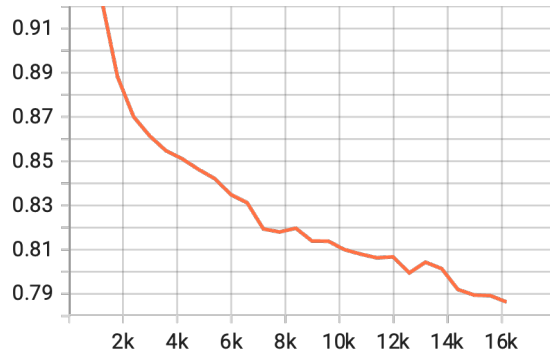


# Diagnosis Classification: MLP

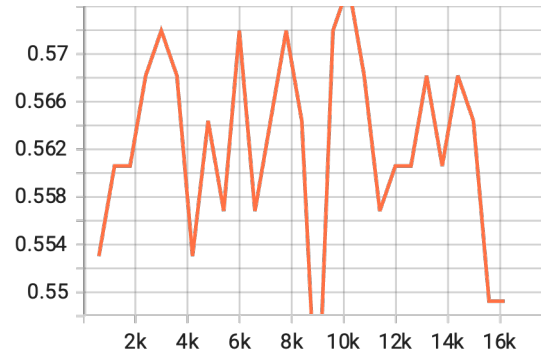


# Diagnosis Classification: MLP

- Training loss curve



- Validation acc curve

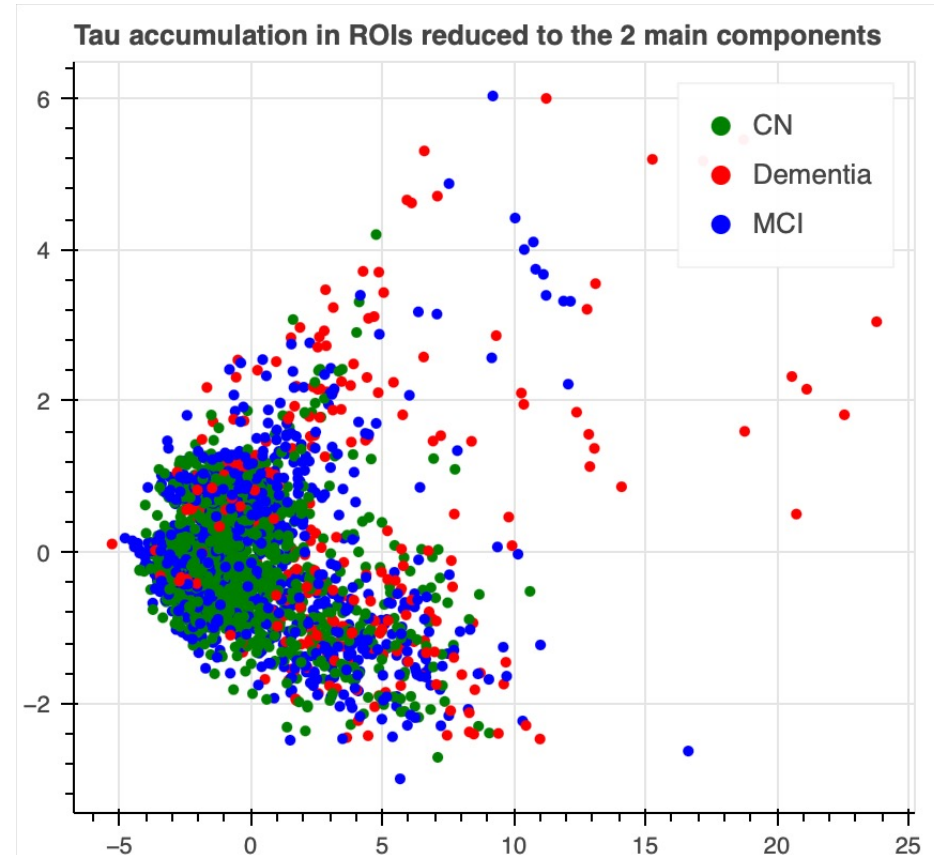


- 0.66 Test accuracy

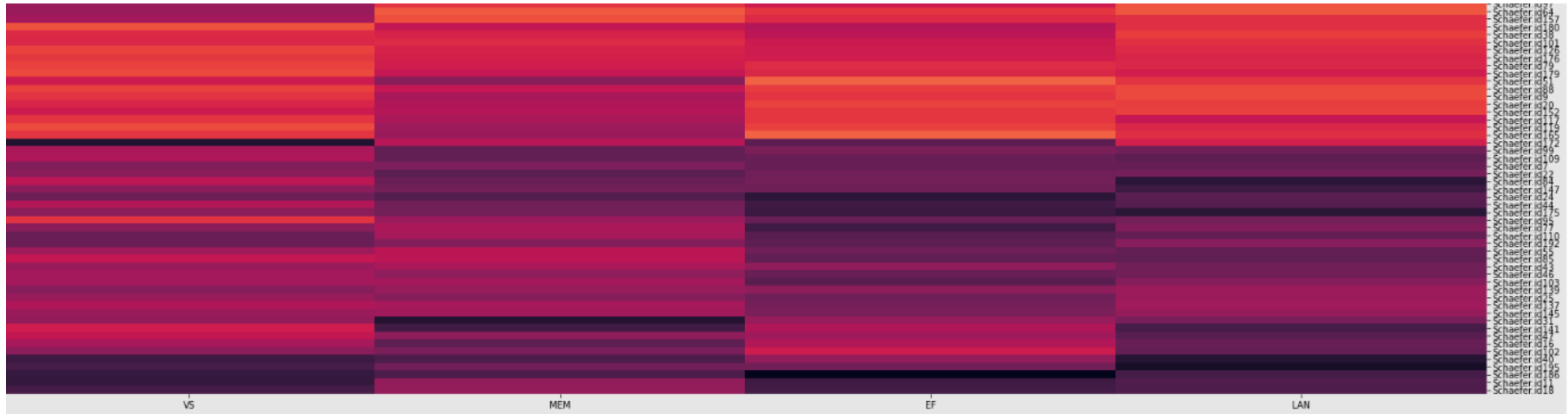


# Diagnosis Classification: Challenge

- No inherent clusters among the classes
- Classification solely based on Tau accumulation in ROIs is challenging



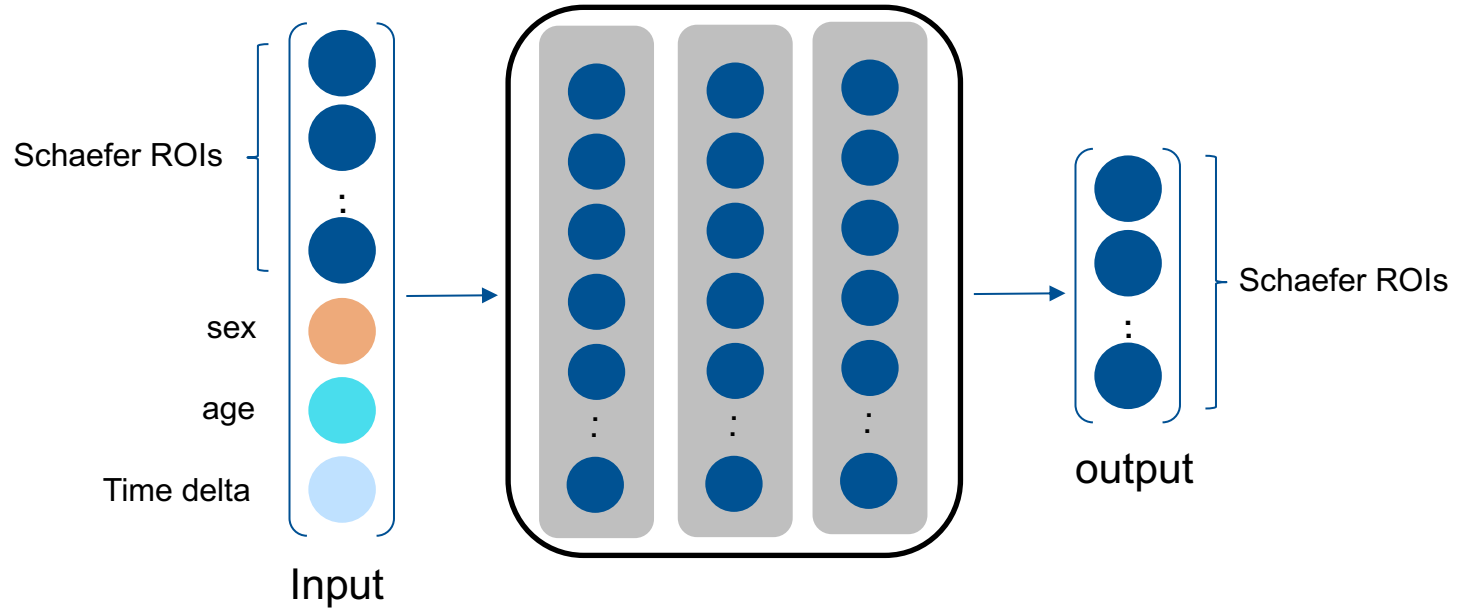
# Influence of Tau Accumulation on Cognitive Benchmarks



# 1. Progress and Findings

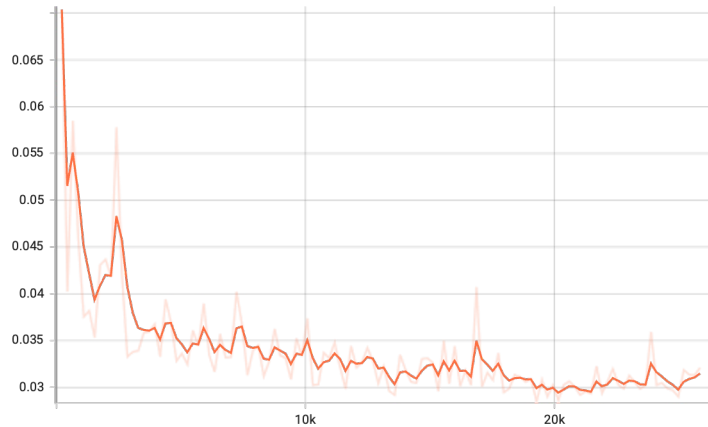
- Diagnosis Classification
- **Tau Progression Prediction**
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# Tau Progression Prediction: MLP



# Tau Progression Prediction: MLP

- Training curve



- Best model achieved a test MSE loss of 0.038

# Tau Progression Prediction: MLP

- Minimal Implementation
- Only one Time-step information

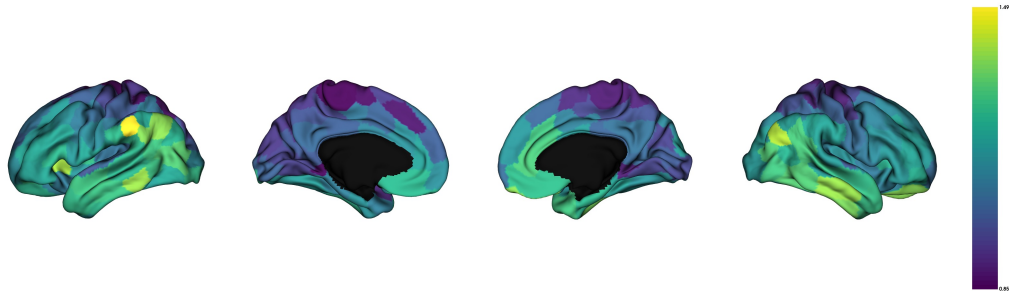


- Useful for testing impact of addition of temporal information
- Easy to train

# 1. Progress and Findings

- Diagnosis Classification
- Tau Progression Prediction
- **Visualization of Tau density in the Brain**
- Dataset Generation for Tau Progression

# Visualization of Tau Density in the Brain



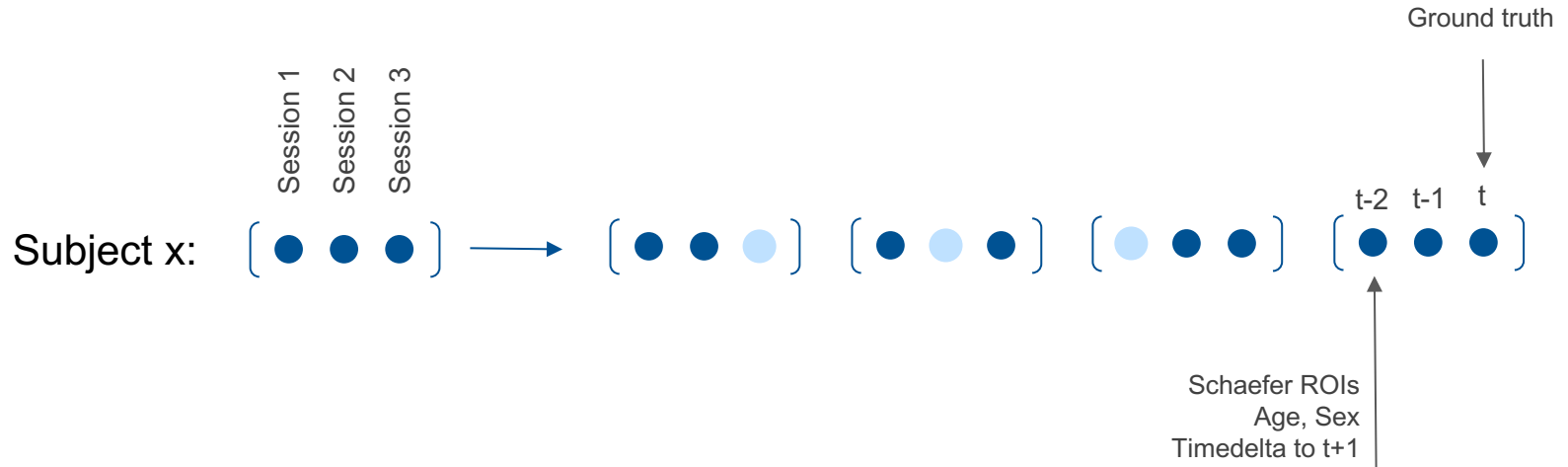
- Interactive
- Intuitive
- Easy



# 1. Progress and Findings

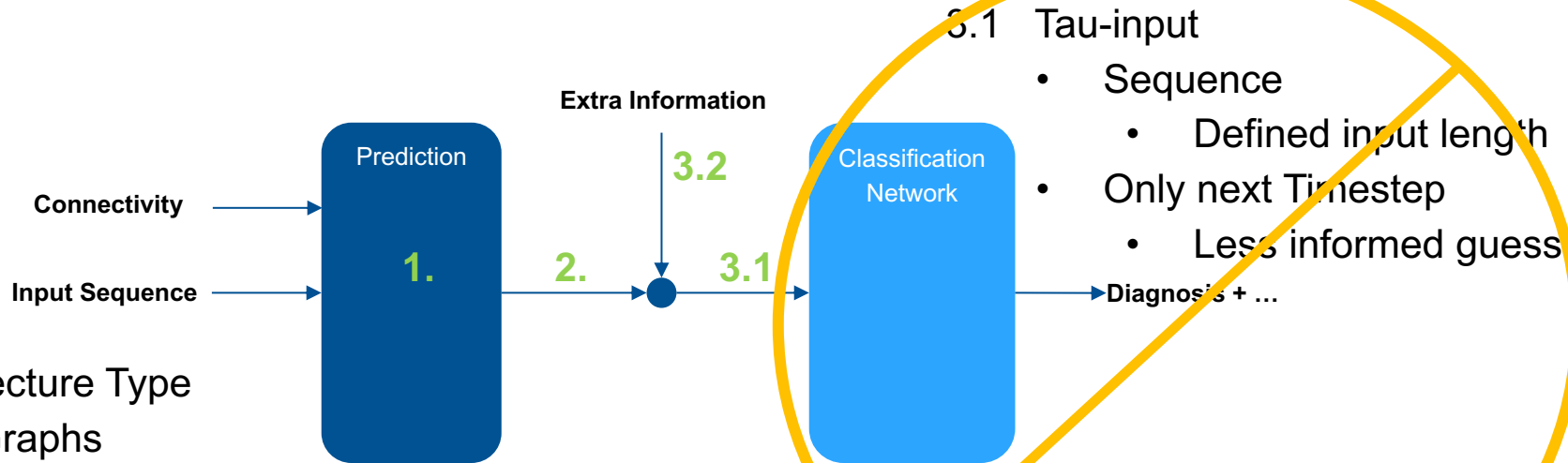
- Diagnosis Classification
- Tau Progression Prediction
- Visualization of Tau Density in the Brain
- **Dataset Generation for Tau Progression**

# Dataset Generation for Tau Progression



## 2. Next Steps

# General Envisioned Architecture -Mods



## 1. Architecture Type

- Graphs
- Attention
- RNN LSTMs ...
- Classical Methods

## 2. Two Output options

- Sequence
- Only next Timestep

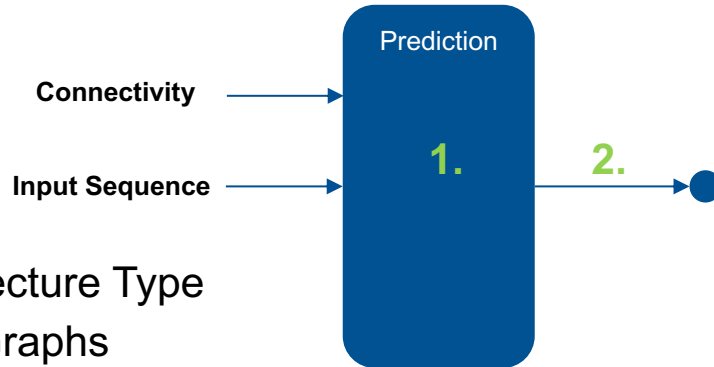
## 3.1 Tau-input

- Sequence
  - Defined input length
- Only next Timestep
  - Less informed guess

## 3.2 Additional Information

- Test-scores ?
- Patient age ?
- More suggestions ?

# General Envisioned Architecture -Mods



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- **Focus on Tau Progression Prediction**
  - **Baseline For Learning on sequences**
  - **Attention-based Model Architecture design**
- Incorporate Connectivity Information
  - Mechanisms for Knowledge Integration
  - Comparison

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- Focus on Tau Progression Prediction
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  - Attention-based Model Architecture design
- **Incorporate Connectivity Information**
  - **Mechanisms for Knowledge Integration**
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Thank you for your attention!