

Working Memory In Older Adults: Machine Learning And Shap Analysis Of Functional, Activity, And Anthropometric Predictors



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Introduction

- Working memory in older adults declines with aging (Pliatsikas et al., 2019)
- Literature suggests that functional performance, anthropometric measures, physical activity, and non-movement behavior (e.g., sedentary behavior and sleep) are associated with working memory in older adults (Guardia et al., 2024; Myrman, 2015)
- Identifying the most influential predictors of working memory is important to develop optimized interventions aimed at mitigating cognitive decline and reducing the risk of Alzheimer's disease.
- Therefore, this study examined the relative importance of functional performance, physical activity, and anthropometric measures as predictors of working memory in older adults.

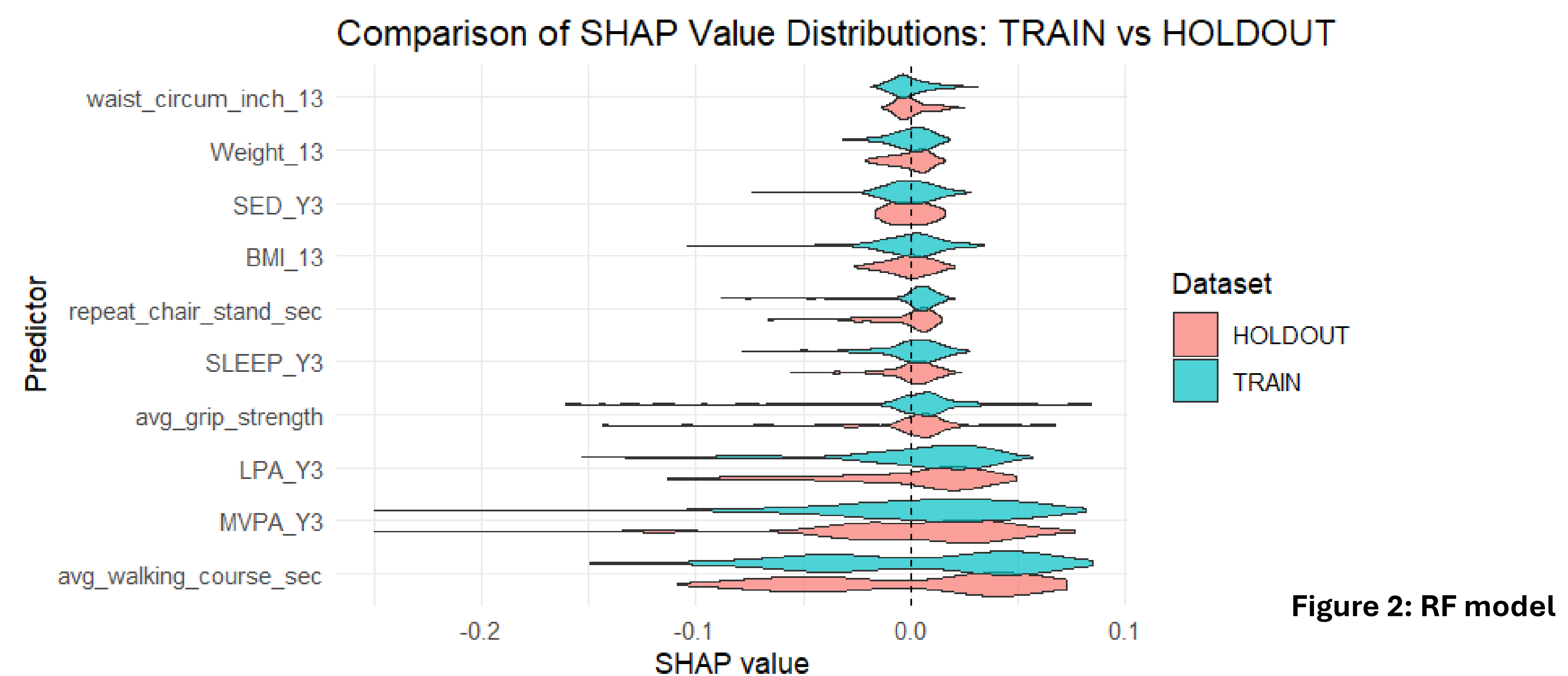
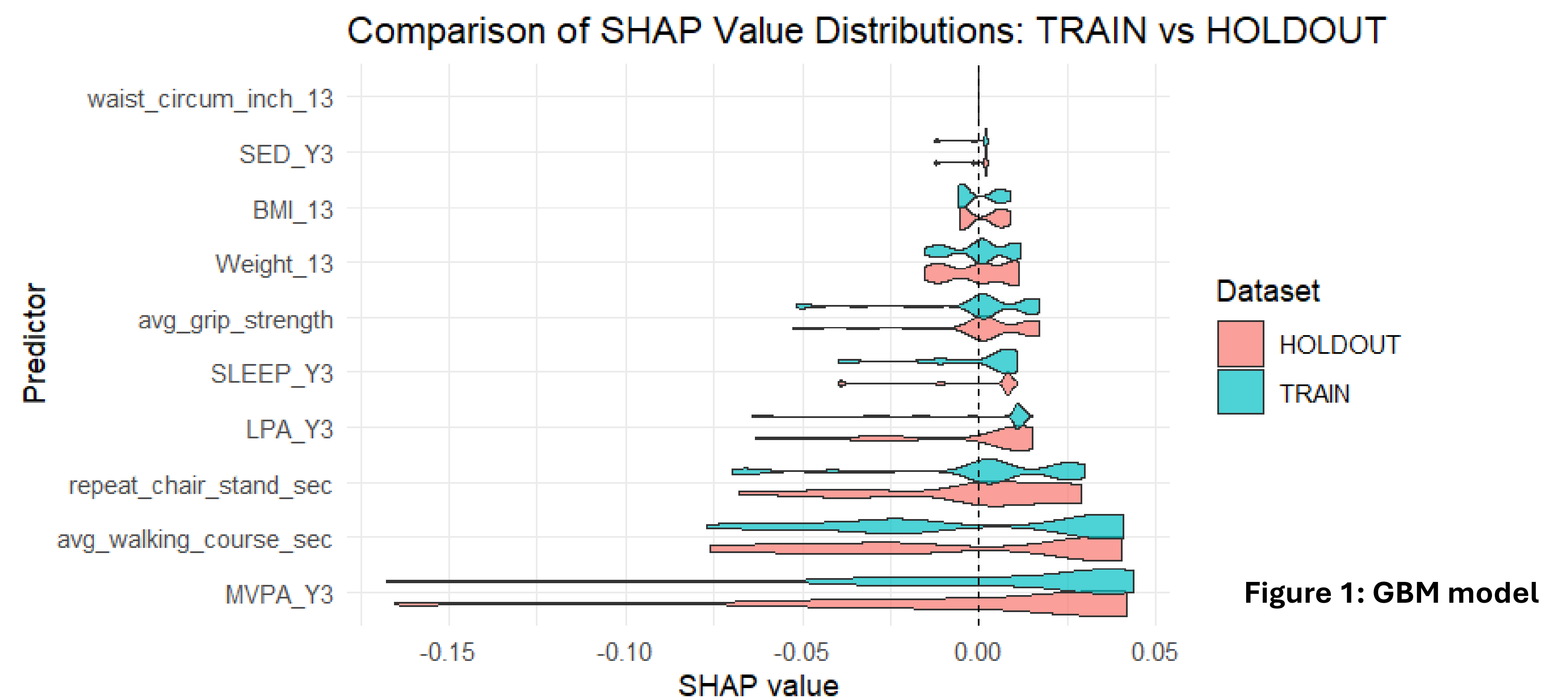
Methodology

- Data were drawn from Wave 3 of follow-up data (2023) from 354 U.S Medicare beneficiaries aged 65 and older in the National Health and Aging Trends Study.
- Physical activity intensity, sedentary time, and sleep were measured using an Actigraph Insight Watch and processed using the Bamman cut point (Bammann, 2021) and the GGIR package.
- Functional performance was measured using a short performance battery.
- Anthropometrics included self-reported weight and height, with waist circumference assessed using a tape measure.
- Machine Learning (ML) models, including naïve linear regression, Elastic net, Support vector regression (SVR), gradient boosting regression (GBM), random forest (RF), and principal component regression, were used to predict working.
- The accuracy of the models was compared using the root mean square error (RMSE).
- Shapley additive explanation (SHAP) was applied to determine the feature importance and model explainability.

Results

- The best performing ML model was the gradient boosting regression (RMSE: 0.236 unit) and random forest (RMSE: 0.236 unit), while the least performing model was the naïve linear model (RMSE: 0.240 unit) for working memory prediction.

Results



- SHAP analysis identified that functional performance, particularly average walking course time, emerged as a key predictor, with longer walking times associated with lower predicted working memory. (Figure 2).
- Another prominent predictor was moderate-to vigorous physical activity (MVPA), which showed a predominantly positive association with working memory. (Figure 1)
- Anthropometric measures contributed minimally to working memory prediction (Figure 1 & 2)

Discussion & Conclusion

- ML models and SHAP analysis identified functional performance and physical activity as the most influential predictors of working memory in older adults. These findings highlight the potential role of mobility and increased MVPA in cognitive health.