Initial Presentation – Connectome Informed Attention

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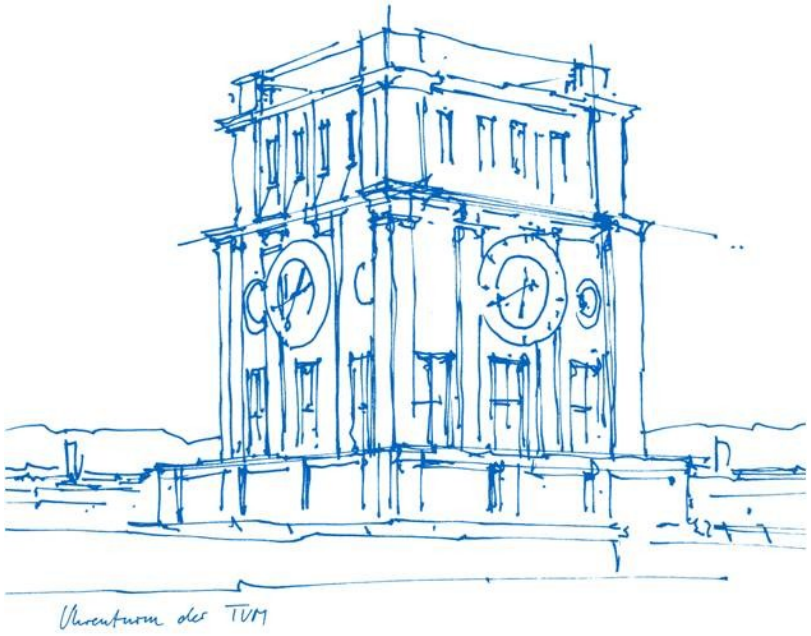


Initial Presentation - Connectome Informed Attention

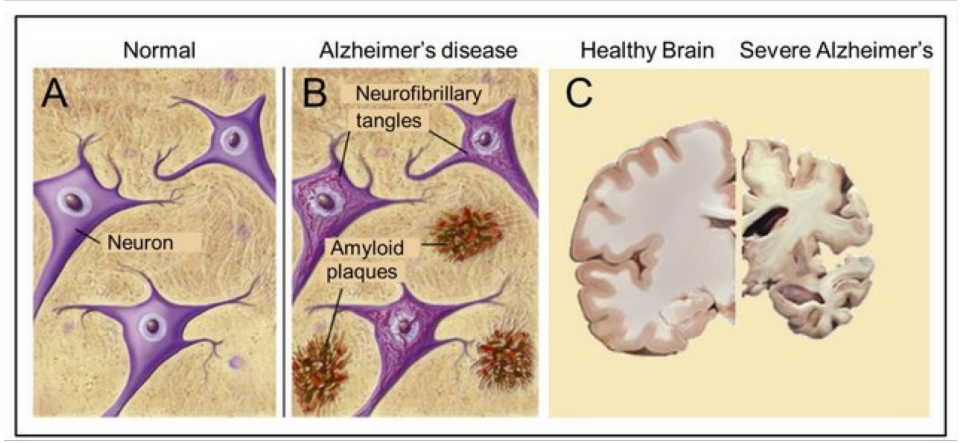
Overview

1. Biological Fundamentals
   - Alzheimer’s Disease Progression Fundamentals
   - Tau Spreading
   - Functional Connectivity
2. Goal Definition
   - Research Goals
   - Project Goal and Challenges
3. Approach
   - Tau-accumulation in Schaefer Regions of Interest (ROIs)
   - Connectivity Matrix
   - General Envisioned Architecture
4. Project Milestones

Biological Fundamentals

1. Alzheimer's disease progression fundamentals
2. Tau spreading
3. Functional Connectivity

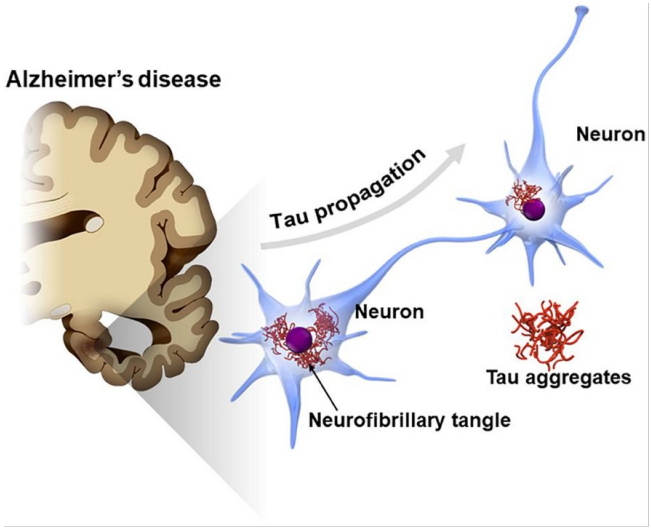
Alzheimer’s Disease (AD) Progression Fundamentals



Loof, Arnold & Schoofs, Liliane. (2019). Alzheimer’s Disease: Is a Dysfunctional Mevalonate Biosynthetic Pathway the Master-Inducer of Deleterious Changes in Cell Physiology?. OBM Neurobiology. 3. 1-1. 10.21926/obm.neurobiol.1904046.

- Amyloid plaques have a weak correlation with cognitive impairment
- Tau Protein tangles seem to have a higher correlation and higher temporal contingency with cognitive degeneration

Tau Spreading



Takeda, S. (2019). Tau propagation as a diagnostic and therapeutic target for dementia: Potentials and unanswered questions. Frontiers in Neuroscience, 13, 1274

Tau spreading behavior:

- Spreads 'prion-like'
- Phenomenon explainable by diffusion and neural firing rates

Patient-centered connectivity-based prediction of tau pathology spread in Alzheimer's disease
NICOLAI FRANZMEIER ANNA DEWENTERLUKAS FRONTZKOWSKI MARTIN DICHGANS ANNA RUBINSKIJULIA NEITZEL RUBEN SMITH OLOF STRANDBERGRIK OSSENKOPPELE [...] MICHAEL EWERS

Functional Conncetivity

Tau Spreading behavior:

- Tau concentration spreads from Epicenters towards connected brain regions.

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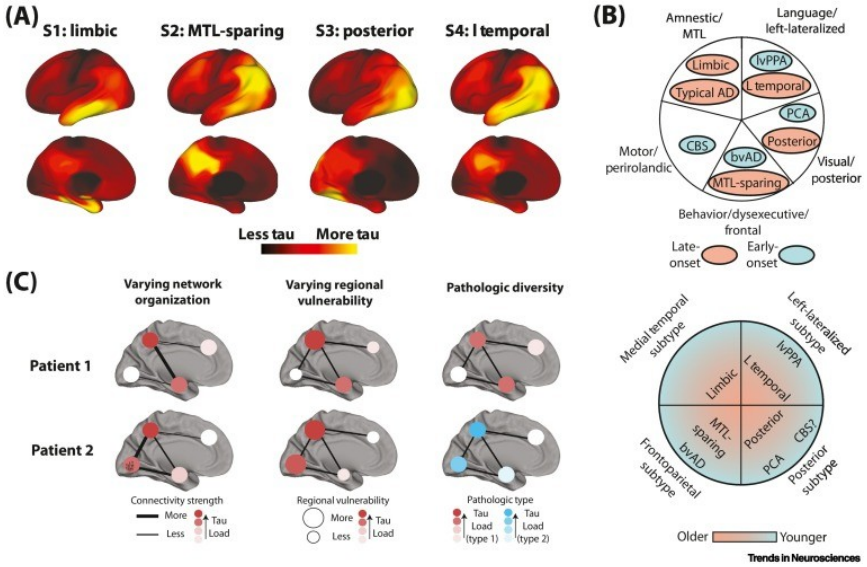


Subtypes of Alzheimer's disease: questions, controversy, and meaning
Jacob W. Vogel Oskar Hansson

Goal Definition

1. Research Goals
2. Project Goal and Challenges

Research Goals

- Can the Tau-spreading sequence be simulated or predicted?
- Can the Tau-spreading prognosis be useful in a clinical setting ?
- Can Alzheimer‘s disease progression be prognosticated on the base of the Tau-spreading sequence ?

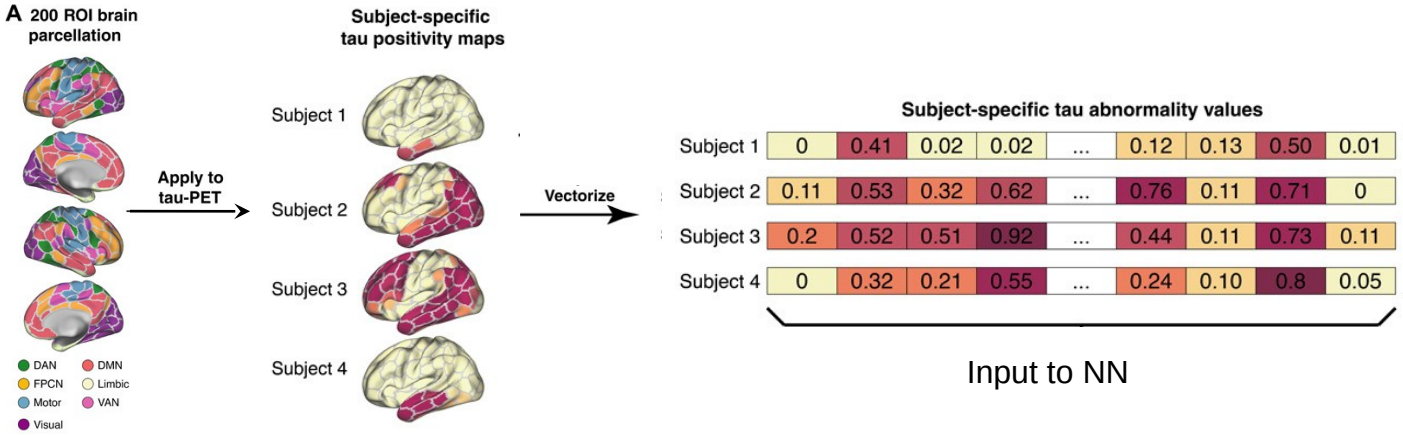
The successful prediction of Tau-spreading patterns is an impactful asset in dealing with Alzheimer’s disease:

- It might facilitate possible personalized and localized treatment methods.
- It might help with early detection and automatic diagnosis.

Approach

1. Tau-accumulation in Schaefer Regions of Interest (ROIs)
2. Connectivity Matrix
3. General Envisioned Architecture

Tau-accumulation in Schaefer regions



Adapted from:
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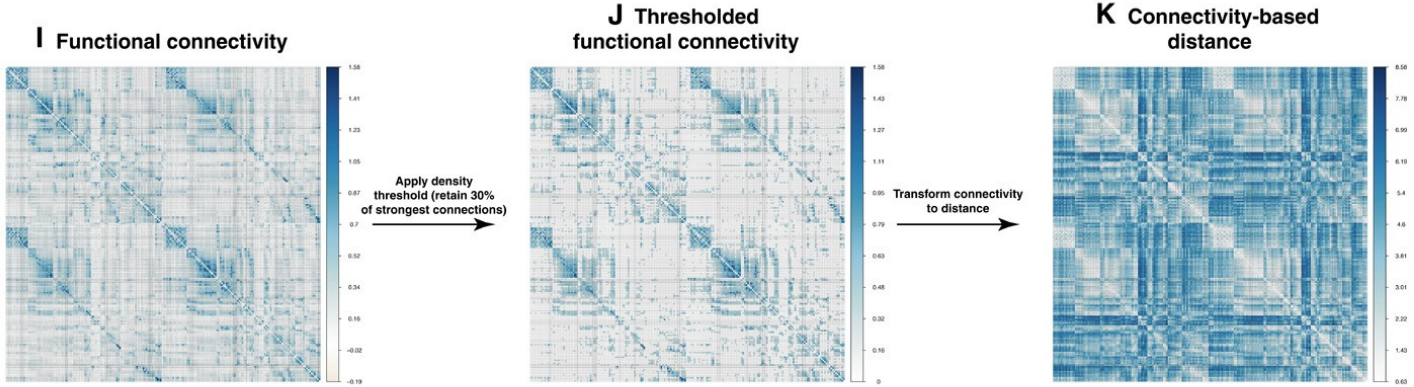
Connectivity Matrix



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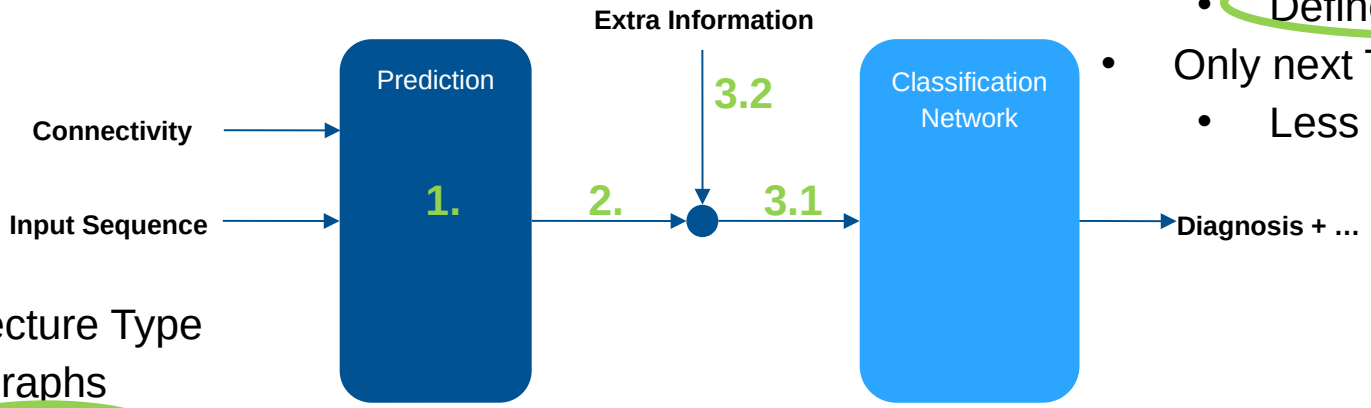
General Envisioned Architecture



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 ?

Project Milestones

Milestones - Overview

- Project planning & literature review
- Data & Setup
- Implement baseline models & Pipeline
- Experiment with complex Architectures
- Model testing & Eval

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Thank you for your attention!