Assignment-1
Cognitive Science in AI

ASSIGNMENT REPORT

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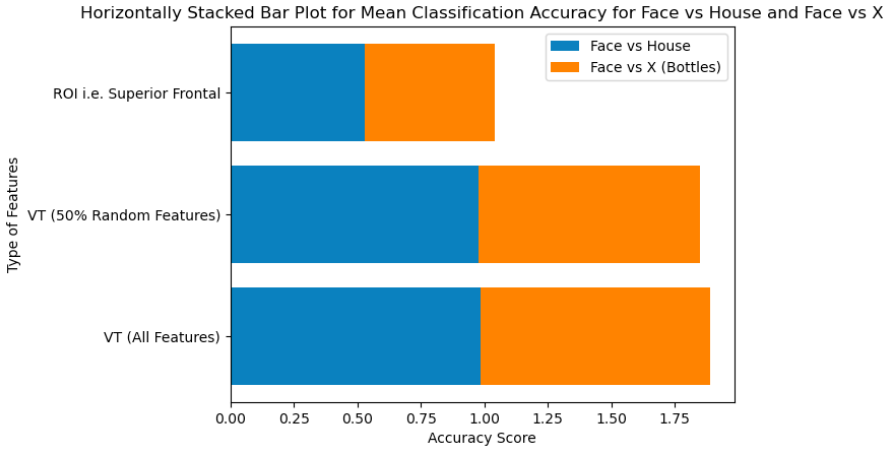


Results

Face vs House

VT (All Features) : Accuracy Score- 0.9861111111111112

VT (Random 50% Features) : Accuracy Score- 0.9814814814814815 (for a run)

ROI (Superior Frontal) : Accuracy Score- 0.5277777777777778

Face vs X (Bottles)

VT (All Features) : Accuracy Score- 0.9027777777777778

VT (Random 50% Features) : Accuracy Score- 0.8611111111111113 (for a run)

ROI (Superior Frontal) : Accuracy Score- 0.513888888888889

Inferences

1) Accuracy for binary classification between two objects more when VT features used than when Superior Frontal region Features are used

From the above stacked bar chart, we see that the mean accuracy of the binary classification performed between objects using features extracted from VT region of fMRI data is more than for those extracted from the Superior Frontal region and also that the accuracy is very high for the VT features (almost equal to 100%).

So, we can conclude that the Ventral Temporal (VT) region of the brain plays the crucial role of differentiating between the objects seen by our eyes.

What is VT cortex in brain?

The ventral temporal cortex, or simply ventral temporal region, is a part of the brain's visual processing system. It is located in the ventral (bottom) aspect of the brain's temporal lobe. This region is especially important for higher-order visual processing and plays a crucial role in object recognition

and identification. For example, if you see a face, the ventral temporal cortex helps you recognise that it is a face and identify the person. Lesions or damage to this region can result in specific deficits in object recognition, a condition known as visual agnosia.

2) **Superior Frontal region and its lesser role in object classification**

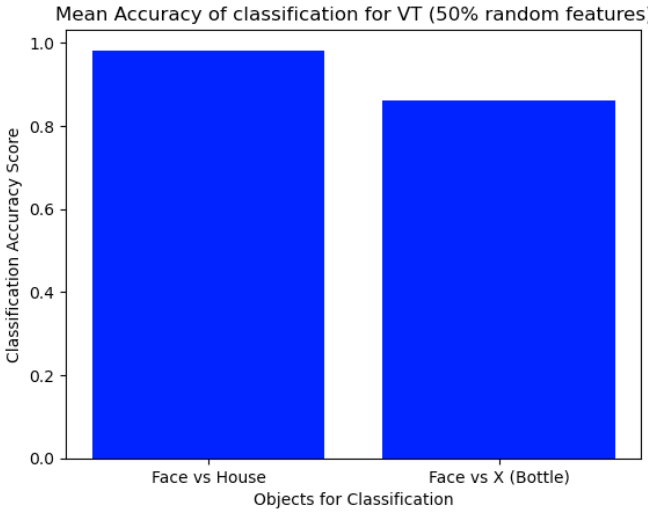
The superior frontal region is a part of the frontal lobe in the brain, specifically located at the top (superior) portion of the frontal cortex. This region is involved in various cognitive functions, including motor planning, decision-making, working memory, and attention. It is a complex area with different subregions that contribute to different aspects of cognitive processing.

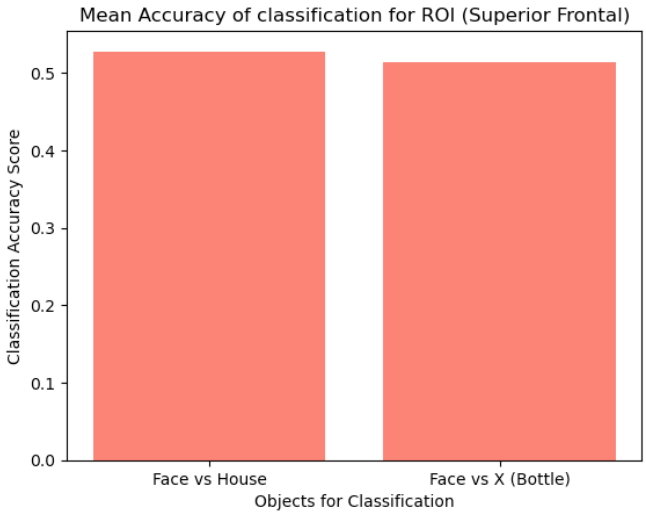
Research in neuroscience suggests that while the superior frontal region is involved in various higher-order cognitive processes, it may play a lesser role in the detailed and specialised processing required for object classification. Object recognition, including the ability to identify and categorise objects based on their visual features, seems to rely more on the ventral temporal region's specialised processing capabilities.

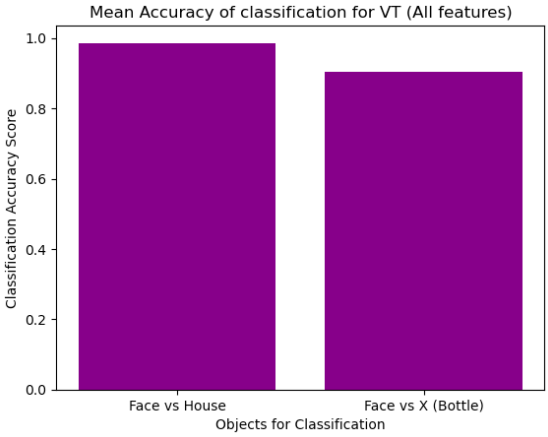
3) **The accuracy of Classification between Face and House is more than that for Face and X (i.e. Bottle for me)**

From the bar plot, we can infer that the models give better mean accuracy for classifying face vs house than for face vs bottle. So, we can say that faces and houses could have more distinct and separable patterns in the fMRI data, making it easier for the classifier to learn and generalise. Visual representation of faces and houses in the brain might be more distinct compared to faces and bottles. The brain regions responsible for processing faces and houses might exhibit clearer activation patterns.

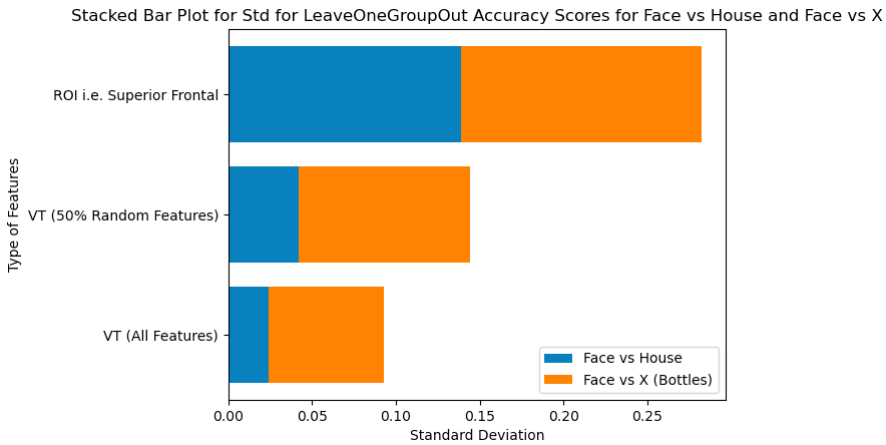
These bar plots show the above described inferences.







4) **Standard Deviation for accuracy scores (LeaveOneGroupOut validation) is less for face vs house than for face vs X (Bottles) and also it increases for VT (half random features) and further more for ROI (Superior Frontal) features.**



So, we can say that the model's performance in distinguishing between faces and houses is more consistent or stable than when distinguishing faces from X, in this case, bottles. The introduction of half-random features (VT) and the use of features from the Superior Frontal region result in increased variability in model performance. This suggests that these features or conditions may be more challenging or less consistent in contributing to accurate predictions.

In summary, the model seems to perform more consistently when distinguishing between faces and houses compared to faces and another category (X, bottles). Additionally, the introduction of half-random features (VT) and the use of specific region-of-interest features (Superior Frontal) lead to increased variability in model performance. These findings can be indicative of the relative difficulty or reliability of different conditions or features in the given classification task.