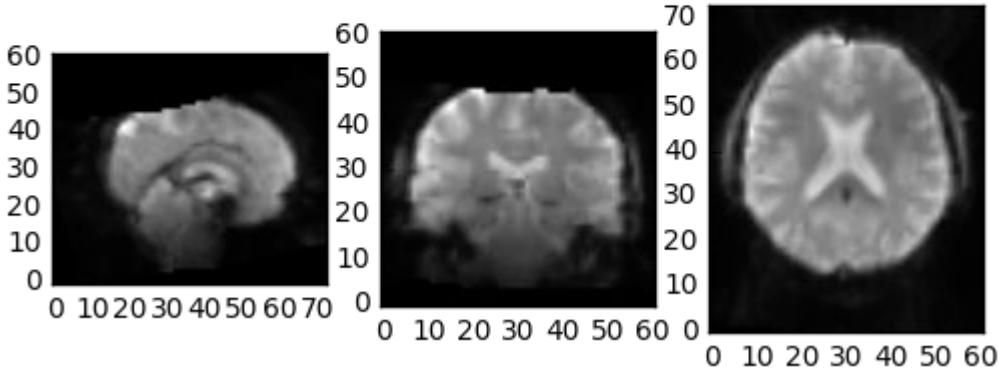
By Daniel Helm

Detecting Autism from rs-fMRI data



The Domain

rs-fMRI:

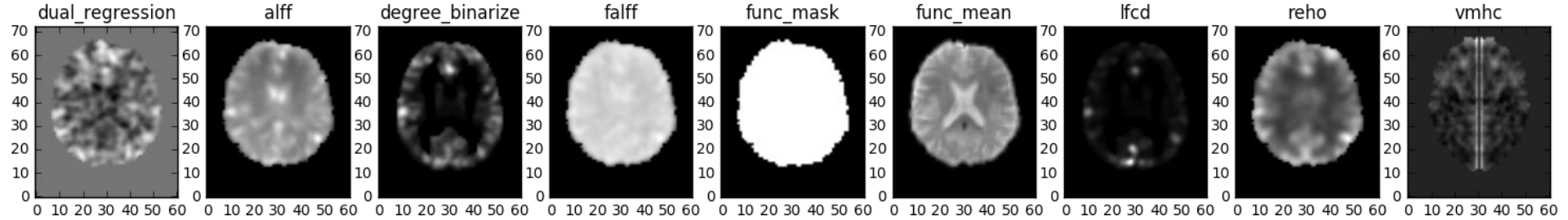
- Resting State Functional Magnetic Resonance Imagery
- Measures blood oxygen levels across time as a proxy for neural activity

ABIDE I Preprocessed Data Set:

- 1112 subjects with 573 typical controls and 539 individuals with ASD

fMRI imagery:

- Volumetric Data across time (61 x 70 x 60 x ~100-200 time steps)
- Statistical derivatives available, used as channels of 3D space



The Experiment

- Plan A: Features will be learned using a stacked autoencoder

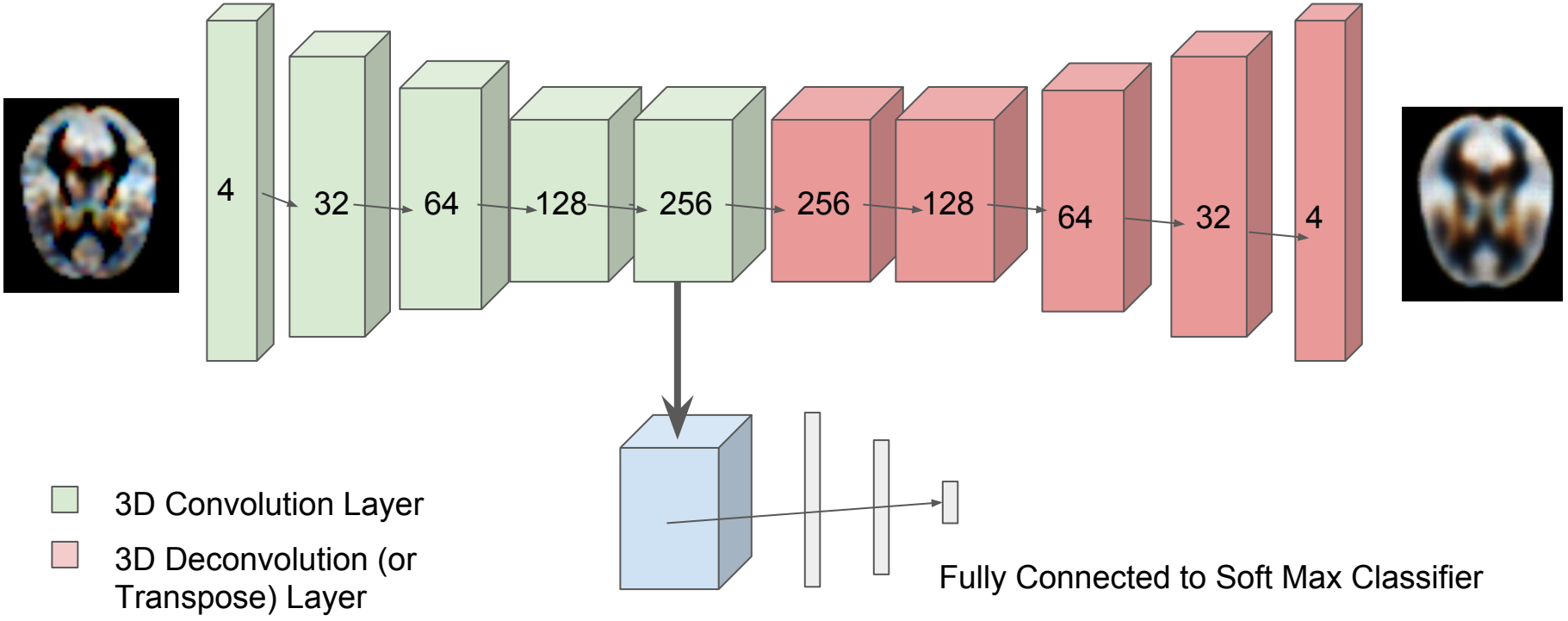
- Plan B: I will transform data to 227x227x3 and use pre-trained weights from a successful ImageNet model

I've done this! To be more precise:

- I used a stacked convolutional autoencoder
- This is called Transfer Learning, and I used a model with no height or width restrictions.

Note: All of this was made for success metrics and to feed my own fully connected network. It was written and run using TensorFlow on a single GPU with 8GB of memory. I abandoned OSCER ambitions.

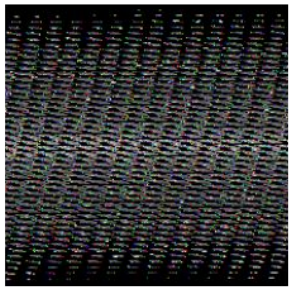
a. Stacked Convolutional Autoencoder



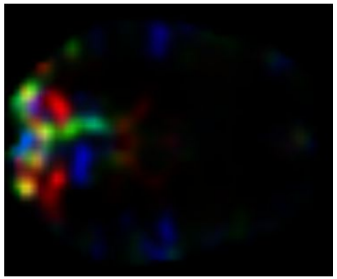
b. Transfer Learning with VGG-19

Challenge:
-Input must be 2D, 3 Channels

Solutions:

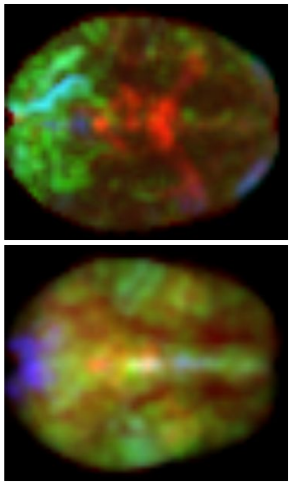


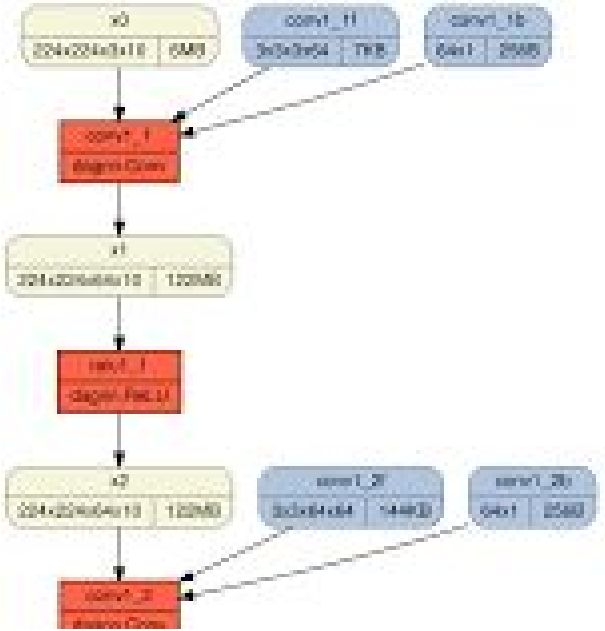
a) Reshape

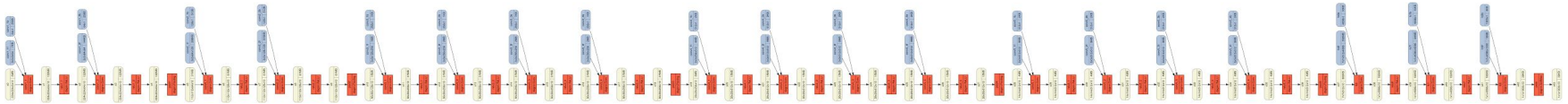


b) Slice

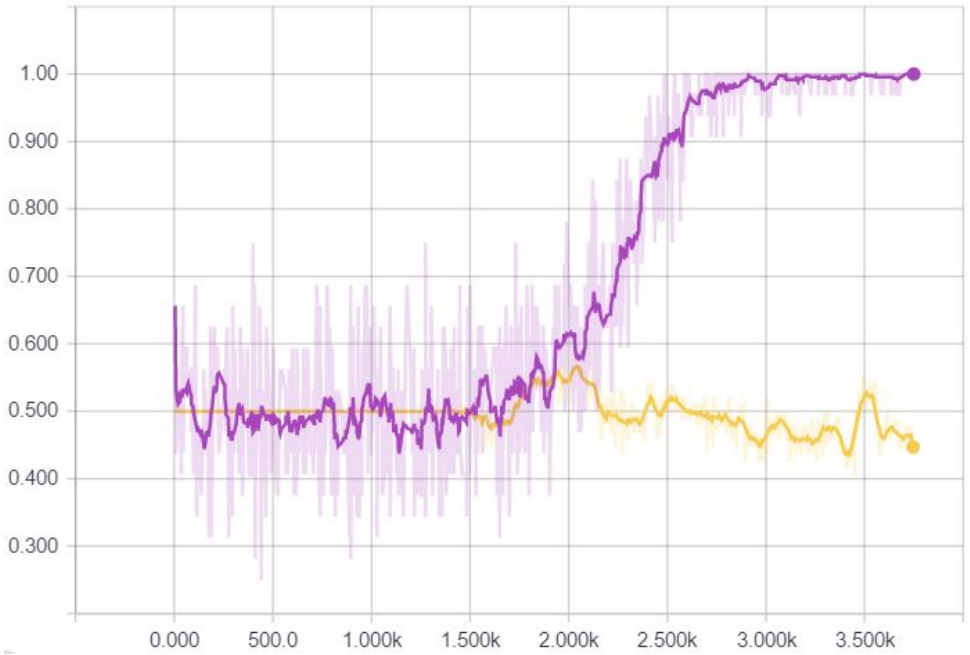
c) Max or Mean Project
1 Derivation / channel

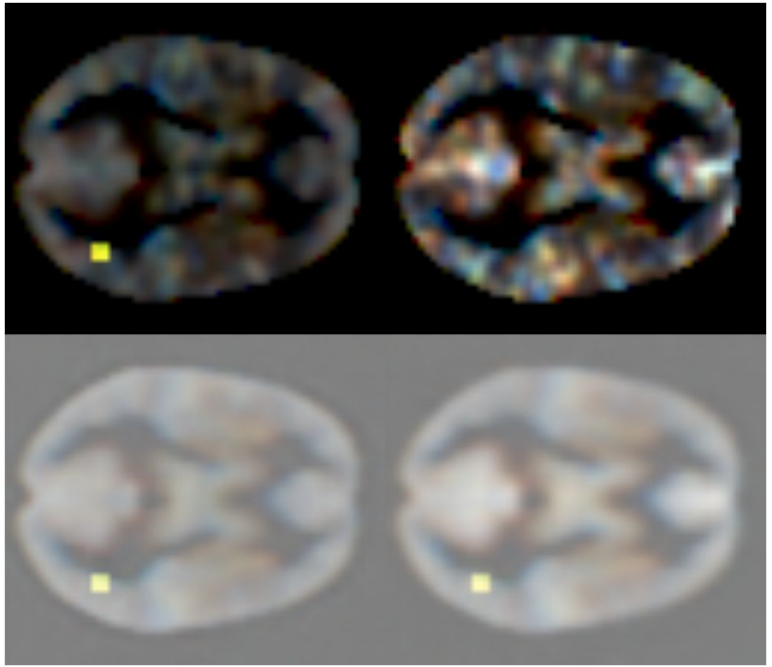




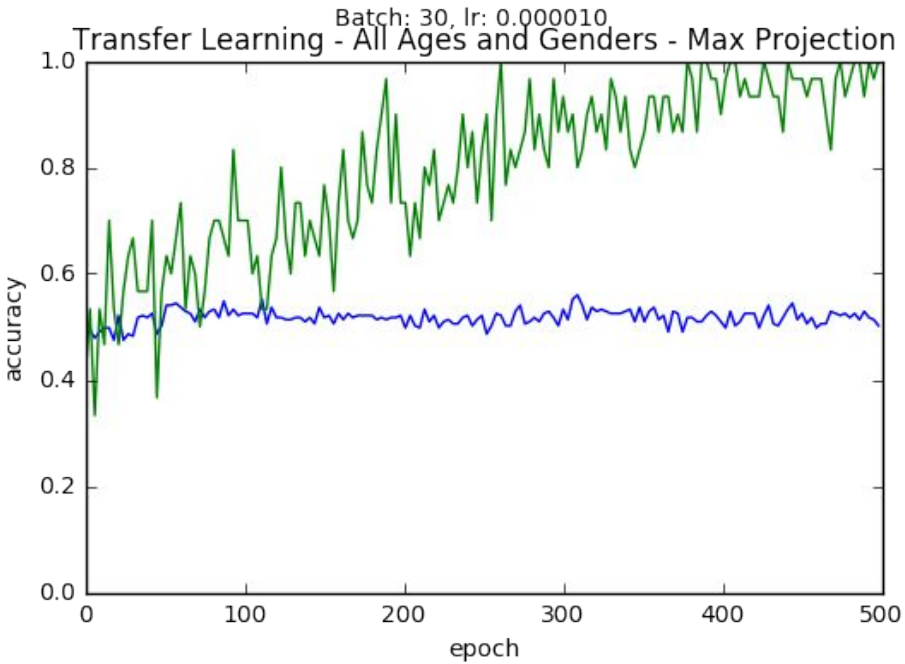


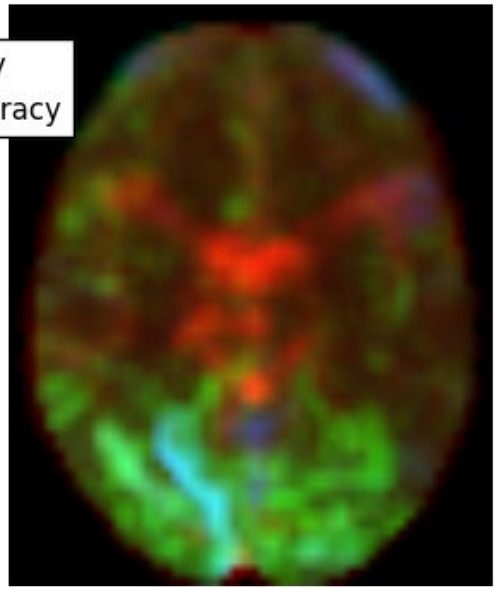
The Results - Autoencoder





The Results - Transfer Learning





What is left?

For me? Keep experimenting:

- Transfer Learning: More projection methods and tweak parameters
- Autoencoders: Tests are currently being run doing “layerwise” training, I may also try integrating “denoising” which feeds the input areas of dropped pixels while comparing it to full volume output.

For others?:

- Combining ABIDE I with the ABIDE II, ADHD data sets and more to build robust feature models of the brain that can be applied to any neuroscience problem. Transfer Learning for fMRI data.

The Questions