We choose the dataset ds105 which can be loaded from <https://openneuro.org/datasets/ds000105/versions/00001>. This dataset is about visual object recognition. Since functional brain imaging has revealed that the human ventral object vision pathway has a complex functional architecture and different categories of objects evoke different response patterns in cortices, object perception and the corresponding patterns of response in ventral temporal cortex analysis have been a subject of extensive fMRI studies. To analyze the patterns of neural response to object categories, take fMRI method to record peoples’ brain images when they looked at the pictures of faces, cats, five categories of man-made objects (houses, chairs, scissors, shoes, and bottles). In the reference [1], Haxby et al found that for each stimulus category there is a distinct response pattern, but the distinctiveness of the response to a given category was not due simply to the areas that responded maximally to this category, since the category can also be identified at the condition that these areas were excluded from the analysis. And in the areas that responded maximally to only one category, the patterns of response which discriminated among all categories were found. That is, the representations of faces and objects in ventral temporal cortex are widely distributed and overlapping.

In the reference[2], Stephen et al continue Haxby’s work by using a artificial neural network(ANN) to verify their conclusion. What Haxby revealed is that category-related responses in the ventral temporal lobe during visual object identification were overlapping and distributed in topography. However, this observation contrasts with prevailing views that object codes are focal and localized to specific area such as the fusiform and para-hippocampal gyri. The author implemented an artificial neural network to detect more general topographic representations and achieved 83% correct generalization performance on patterns of voxel responses in out-of-sample tests. By using voxel-wise sensitivity analysis, they show that substantially the same VT lobe voxels contribute to the classification of all object categories, suggesting the code is combinatorial. Moreover, they found no evidence for local single category representations. The neural network representations of the voxel codes were sensitive to both category and superordinate level feature that were only available implicitly in the object categories.

In the reference[3], object and face representations in ventral temporal cortex were investigated by combining object confusability data from a computational model of object classification with neural response confusability data from a functional neuro-imaging experiment. A pattern-based classification algorithm learned to categorize individual brain maps according to the object category being viewed by the subject. An identical algorithm learned to classify an image-based, view-dependent representation of the stimuli. High correlations were found between the confusability of object categories and the confusability of brain activity maps. This occurred even with the inclusion of multiple views of objects, and when the object classification model was tested with high-spatial frequency ‘‘line drawings’’ of the stimuli. Consistent with a distributed representation of objects in VT cortex, the data indicate that object categories with shared image-based attributes have shared neural structure.

In our project, we choose to reproduce the work of the three references mentioned above, by verifying the correlation between viewed objects the activated area of our brain and whether the representations are overlapping among different objects.

## References

1. Distributed and Overlapping Representations of Faces and Objects in Ventral Temporal Cortex
2. Combinatorial codes in ventral temporal lobe for object recognition: Haxby revisited: is there a “face” area?
3. Partially Distributed Representations of Objects and Faces in Ventral Temporal Cortex