

# Associations between sleep and cognitive performance using the ENIGMA-Sleep data

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## **BACKGROUND**

- Sleep disturbance is considered a potential risk factor for cognitive decline and dementia<sup>1,2</sup>.
- Previous large-scale studies using the UK-Biobank data have highlighted a significant, albeit small effect size, non-linear relationship between self-reported sleep duration and cognitive performance<sup>3,4</sup>.

In this study, we performed machine learning (ML) analysis based on both self-reported and objective sleep duration and sleep efficiency using the ENIGMA-Sleep<sup>5</sup> data to predict cognitive scores at the individual level.

#### METHOD

## **ENIGMA-Sleep Datasets**

#### **SHIP-Trend:**

- N = 831 (396 Female, 435 Male)
- Age 21-81 (52.7  $\pm$  13.5)
- Stroop interference score 1-113 (20.2  $\pm$  11.4)

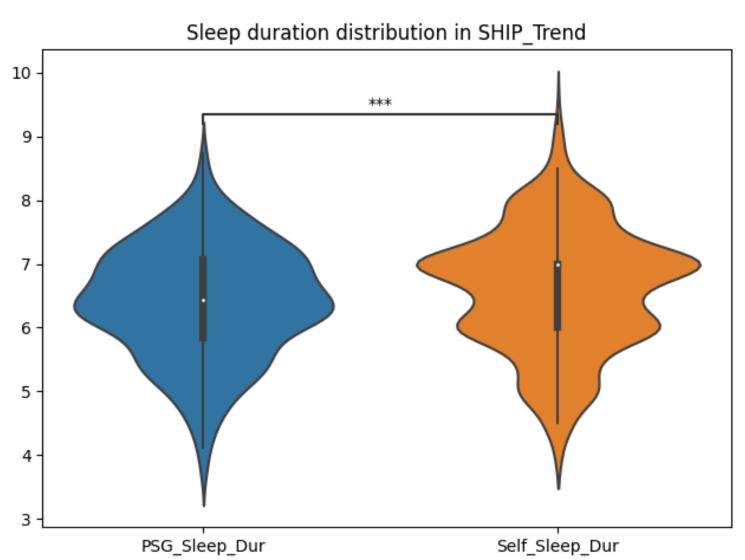
#### Liege:

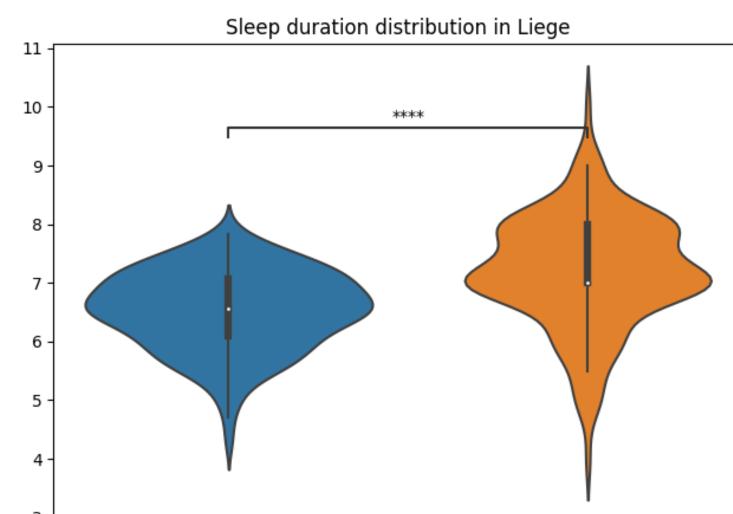
- N = 192 (99 Female, 93 Male)
- Age 50-82 (64.0  $\pm$  7.1)
- Stroop interference score  $-0.02-0.57~(0.22~\pm~0.14)$

#### **Sleep measurements:**

Sleep duration and sleep efficiency from:

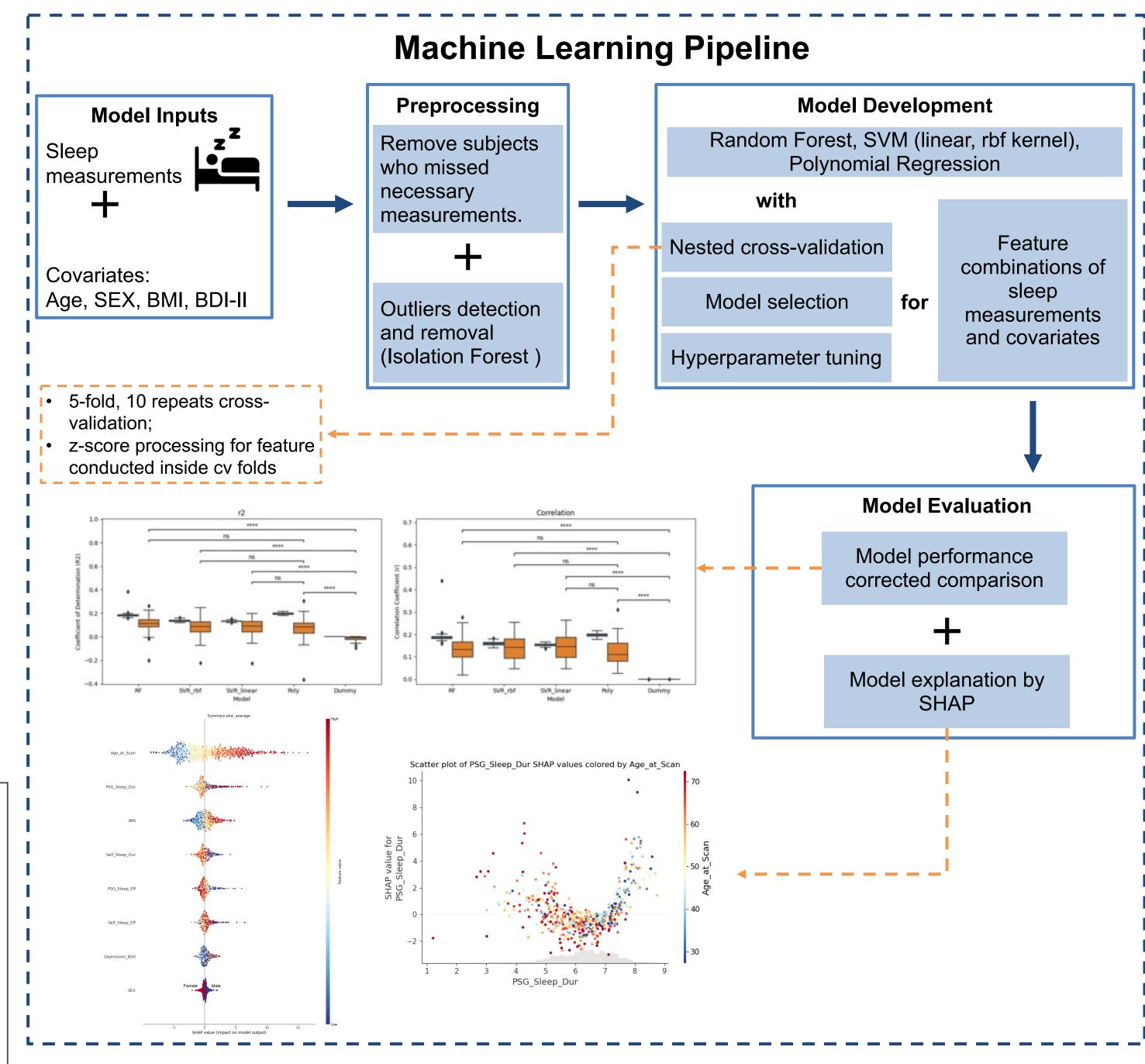
- Polysomnography (PSG)
- Pittsburgh Sleep Quality Index (PSQI)





PSG\_Sleep\_Dur

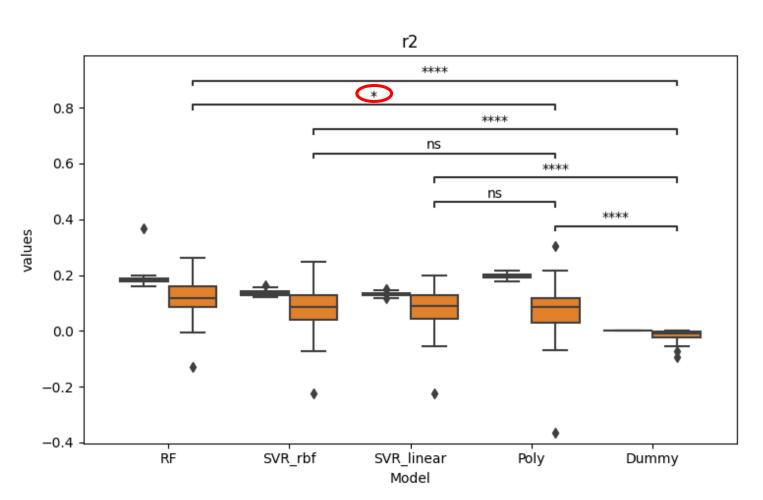
Relationship between Sleep Duration and Stroop Test

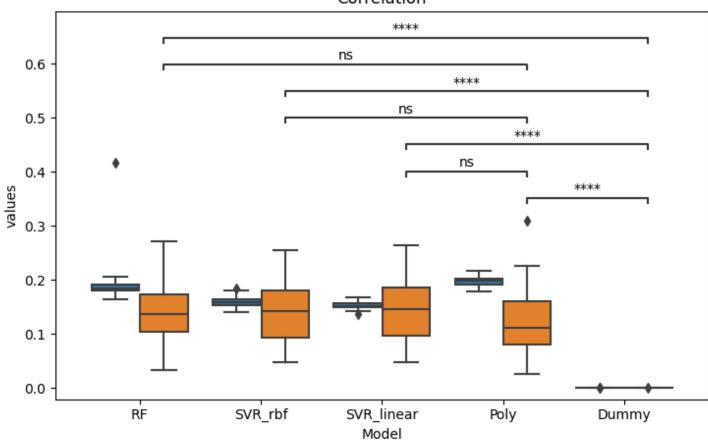


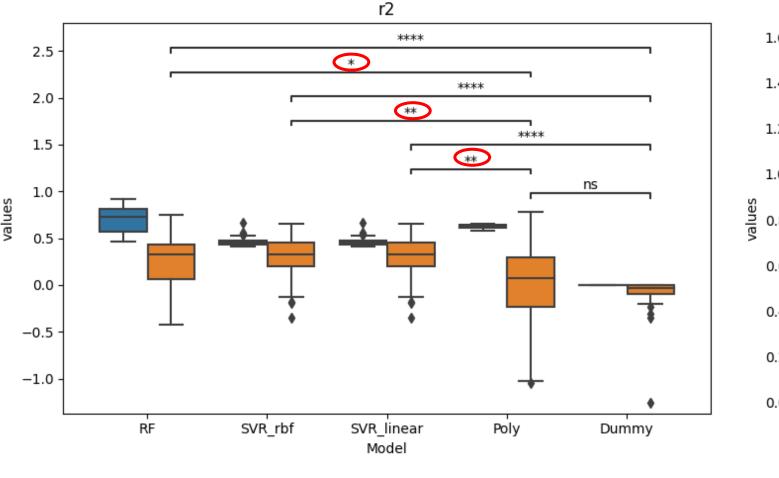
## **RESULTS**

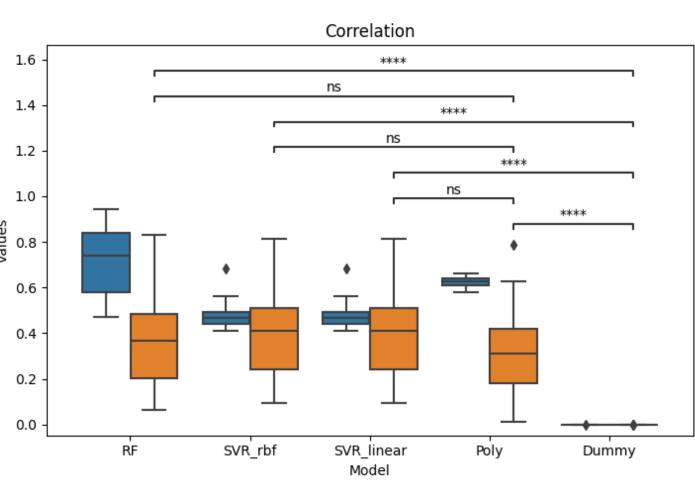
Random Forest and SVM-rbf showed weak prediction to Stroop Interference Score in both SHIP-Trend and Liege dataset. (Left: SHIP-Trend; Right: Liege)

Self\_Sleep\_Dur

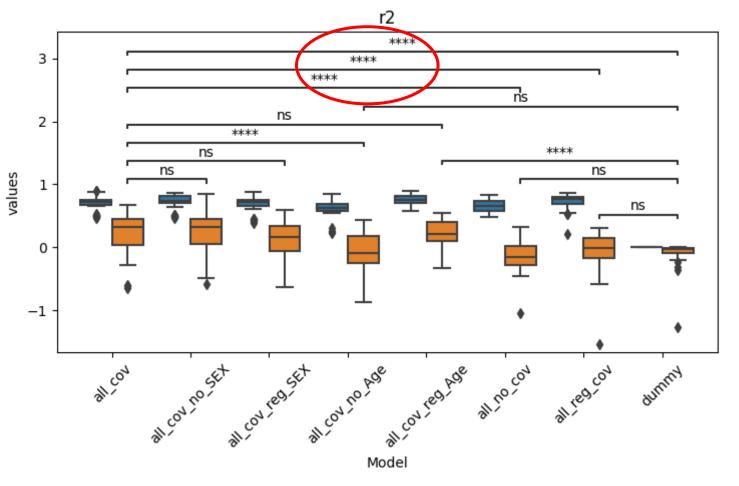


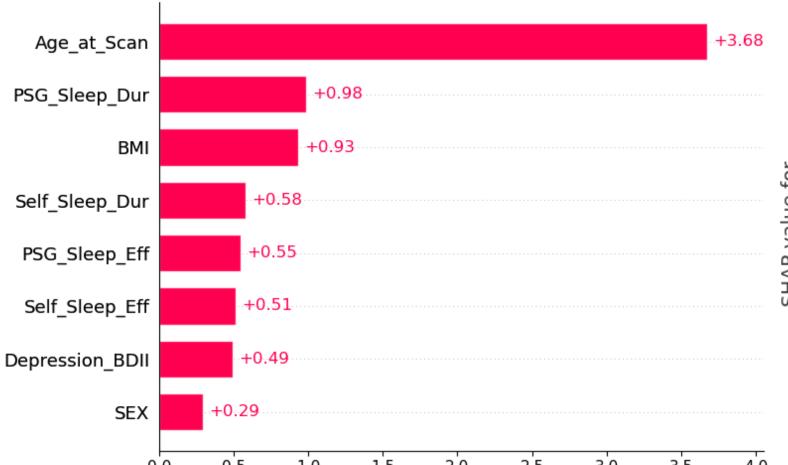


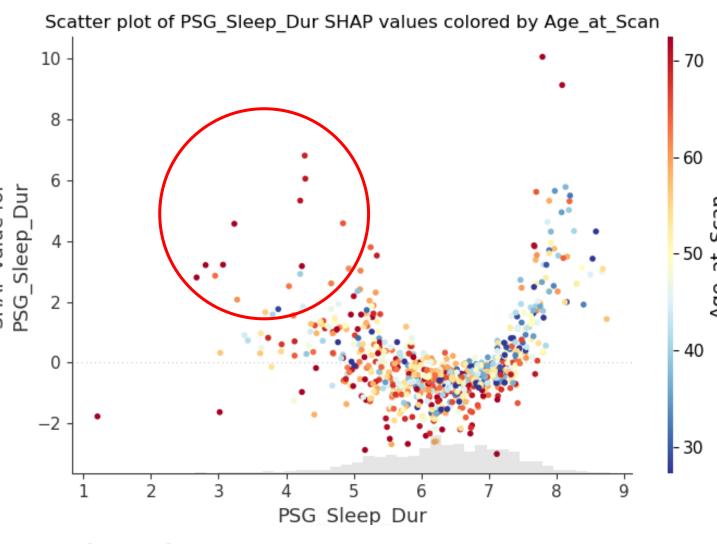




The comparison of model inputs and SHAP values showed the weak prediction is driven by the interaction between age and sleep measurements.







# CONCLUSION

- Stroop interference and reaction time scores can be weakly predicted by sleep measurements and demographic data (mainly age) based on non-linear ML models.
- Model explanation showed that the ~14% variance prediction is driven by age (most) and sleep measurements interaction.

## REFERENCES

1. F. Emamian, et al. Front. Aging Neurosci. 8, 78 (2016); 2. R. S. Osorio, et al. Neurology 84.19, 1964-1971, 2015; 3. Y. Li, et al. Nat. Aging. 2.5 (2022); 4. S. D. Kyle, et al. Sleep Med. 38, 85-91 (2017); 5. M. Tahmasian, et al. J. Sleep Res. 30.6, e13347 (2021).

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