

# CEDL Homework 3 Report

1. First, we keep the DC-GAN network structure unchanged, and only modify the input image size setting to  $256 \times 256$ .

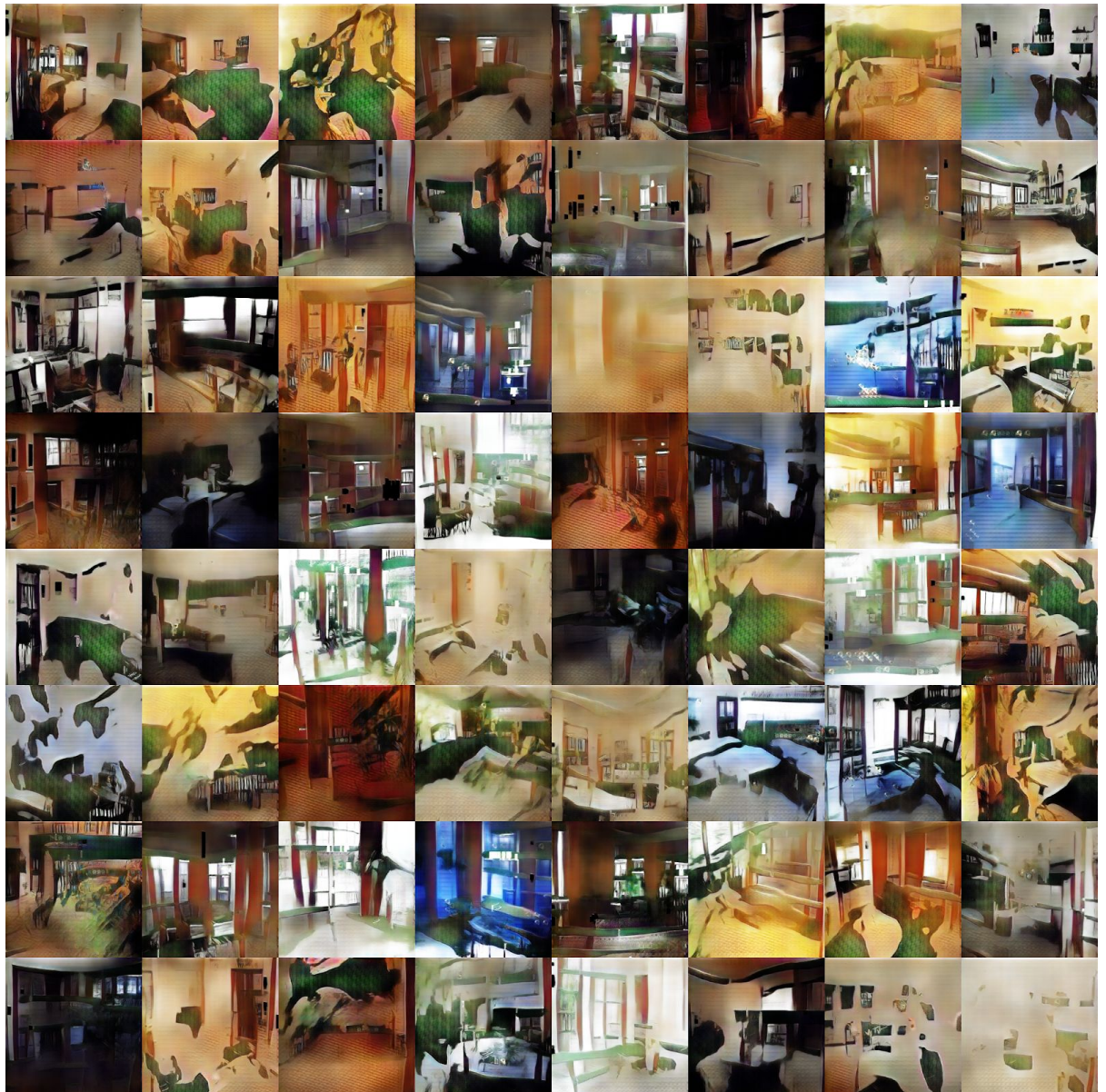
Sample results after 25 epochs:





2. Secondly, we try to do some data augmentation. We do horizontal flipping to increase the training data size from 50,000 to 100,000 images.

Sample results after 25 epochs:



**This is the model we finally use to generate samples and do discriminating tests.**

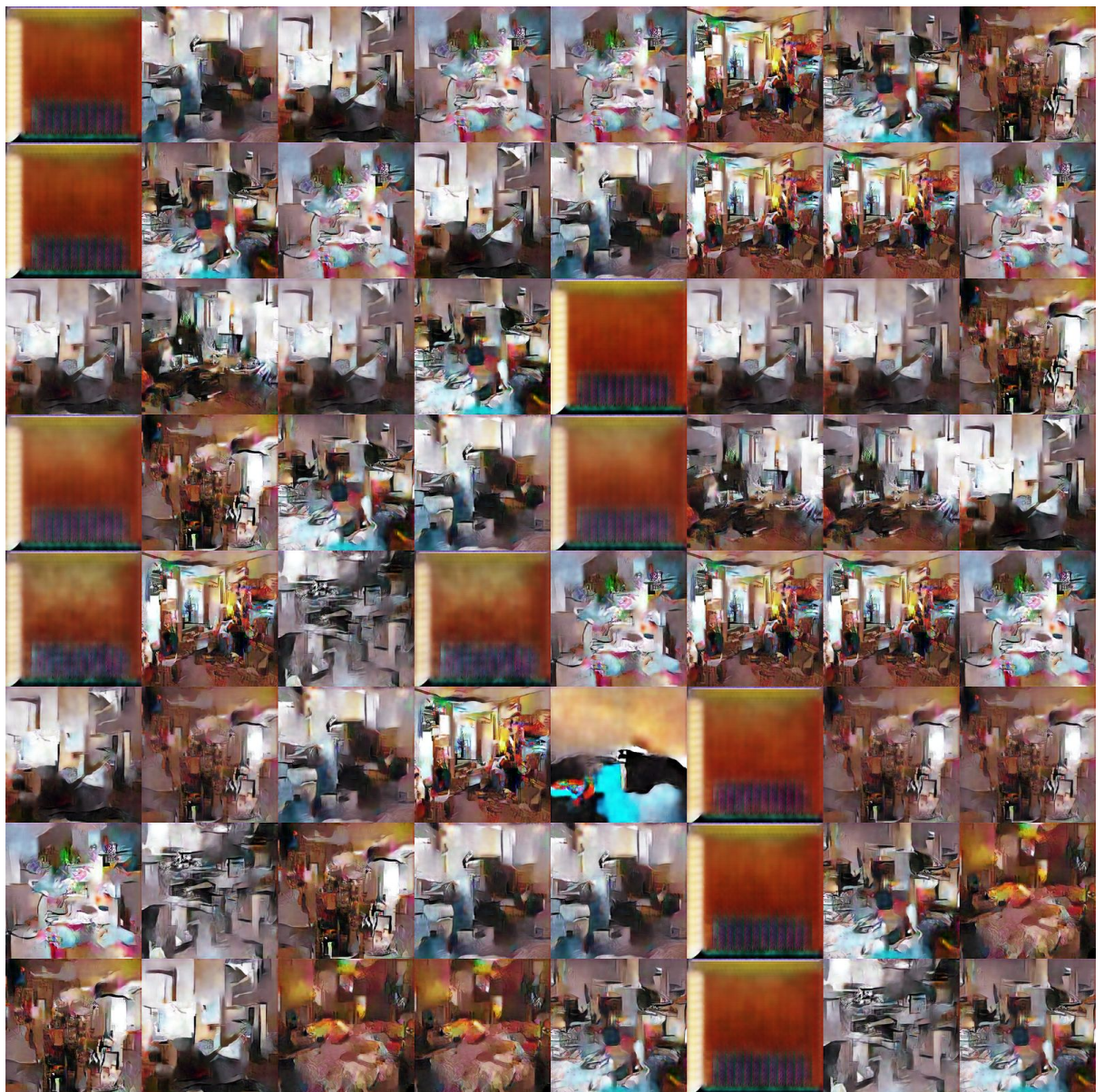


3. Thirdly, we modified the structure of network as below:
- **Discriminator:** 2 fc + 6 deconv. Relu + tanh at the last. Do batch-normalization except at the last conv output.
  - **Generator:** 5 conv + 1 fc. Leaky-relu + sigmoid at the last. Do batch-normalization except at the the first conv output.

We also do **semi-supervised training** proposed by Improved-GAN in this modification. Therefore, the output dimension of discriminator is  $K+1$  instead of 1.  $K$  is the number of different classes. While sampling, generator takes in another  $K$ -dim one-hot vector together with a 100-dim random vector.

Moreover, we add **feature loss** for generator loss. Feature maps are extracted from the fully connected layer of the discriminator.

Sample results after 10 epochs (Because of time, we only train for 10 epochs):



It shows that our model tends to collapse to a same mode for same classes. It's really tricky to make the GAN training successful.

#### 4. Discussion for testing results

Our discriminator score ranking is the worst. However, our generated samples seem not bad over all 12 teams, ranked at the 4th place. This situation seems unreasonable.

Our assumption is that maybe we shouldn't use 0.5 as the probability threshold for discriminating. Maybe higher threshold will improve the result a lot for this particular evaluation.