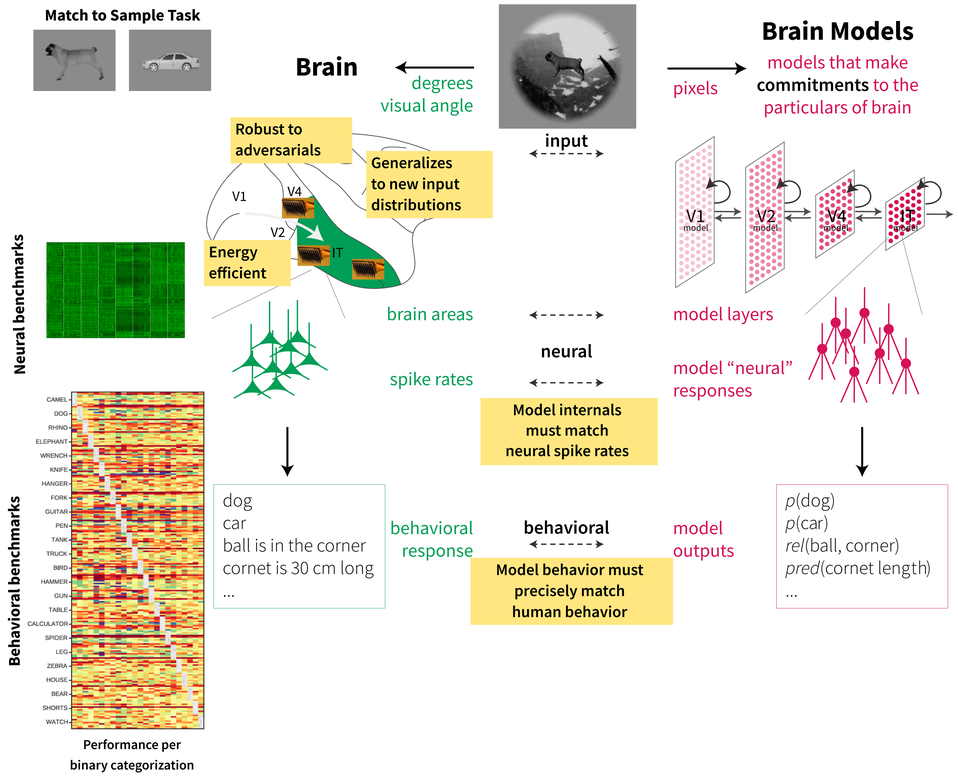
Brain-Like Object Recognition with High-Performing Shallow Recurrent ANNs

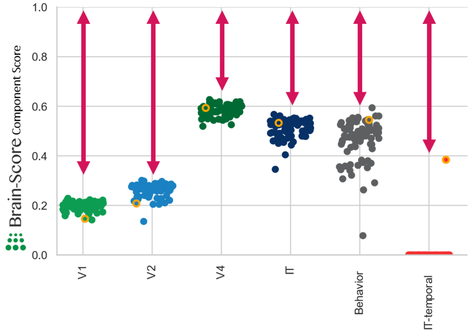
Jonas Kubilius*, Martin Schrimpf*, Kohitij Kar, Rishi Rajalingham, Ha Hong, Najib J. Majaj, Elias B. Issa, Kohitij Kar, Pouya Bashivan, Jonathan Prescott-Roy, Kailyn Schmidt, Aran Nayebi, Daniel Bear, Daniel Yamins, and James J. DiCarlo

github.com/dicarlolab/neurips2019
github.com/dicarlolab/cornet
brain-score.org

Object Recognition in the Brain



Lots of work to do



Things models are not yet capturing:
- V1/V2 benchmarks (Normalization)
- Causal Experiments
- Topography (Energy)
- Side-reads (Fast inference)
- Long-range feedback
- …

We could use your help! Submit your model on www.Brain-Score.org

Acknowledgments

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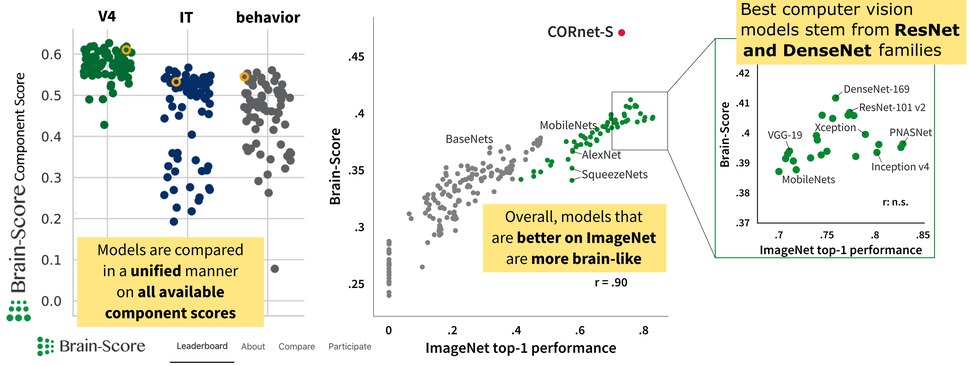
Large Scale Model Comparison on Brain-Score

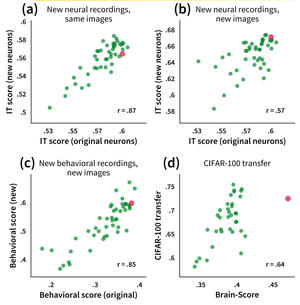


Brain-Score Leaderboard About Compare Participate

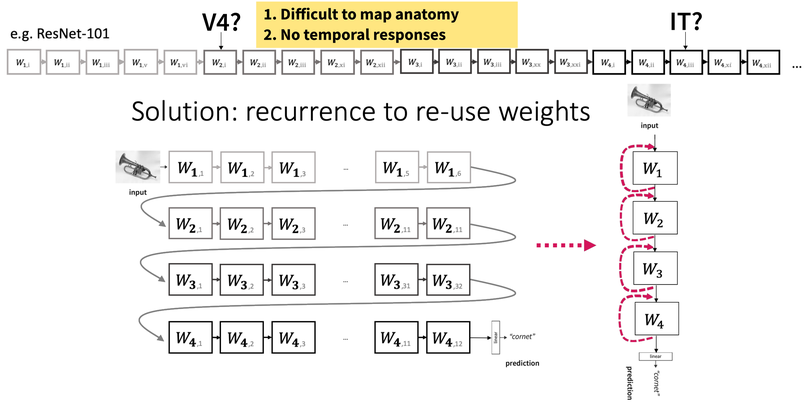
Rank	Model	average	V4	IT	behavior	ImageNet
1	CORnet-S *Kubilius et al., 2018*	.539	.781	.730	.545	.747
2	resnet-50_v2 *He et al., 2015*	.509	.780	.710	.553	.766
2	resnet-101_v1 *He et al., 2015*	.509	.775	.738	.561	.764
4	densenet-169 *Huang et al., 2016*	.508	.788	.736	.543	.759
4	resnet-101_v2 *He et al., 2015*	.508	.784	.713	.555	.774
6	resnet-152_v1 *He et al., 2015*	.507	.779	.740	.533	.768
6	densenet-201 *Huang et al., 2016*	.507	.777	.738	.537	.772
8						

We are going to add more and more benchmarks that evaluate all available models

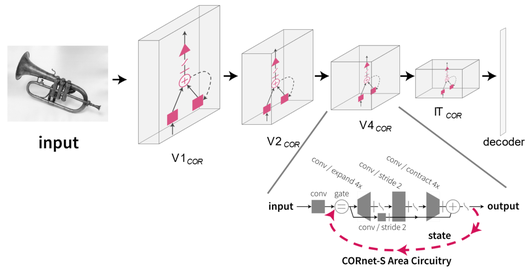
Benchmarks generalize to new data



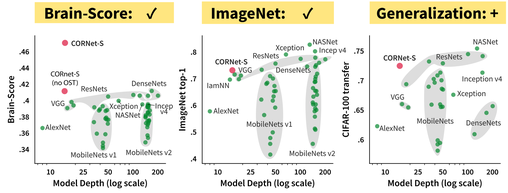
Model-Brain Mismatch: Two Problems



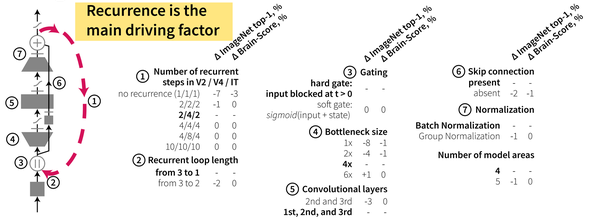
CORnet-S: A Shallow Recurrent ANN



CORnet-S Rivals Deeper Networks

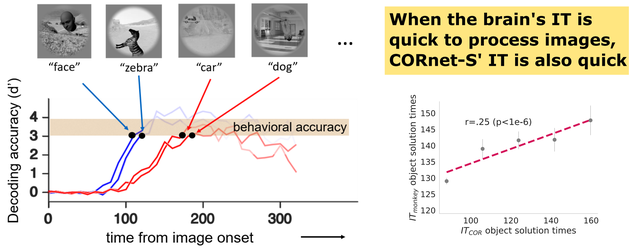


Driving Factors for CORnet-S Performance



CORnet-S Predicts Temporal Dynamics

Kar et al., Nature Neuroscience (2019)



When the brain's IT is quick to process images, CORnet-S' IT is also quick

Unlike feedforward models, CORnet-S can **predict neural responses over time**