

Working Title: Applied Machine Learning In
Aging Neuroscience

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Acknowledgement

Abstract

Aim: Apply data science methods to questions in aging Neuroscience

Methods: Supervised and unsupervised methods in different settings

Results: Novel Data Driven insights

Coclusion: ML rocks!

Figures

Tables

List of Abbreviations

Publications and other scientific contributions

Chapter 1

Introduction

- ML as the next frontier in science
- Open questions in aging neuroscience
- What can ML tell us?
- Age related changes occur at different scales and are manifestet at several levels.
- There is a wide variety in how this changes occur
- Changes are e.g. neural dedifferentiation and compensatory mechanisms (see Reuter Lorenz et al. 2010) and are noticable brain network level and dynamics
- NOTE: Check what EEG studies said about this...
- The idea is to model these changes with tools from datascience to answer questions in aging neurosci
- First study is about detecting dedifferentiated and compensatory mechanisms with EEG
- Tools used are DMD and Machine learning
- Main idea: Study classification performance as proxy for age related changes in different motor control tasks
- Expertise as possible way of builing a reserve:

- Higher individuality
- Dynamics of dedifferentiation and how do they relate to fitness
- Basic for targeted interventions
- How much and what (relate to Julia)
- Background of ML
- ML as tool
- novel insights
- Problem: Data is multidimensional and we have often limited data
- Solution: Use DMD to reduce Complexity and "model" evolution of signal
- Dynamic Mode Decomposition
- DMD extracts coupled spatio-temporal modes and is able to kind of model the evolution of the signal
- Background + Papers
- Mathematical Formulation
- What can ML tell us?
- ML applied in aging Neuroscience
- Formulating Aims and goals
- Formulation expected outcomes

Chapter 2

Theoretical Background

2.1 Datascience in Neuroscience

2.1.1 Dimensionality reduction

2.1.2 Machine learning

2.1.3 Applications to Neuroscience

2.2 Age and Expertise related changes

2.2.1 "Central Changes"

2.2.2 "Behavioral Changes"

2.2.3 Machine learning framework

Chapter 3

Aims and scope

Chapter 4

General methodology

Chapter 5

Publications

5.1 Paper 1

5.2 Paper 2

5.3 Paper 3

Chapter 6

General discussion

Chapter 7

Bibliography

Chapter 8

Statutory Declaration