

# Deep generative models for decoding visual stimuli from brain scans

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Despite over a century of research, essential principles of brain function remain elusive. In particular, we know little about how the brain encodes visual information and pays attention to particular objects in cluttered scenes. In this project, we will have subjects view and pay attention to particular objects or features in cluttered scenes. We will simultaneously record brain activity with functional MRI and EEG. From these scans, we will try to decode -- classify, and even "reconstruct" -- what the subject was viewing/paying attention to in the cluttered scene. We will use deep neural networks, and deep generative models including GANs, VQVAEs, and more recent diffusion models. The ultimate goal is to try and understand how the brain encodes visual information, and how it prioritizes some of that information for behavioral decisions.

## Additional reading

- <https://www.nature.com/articles/ncomms15037>
- <https://proceedings.neurips.cc/paper/2019/file/7d2be41b1bde6ff8fe45150c37488ebb-Paper.pdf>
- <https://doi.org/10.1016/j.neuroimage.2021.118812>