# Replicating the Neural Mechanisms of Working Memory in the Prefrontal Cortex using Machine Learning

Ezekiel Ajayi[1], Yu (Yudi) Xie[2], Robert Guangyu Yang[2]

[1]Brain and Cognitive Sciences, Massachusetts Institute of Technology

[2]Computer Science and Electrical Engineering, University of Maryland, Baltimore County

## Background

Working Memory (WM) is the nervous system function for storing small amounts of information for executing cognitive tasks and mental processing. Numerous experiments have yielded a deeper understanding of how WM manifests in short-term scenarios. An example of such experiments is the Delayed Match to Sample (DMS) task observed below (Figure 1.) [1]. The DMS task is an experiment focused on studying visual working memory, attention, and working memory capacity.

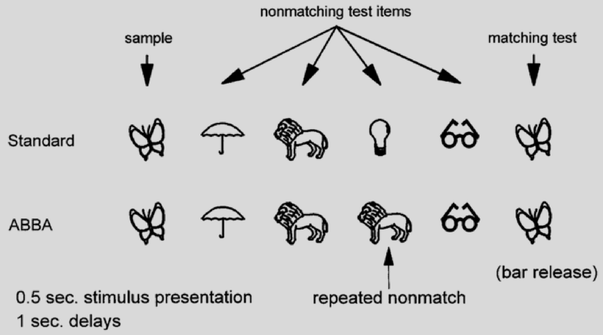



Figure 1 – Outline of the DMS task with a standard and ABBA version displayed. [1]

## Introduction

In [1], results show increased neural activity when introducing new stimuli throughout the task. Our goal is to investigate similar behaviors in artificial neural networks (ANNS) to identify parallels in the fidelity of information received from a computational neural network.

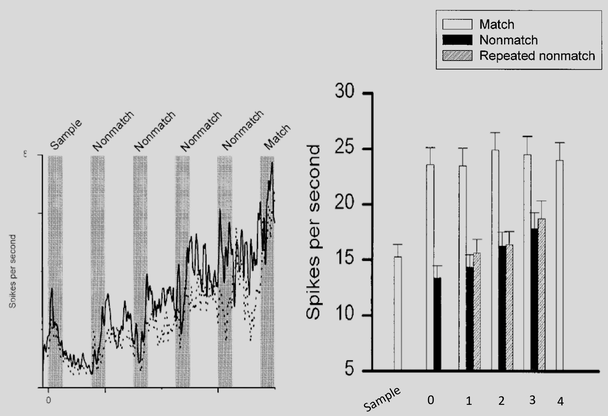
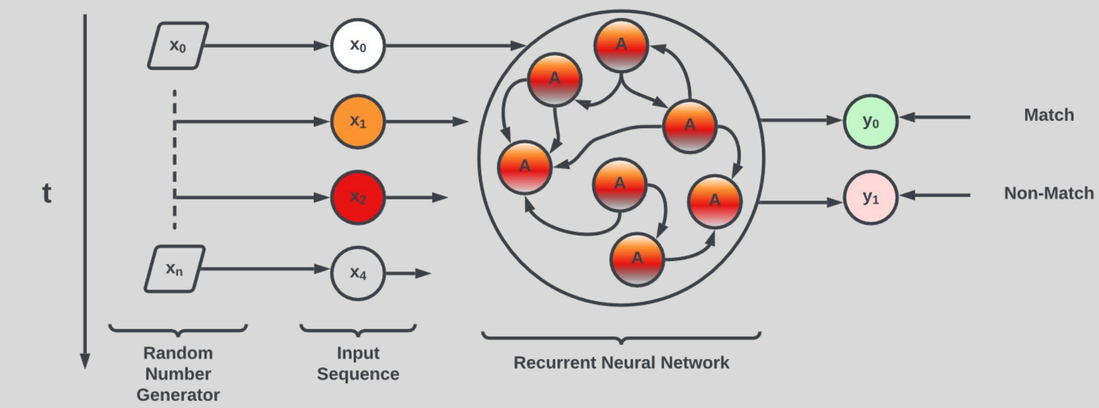


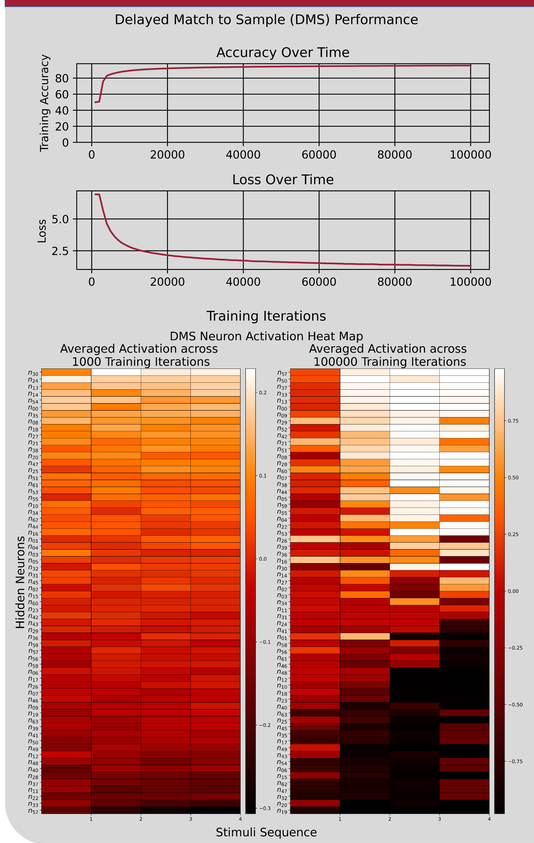

Figure 2 – Response histogram of a PF neuron showing sample-selective delay activity [1].

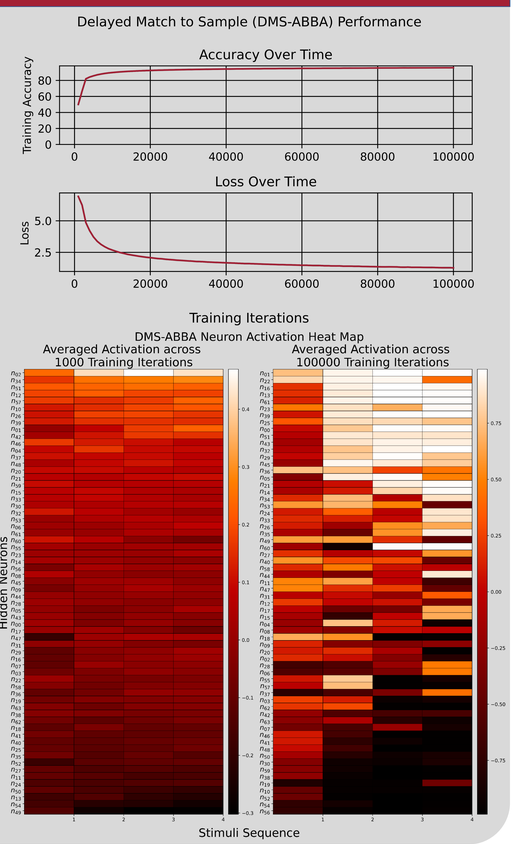
Figure 3 – Avg response of 26 enhance neurons to a series of 45 stimuli eliciting stronger responses [1].

## Methodology




## Results

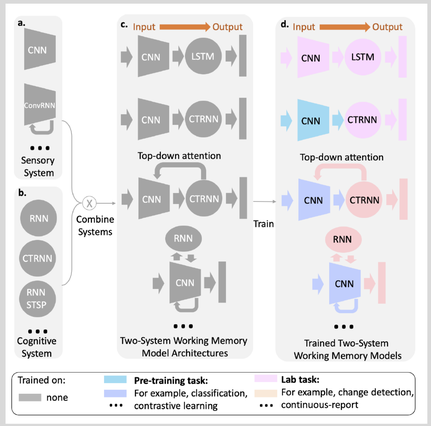



## Conclusion & Future Work

From numerous training iterations, we find that:

- The ANN can learn the task quickly (~3000 training iterations)
- Neuron activation increases sequentially with stimuli for initially excited neurons.
- The ANN is able to learn both ABBA and DMS tasks effectively.

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## References

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