

Assignment 2: Summed Similarity

Mini-Project 2
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Show all work and provide answers rounded to the nearest thousandth (third decimal place). Please submit your assignment online through Canvas Assignments as a PDF file.

1 Summed Similarity

After studying a list of 4 items during a trial of a Sternberg task, a participant's memory matrix M is given by:

$$\begin{aligned} M &= \begin{pmatrix} 1 & 3 & 5 & 7 \\ 2 & 4 & 6 & 8 \\ 4 & 3 & 2 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix} \\ &= \begin{pmatrix} \mathbf{m}_1 & \mathbf{m}_2 & \mathbf{m}_3 & \mathbf{m}_4 \end{pmatrix} \end{aligned}$$

1. Suppose the probe item is the target m_3 . Compute the similarities to m_1 , m_2 , and m_4 using distance-based similarity (let $\tau = 0.5$):

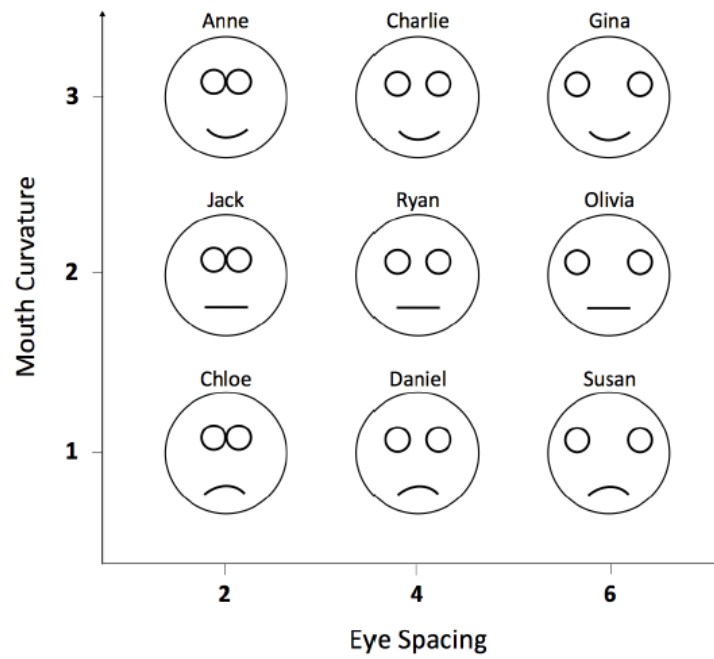
$$\text{similarity}(a, b) = e^{-\tau \|a-b\|} = e^{-\tau \sqrt{\sum_{i=1}^N (a(i)-b(i))^2}} \quad (1)$$

2. Suppose the participant instead receives the probe item p_1 :

$$\mathbf{p}_1 = \begin{pmatrix} 5 \\ 7 \\ 1 \\ 0 \\ 0 \end{pmatrix}$$

- (a) If the participant's summed similarity decision threshold is 0.75, do you predict that they'll call the probe item old or new? Use distance-based similarity (with $\tau = 0.5$) to justify your prediction.
- (b) Plot the distance-based summed similarity as a function of τ by ranging τ from 0 to 1 for the probe p_1 and the memory m_1 . Does increasing τ make a subject tend to (or be more likely to) recognize a given probe as old or new?

3. Consider an experiment in which participants are shown faces that vary in eye spacing and mouth curvature:



During study, participants see Face Anne and then Face Olivia. Answer the following questions and assume $\tau = 1$.

- (a) During testing, participants perform a recognition task in which they are shown lure Face Daniel. What is the summed similarity of lure Face Daniel to the items stored in memory?
- (b) What is the minimum and maximum value of the decision threshold such that a participant would say "yes" to the target faces Anne and Olivia and "no" to lure Face Chloe?