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

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Introduction

- “Taskonomy” describes the task relationships found through transfer learning using computer vision models.
- The Goal: Does the brain represent task information the similar way as found through transfer learning?

- BOLD50002 – fMRI dataset using stimuli sampled from ImageNet, COCO and SUN.

Model Performance – Whole Brain

- Scene Classification
- Distance
- 2D Segmentation
- 3D vs. 2D Segmentation
- 3D vs. 2D Keypoints
- 3D vs. 2D Edges

Neural Taskonomy

- Object Class
- 2D Segm.
- Semantic Segm.
- Scene Class
- Denoising
- 2D Edges
- Occlusion Edges
- Jigsaw
- Autoencoding
- Color
- 3D Keypoint
- Reshading
- Distance
- Depth
- Normals
- Layout
- 2.5D Segm.
- 2D Keypoint
- Inpainting
- Curvature
- Vanishing Pts.

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.

Methods

- 2D Segm.
- 3D Keypoints
- 2.5D Segm
- Normals
- Reshading

Output

Task Space (representation)
Input

# of images
predict using each task
(fMRI)
ridge regression

Acknowledgement and References

This work is supported by the CMU Center of Excellence on Human-Machine Teaming.
