

# **CLASSIFYING TEXTURE IMAGES WITH CNNs & GENERATING NEW TEXTURE IMAGES WITH VARIABLE AUTOENCODERS.**

# PROJECT DESCRIPTION

- Attempt to refine last Capstone project:
  - Using Convolutional Neural Networks in order to classify image textures from Nintendo 64 games by use in game development or game modding.
- Use pre-trained CNNs to accurately classify CC0 or open source image textures across a variety of common useful categories
- Data was hand labeled into what I consider to be the most useful categories based on personal experience and input from game dev communities
- Compare new pre-trained models to ResNet-34 model used in last Capstone to track improvement
- Use a variational autoencoder to generate new image textures based on the most accurate predicted images per category from the best performing CNN model



# IMAGE TEXTURES



**2D COLOR IMAGE  
TEXTURE**



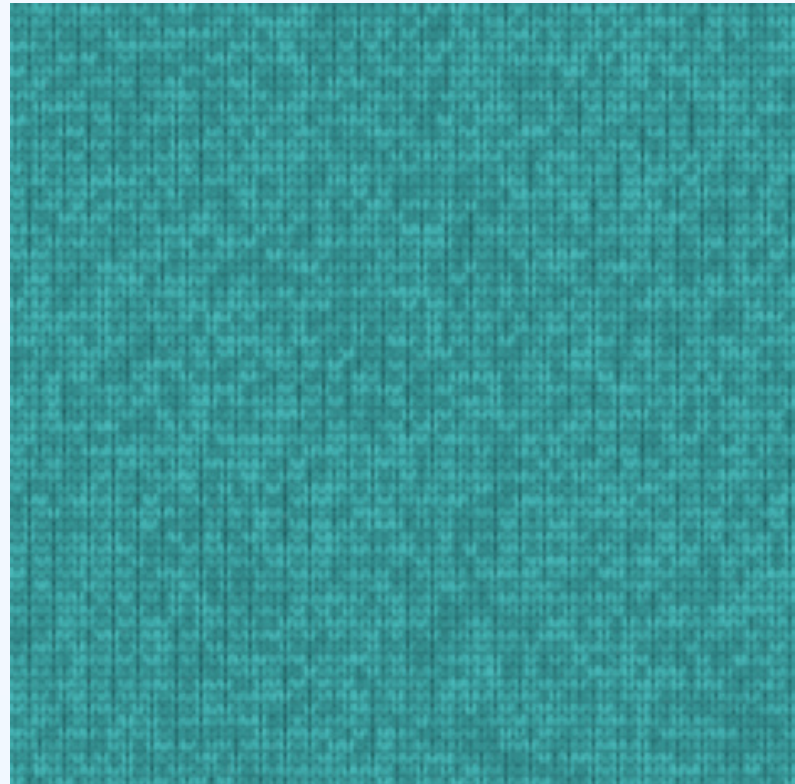
**“WRAPPED” AROUND 3D  
MODEL**



# DATA ORGANIZATION

- Around 1,500 .png and .jpg images were taken from **polyhaven.com**, **ambientcg.com** and **opengameart.org**
- Most images were 1024x1024 pixels in RGB colorspace
- Images were successfully labeled into 6 categories:

**FABRIC**



**METAL**



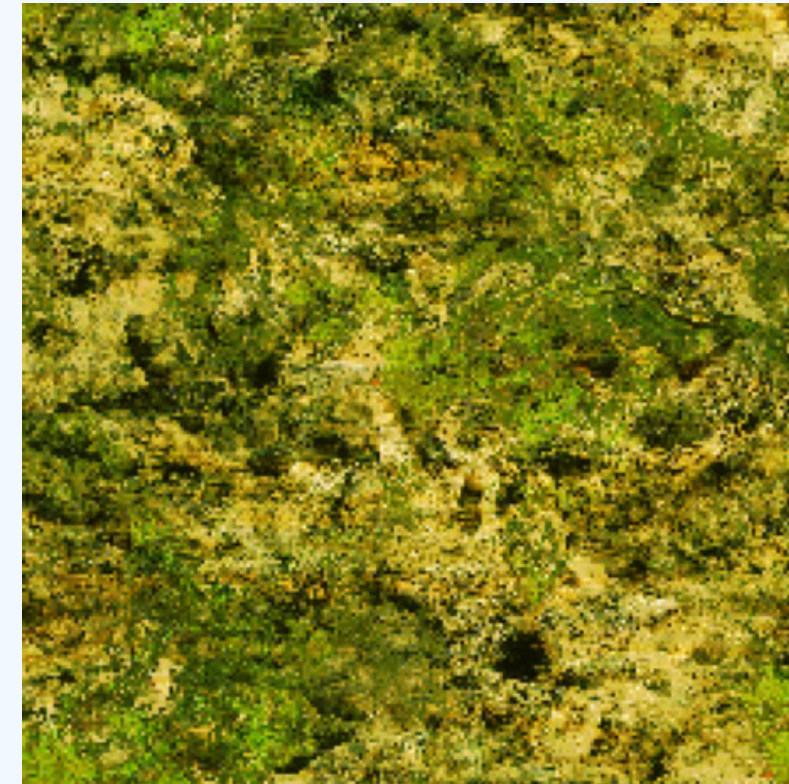
**MASONRY**



**STONE**



**TERRAIN**



**WOOD**

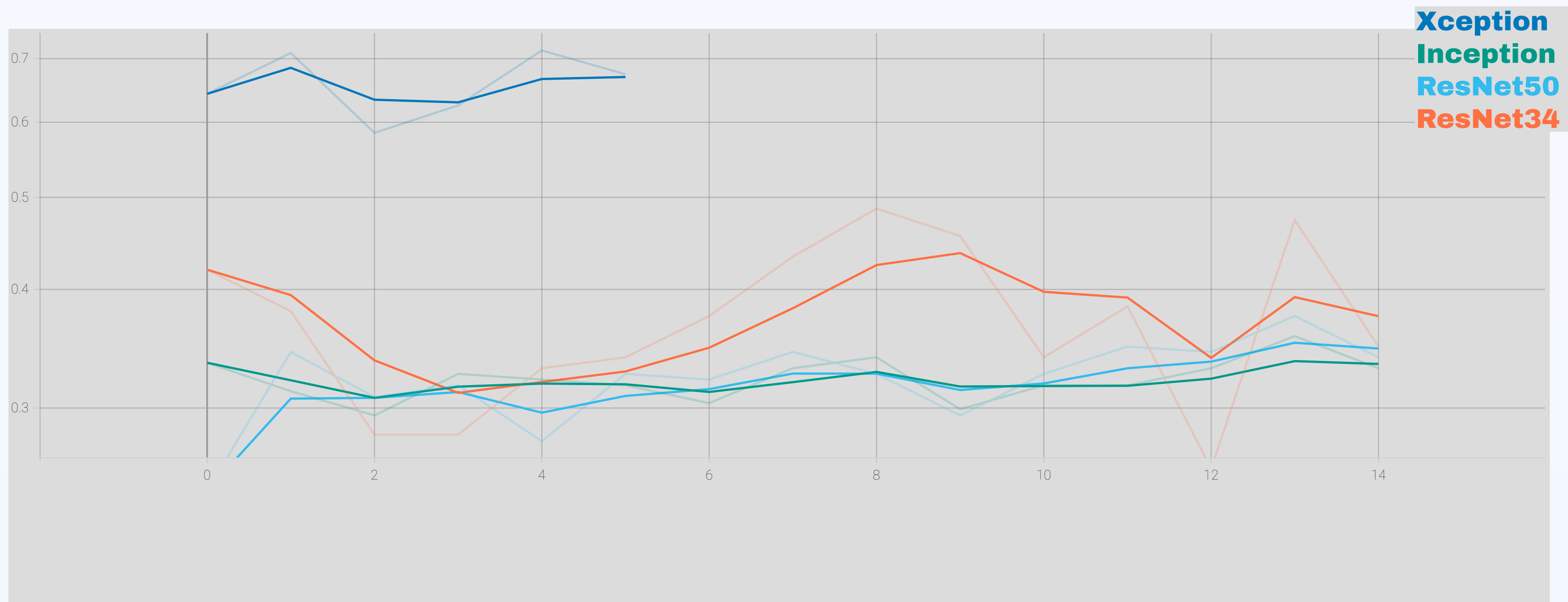




# MODEL DESCRIPTIONS

- In order to address the unbalanced nature of the the hand-labeled image sets, pre-trained models were used with weights inherited from the standard image dataset **ImageNet**
- Several models were attempted including: **ResNet 50, Inception, Xception and ResNet34**
- **ResNet34** model was the best performing model on last attempt at texture image classification
- **Xception** model was the most accurate by far

# ACCURACY SCORES



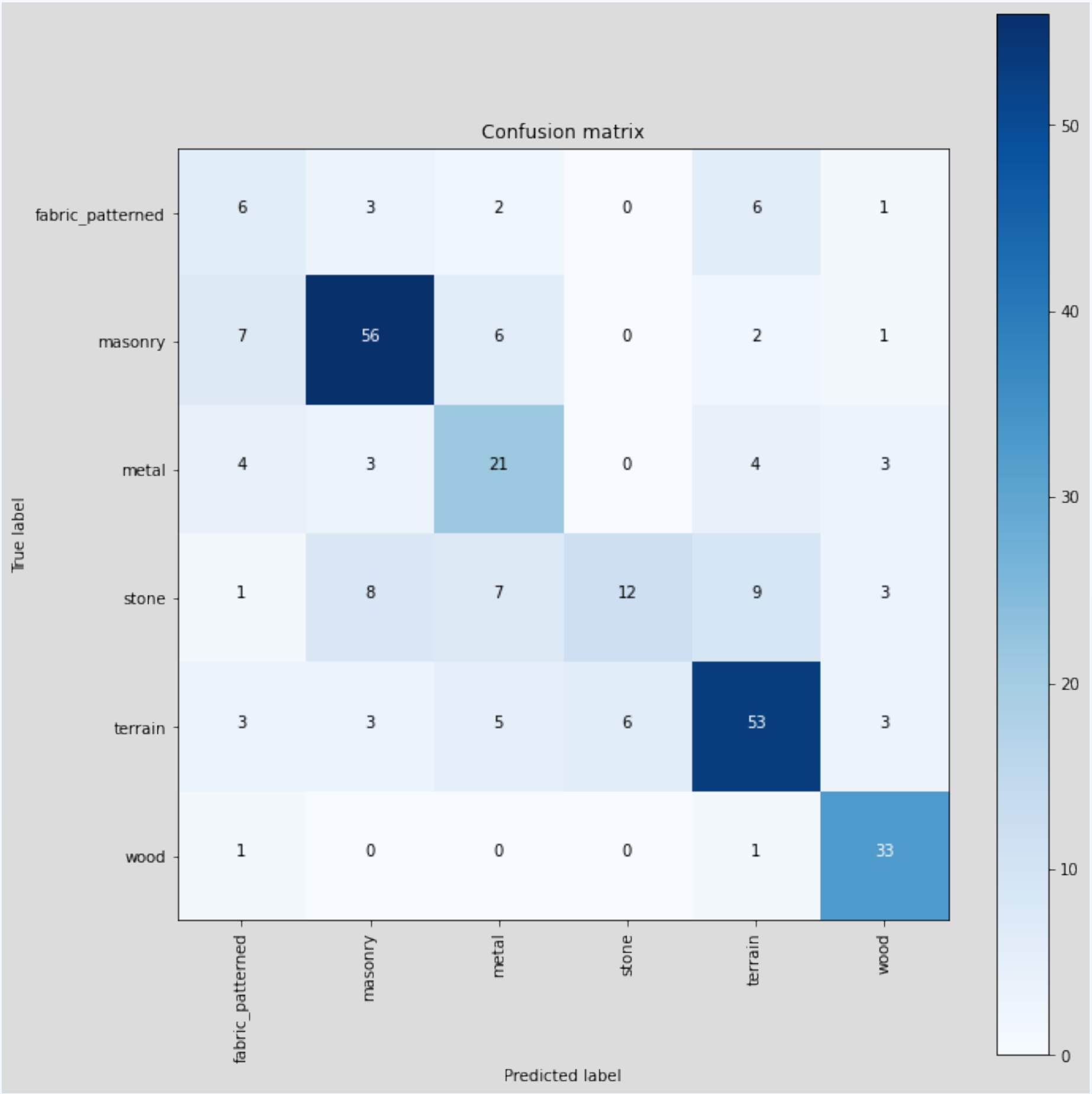
**Xception val accuracy: 0.82**

**Inception val accuracy: 0.36**

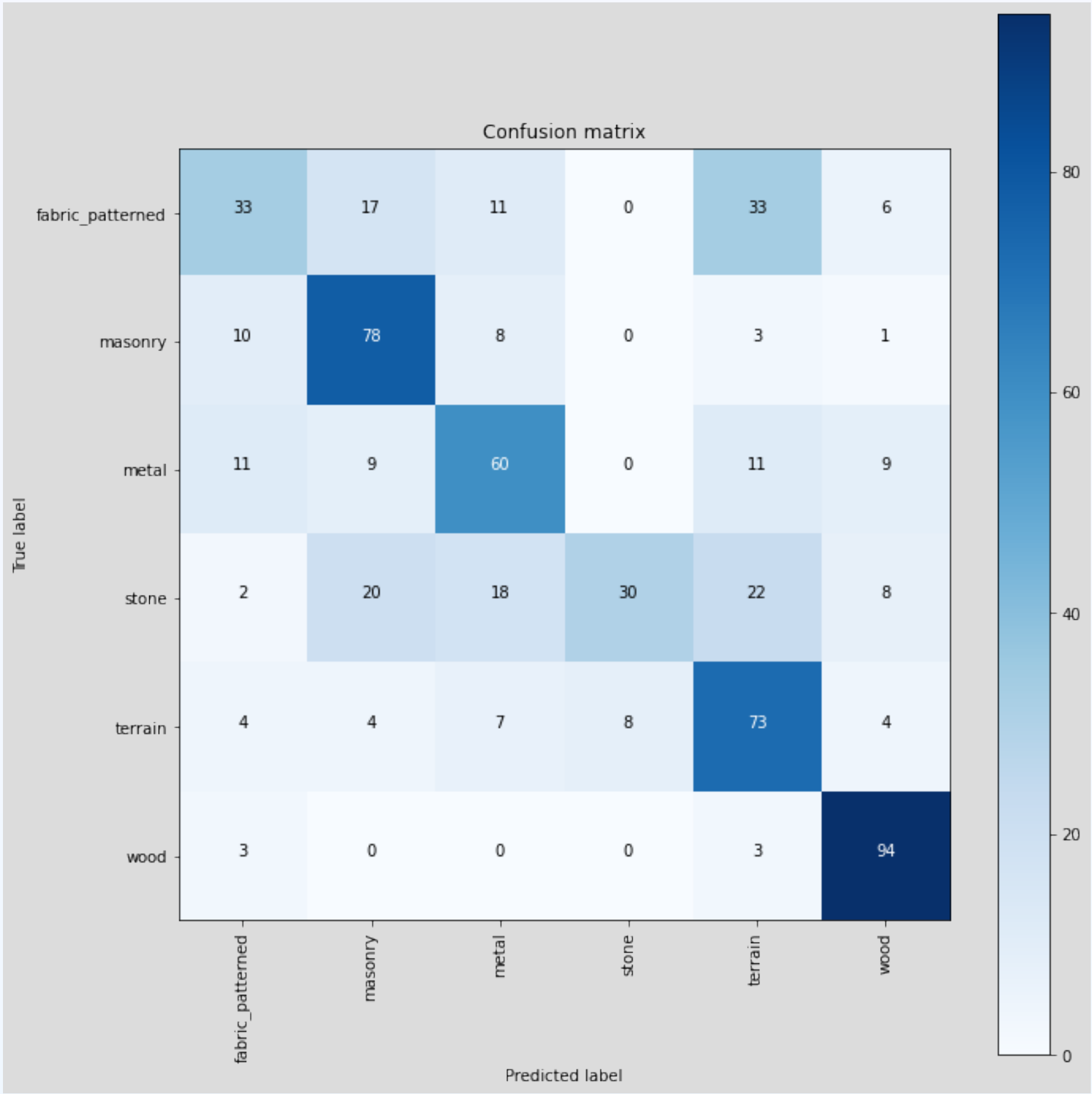
**ResNet50 val accuracy: 0.38**

**ResNet34 val accuracy: 0.49**

# XCEPTION CONFUSION MATRICES



**NOT NORMALIZED**



**NORMALIZED**

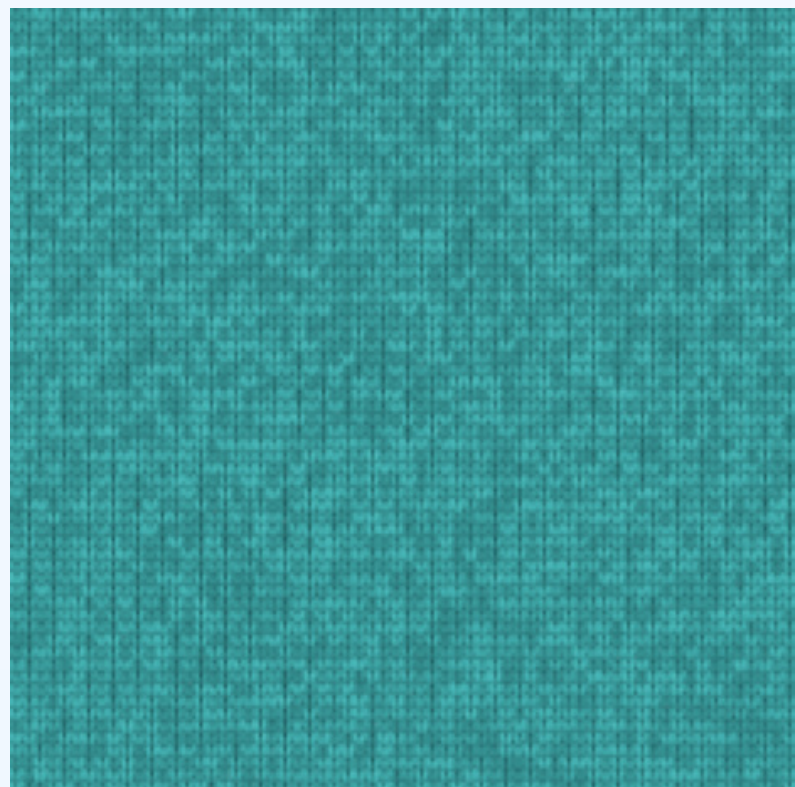


# VARIABLE AUTOENCODER

- Encoded the 5 most confident, accurately predicted image for each category
- Replaced the first input of the encoded matrix with a random sample
- Decoded the new “randomized” matrix
- Repeated several times for each category

Most Confident, Accurate Predictions Per Category:

**FABRIC**



**METAL**



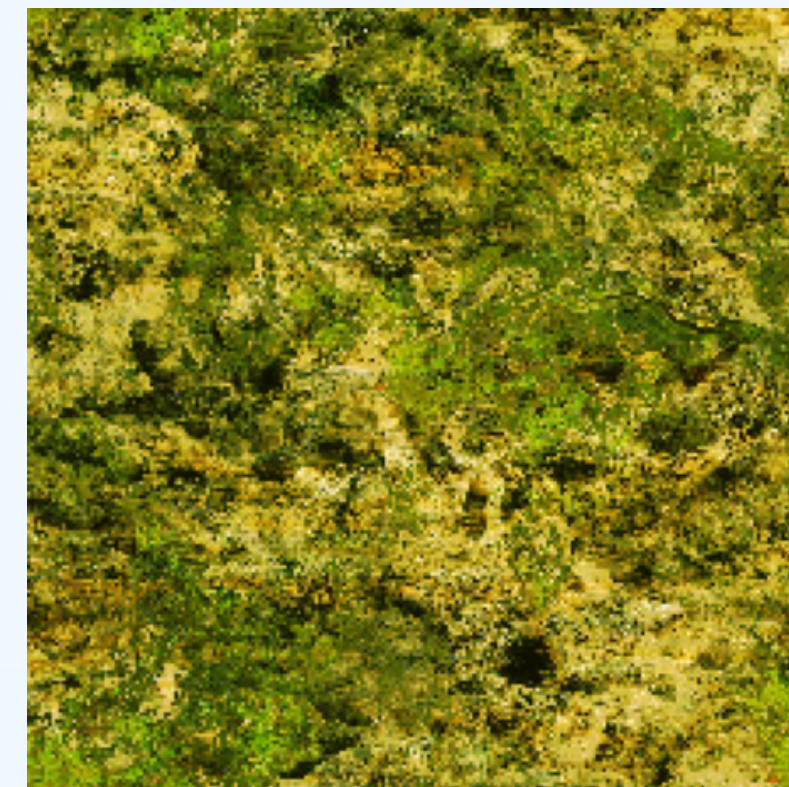
**MASONRY**



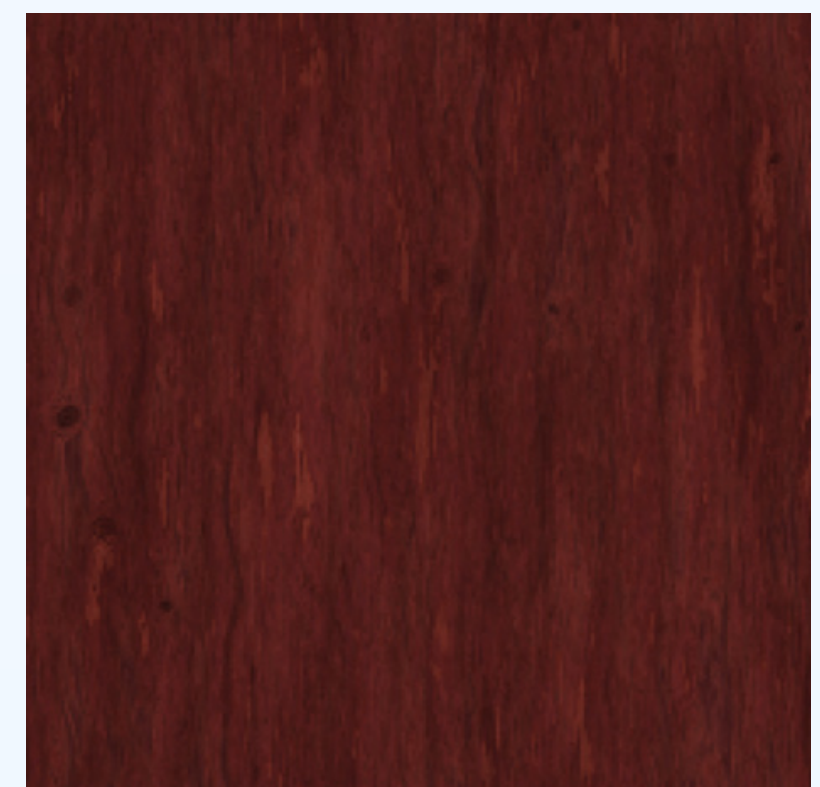
**STONE**



**TERRAIN**

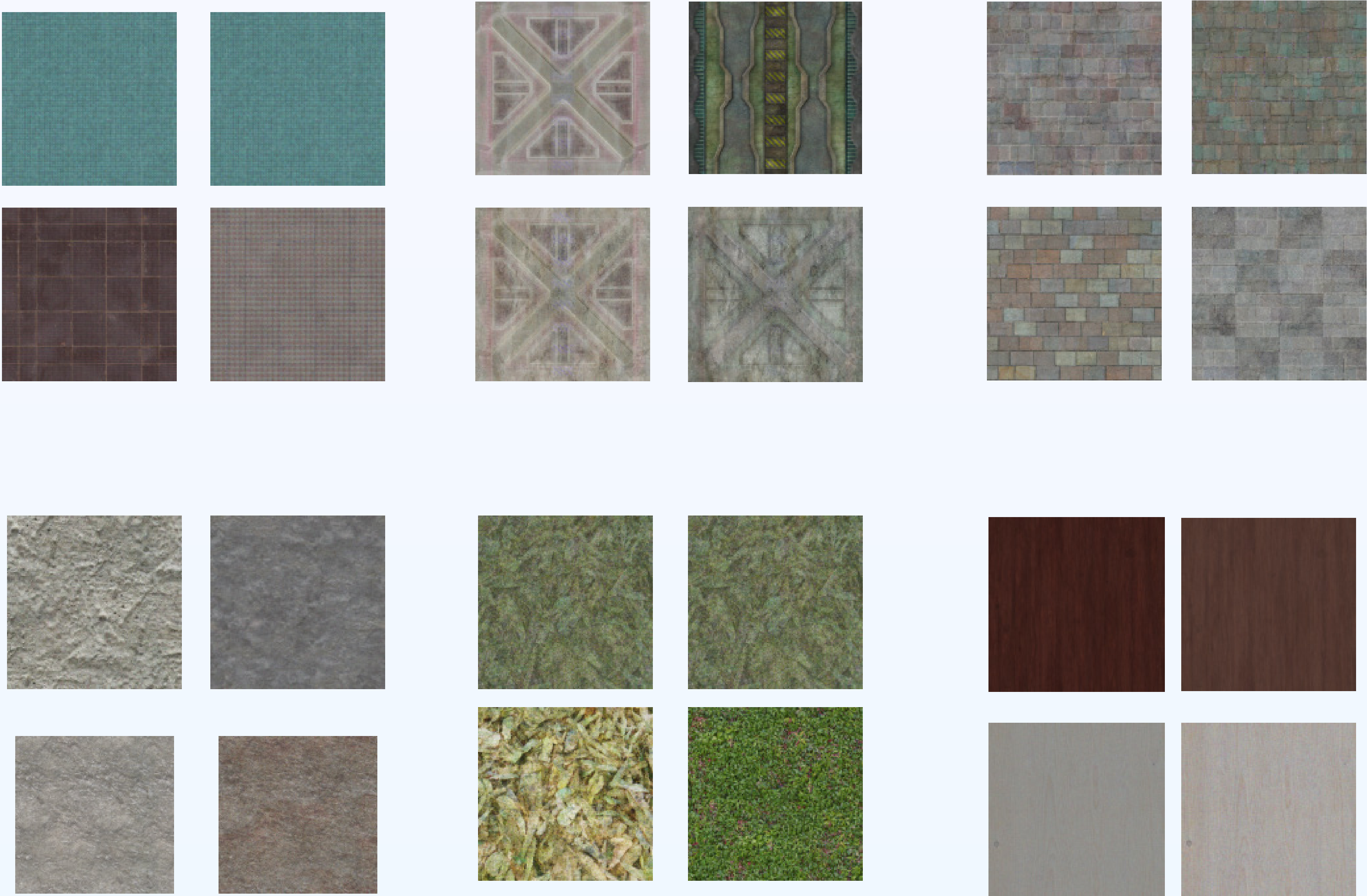


**WOOD**





# VAE GENERATED IMAGES





# NEXT STEPS

- Improve other CNN models
- Gather more data
- Attempt to generate images with GANs
- Assess usefulness for auto-generated image textures