Decoding fMRI to classify images

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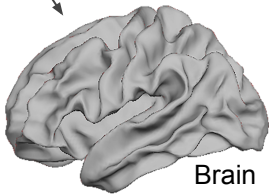
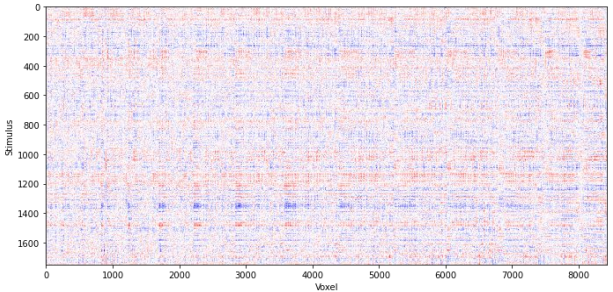
High-dim sensory information

Low-dim activities of neuronal populations

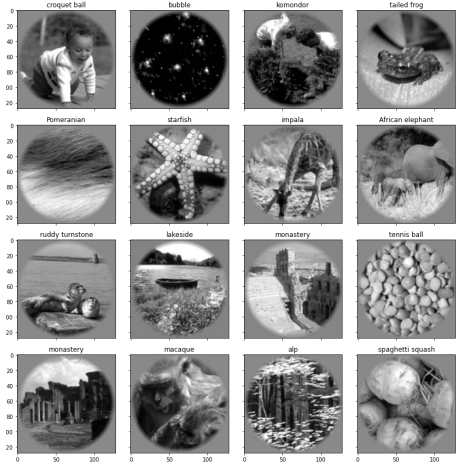


Brain

fMRI BOLD signals



Kay & Gallant dataset



1750 images & corresponding brain activities in BOLD signals.

Decoding model

Objectives

- Predicting the classification of images with fMRI BOLD signals.
- Understanding the relationship between the class of stimuli & fMRI activation patterns.

2 classes: Animal / Artifact

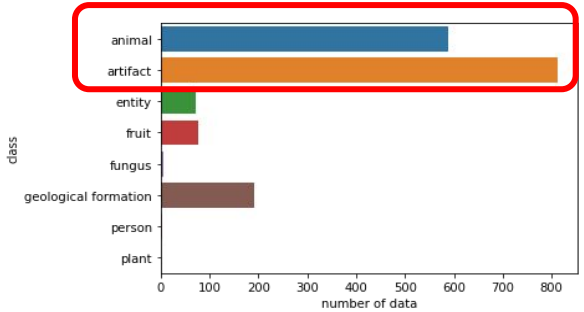
Problems:

- **No true labels**
  Only predicted labels by DNN pretrained on Imagenet.
- **Overfitting**
  Small dataset might lead to overfitting during training.

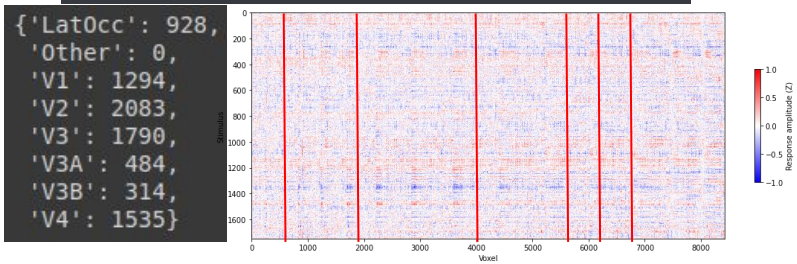
Method

Only use animal/artifact data

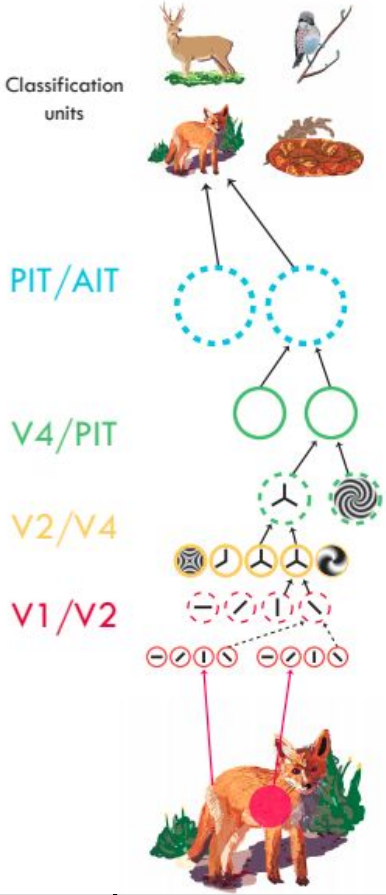
1401 train data
104 test data

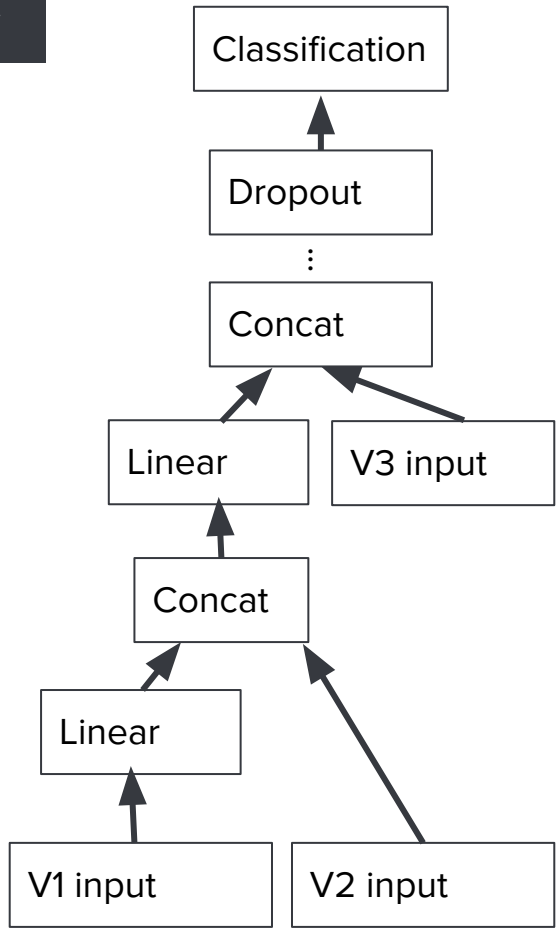


Divide fMRI input according to ROI



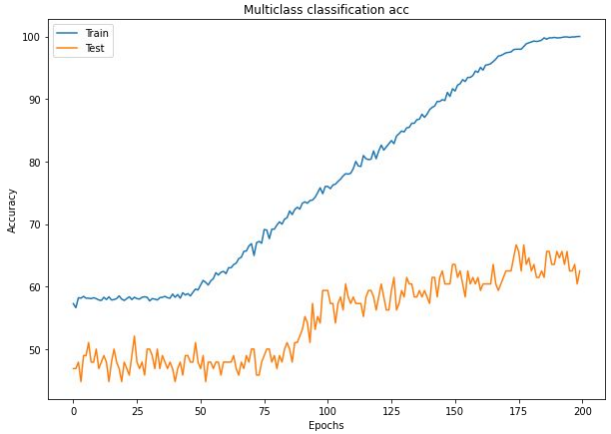
Build model with visual hierarchy

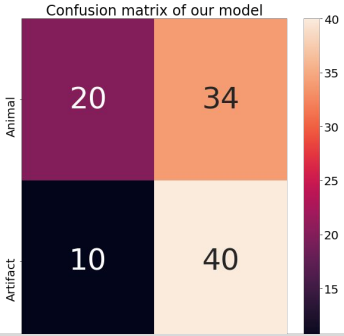




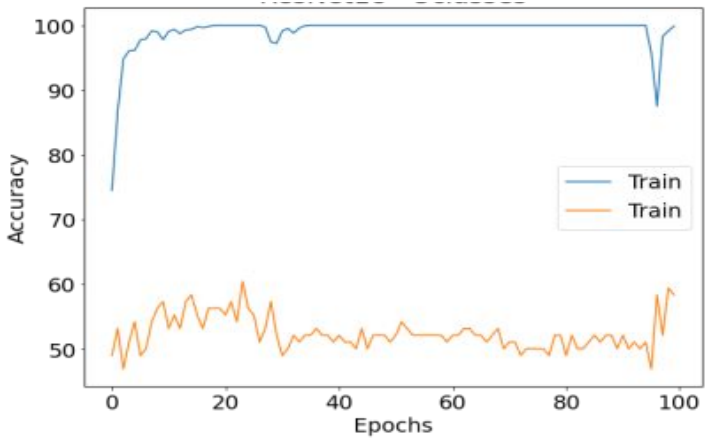
Results

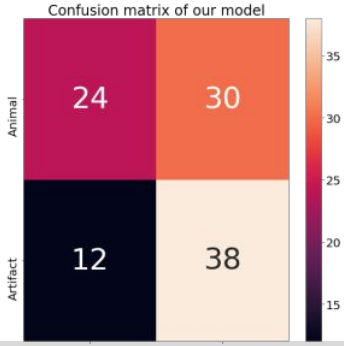
Classification acc of **our model**





Classification acc of **resnet**





Conclusion

- BOLD response better representation for classifying image stimulus.
- DNN using BOLD response better learner in classification task- compared to ResNet.
- Hierarchical processing of information provided better accuracy than processing information from all ROIs together.

Limitations and Further Work-

- Non-availability of true labels.
- Can be further extended to understand similarity between BOLD representation when objects become similar.
- Check the validity of the model with other similar type of datasets to validate our conclusion.

Thank You !