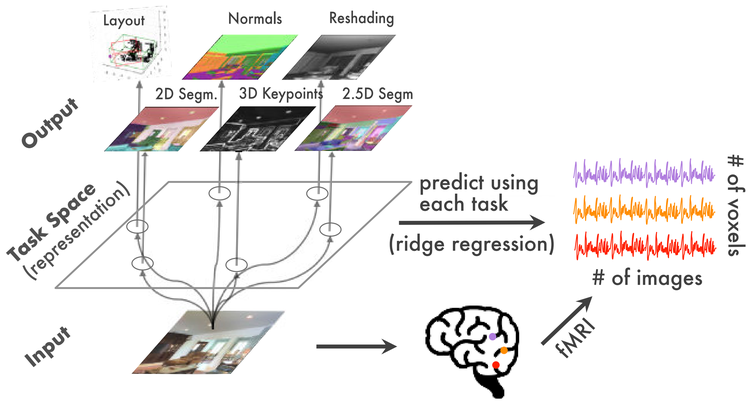
# Neural Taskonomy: Inferring the Similarity of Task-Derived Representations from Brain Activity

Aria Y. Wang[1,2], Michael J. Tarr[1,2,3], Leila Wehbe[1,2]
[1]Carnegie Mellon Neuroscience Institute, [2]Machine Learning Department, [3]Department of Psychology

## Introduction

- "Taskonomy" describes the task relationships found through transfer learning using computer vision models[1].
- The Goal: Does the brain represent task information the similar way as found through transfer learning?
- BOLD5000[2] – fMRI dataset using stimuli sampled from ImageNet, COCO and SUN.

## Methods

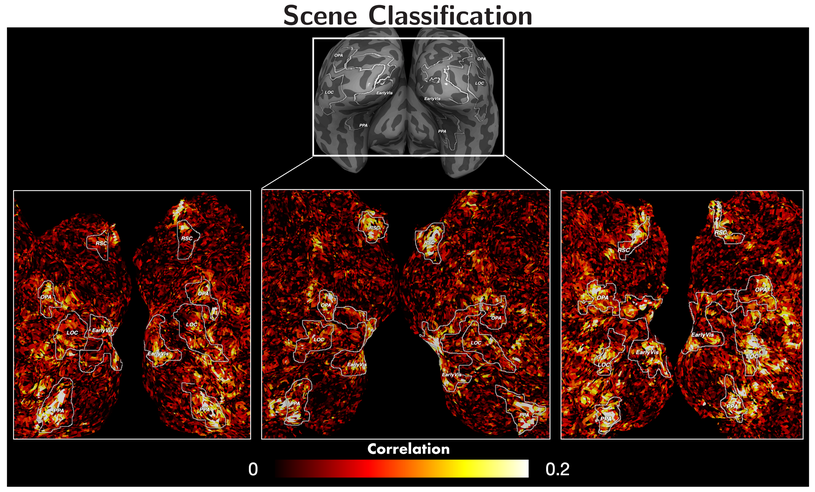



- We extracted features from the latent spaces of 21 vision tasks in the Taskonomy model bank[1] and constructed encoding models with individual task representation spaces to predict brain activity (about 50,000 voxels) to images. Similarity among prediction maps were then used to infer the relationships between tasks.

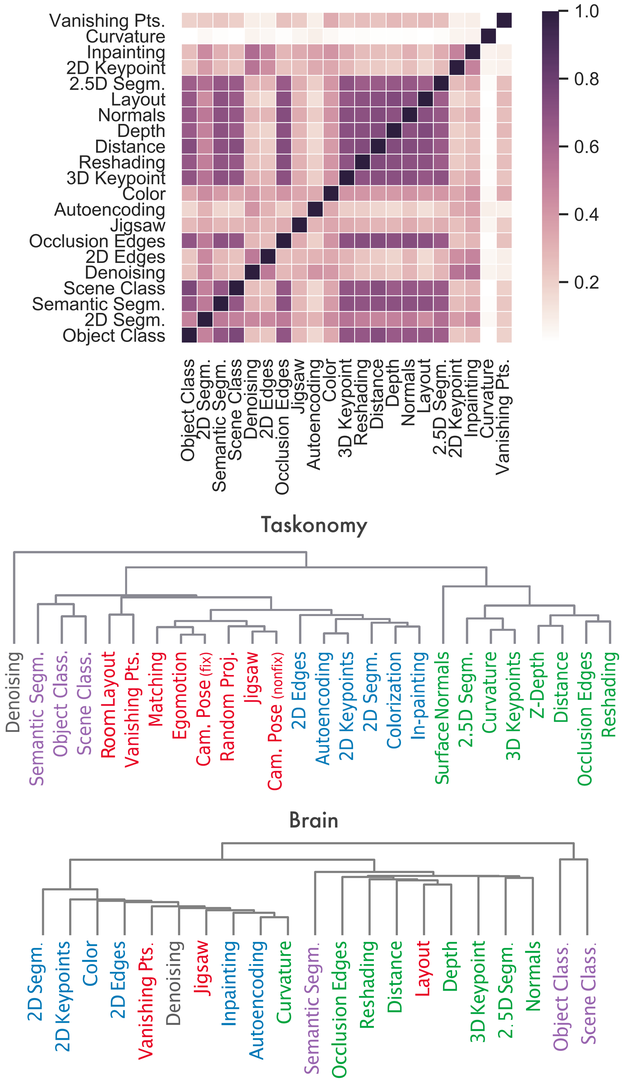
## References

[1] A. R. Zamir et al. "Taskonomy: Disentangling task transfer learning". In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2018, pp. 3712–3722.
[2] N. Chang et al. "BOLD5000, a public fMRI dataset while viewing 5000 visual images". In: *Scientific data* 6.1 (2019), p. 49.

## Model Performance - Whole Brain




## Neural Taskonomy




## Conclusions

- Task-specific models are useful for explicating the neural encoding of task-related information.
- Features from 2D tasks and 3D tasks recruit distinct regions of visual cortex (3D features preferred).
- The neural representation of different tasks can be used to infer the relationships between tasks.