MVPA – *Representation: How is information represented in different brain structures; how is that information transformed?*

1. Issues with traditional analysis:
   1. Weak responses may carry information, but traditional analysis ignores them
   2. Spatial averaging blurs the fine-grained “patterns” of activity
   3. Goal of boosting sensitivity Signal to noise Ratio by using many voxels, without losing signal by averaging or ignoring weak responses.
   4. Traditional group analysis requires averaging across subjects
2. Advantages of MVPA:
   1. Can identify the neurons that represent a specific property of a stimulus
   2. Can identify the cognitive state that a participant is in
   3. Pattern presence or absence can appear/disappear over a timescale of seconds, for example in binocular rivalry
3. Pattern Classifiers: Quantifying how well a region represents a process
   1. Feature selection -> pattern assembly (training) -> classifier
   2. Linear vs. non-linear patterns (univariate analysis *cannot* capture nonlinear effects)
      1. Linear tells us that some of the voxels we chose are individually sensitive to the dimension of interest, therefore the information is explicit in the input.
      2. Non-linear has no constraints: but this means we cannot be sure whether the information is contained in the classifier weights (implicit in the input) or explicitly in the input.
   3. Small irregularities in voxel contents can, when averaged across the voxel, appear as a ‘pattern’ of activity. The actual information is sub-voxel, but the pattern is super-voxel, which allows the classifier to pick up on it.
4. Downsides:
   1. Using classifier ‘weights’ depends on the method chosen, and tend to represent the most discriminative voxels—not necessarily the voxels that responded most to a category. Shared information is discarded.
   2. MVPA results are very difficult to interpret…

fMRI-A –

1. Repetition suppression as a way of inferring knowledge about representations:
   1. For example: visual aftereffects to understand how orientation tuning is represented