Measures of Neural Similarity

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Presentation Abstract Summary What makes two brain states similar? For example, when viewing a sparrow, representations in the visual system should be more similar to those of a robin than to a truck. When using fMRI to measure brain state, the field tacitly assumes that Pearson correlation across voxels is an appropriate measure of neural similarity (i.e., when the voxel representations elicited by two stimuli correlate, then the brain states are similar), but this major theoretical assumption that has not been fully evaluated. Which similarity measure best describes the brain's operation? We endeavour to answer this question by evaluating a range of possibilities, including Pearson correlation. We address whether the nature of neural similarity is common across tasks and brain regions. To answer these questions, we follow the tradition of grounding similarity in confusability. Confusability of different brain states can be measured with classification procedures such as linear support vector machines (SVM). We consider which similarity measure best characterizes this confusability data for each brain region and task considered. Considering two previously published fMRI datasets, we find that similarity measures perform comparably across brain regions within a task, but that the best similarity measure depends strongly on the task.

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