

Stimulus-Informed Generalized Canonical Correlation Analysis of Stimulus-Following Brain Responses

EUSIPCO 2023

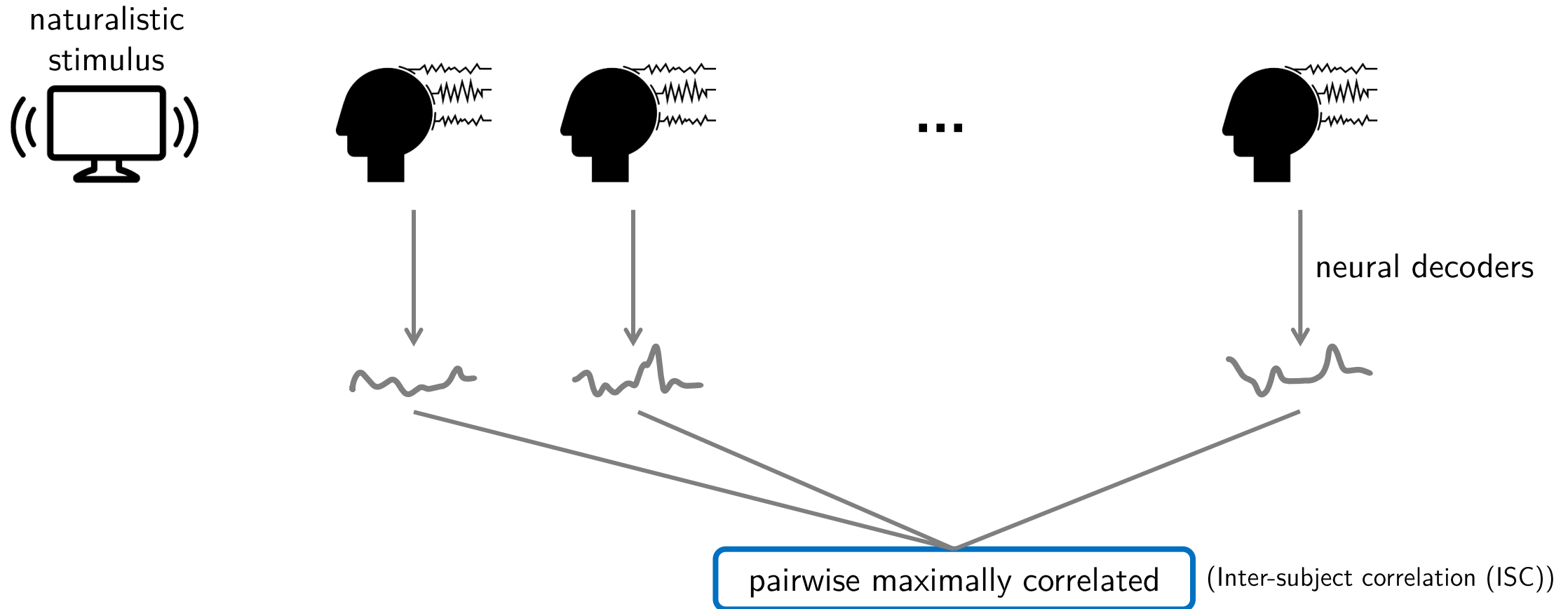
paper

Simon Geirnaert

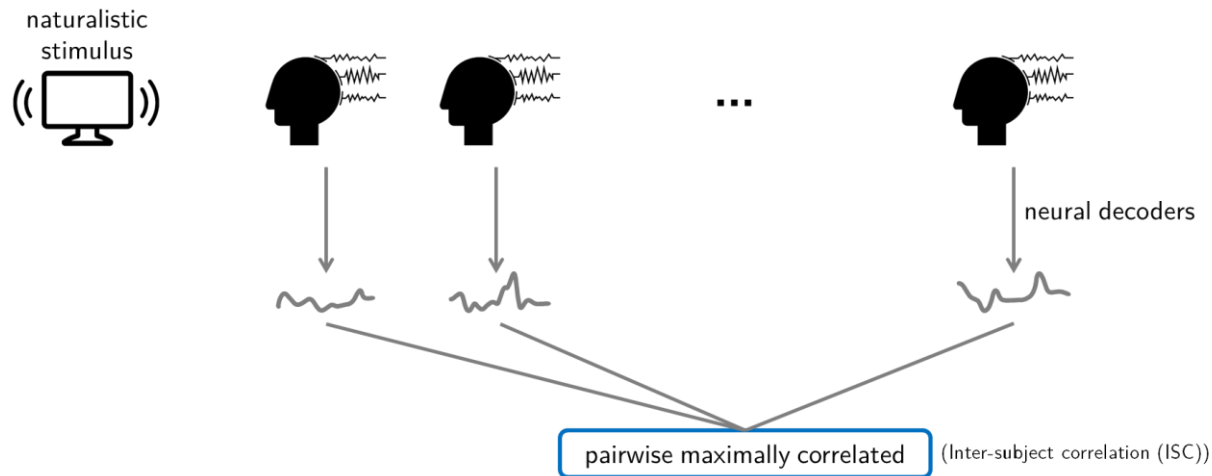
Joint work with Tom Francart and Alexander Bertrand



Generalized canonical correlation analysis (GCCA) is a powerful EEG/brain signal processing tool



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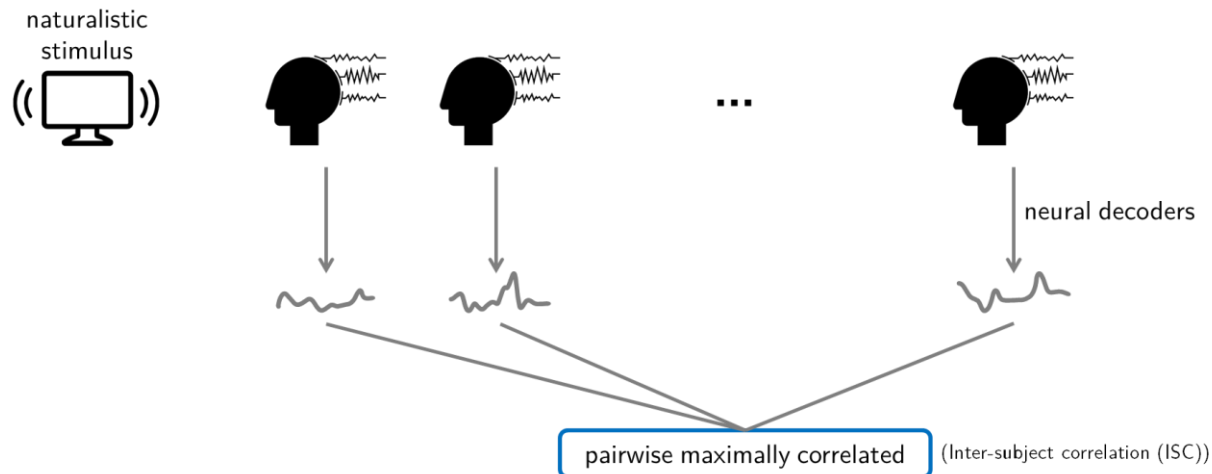


Use cases

- Quantify inter-subject correlation
- Dimensionality reduction
- Summarize set of EEG recordings

✓ GCCA is **stimulus-unaware**

Generalized canonical correlation analysis (GCCA) is a powerful EEG/brain signal processing tool

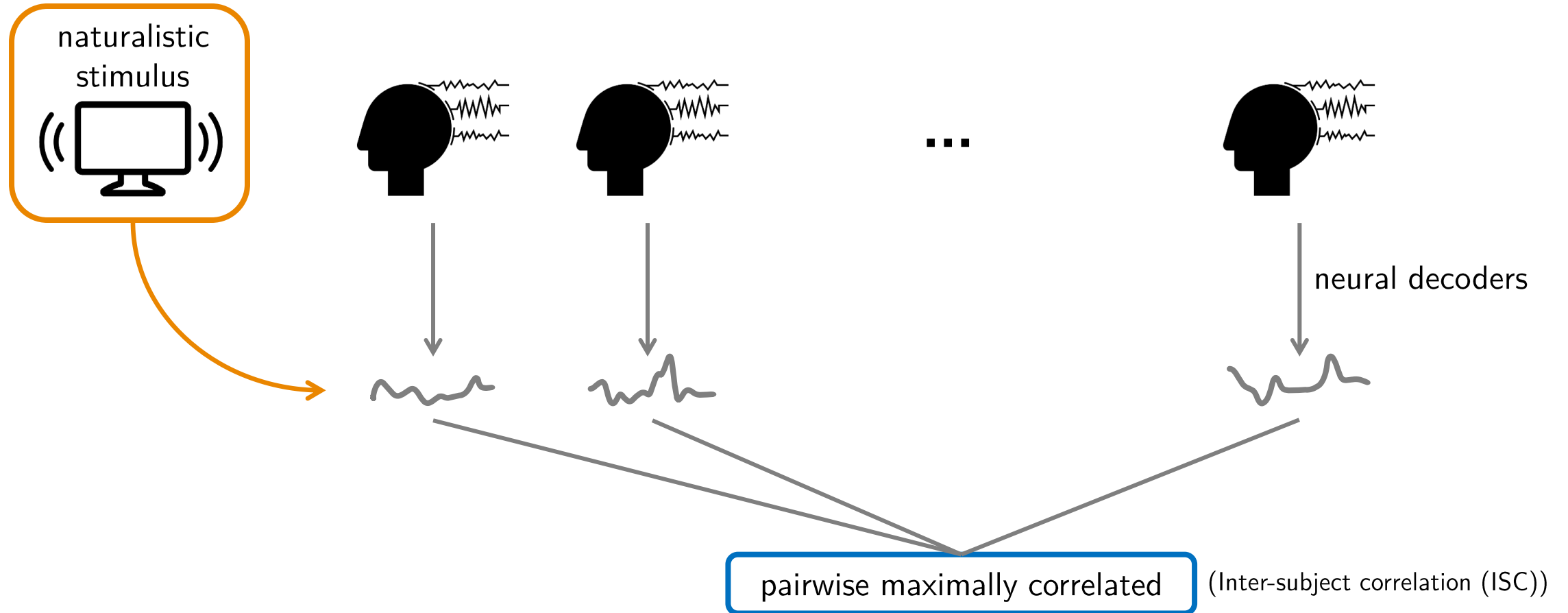


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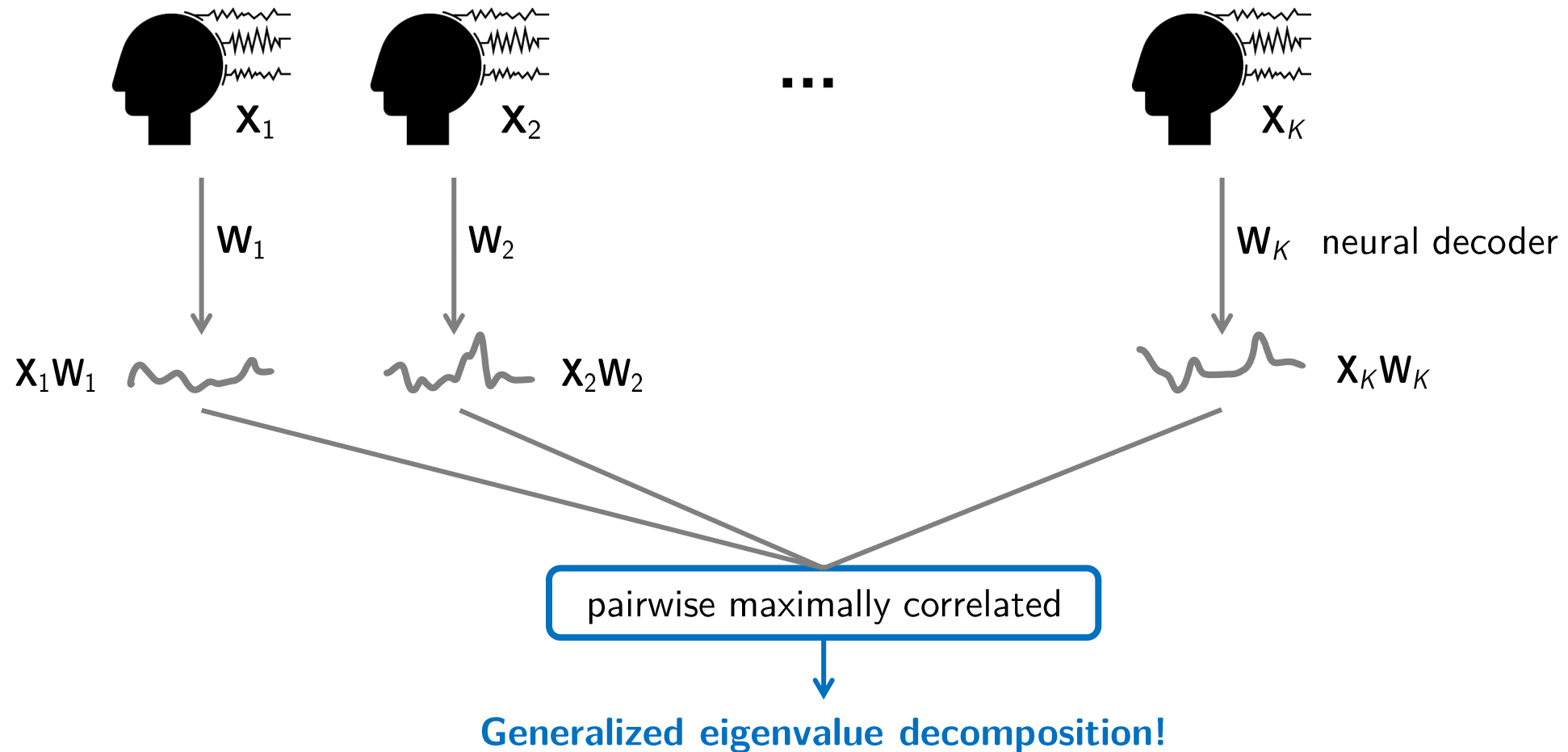
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? GCCA is **stimulus-unaware**

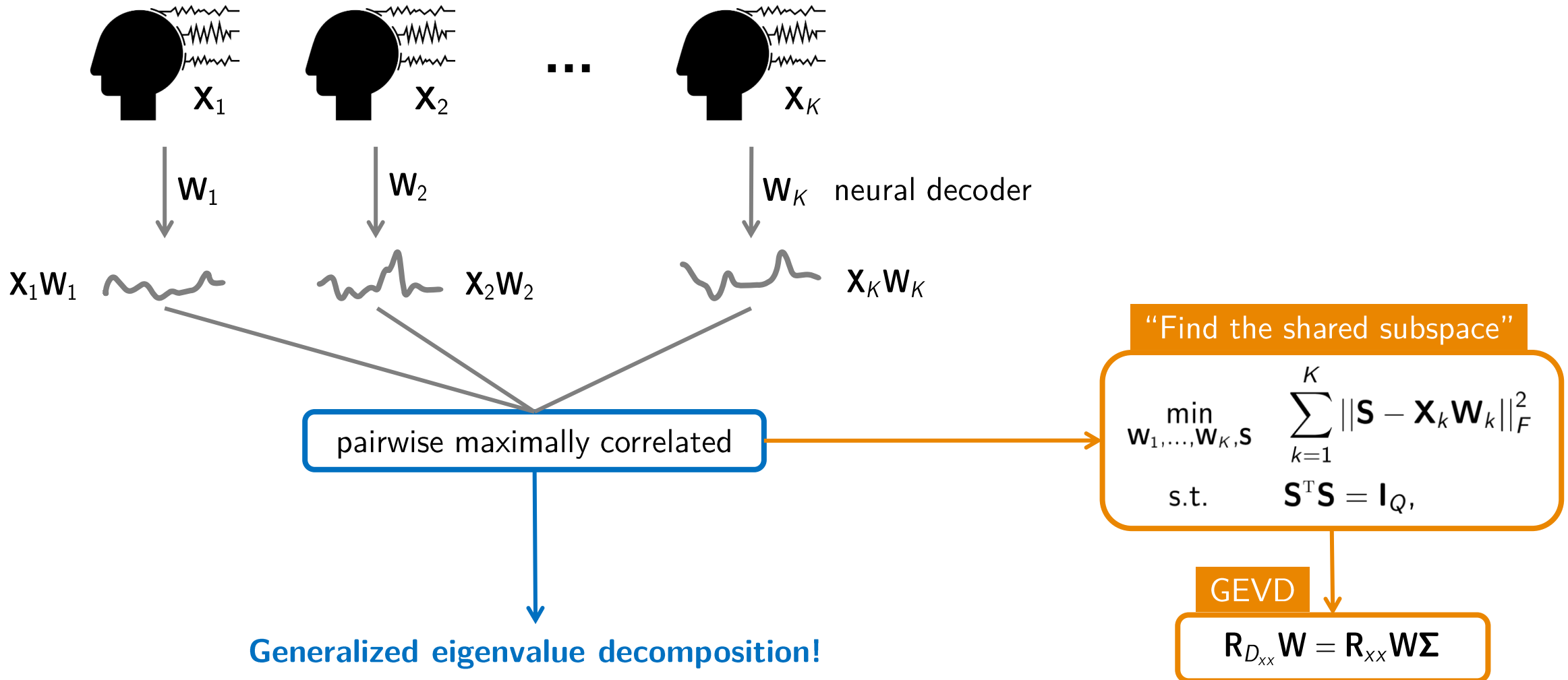
Objective: stimulus-informed GCCA to cope with extremely low SNR



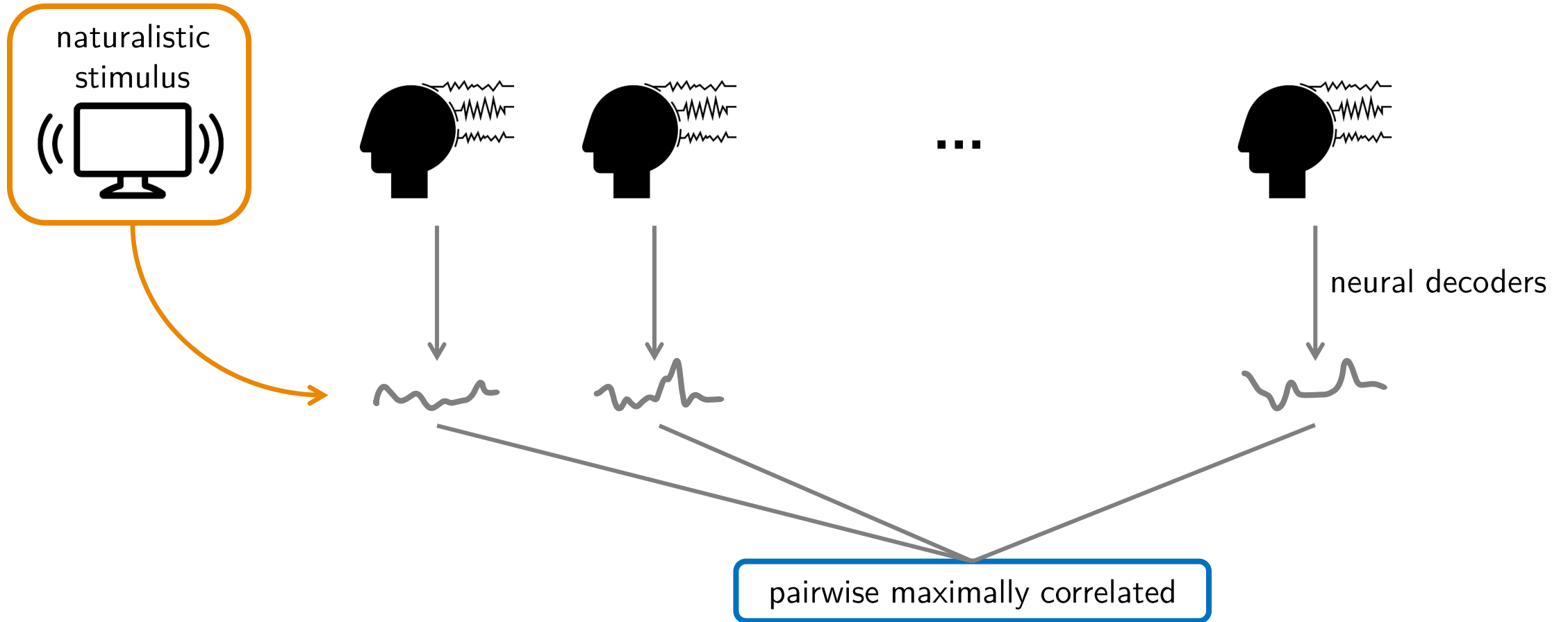
MAXVAR-GCCA can be solved as a generalized eigenvalue decomposition (GEVD)



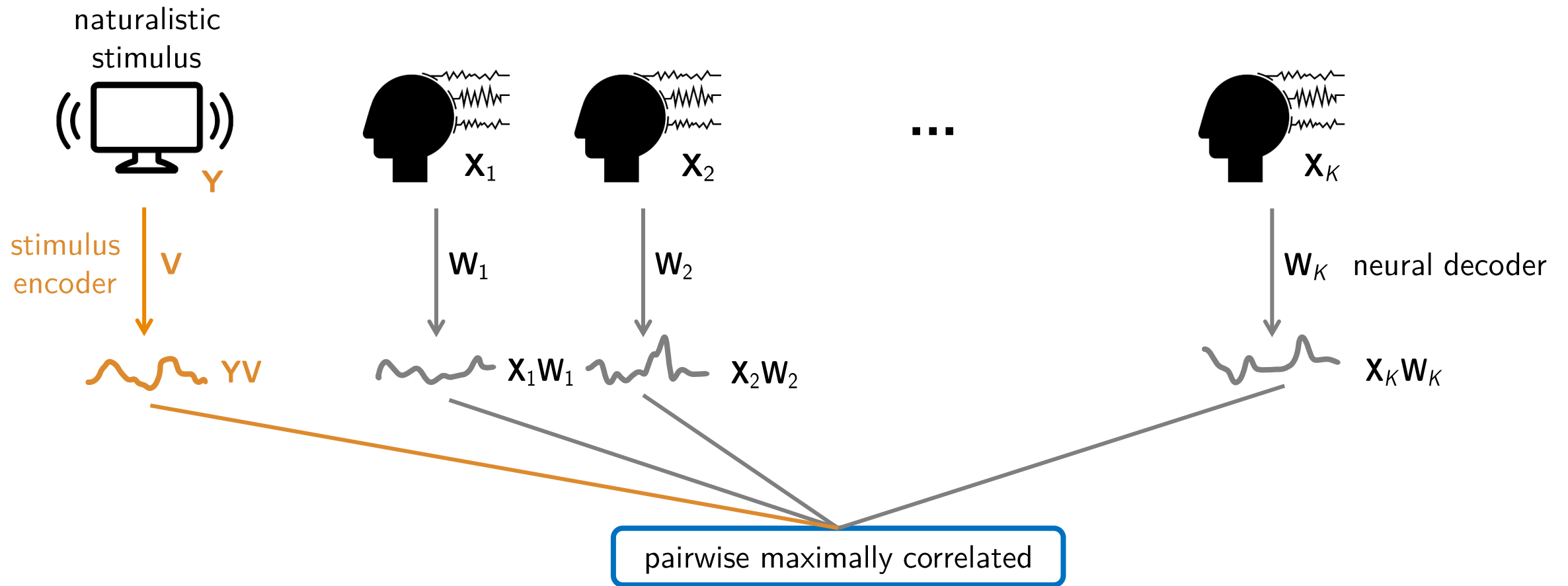
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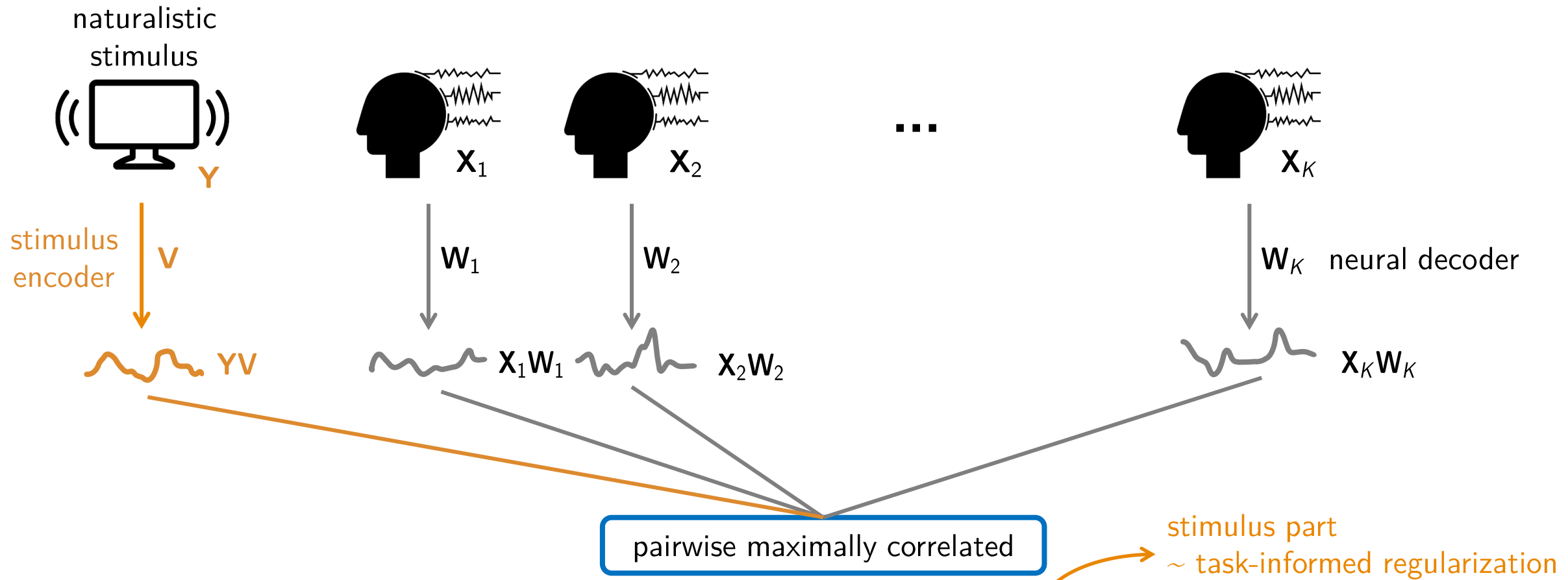
Stimulus-informed GCCA (SI-GCCA) to cope with extremely low SNR



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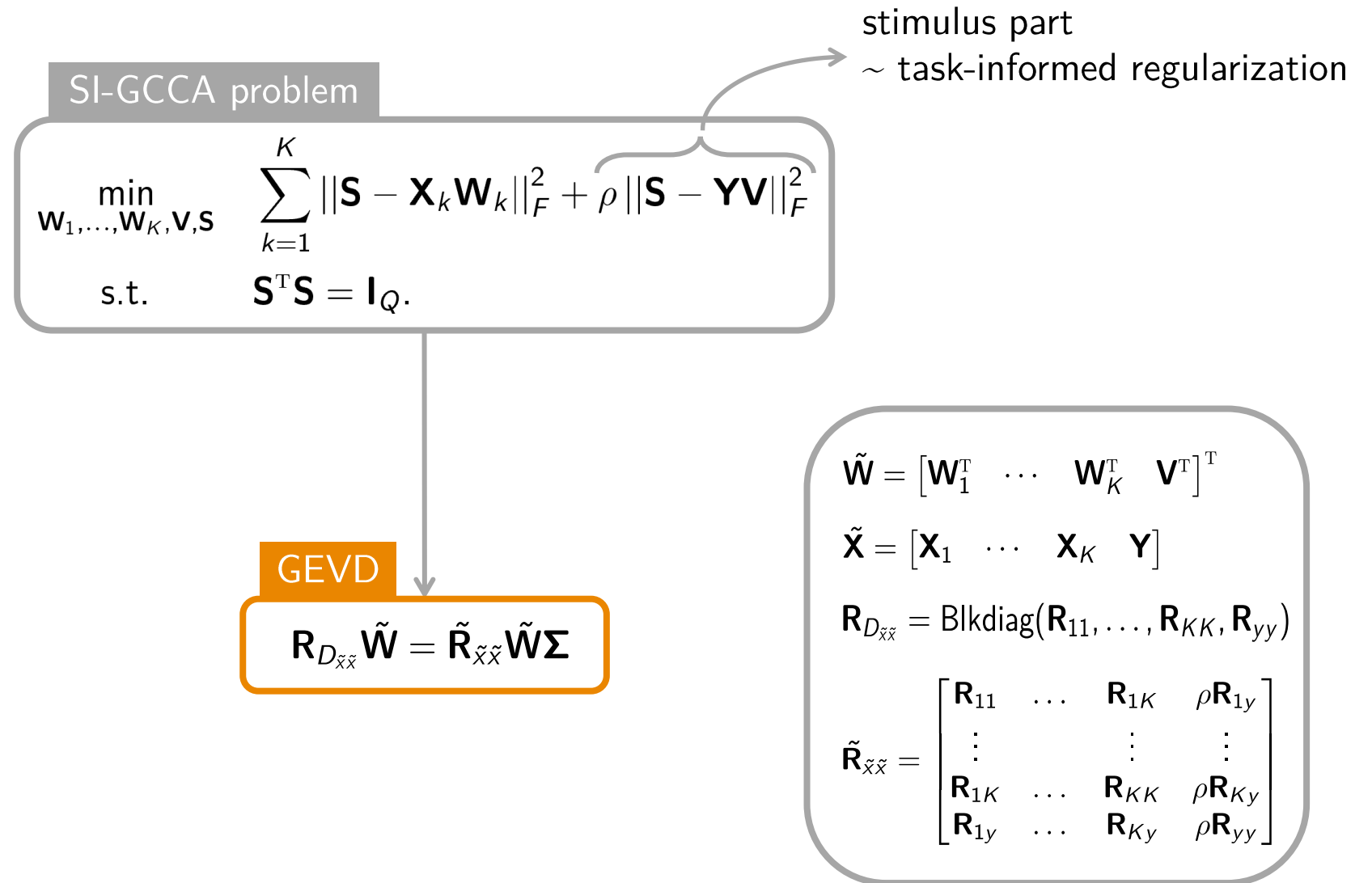
Stimulus-informed GCCA (SI-GCCA) to cope with extremely low SNR



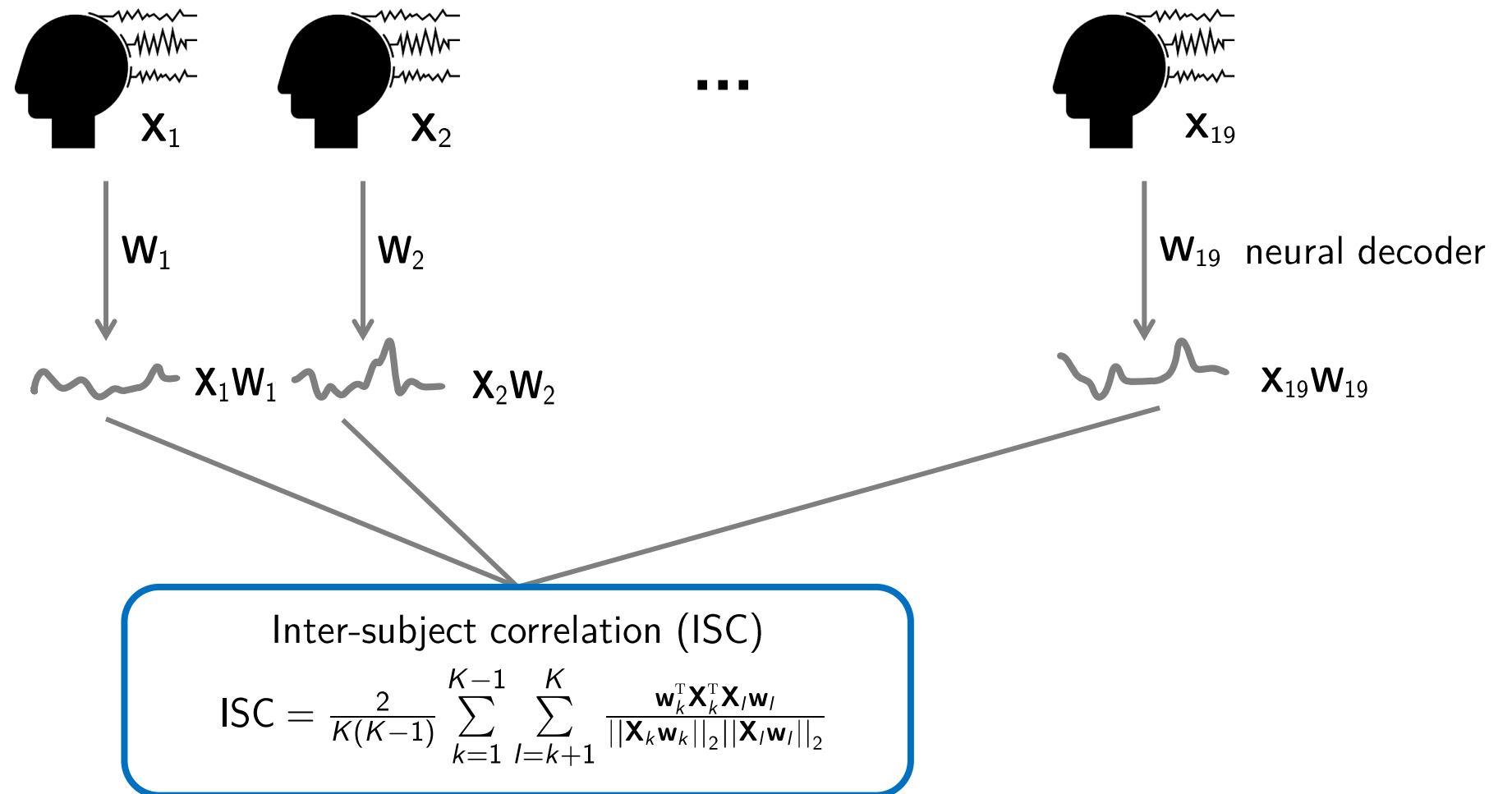
$$\min_{W_1, \dots, W_K, V, S} \sum_{k=1}^K \|S - X_k W_k\|_F^2 + \rho \|S - YV\|_F^2$$

$$\text{s.t. } S^T S = I_Q.$$

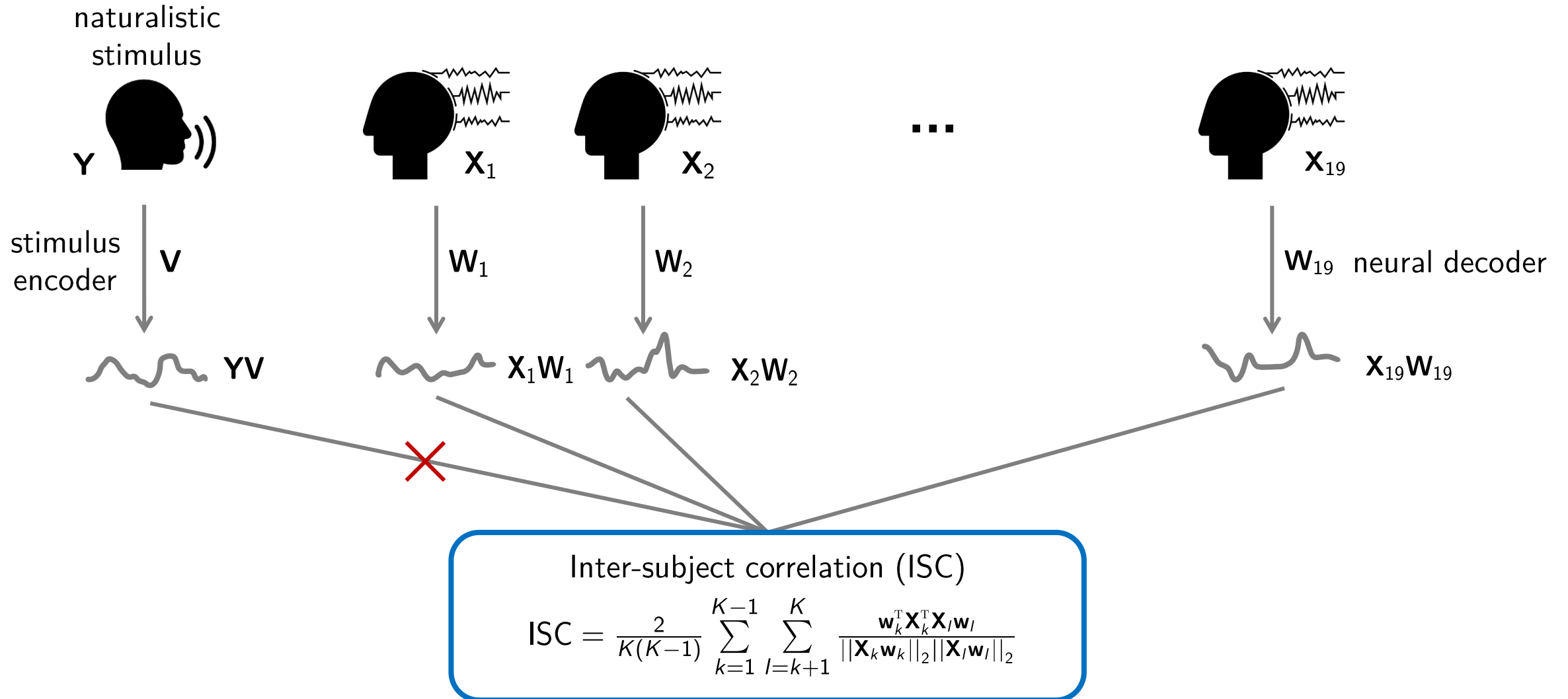
The SI-GCCA can again be solved as a **GEVD**!



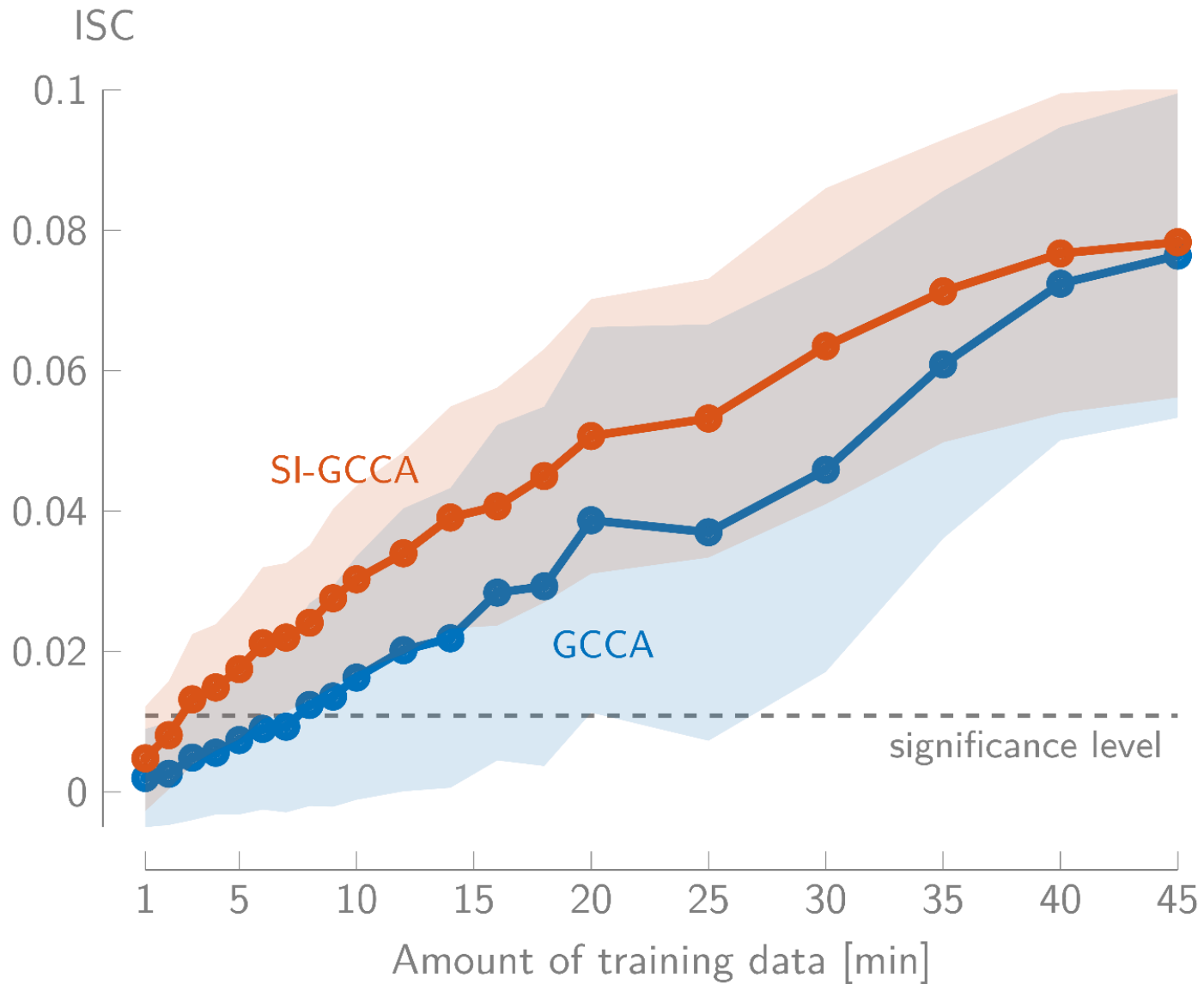
GCCA to quantify the inter-subject correlation



SI-GCCA to quantify the inter-subject correlation



Stimulus-informed GCCA is superior when **little data** are available



Stimulus-informed GCCA is superior when few subjects are available

