Introduction to Eriksholm Projects
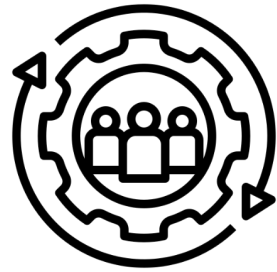
Emina Alickovic
Principal Scientist, Adj. Assoc. Professor
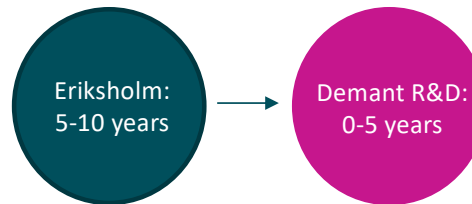**eali@eriksholm.com**

Eriksholm Research Centre
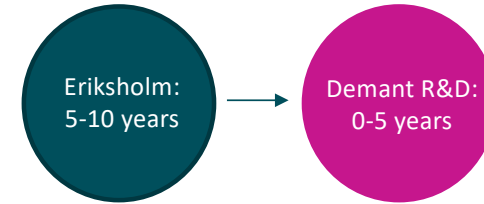
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About Eriksholm

Demant business areas

Eriksholm
Research
Centre
PART OF OTICON

Eriksholm:
5-10 years

Demant R&D:
0-5 years

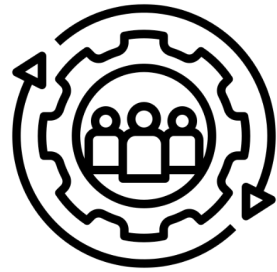# A brief history of Eriksholm

1977   Eriksholm Research Centre opening

2001   New building added

2014   Brain Hearing Lab added, extended 2019

Eriksholm:
5-10 years → Demant R&D:
0-5 years

About Projects

CAN WE IDENTIFY YOU
TARGET SPEECH
BASED ON YOUR
PHYSIOLOGICAL (i.e., brain)RESPONSES?
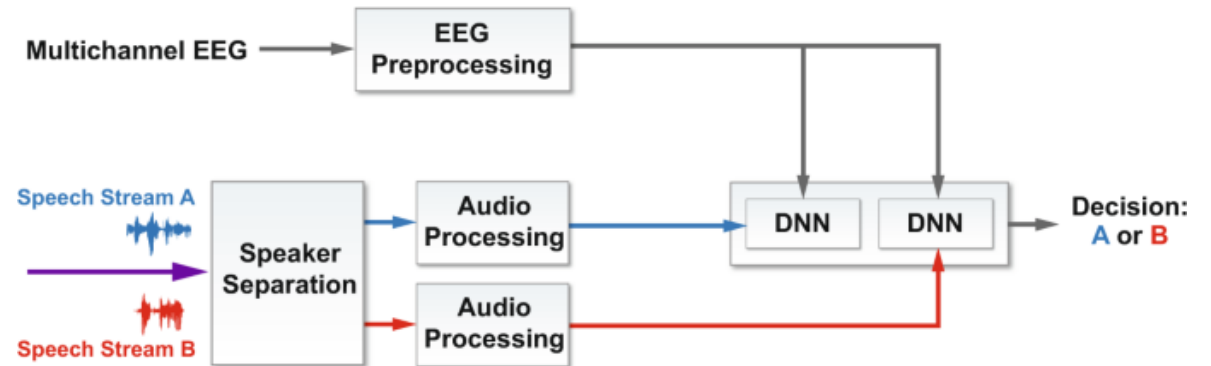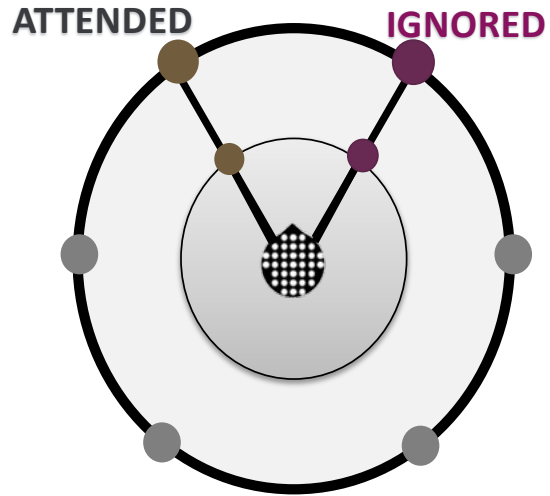
CAN WE PREDICT WHEN SPEECH BECOMES (UN)UNDERSTADANBLE BASED ON YOUR PHYSIOLOGICAL (i.e., brain)RESPONSES??
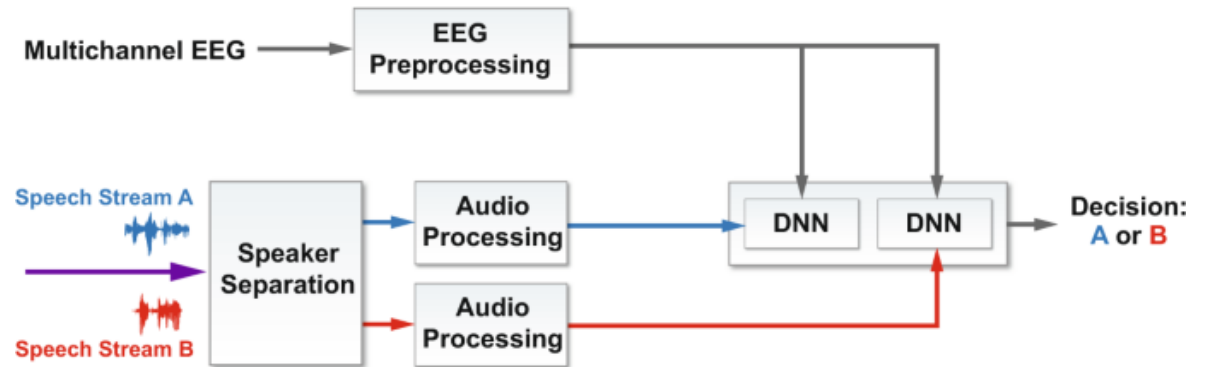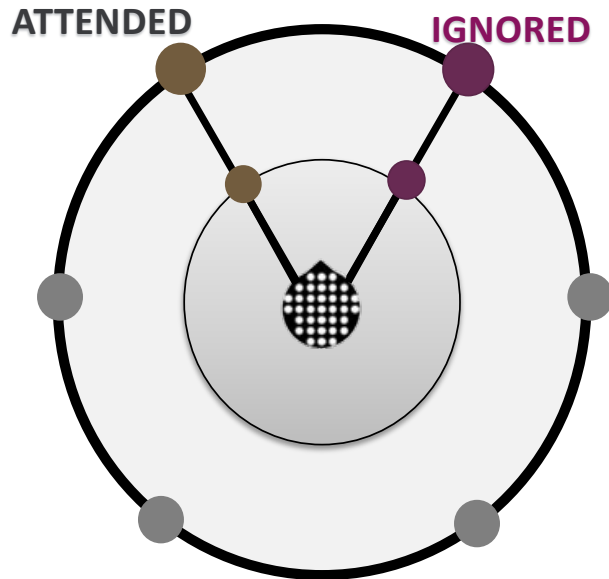
Project 1: Neural Tracking of Target Speech

PROJECT GOAL 1:
IDENTIFY ATTENDED TALKER
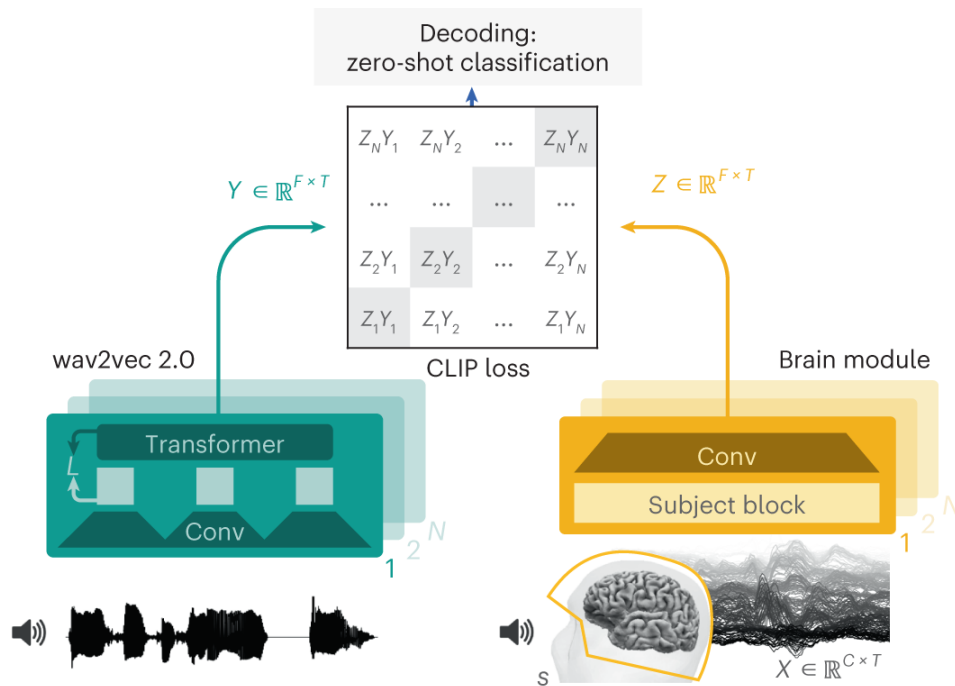## FROM SUBSET OF EEG ELECTRODES
USING DEEP LEARNING (e.g., SSL)

Project 2: Tracking Understanding of Target Speech

**PROJECT GOAL 2:
TO GENERATE SUFICIENTLY
GOOD MULTIMODAL (BRAIN&SPEECH)
DATA USING
GENERATIVE MODELS.**

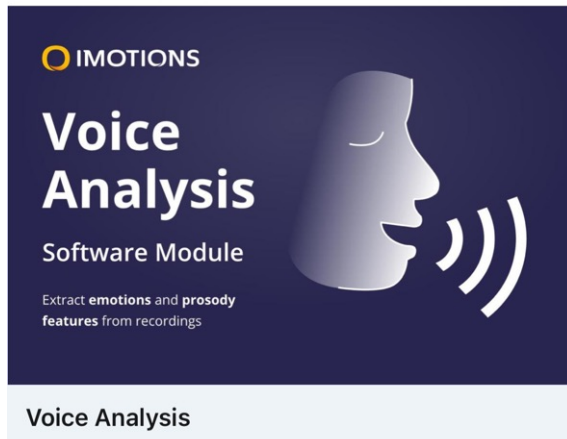# PROJECT 3: BRAIN-BASED SPEECH RECOGNITION SYSTEM

PROJECT GOAL:

To use ASR systems to study how competing speech is processed and understood in the brain.

PROJECT 4: USING ASR AS A BIOMARKER

Pitching PROSODY: The Human Voice as a Biosensor Modality ...see more

IMOTIONS
Voice Analysis
Software Module
Extract **emotions** and **prosody** features from recordings
Voice Analysis

PROJECT GOAL:

Are ASR systems informative enough to be used as biomarkers of neurocognitive disorders?

INTERSPEECH 2023
20-24 August 2023, Dublin, Ireland

Capturing Mismatch between Textual and Acoustic Emotion Expressions for Mood Identification in Bipolar Disorder

PROJECT 5: Early brain responses from continuous speech for automatic control of hearing device

Early brain responses to natural speech contain information whether sound is 'loud' enough to reach the brain

→ automatic, self-adjusting hearing devices for seamless hearing experiences in daily life

Current: Temporal Response Functions (TRFs)

$$y = h * x$$
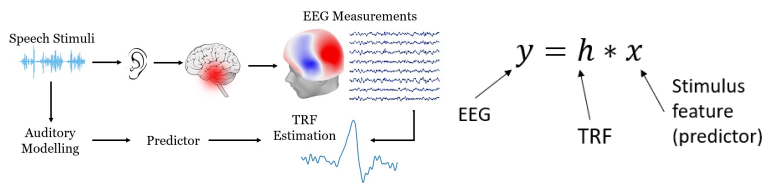
- Noisy data (sensors far from source, interfering generators)
- Low-amplitude early responses overshadowed
- Linear models used for modeling processes that are known to be non-linear
- Different sensor placement across sessions

Future: Deep learning
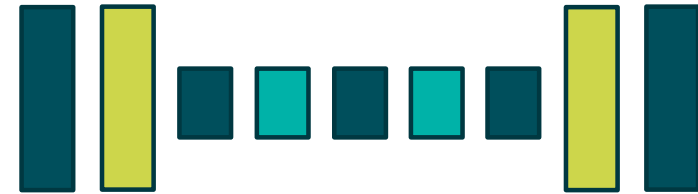
➢ **Deep neural networks with**
➢ **Multiple layers that**
➢ **Can model non-linearities**
➢ **Transfer learning**

PROJECT 6: Which spectro-temporal features of sound lead to pupil dilation?

- Pupil dilation in response to sounds in the background can be considered as a measure of distraction.
- However, existing models for acoustic salience only explain a small amount of variability in pupil dilation.
- Goal of a master thesis can be to train and test a deep neural network to predict pupil dilation in response to sounds in the background.
- We can provide an existing dataset from 47 participants who listened to continuous speech while one-second-long sounds were played in the background (a total of ~12000 sound events)
- Interested? Ask Lorenz Fiedler (lfie@eriksholm.com) for more info.

Spectrogram of sound   DNN   Pupil dilation
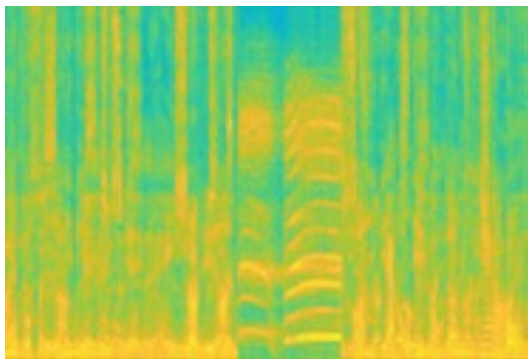
14
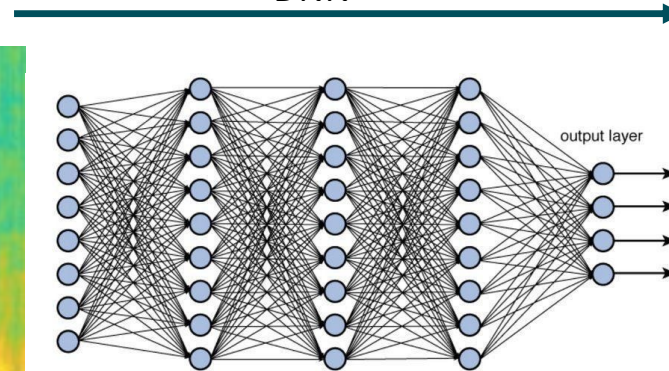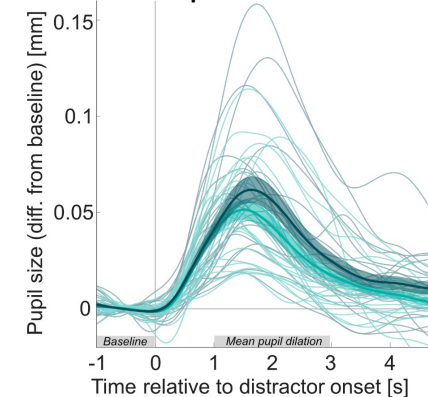
PAPER • OPEN ACCESS

Improving EEG-based decoding of the locus of auditory attention through domain adaptation *

Johanna Wilroth[6,1] (iD), Bo Bernhardsson[3] (iD), Frida Heskebeck[3] (iD), Martin A Skoglund[1,2] (iD), Carolina Bergeling[5,4] (iD) and Emina Alickovic[5,1,2] (iD)

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