

Robust PPG Authentication: The Role of Temporal, Individual, and State Variability

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Authentication systems

What you know



What you are



Authentication systems

Advantages:

- Do not rely on memory
- Unobtrusive
- Continuous authentication

What you are



PPG-Based Authentication

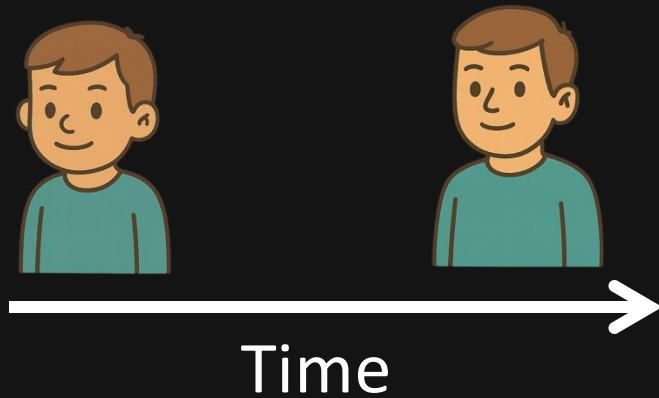
Limitations of existing works:

- Laboratory studies
- Missing assessment of the impact of contextual factors

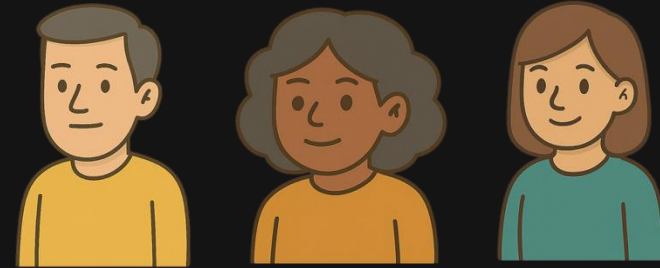


Focus of our work – Real world data

Temporal Variability



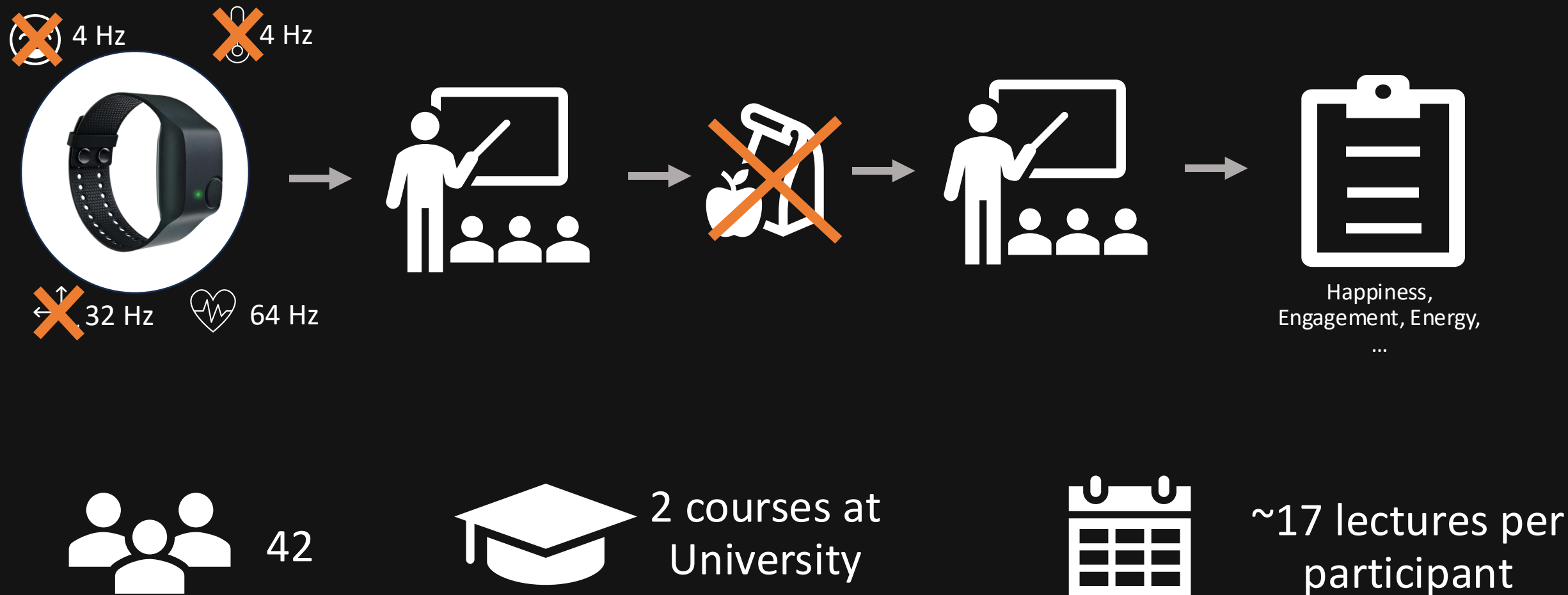
User-specific Variability



State-dependent Variability

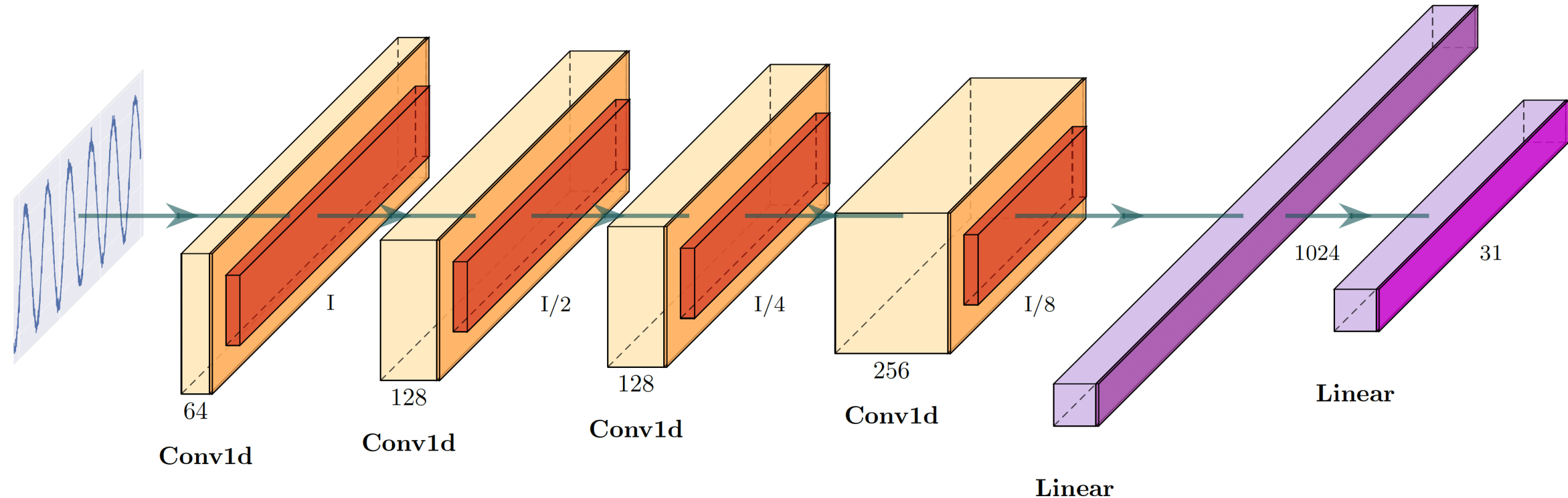


Dataset – LAUREATE

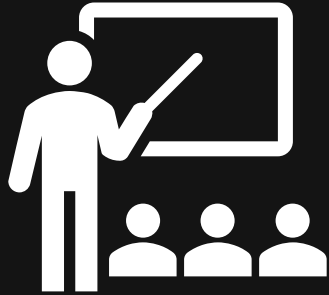


Methodology

- Convolutional Neural Network (CNN) architecture
- Window-size: 180 seconds
- Classification (user ID)

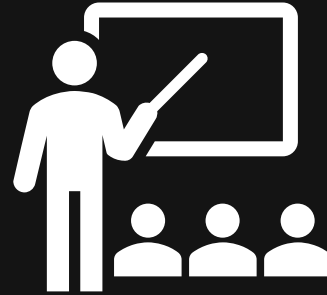


Methodology – Temporal and User-specific



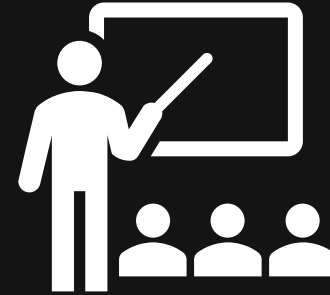
Training:

First 11th lectures



Validation:

12th lecture

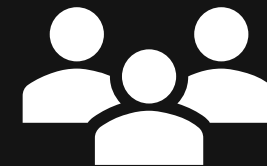


Test:

13th to 17th lectures

Remove participants that:

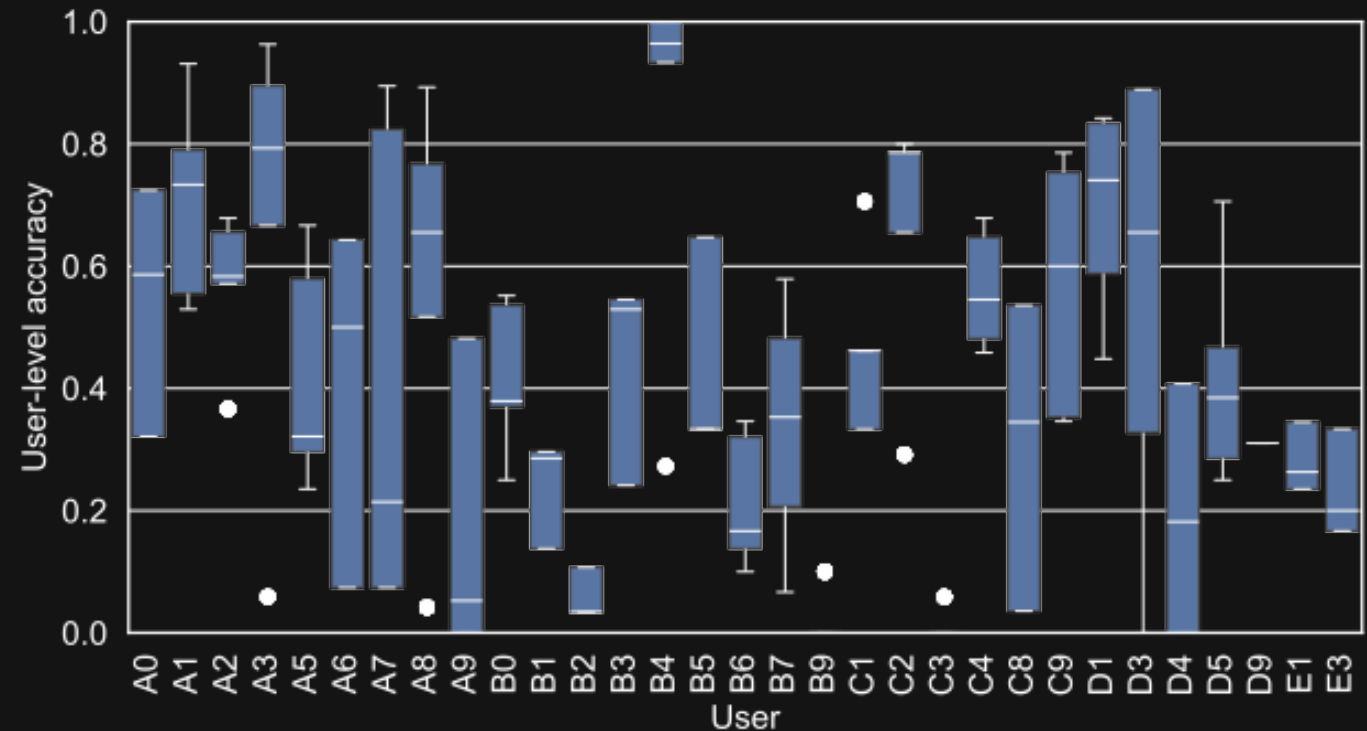
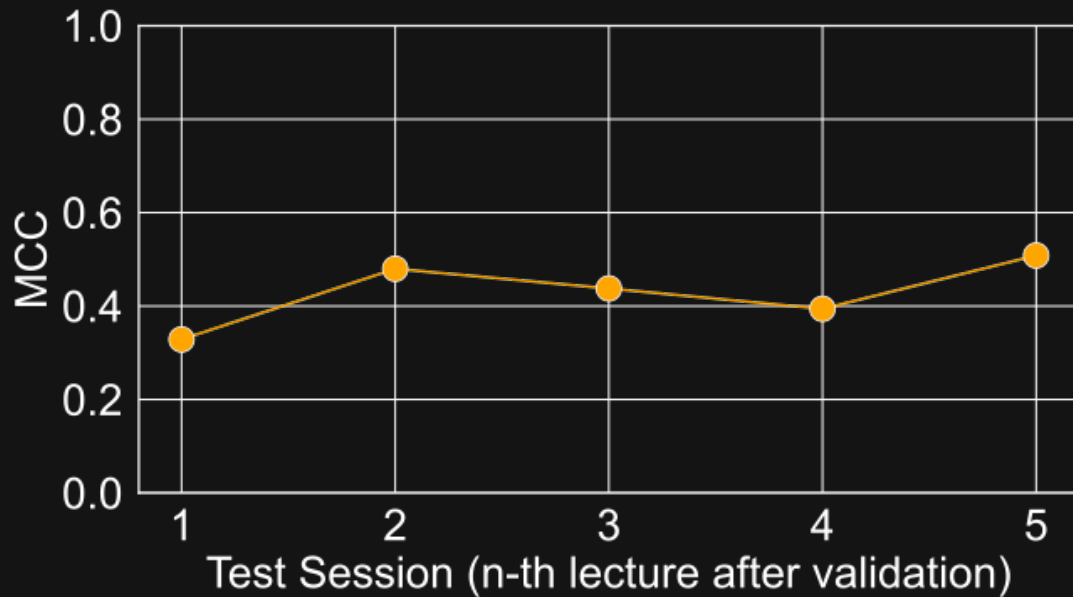
- < 5 lectures in Training
- < 3 lectures in Test



31

Results – Temporal and User-specific

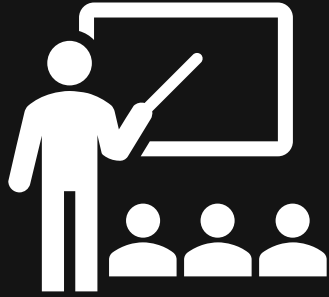
Temporal factors do not influence the performance



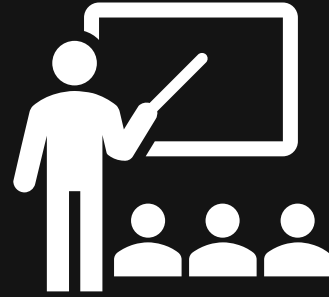
Some users have a narrow range suggesting consistent identifiability while others are inconsistent

$$A_u = \frac{u_{correctly}}{u_{windows}}$$

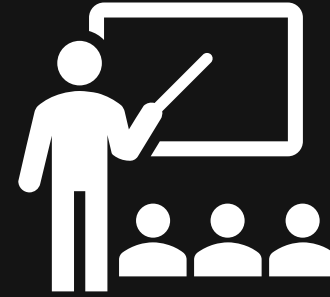
Methodology – State-dependent



Training with state:
Remaining lectures



Validation:
One random
lecture per user



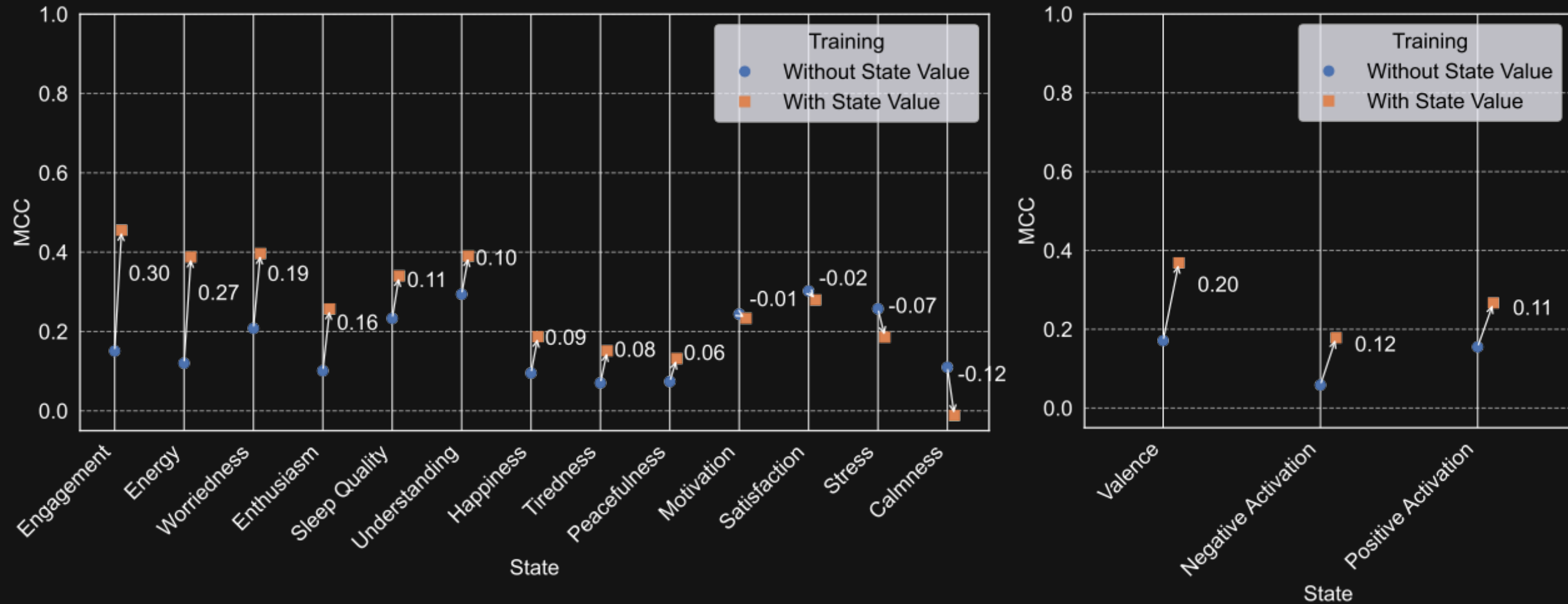
Test:
One random
lecture per user

Undersampled to have equal size

Training without state:

Remaining lectures with a state
different from the test lecture

Results – State-dependent

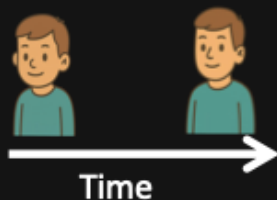


Including the same state in the training set improves performance on the test set

Conclusion



Paper



Temporal Variability

- No clear temporal degradation over the several weeks assessed (ranging from 21 to 47 days)



User-specific Variability

- Substantial variability across individuals



State-dependent Variability

- Same state conditions → MCC rose by up to 0.30



GitHub Repo