Objective Measure of Working Memory Capacity Using Eye Movements

James Owens  
*Old Dominion University*

Gavindya Jayawardena  
*Old Dominion University*

Yasasi Abeysinghe  
*Old Dominion University*

Vikas G. Ashok  
*Old Dominion University*

Sampath Jayarathna  
*Old Dominion University*

Follow this and additional works at: https://digitalcommons.odu.edu/undergradsymposium

Part of the Artificial Intelligence and Robotics Commons, Cognitive Psychology Commons, and the Data Science Commons

Owens, James; Jayawardena, Gavindya; Abeysinghe, Yasasi; Ashok, Vikas G.; and Jayarathna, Sampath, "Objective Measure of Working Memory Capacity Using Eye Movements" (2022). *Undergraduate Research Symposium*. 22.  
https://digitalcommons.odu.edu/undergradsymposium/2022/posters/22

This Poster is brought to you for free and open access by the Undergraduate Student Events at ODU Digital Commons. It has been accepted for inclusion in Undergraduate Research Symposium by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.
Objective Measure of Working Memory Capacity Using Eye Movements

James Owens, Gavindya Jayawardena, Yasasi Abeysinghe, Vikas G. Ashok, and Sampath Jayaratna

Department of Computer Science, Old Dominion University, Norfolk, VA

ABSTRACT

Working memory capacity is an important measurement in the development of autonomous systems that require human supervision. Currently, there is no direct method of determining working memory capacity. This study utilizes a publicly available dataset, containing multiple response measurements to tasks requiring various levels of cognitive load, to generate machine learning models that infer a relationship between participant eye tracking measurement and their subjective responses to the cognitive workload of each task. The focus of the study is to analyze the relationship between eye-tracking measurements and working memory capacity.

BACKGROUND

- Working memory capacity is the measurement for how information is being stored for a short time and interacting with long term memory with a capacity limit that is dependent on attention and other executive functions.
- Working memory capacity is crucial for human autonomy learning (humans and autonomous systems working together) because the human operator’s working memory capacity must be kept at appropriate levels to monitor the system.
- The dataset contained data on each participant for two levels: single (without DRT, three trials) and dual (with DRT, four trials including a control).

METHODOLOGY

Participants
- 28 participants aged between 18-30 years (16 M, 12 F)

Task Measurements
- N-back task (recalling numbers read aloud from an audio file)
- DRT task (vibrotactile stimulus response time)

RESULTS

- The Random Forest classifier yielded the highest accuracy at 97.37% for the physical demand measurement using the dual machine learning classification.
- The physical demand was the only measurement that could be predicted at an accuracy greater than 75% by any classifier.

CONCLUSION & FUTURE WORK

- The results suggest that it possible to use eye tracking metrics to predict working memory capacity, but more research must be done to improve accuracy.
- Future work in this area should include the DRT and N-back measurements in predicting the working memory capacity.
- NASATLX scores should be made less subjective by being placed on a scale that is normalized for each participant based on the mean and variance of their responses.

REFERENCES