

Auto-Stereo

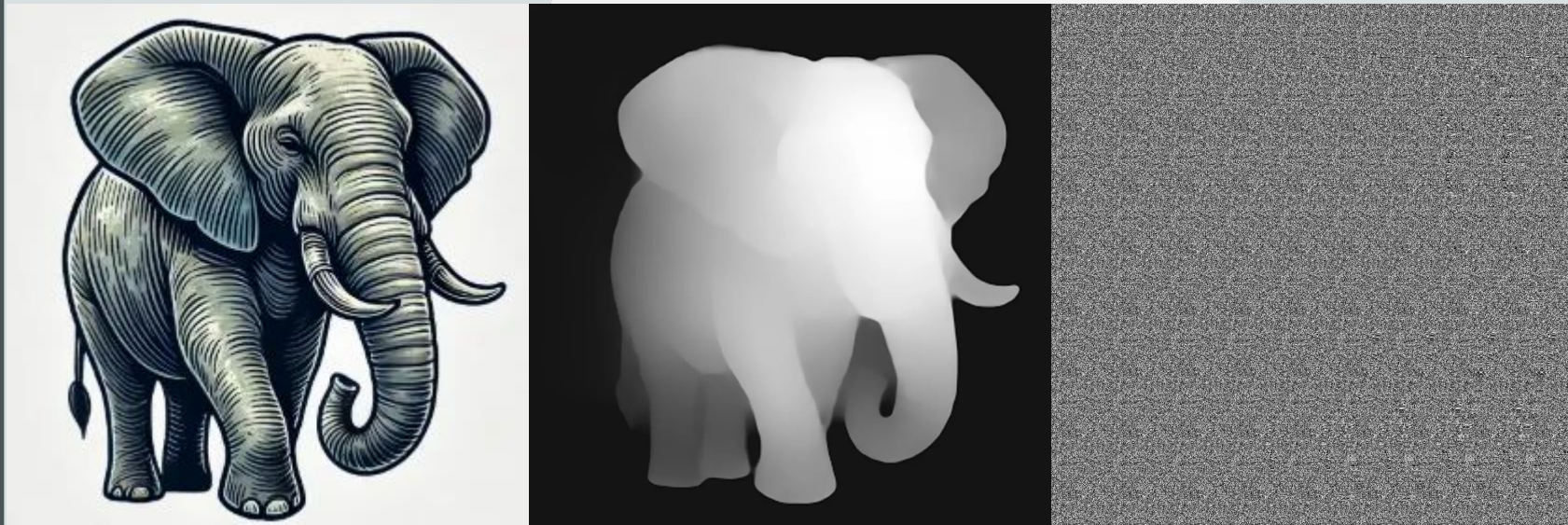
Aidan Mokalla
Computer Science 378
Reed College
May 2025

STEREOGRAMS

2

·3D:

Quasi-periodic
Stereopsis & Disparity

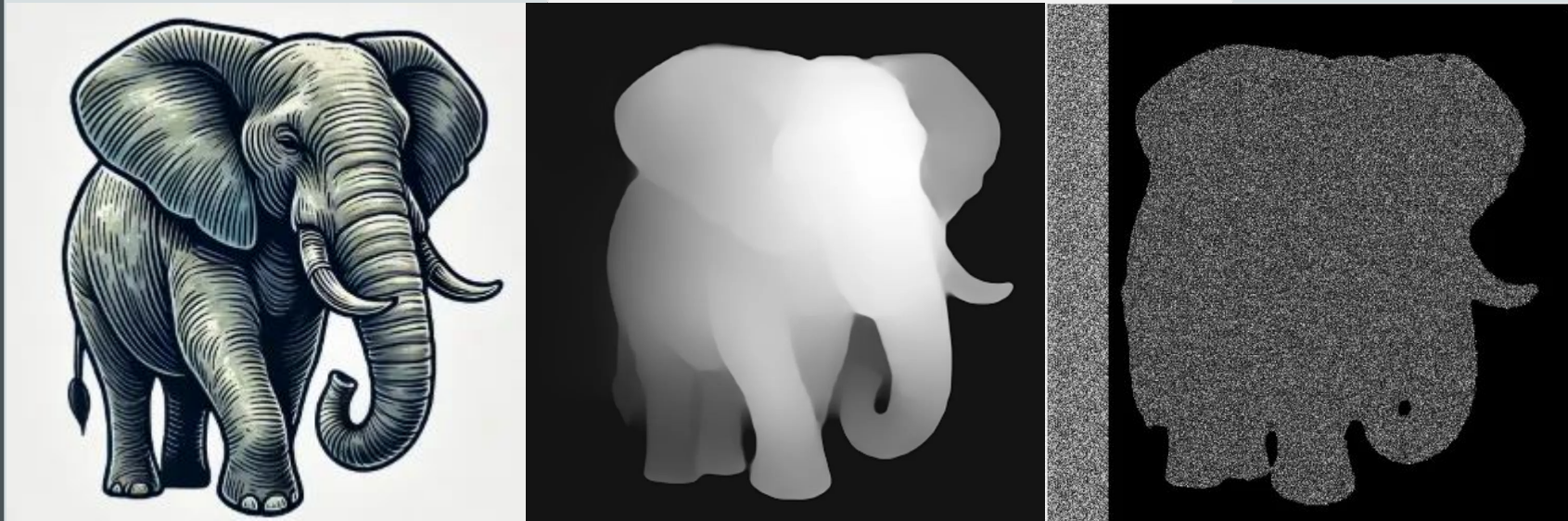


STEREOGRAMS

2

·3D:

Quasi-periodic
Stereopsis & Disparity



The background is a grayscale, high-angle photograph of a dense urban environment, specifically a tall apartment building. The building's facade is characterized by a repeating pattern of balconies and windows. A dark gray grid is overlaid on the image, with a central rectangular area containing the text. The grid lines are thin and extend across the entire frame.

Depth-Dependent Horizontal Pixel Shifting

Depth Map to Stereogram

PLAN A

4

Learn conversion from
stereograms to depth maps

- CNN
- Residual
- Fully-connected initial
layers

- Noisy

PLAN B

5

Build something new atop
existing models:

Image



Depth Map



Stereogram

Depth Anything

Image to Depth Map

Depth Anything

7

- Issue: No quality image dataset w/ depth labels

Depth Anything

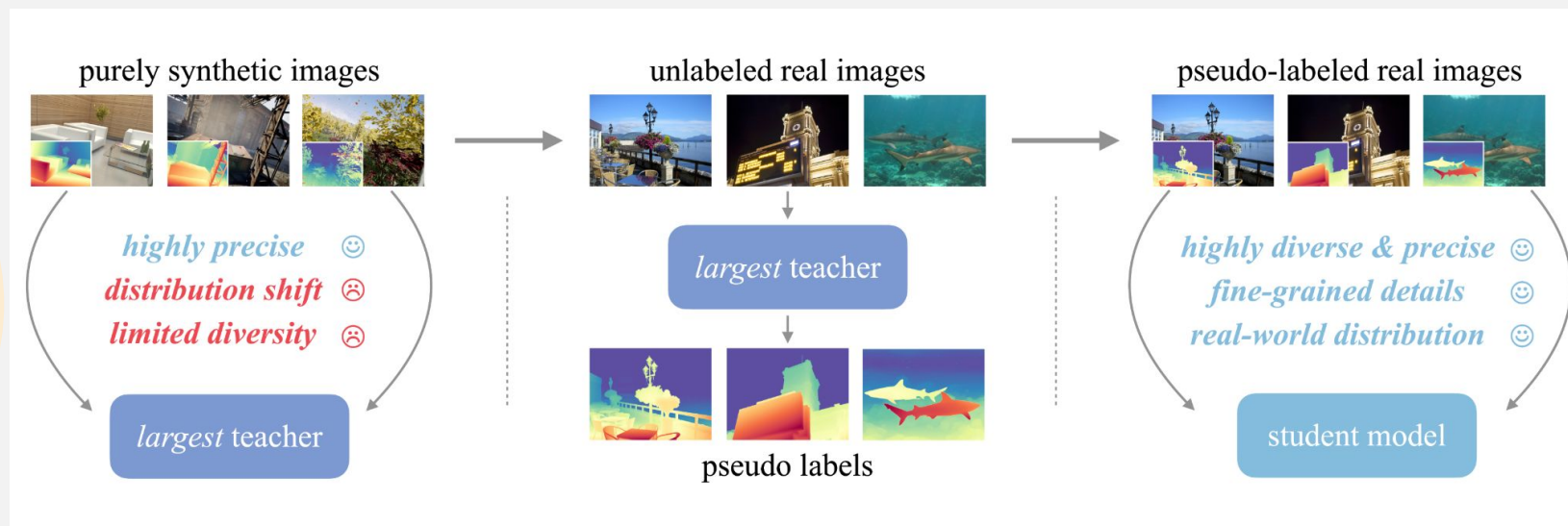
7

- Issue: No quality image dataset w/ depth labels
- Solution: Teacher-student model

Depth Anything

7

- Issue: No quality image dataset w/ depth labels
- Solution: Teacher-student model



- Teacher
 - Learns from synthetic data
 - Labels real data
- Student
 - Learns from real data

An aerial view of the London skyline, featuring prominent buildings like the Gherkin and the Shard. The image is overlaid with a black grid consisting of two vertical and two horizontal lines, creating a 3x3 grid pattern. The text is centered in the middle of the grid.

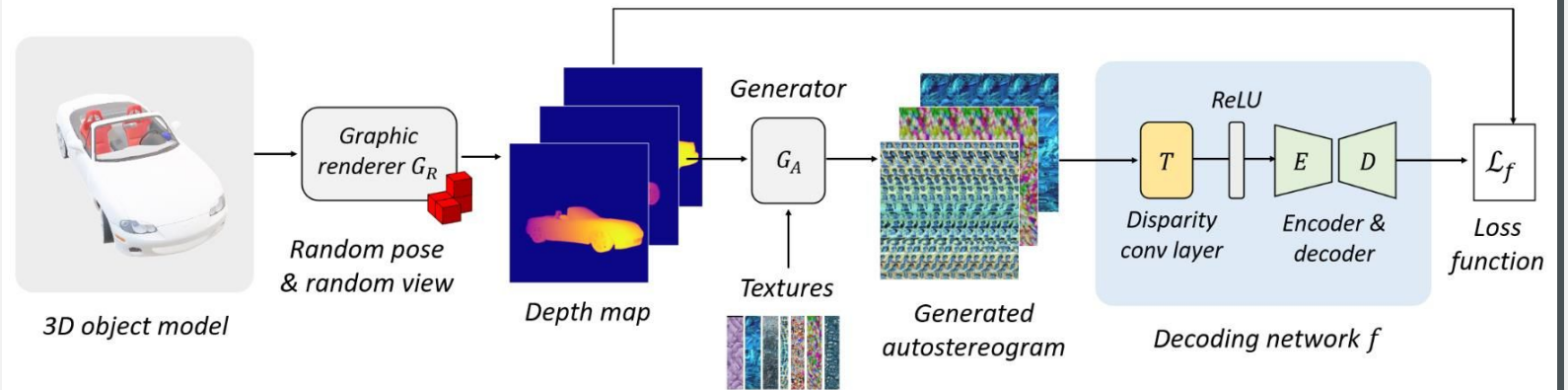
Neural Magic Eye

Stereogram to Depth Map

Neural Magic Eye

9

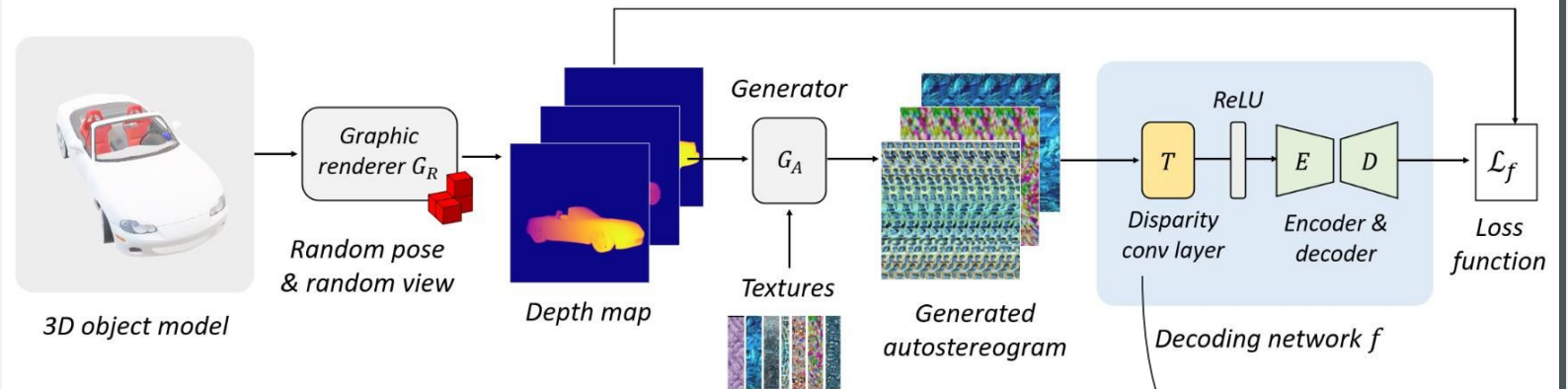
- *Disparity* convolution + standard convolutional autoencoder



Neural Magic Eye

9

- *Disparity* convolution + standard convolutional autoencoder



$$u(i, j, s) = \sum\{k = 1..c: |x(i, j, k) - x(i, j - s, k)|\}$$

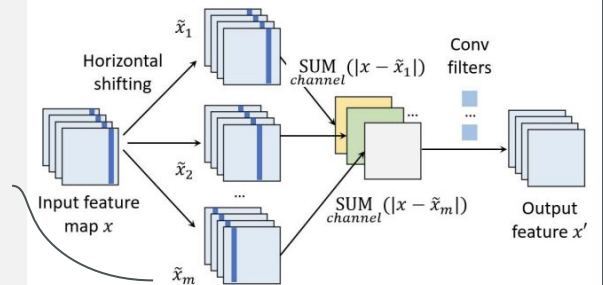


Figure 4: An illustration of the proposed disparity convolution layer.

Neural Magic Eye

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- *Disparity* convolution + standard convolutional autoencoder
- SOTA

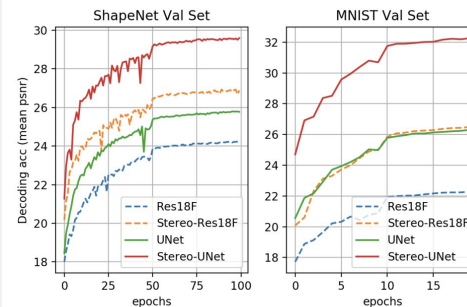
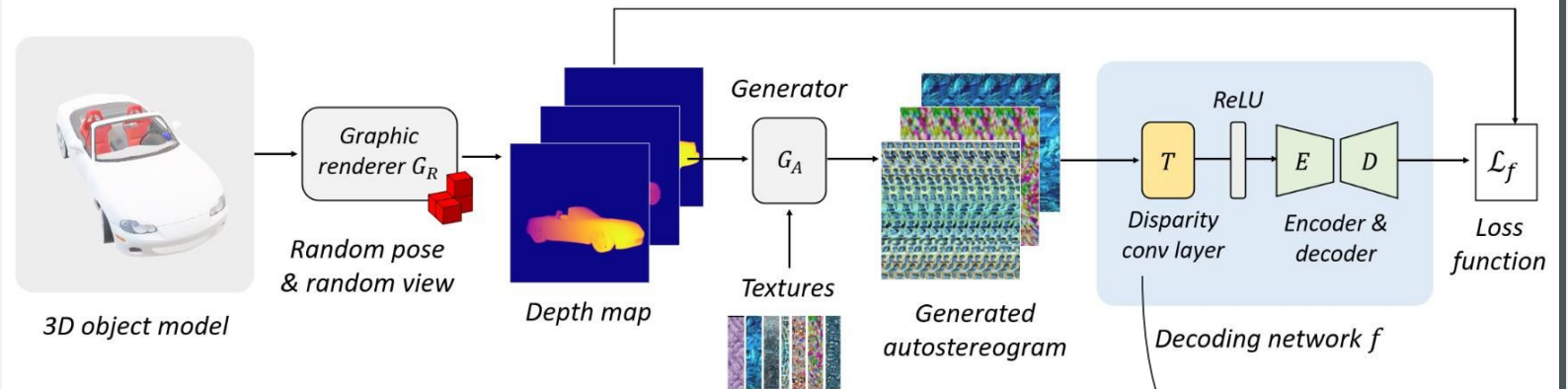


Figure 11: Validation accuracy on different training epochs with (Stereo-Res18F, Stereo-UNet) and without (Res18F, UNet) using disparity convolutions.

$$u(i, j, s) = \sum_{k=1..c} |x(i, j, k) - x(i, j - s, k)|$$

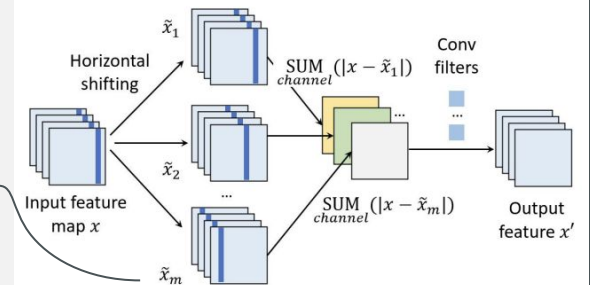


Figure 4: An illustration of the proposed disparity convolution layer.



Auto-Stereo

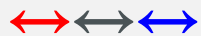


Auto-Stereo

Image



Depth Map

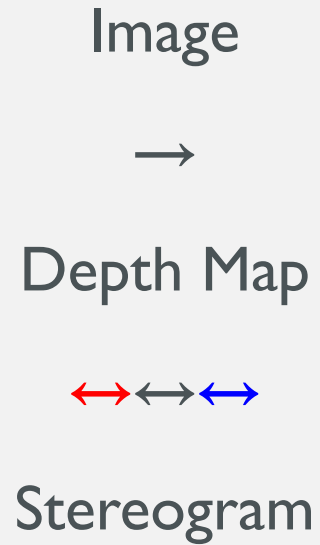


Stereogram

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Auto-Stereo

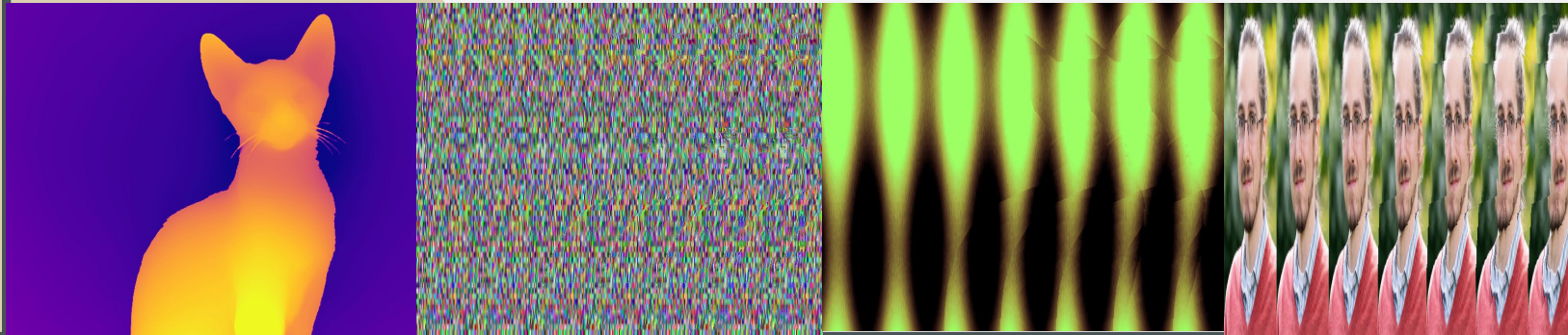
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- python3
depth_anything_stereogram.py
--input
/home/aidanm/scratch/DL/CSCI378/data/oxford_pets/images/Abyssinian_24.jpg **--input_type** image
--textures random,gradient
--texture_dir
/home/aidanm/scratch/DL/stereo/optional_textures

Images in Weftdrive:

/home/aidanm/scratch/DL/stereo/neural-magic-eye/results



Auto-Stereo

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Image



Depth Map

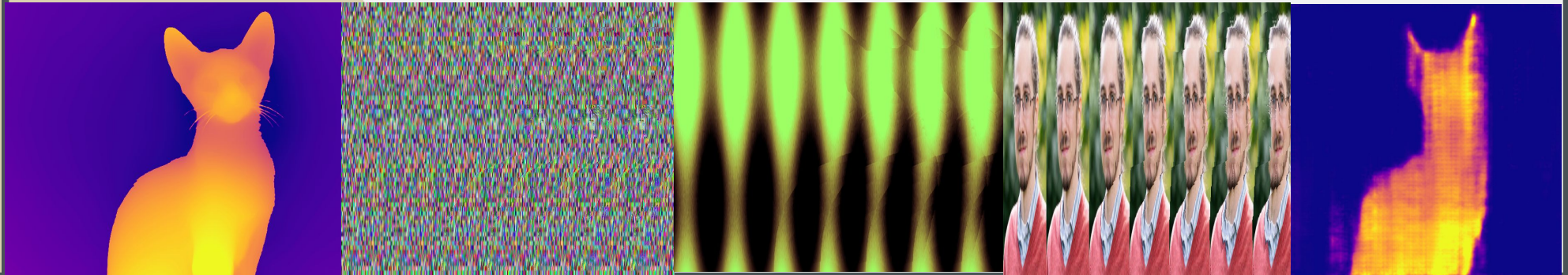


Stereogram

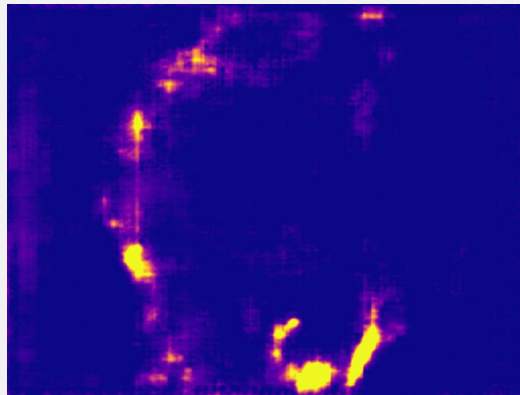
Images in Weftdrive:

/home/aidanm/scratch/DL/stereo/
neural-magic-eye/results

- ```
python3
depth_anything_stereogram.py
--input
/home/aidanm/scratch/DL/CSCI378/d
ata/oxford_pets/images/Abyssinian
_24.jpg --input_type image
--textures random,gradient
--texture_dir
/home/aidanm/scratch/DL/stereo/op
tional_textures
```
- ```
python3  
depth_anything_stereogram.py  
--input  
/home/aidanm/scratch/DL/stereo/  
neural-magic-eye/results/stereo  
gram_anderson-greg.png  
--input_type stereogram
```



- Packaging
 - Website
 - Automatic input type detection
- Watermarking
- Depth map to image?
- Tuning



Conclusion

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- Synthetic Distributions
- Priors & Inductive Biases
- Building on Previous Work

FIN