



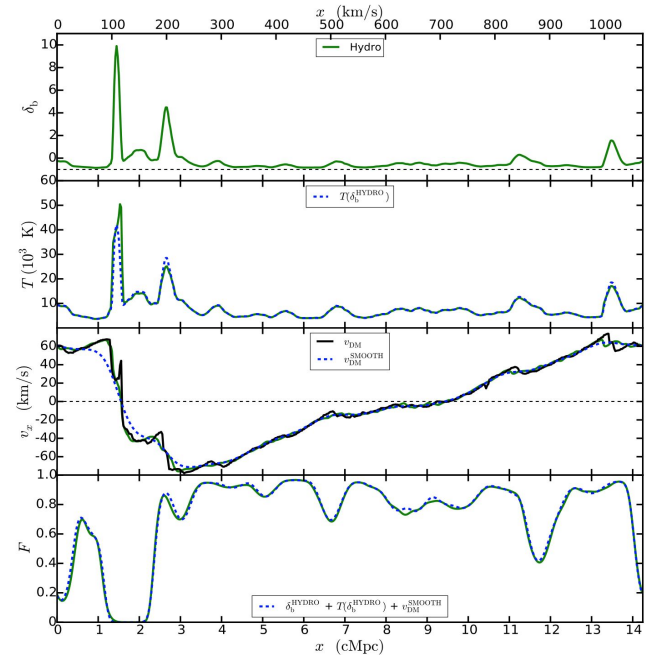
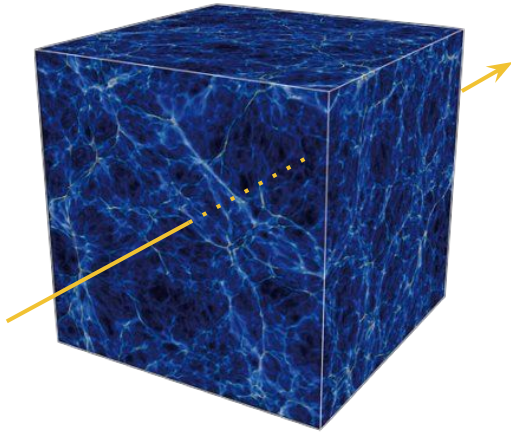
Generating 1D Skewers with GANs

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Premise

- Lyman- α forest simulation generates cubes of baryon densities
- Extract 1D skewers to make data more manageable



Model Compression

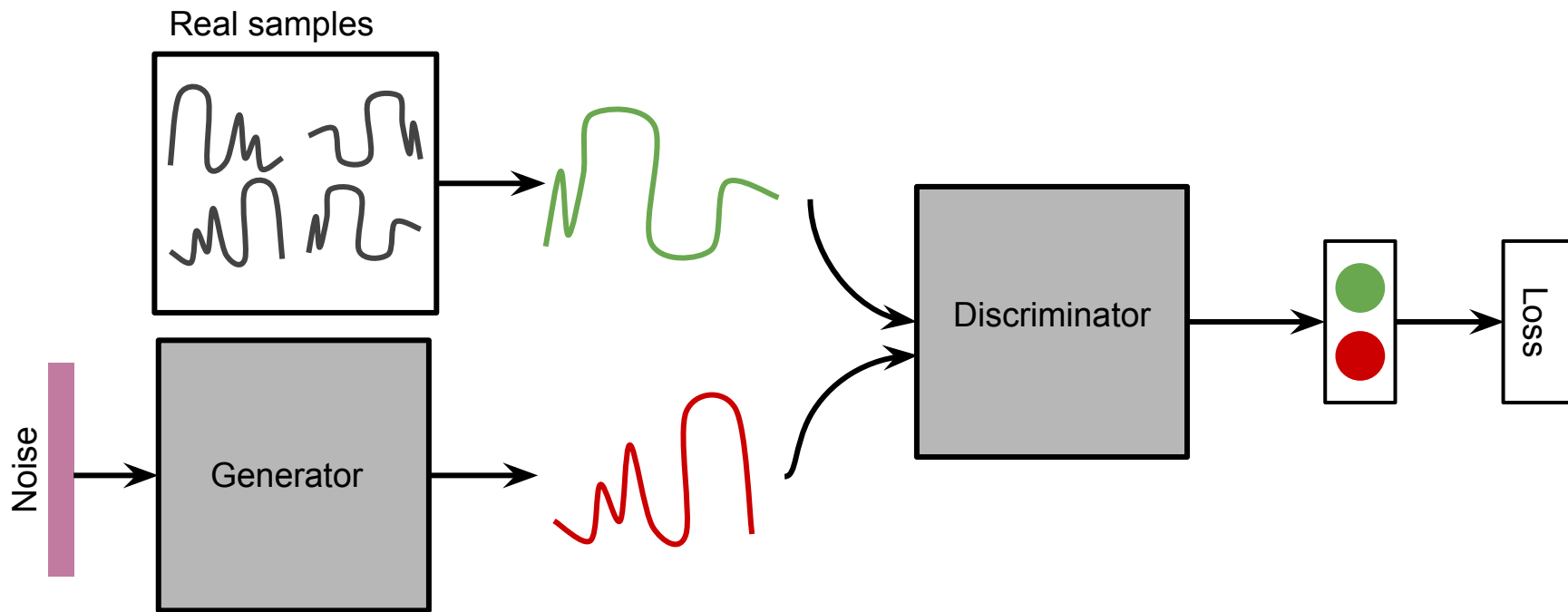
- Original model is computationally intensive
- How can we compress it to just generate skewers?
 - For now: just independent skewers
 - Future: generate a bundle of skewers belonging to a single cube

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GANs!

Skewer GAN



Implications of 1 dimension

- Most GAN implementations in current literature are on 2D images
- Hyperparameters need to be retuned for new 1D architecture
- Unexpected complication:
 - TensorFlow functionalities are aimed at data with 2+ Dimensions (even the simplest functions: 2D or 3D)
 - Work around — keep 2D data structure, but ignore the second dimension

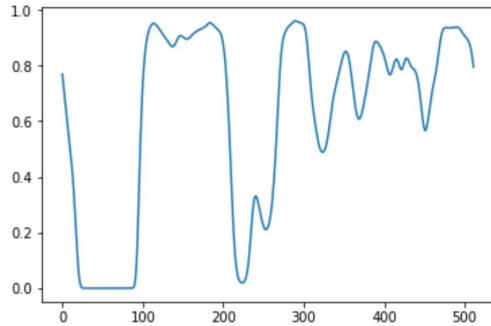
```
conv1d  
conv2d  
conv2d_backprop_filter  
conv2d_backprop_input  
conv2d_transpose  
conv3d  
conv3d_backprop_filter_v2  
conv3d_transpose
```

TensorFlow Convolution Layers

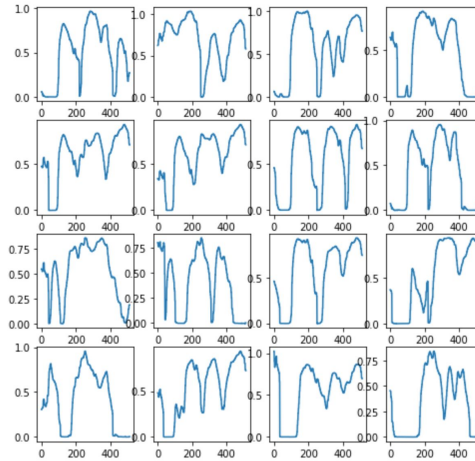
Current Results

- Toy model built with (mostly) reasonable results

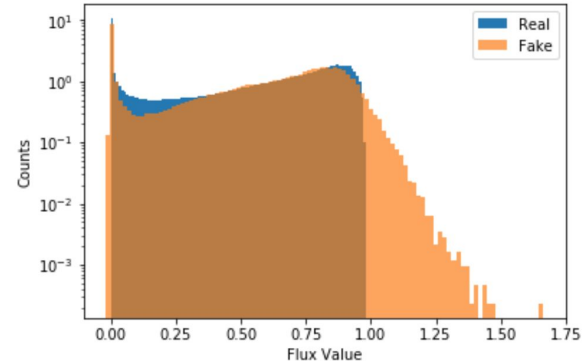
Real sample



Fake samples



Comparing distributions



- TensorFlow model now implemented and running
- Working on selecting the optimal architecture

Future Advances

Technical:

- GANs generally still have trouble converging
 - Implement recent suggestions in field to improve stability:
 - Wasserstein GAN
 - Progressive resolution growth while training GAN

Cosmological:

- Move from independent skewers to bundling skewers in a cube
- Include multiple features in each skewer; learn to reconstruct fields given others from the same skewer
 - **Example:** given *flux* and *velocity* profiles, generate corresponding *temperature* profile