ELEC-E7852 Computational Interaction and Design 2024
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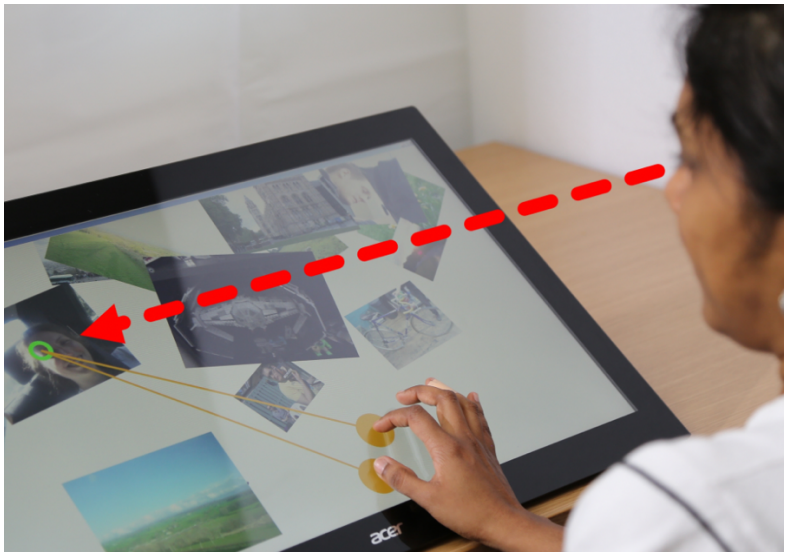
Assignment 5a: Computational rationality (mandatory, 5p)



Goal: During the lecture we discussed two purposes for cognitive models: prediction and explanation. In this exercise, you will first examine predictions from the gaze-based selection model introduced during the lecture. Then, you will improve the model to be a better representation of the human visual system.

Preliminaries: First, make sure that you understand the notebook (esp. Section 3). You need to understand what a saccade and a fixation are and how they are produced.

Tasks:

1. Let's first look at what kind of predictions we can generate with GazeModel. First, generate data for different target widths using GazeModel (you can change the widths in the code template). Also generate some movement times. We assume that the movement duration is the sum of (1) the saccades and (2) the fixations. A helper function **add_movement_time** is given for a rough estimate. Describe what each of the rows in the generated dataset represent. Aggregate the data so that you get total movement times for each trial (episode). (1p)

2. How do total movement times and number of fixations predicted by GazeModel change depending on target width? Plot target width vs. movement time; and target

width vs. number of fixations. Note that you might need to do some averaging over trials or select an appropriate function for plotting. (1p)

3. Let's then improve the human model. The **add_movement_time** function currently randomly samples fixation durations and saccades to generate total movement time. Why is this not a great model? Using empirical literature*, modify the model that generates fixation durations and saccades. For instance, you will want to assume that the time required to make a single saccade is linearly related to the distance moved, such that **saccade_time = distance / saccade_speed**. Also check (and cite) some realistic bounds for the model from the literature. (1p)

4. Plot target width vs. movement time for GazeModel with your new movement time model. How do these predictions compare to the original results that used **add_movement_time**? (1p)

5. Suggest an additional bound that you hypothesize to impact gaze-based selection in addition to those accounted for in the model. Is the bound internal or external? Suggest how you would implement this bound. (1p)

Reporting as usual. Ensure you report your results for the above points clearly. Answer the questions given in the points.