

Computation & Cognition 2024-2025

Assignment 1: Memory

Overview

In this first assignment, we will explore formal models of *recognition memory*. There are two papers that you should read first:

- Yonelinas, A. P. (1994). Receiver-Operating Characteristics in Recognition Memory: Evidence for a Dual-Process Model. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, 20(6), 1341–1354. <https://doi.org/10.1037/0278-7393.20.6.1341>
- Wixted, J. T. (2007). Dual-process theory and signal-detection theory of recognition memory. *Psychological Review*, 114(1), 152–176. <https://doi.org/10.1037/0033-295X.114.1.152>

These papers describe multiple models of recognition memory, including two that we will implement in the assignment: Unequal-variance signal detection theory, and dual-process signal detection theory.

Lab report contents

The goal of the lab report is to describe how you answered the questions in the assignment, and what you learnt about how formal models of memory can help us understand cognitive processes. Structure your lab report as follows.

1. The names and student numbers of all students in the group that participated to the assignment.

By submitting this assignment, all authors listed in the lab report confirm that they have made significant contributions to the project and are collectively responsible for its content.

2. Getting started

Before starting the assignment, read the two papers. How well were the models described in the papers? Did you understand the differences between the formal models?

3. Inspecting data

In the first part of the assignment, we explore how to analyze empirical data from a recognition memory task. There are multiple ways to approach analysis: You could inspect accuracies, hit rates and false alarm rates, or analyze ROC curves.

Was it clear what contingency tables look like, and how to calculate hit rates and false alarm rates? Why is it useful to look at hit rates and false alarm rates, compared to just inspecting accuracy?

Did you succeed in plotting a receiver-operator characteristic (ROC) curve? If not, what information did you miss to make the plot? What does an ROC curve add on top of a contingency table?

4. Model 1: Random guessing

Why is it useful to implement a ‘toy’ model that just models random guesses? What function did you use to simulate random memory strengths, and why?

What does the ROC curve of a random guessing model look like?

5. Model 2: Unequal variance signal detection theory (UVSD)

Describe how you implemented UVSD: Which function(s) did you use to assign memory strength to each item?

What does the ROC curve look like, and how does it differ from the random guess model?

6. Model 3: Dual-process signal detection theory (DPSP):

Describe how you implemented DPSP: How did you choose which items were correctly recalled, and assigned a high confidence rating? How did you assign memory strengths to the remaining items? Is it clear what the two processes are in this model?

What does the ROC curve look like, and how does it differ from the UVSD model?

7. Evaluation

Why is it useful to inspect the ROC curves produced by formal models? How can these be used to determine which formal model best explains human memory?

Overall, which aspects of the assignment did you find difficult? Was there information missing?

Submission

The deadline for submission of this lab report is Friday, February 28th 2025, 23:59.