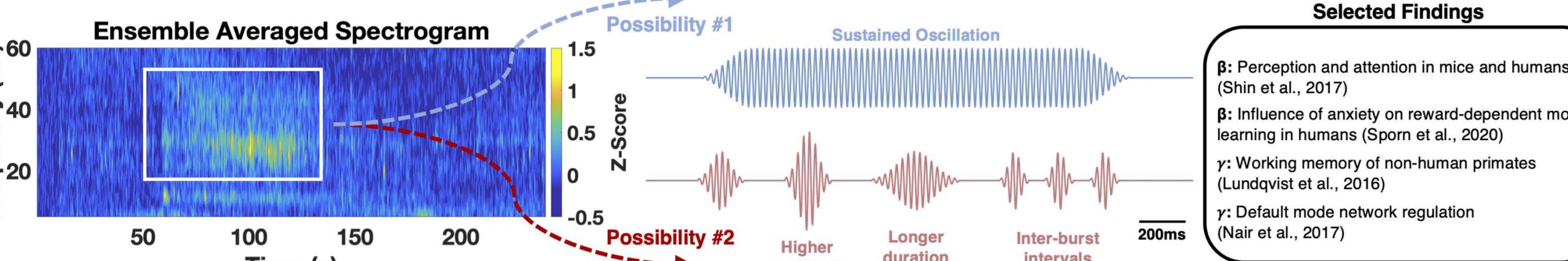


# Decision matrix-based algorithm selection maximizes detection accuracy of transient neural oscillatory bursts

SungJun Cho<sup>1</sup> & Jee Hyun Choi<sup>1,2</sup>

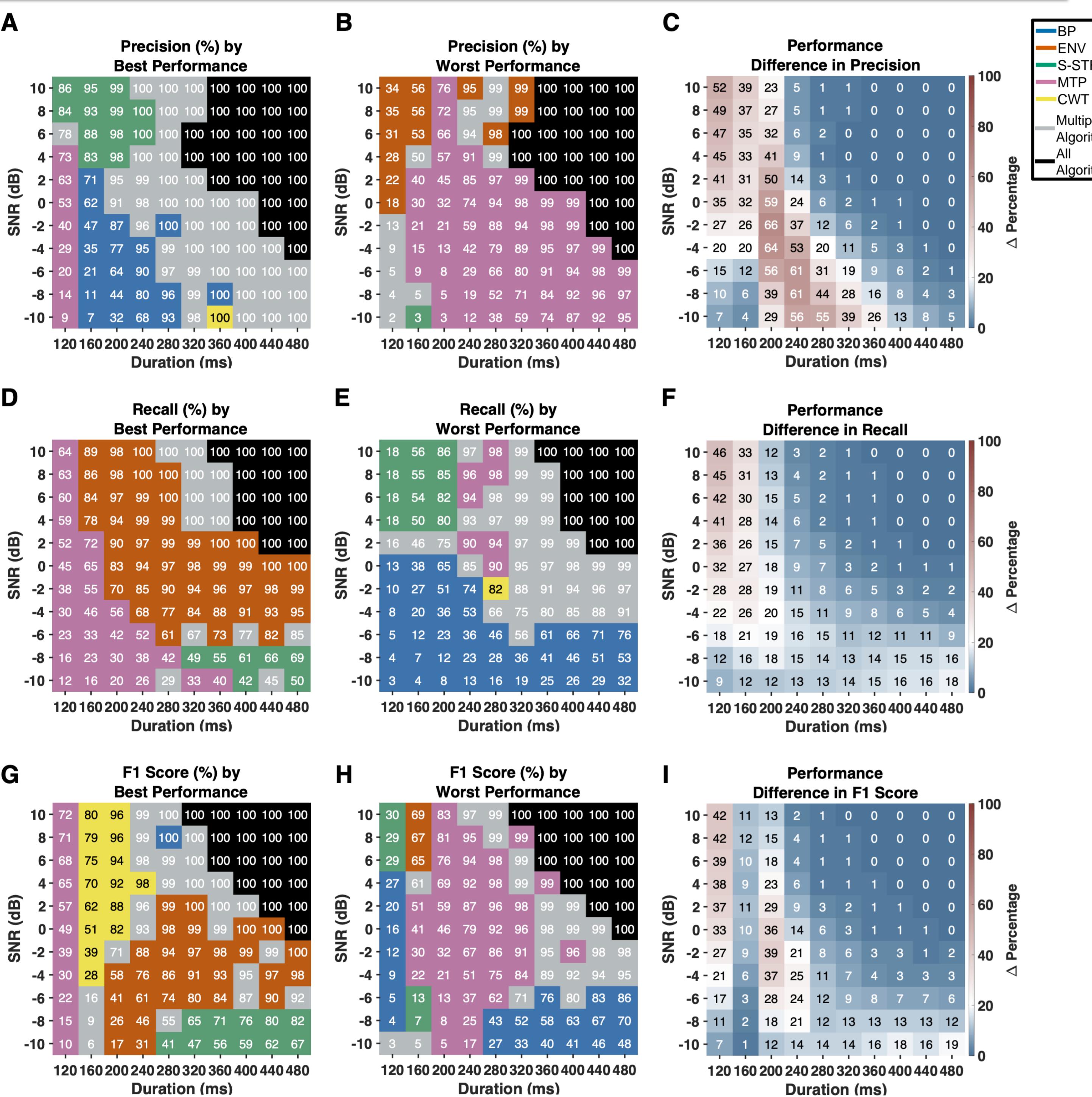
<sup>1</sup>Korea Institute of Science and Technology; <sup>2</sup>University of Science and Technology; Reprint: [scho.sungjun@gmail.com](mailto:scho.sungjun@gmail.com); Correspondence: [jechoi@kist.re.kr](mailto:jechoi@kist.re.kr)

## Introduction

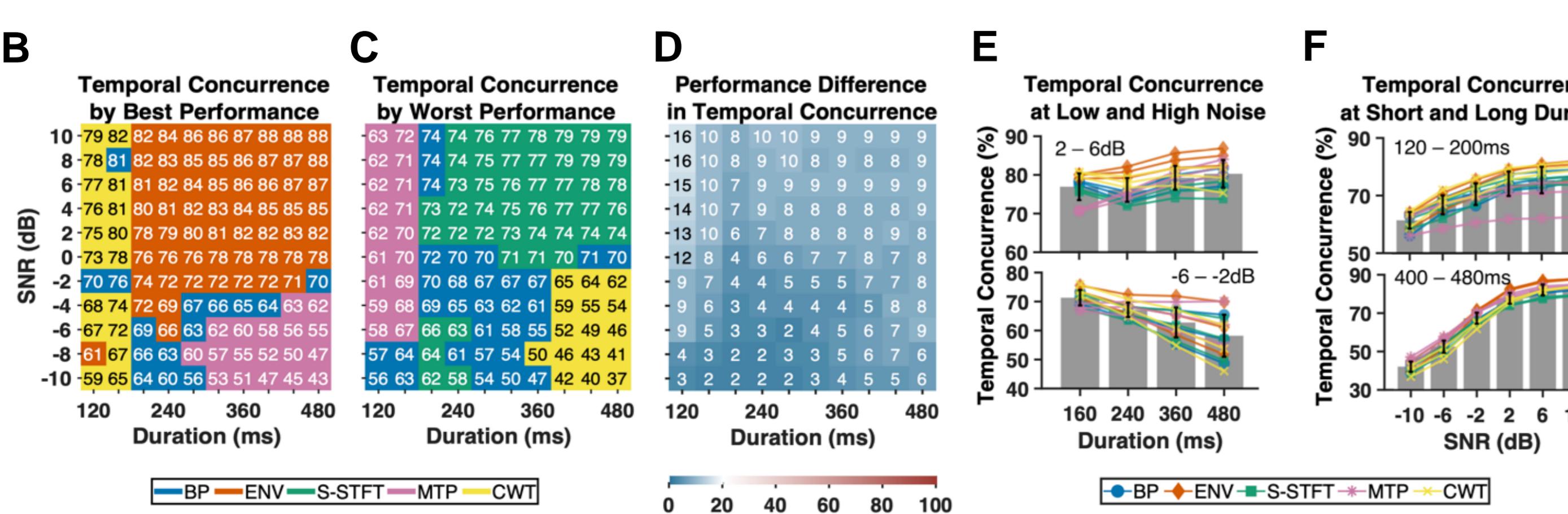
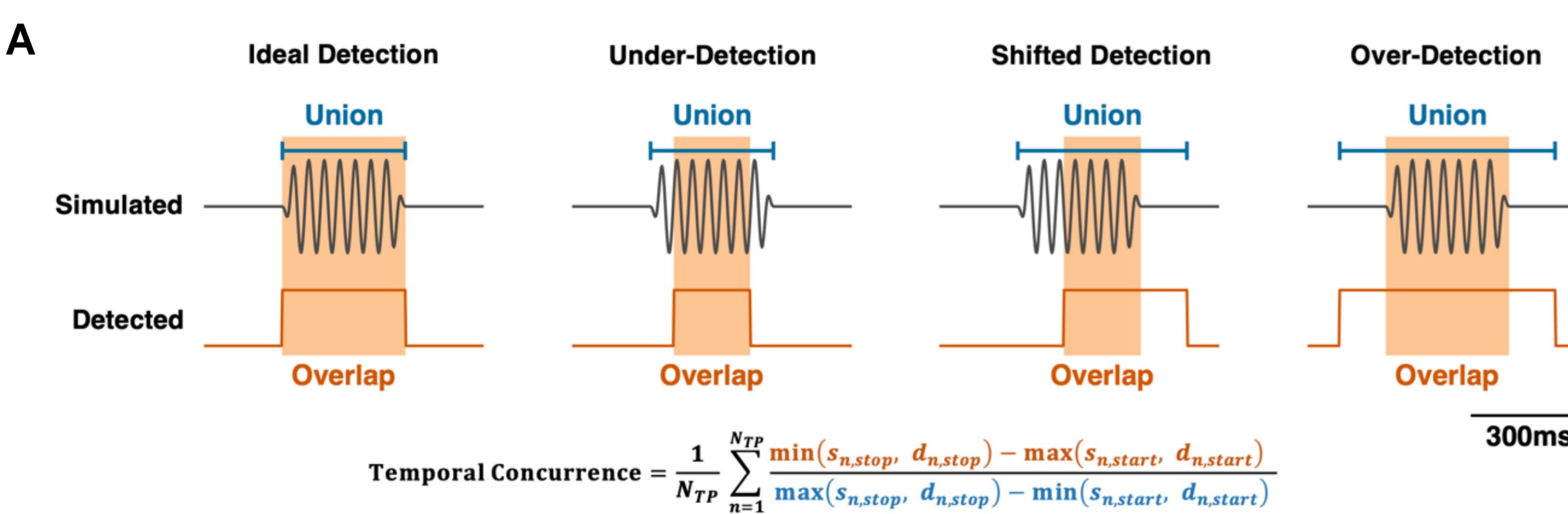


- Background:** Single-trial neural activities manifest a collection of transient burst-like events that correlate with sensorimotor and cognitive abilities.
- Motivation:** Theoretical comparison of widely used burst detection algorithms and non-heuristic criteria for selecting an optimal detection method are necessary.
- Significance:** We offer a reliable solution to a burst detection algorithm selection problem that guarantees better detection accuracies in extracting transient neural oscillatory bursts, using the decision matrix as our cost metric.

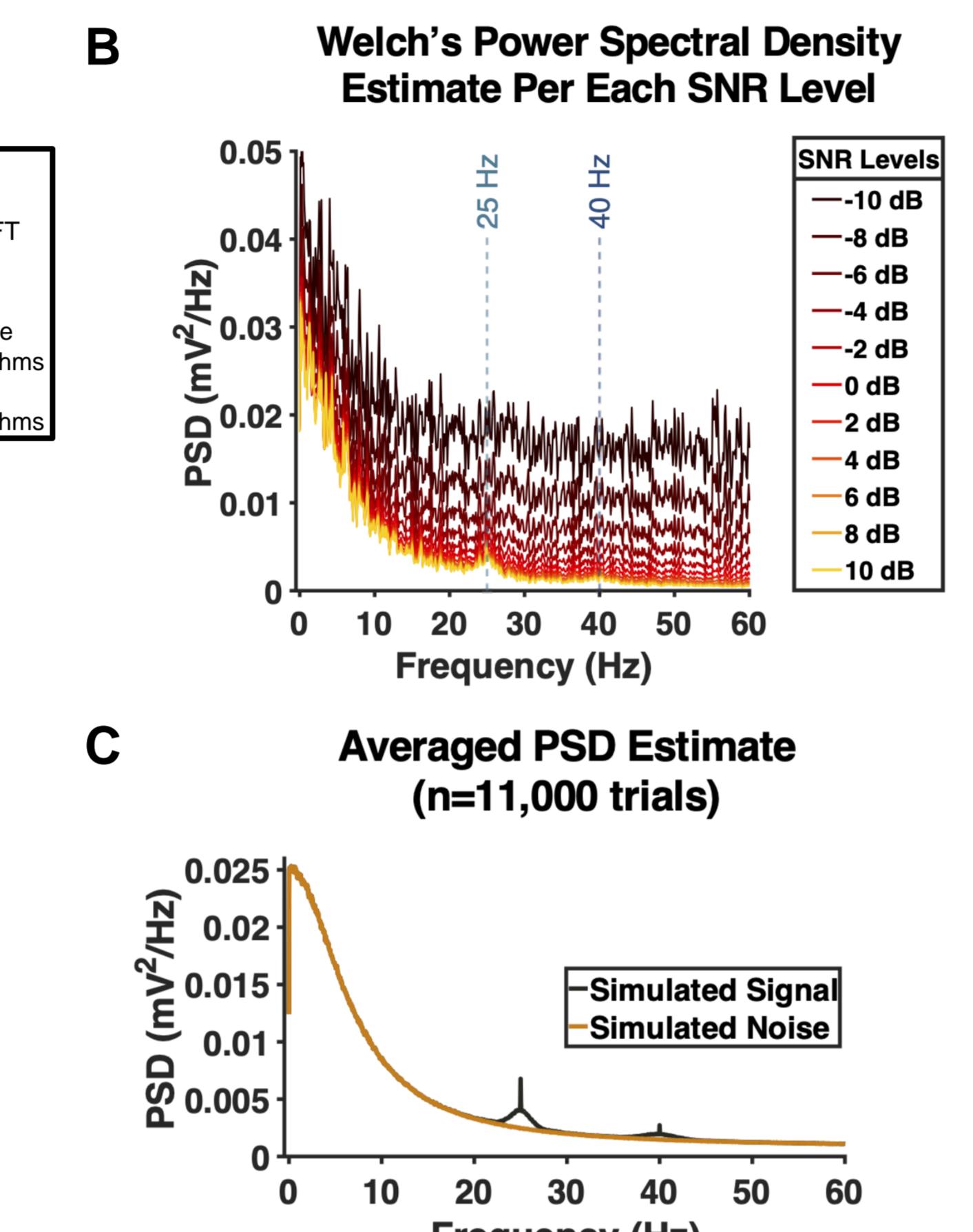
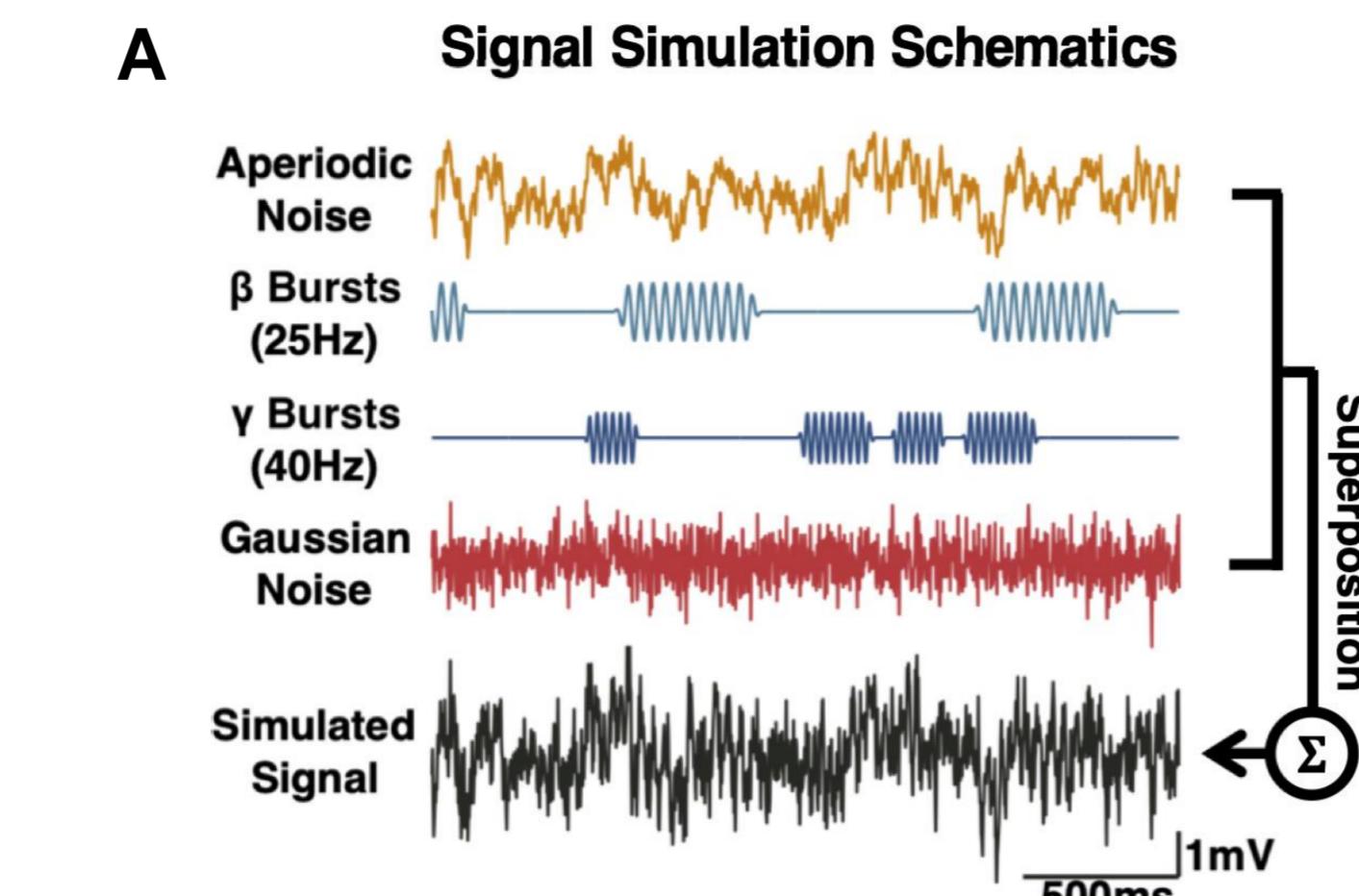
## Result 1. Algorithmic performances in burst classification tasks (precision-recall measures)



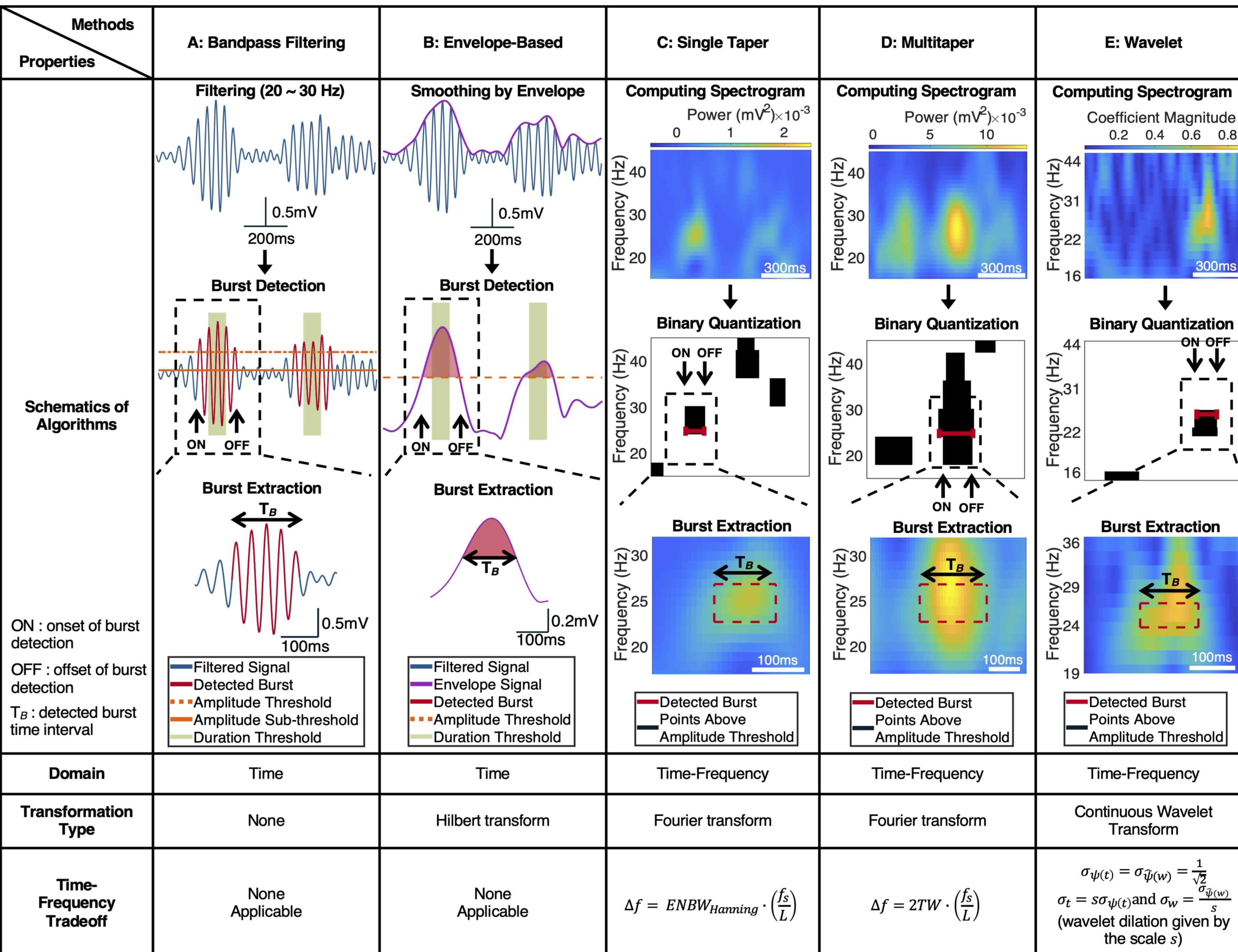
## Result 2. Temporal concurrence: representing detection accuracies in time



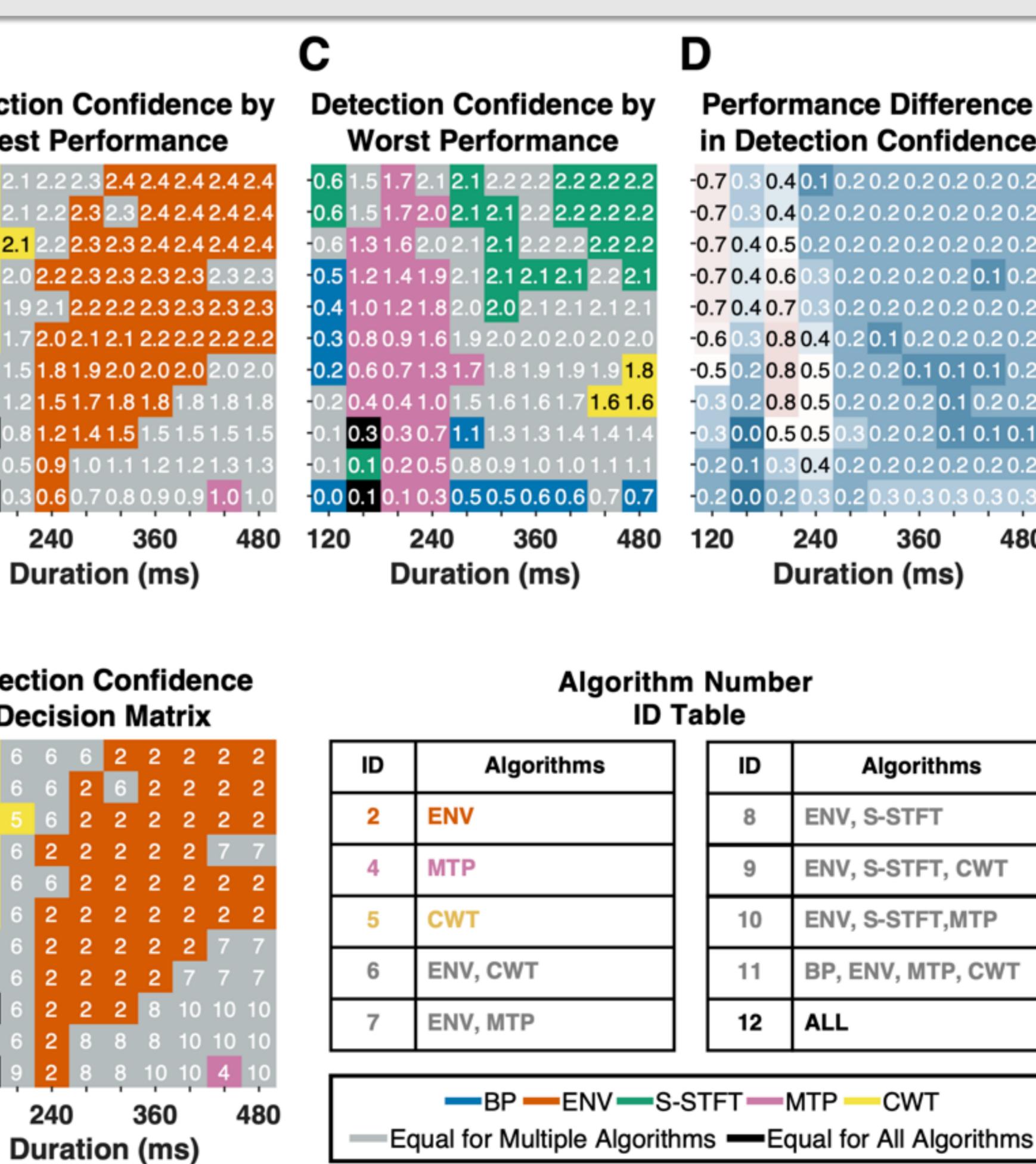
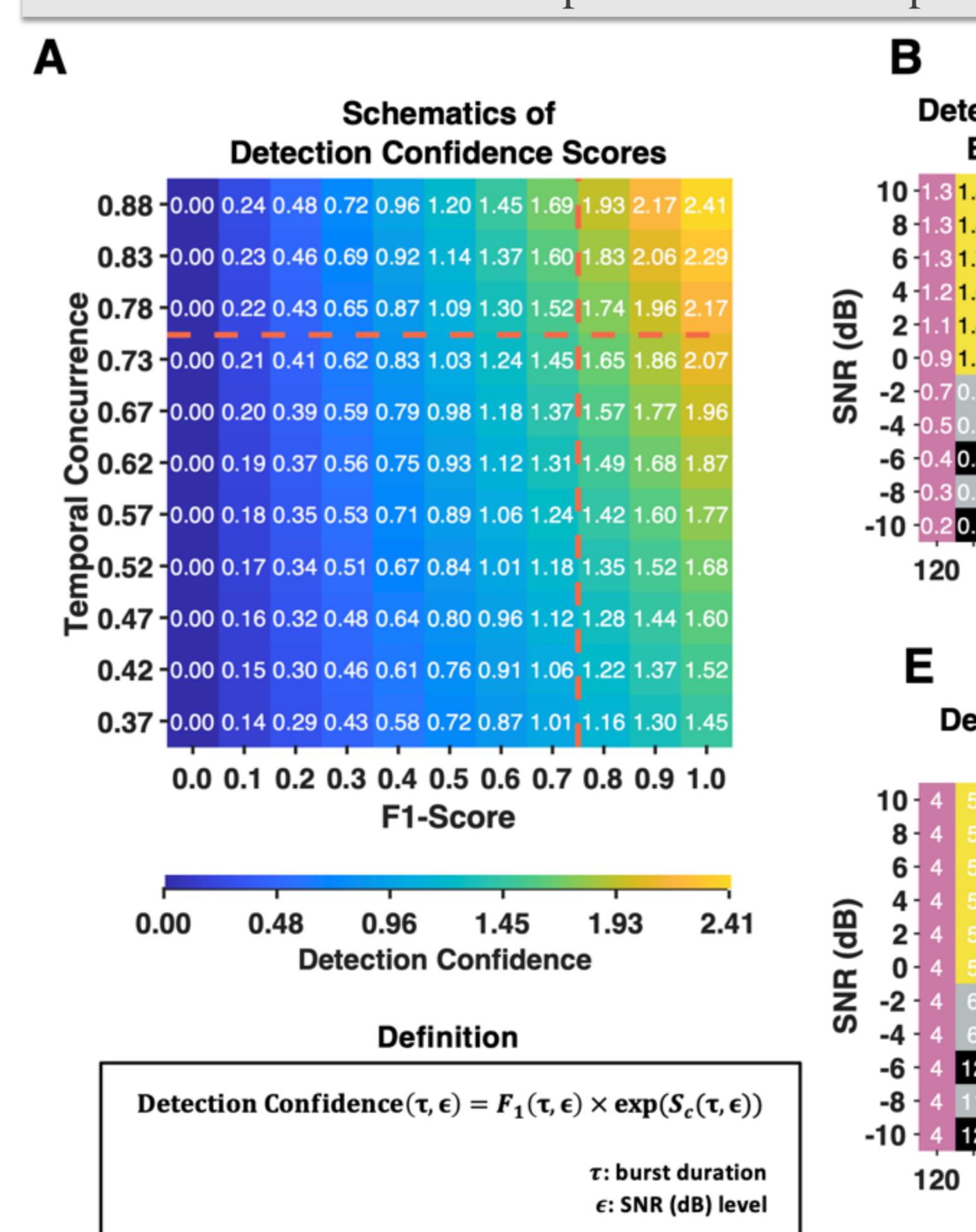
## Method 1. Neural signal simulation schematics



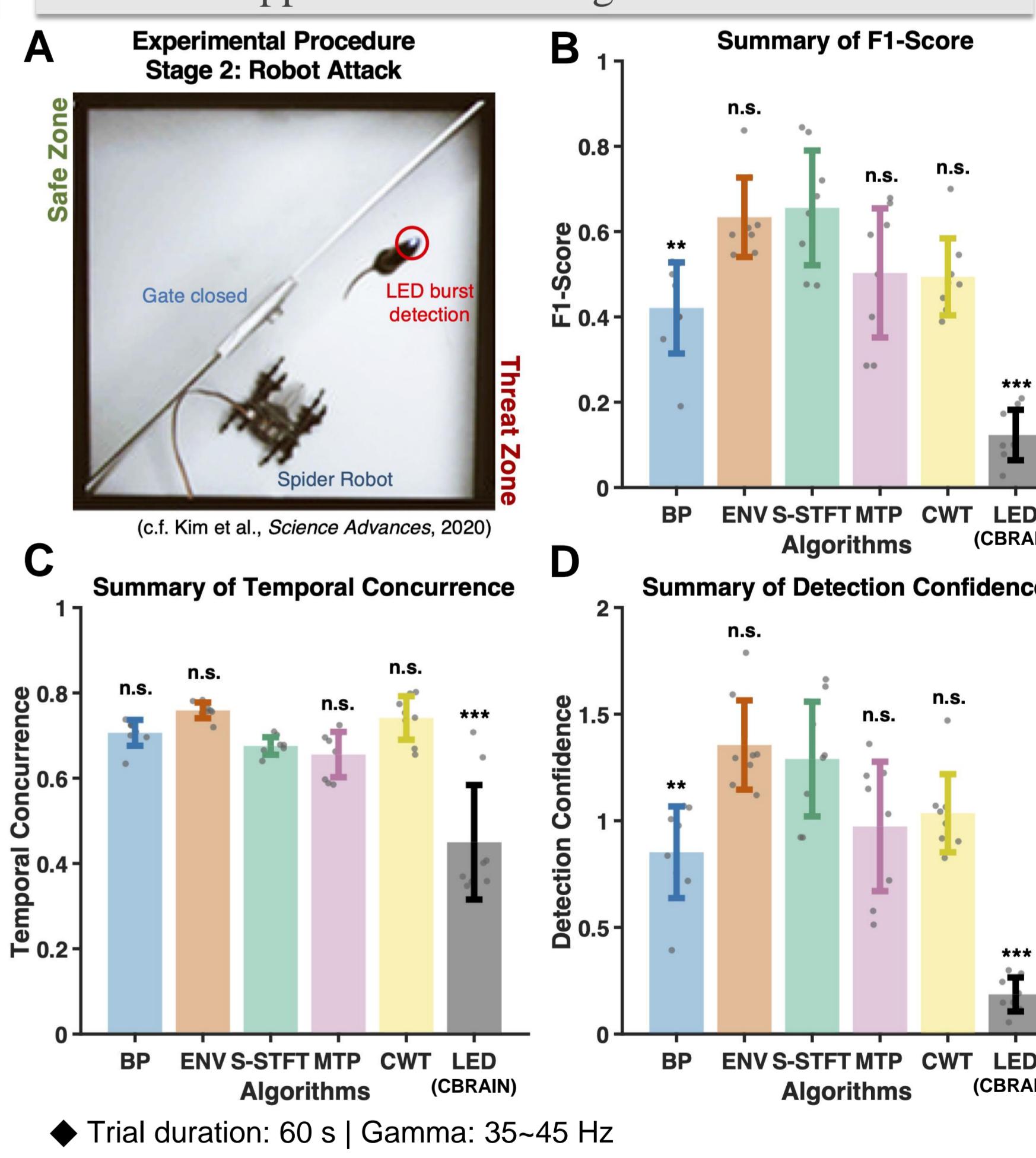
## Method 2. Schematics and properties of the time domain and time-frequency domain-based burst detection algorithms



## Result 3. Overall detection performances recapitulated in detection confidence metrics



## Result 5. Application of the algorithm selection rule



- Trial duration: 60 s | Gamma: 35–45 Hz
- Ground truths (i.e., true bursts) were identified via the human annotation.
- Best:** S-STFT | **Worst:** BP | **Control:** LED
- Our selected algorithm performs significantly better than the control and worst methods.

**Conclusions**

- Classification and temporal accuracies of burst detections differ across different algorithms, especially for more transient and noisy bursts.
- The efficacy of algorithms depends on datasets and frequencies of interest.
- Implementation of an algorithm chosen by our selection rule guarantees better performances in burst detection tasks.

**Acknowledgements**

This study was supported by the National Research Foundation of Korea (grant 2017R1A2B3012659) and the KIST CBRAIN project (2E30962).