Network 종류 변경하여 비교해보기

2021. 07. 29

길다영

https://velog.io/@arittung/3D-Room-Reconstruction-Using-HorizonNet-Network-%EC%A2%85%EB%A5%98-%EB%8B%A4%EB%A5%B4%EA%B2%8C-%ED%95%B4%EA%B0%80%EB%A9%B4%EC%84%9C-%EB%B9%84%EA%B5%90 참고.

https://github.com/sunset1995/HorizonNet 참고.

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- 결과 비교

3 오류

1 Network 종류와 기본 설정

- Network 종류
- 기본 설정

1 Network 종류와 기본 설정 - Network 종류

ResNet 18

ResNet 34

ResNet 50

ResNet 101

ResNet 152

ResNext 50_32x4 d

ResNext 101_32x 8d

DenseNet 121

DenseNet 169

DenseNet 161

DenseNet 201

1 Network 종류와 기본 설정 - 기본 설정

설정

- Batch_size = 1, Epoch = 300으로 고정.
- Epoch를 늘리고 싶었으나, 시간이 너무 오래 걸려 하지 못함.
- Desenet121의 경우, 코드 실행 시 블루스크린이 계속 발생하여 epoch=200로 훈련함.

실행할 수 없는 Network

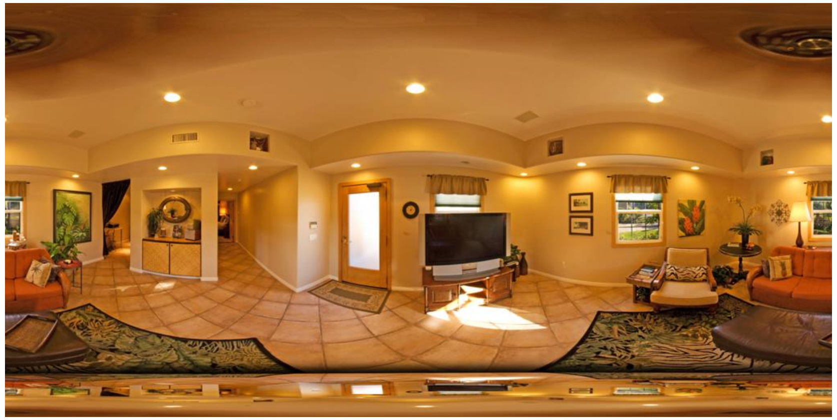
- 다음의 경우, 코드가 실행되지 않았다. 메모리 문제인 것 같다.
- Resnet152
- ResNext101_32x8d
- DenseNet169, DenseNet 161, DenseNet 201

1 Network 종류와 기본 설정 - 기본 설정

● 입력 이미지

Pano_01.png

Pano_07.png



Pano_13.png

Pano_15.png

Pano_18.png

Pano_20.png

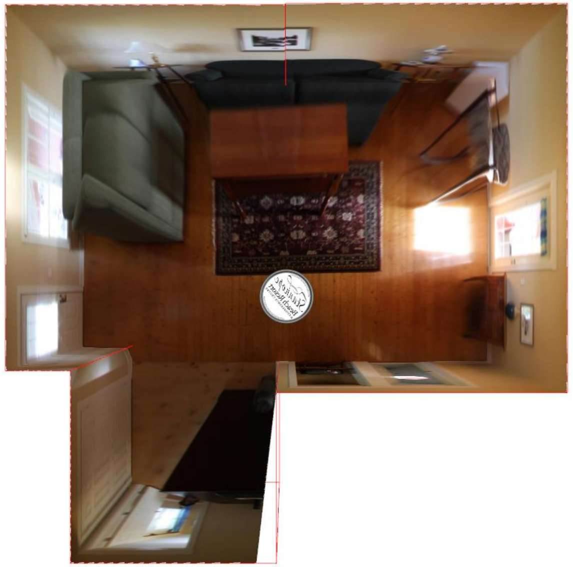
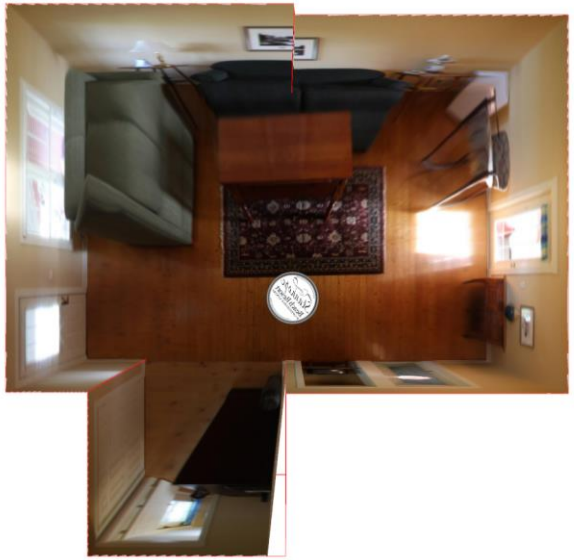
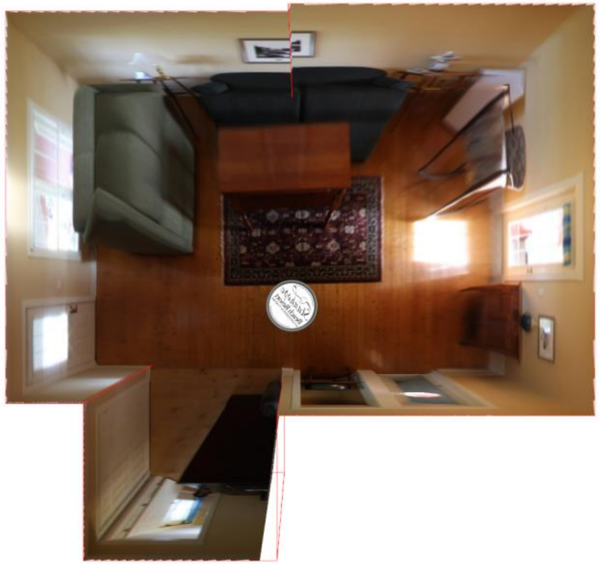
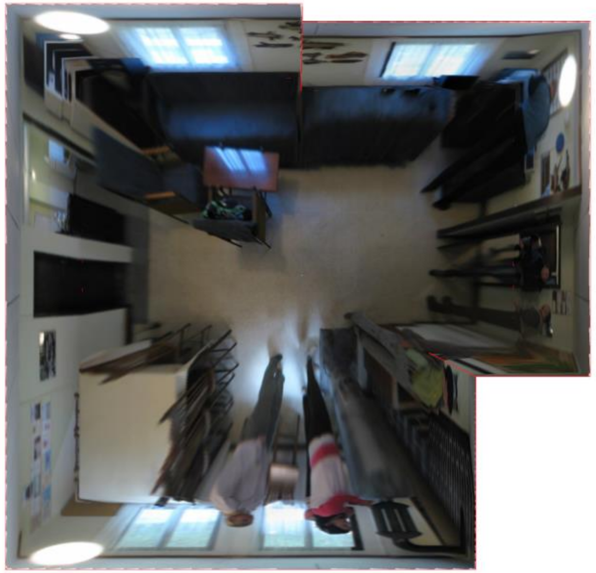
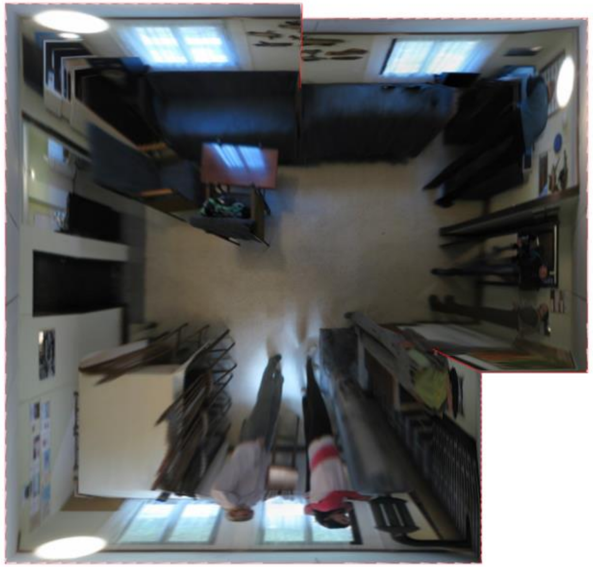
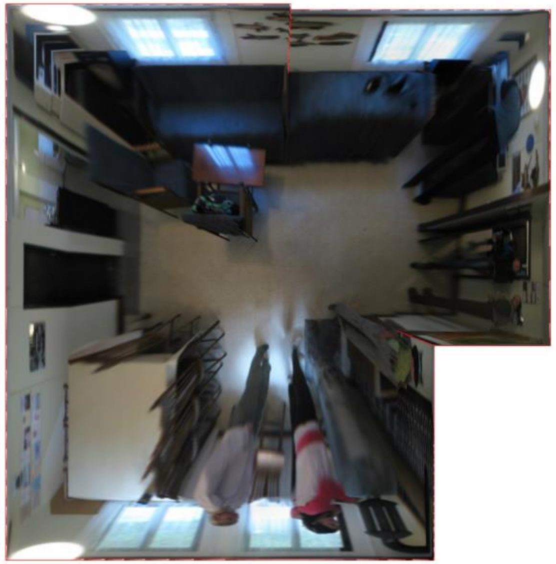
2 결과 분석

- 결과 분석
- 결과 비교

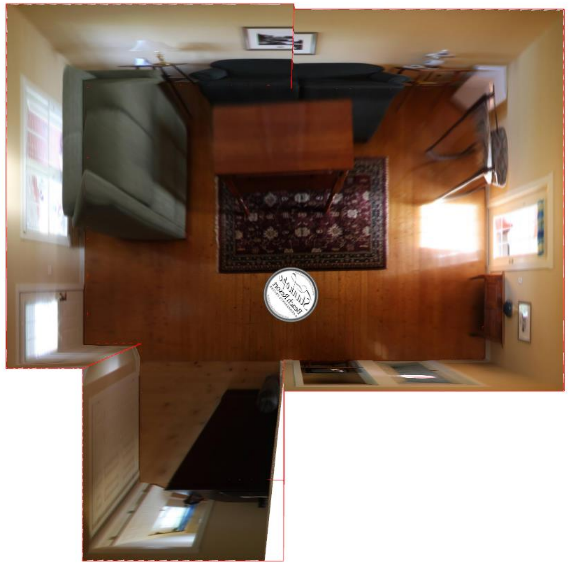
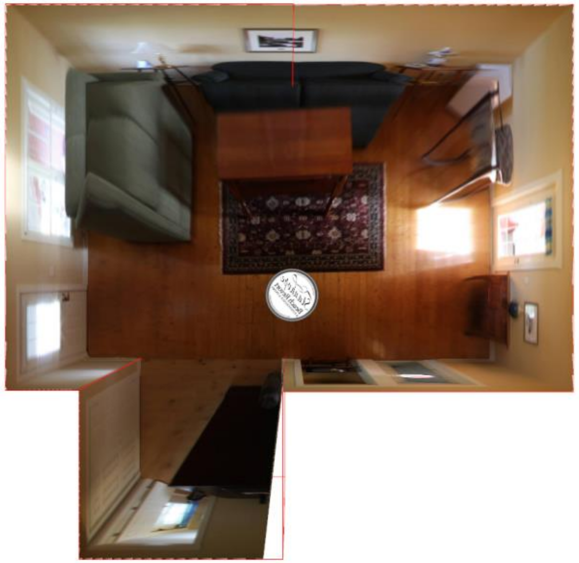
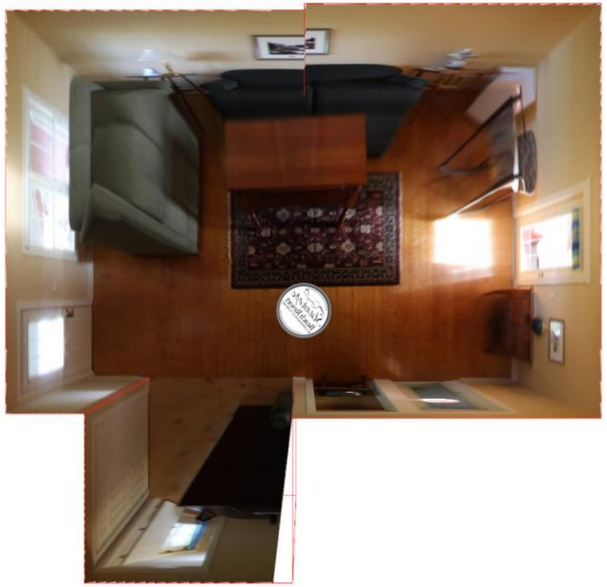
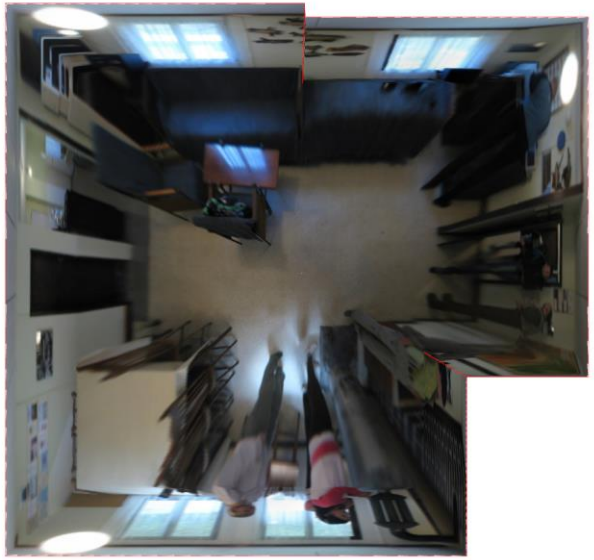
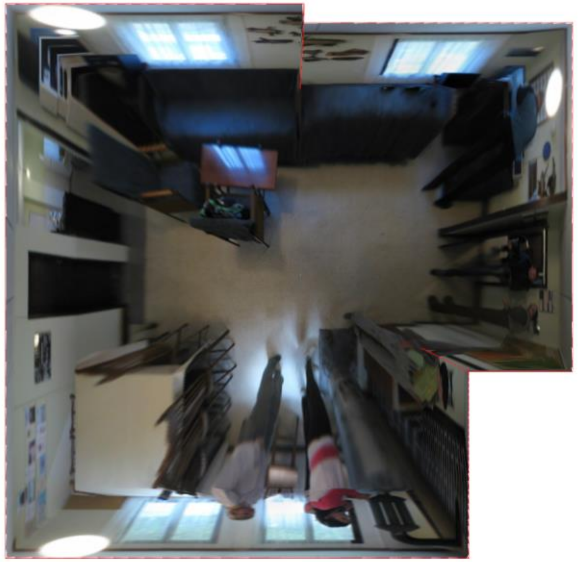
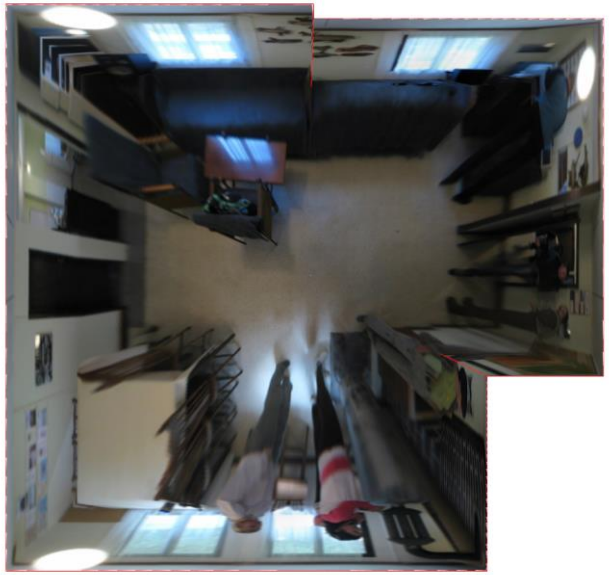
2 결과 분석 - 결과 분석

- 육안으로 확인 시, 액자의 위치 등을 고려하여 벽을 추정해봤을 때 ResNet50이나 ResNext50_32x4d이 대체적으로 성능이 좋아 보임.
- Network 종류마다 사진의 가로 세로 비율이 다름. → 🤔 원인이 뭐징..?
- Densenet은 대체적으로 코드 실행이 어려웠다. 계속 블루스크린이 떴고, 메모리 초과 오류가 발생하였다.

2 결과 분석 - 결과 비교

Img _name	resnet50	resnet101	resnet34
Pano_01			
Pano_07			

2 결과 분석 - 결과 비교

Img _name	resnet18	ResNext50_32x4d	DenseNet 121
Pano_01			
Pano_07			

2 결과 분석 - 결과 비교

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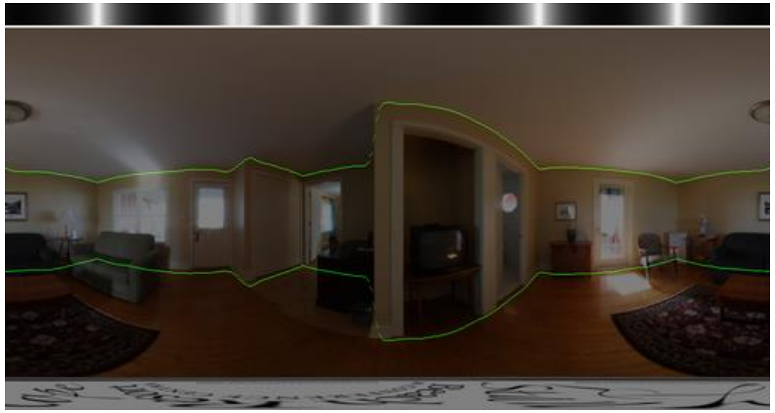
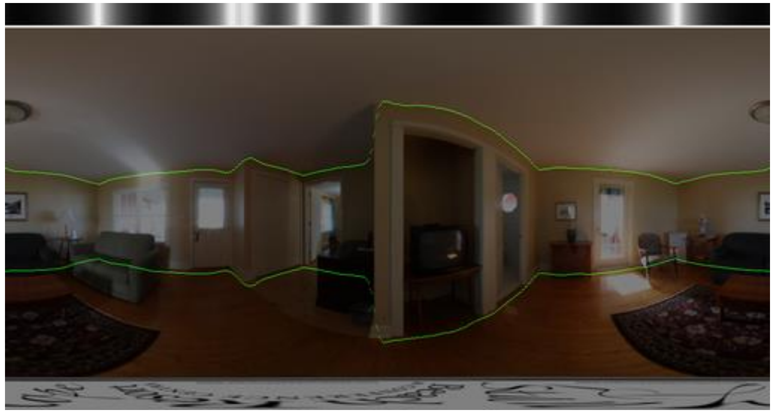
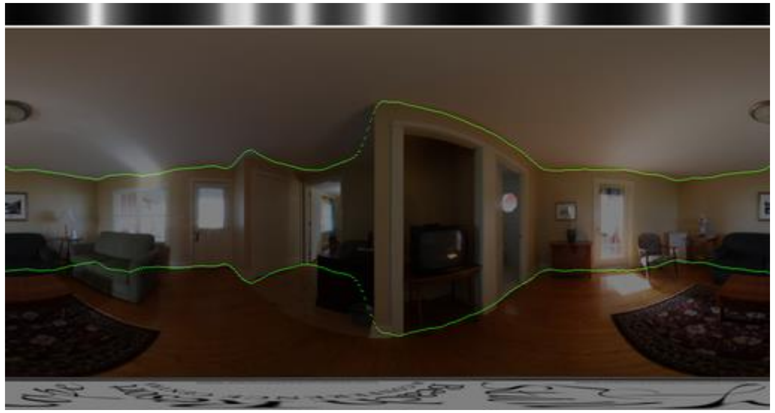
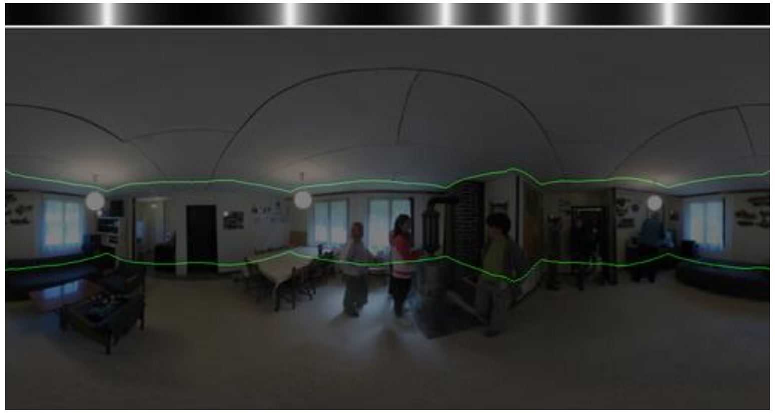
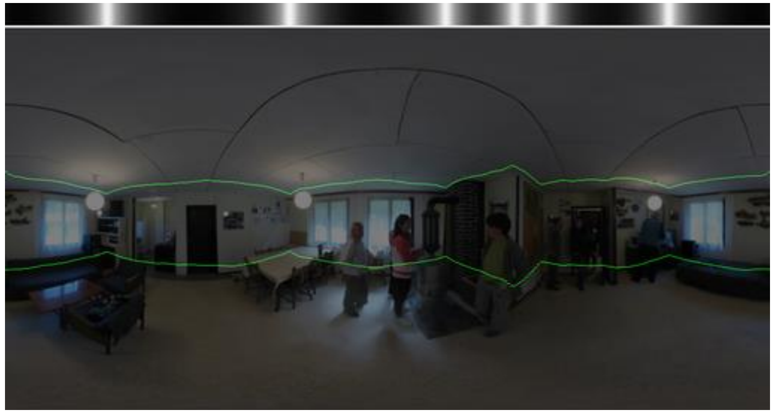
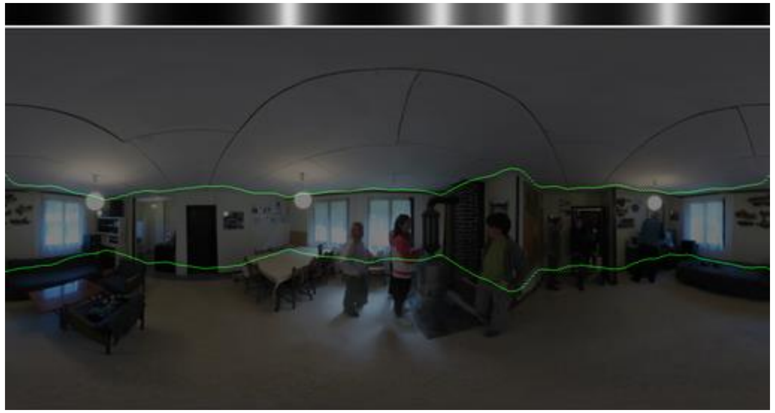
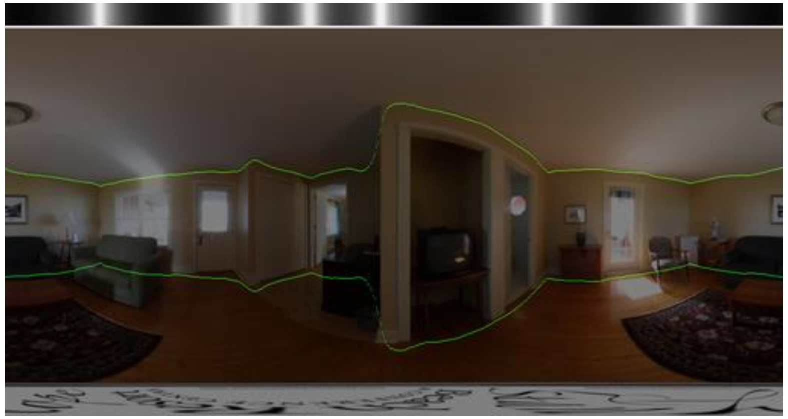
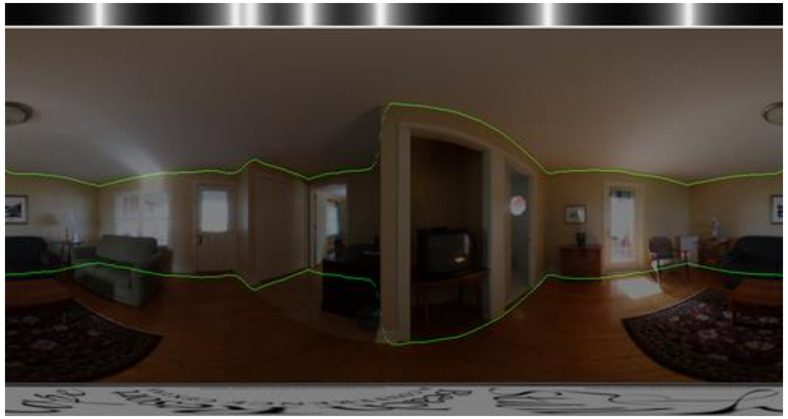
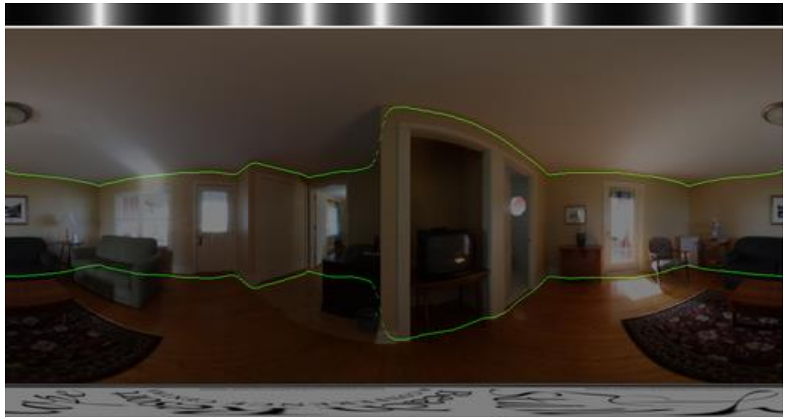
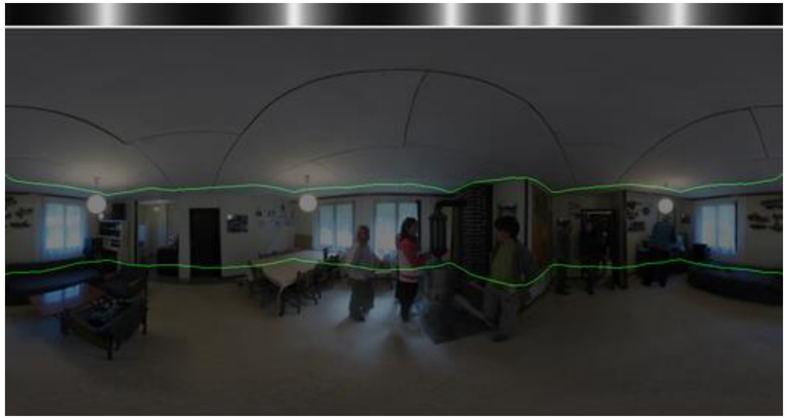
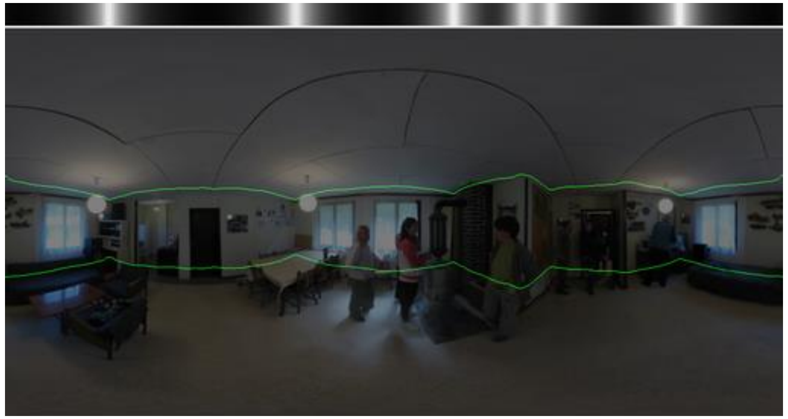
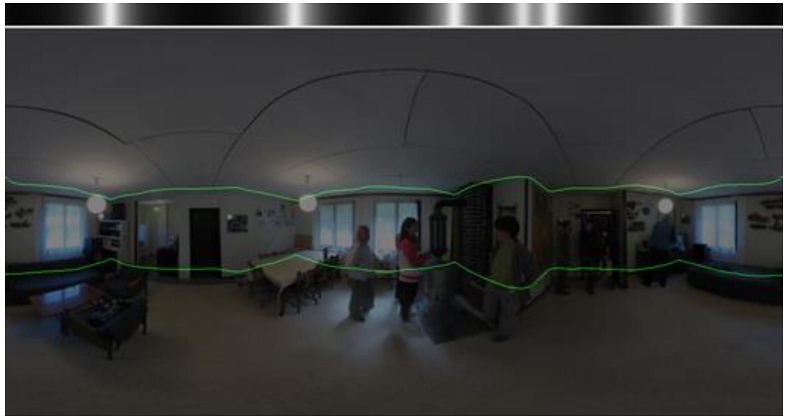
Pano_01			
Pano_07			

2 결과 분석 - 결과 비교

Img _name	resnet18	ResNext50_32x4d	DenseNet 121
Pano_01			
Pano_07			

2 결과 분석 - 결과 비교

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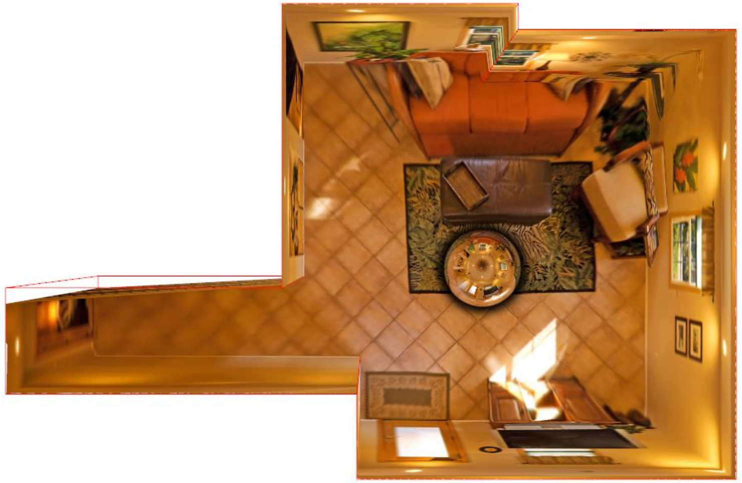
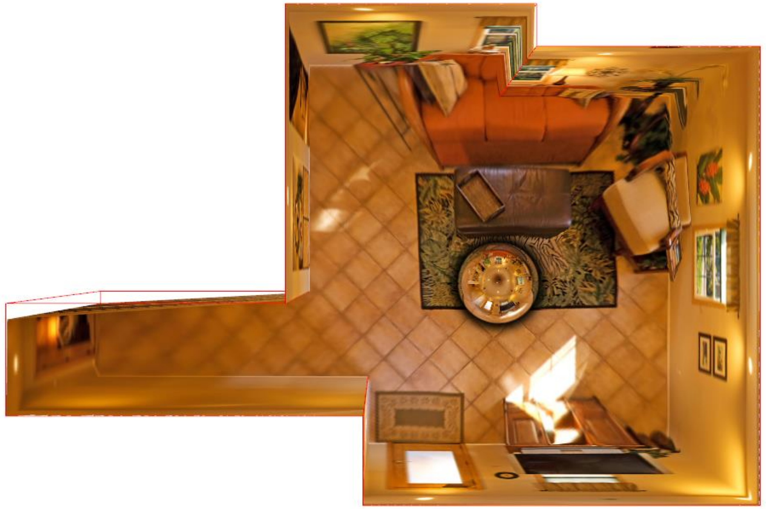
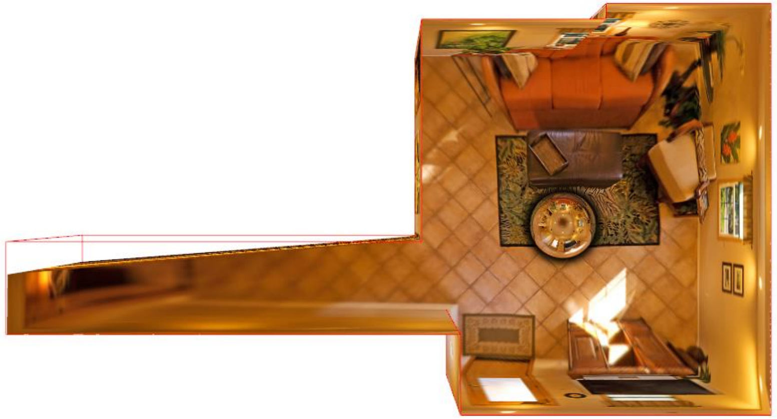
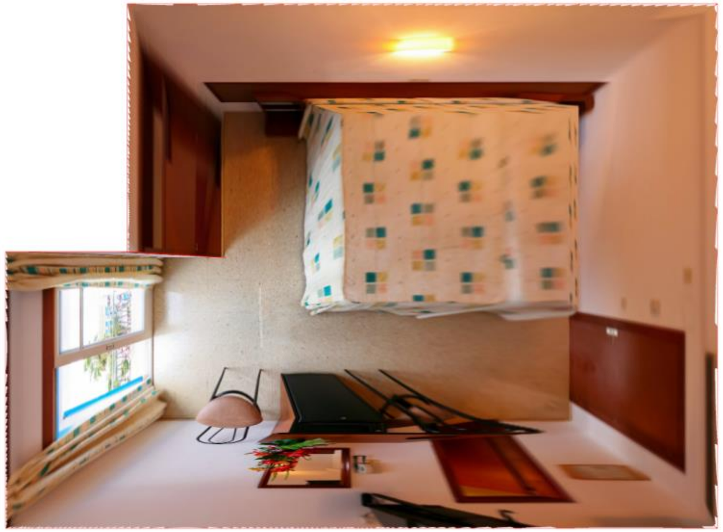
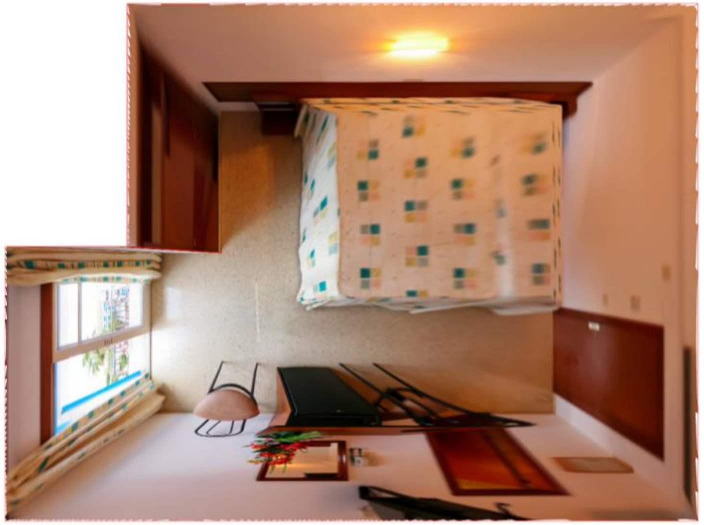
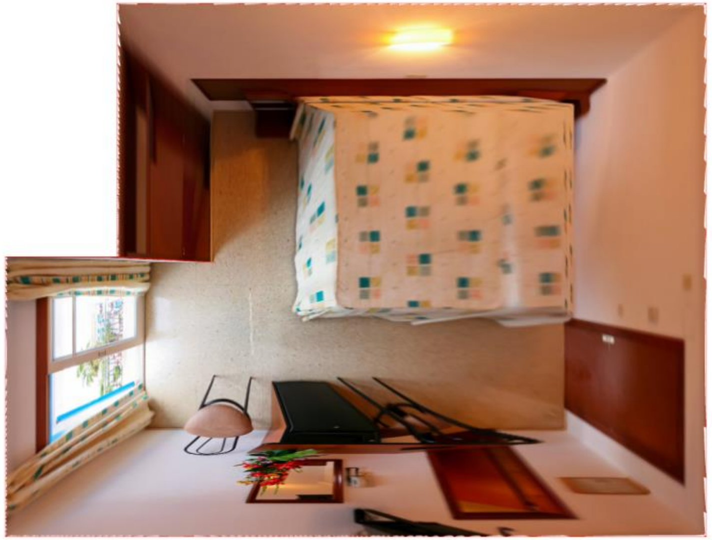
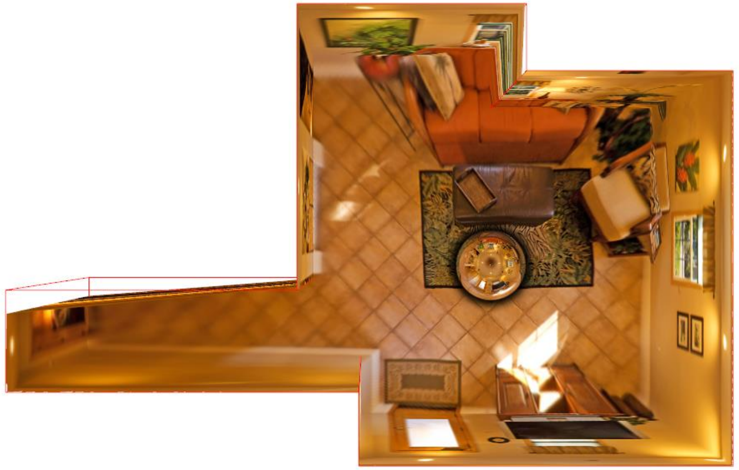
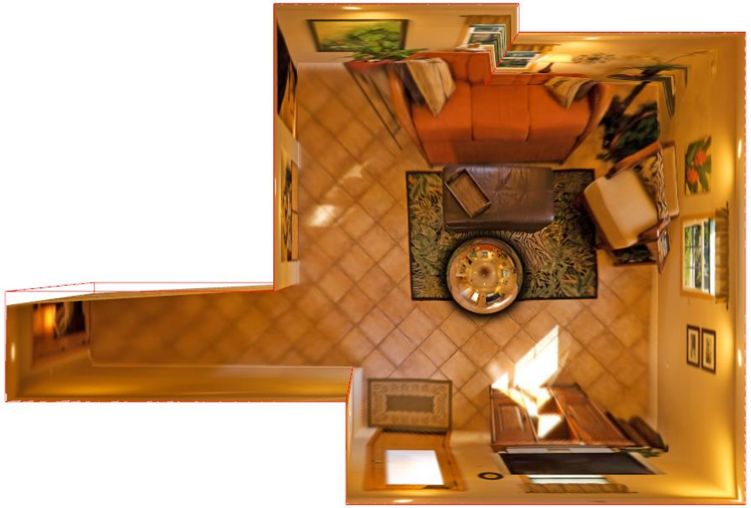
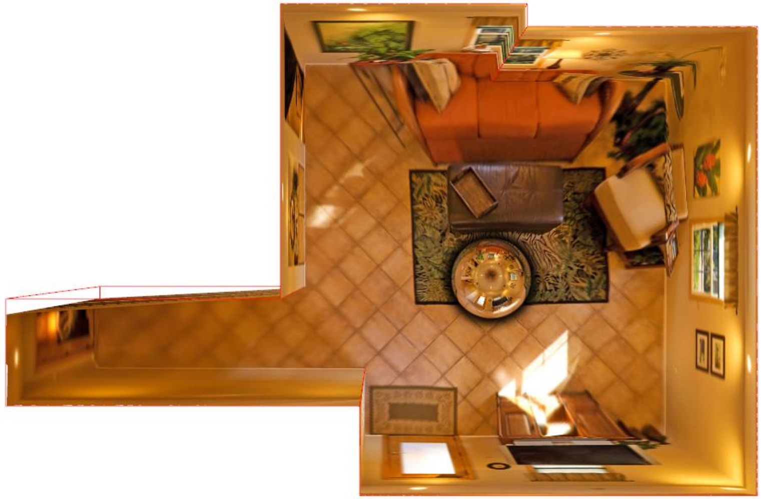
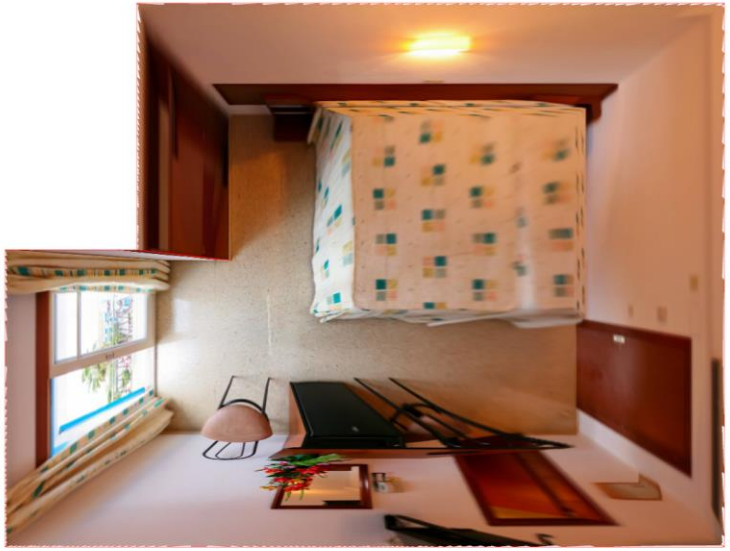
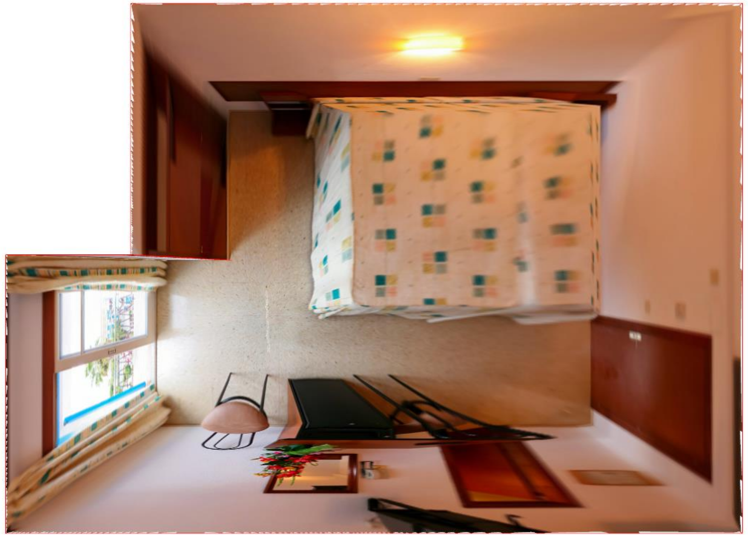
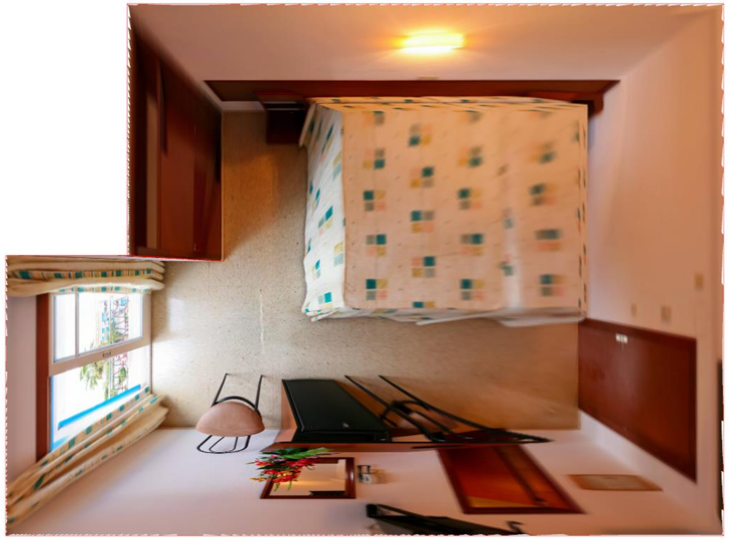
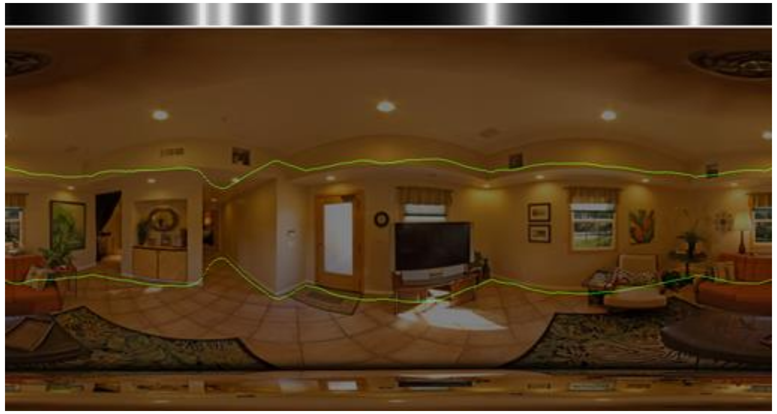
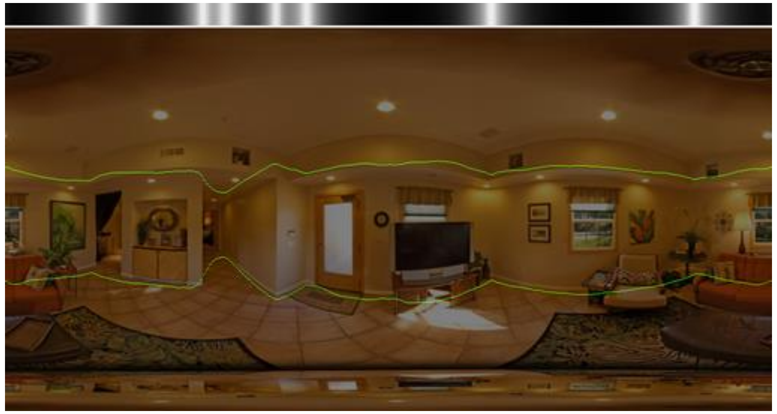
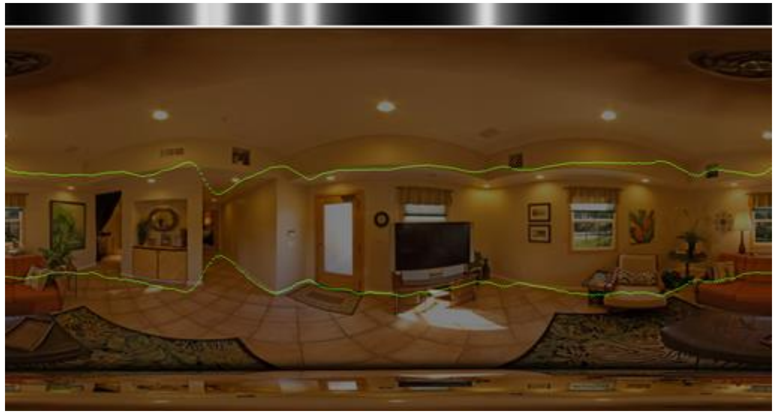
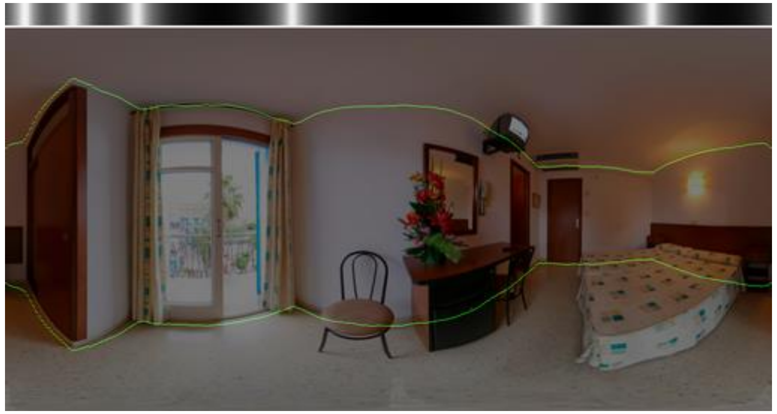
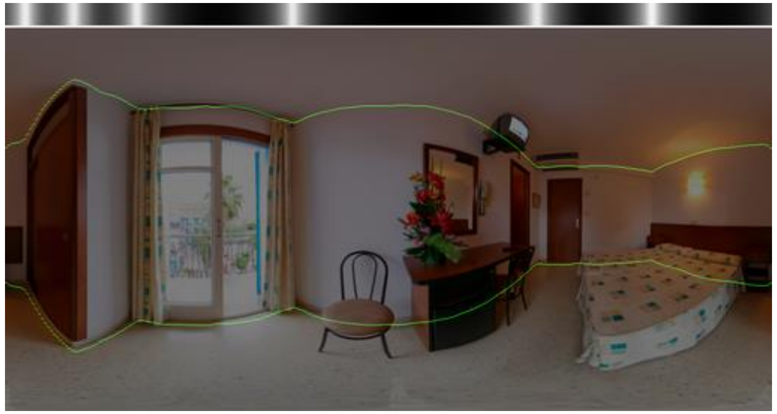
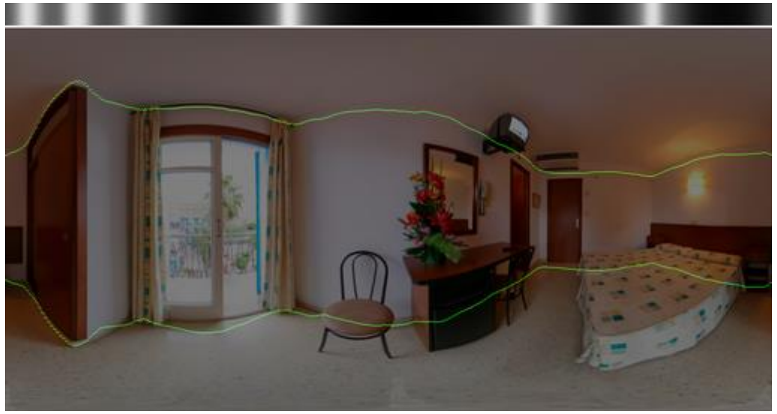
Pano_13			
Pano_15			

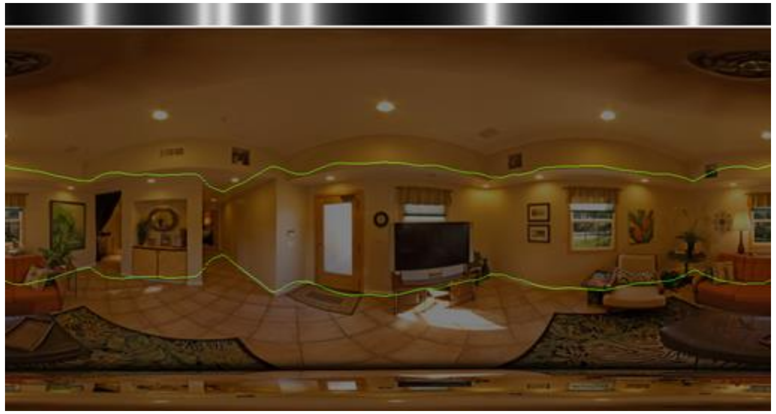
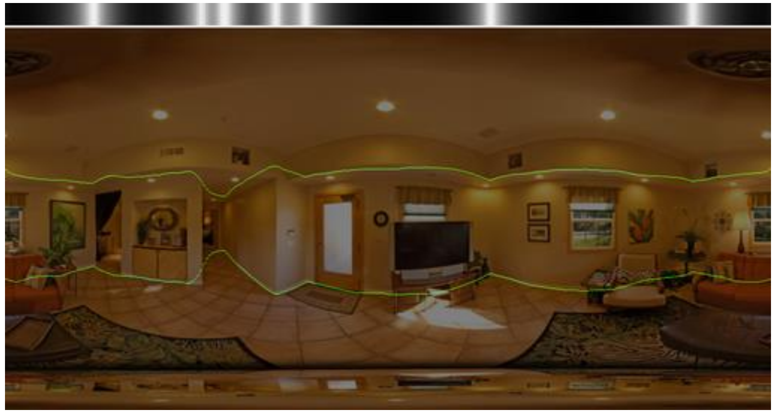
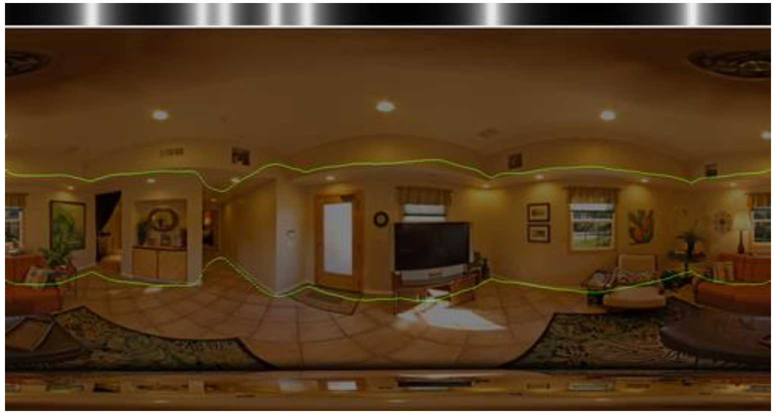
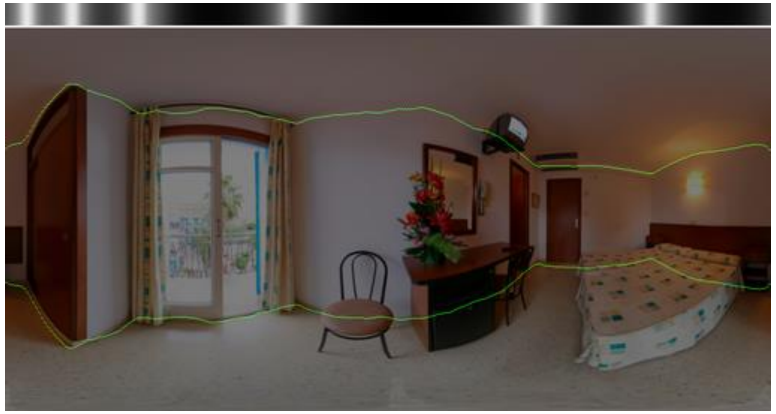
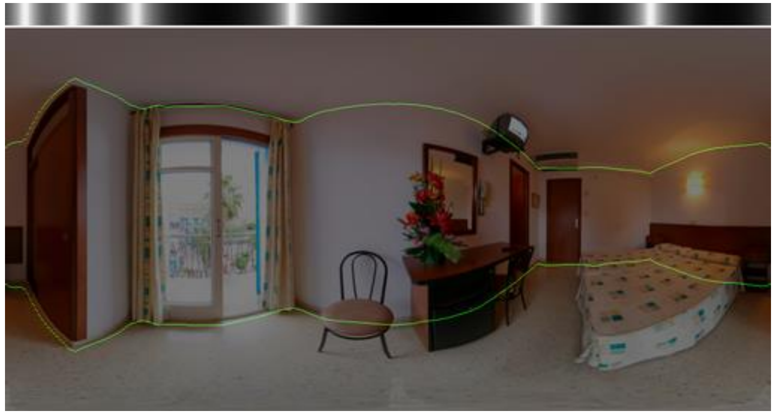
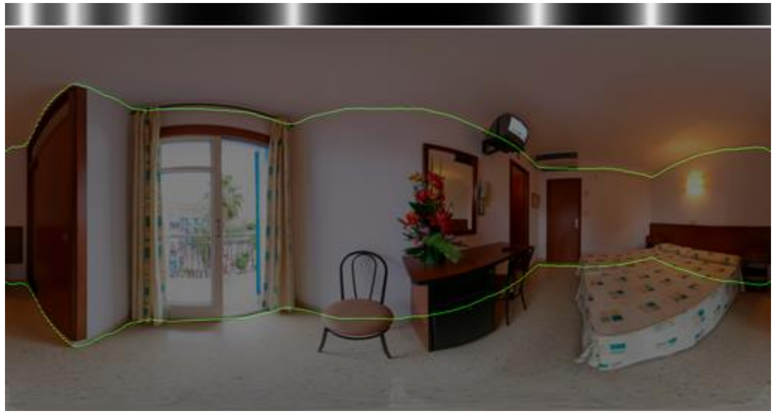
2 결과 분석 - 결과 비교

Img _name	Resnet18	ResNext50_32x4d	DenseNet 121
Pano_13			
Pano_15			

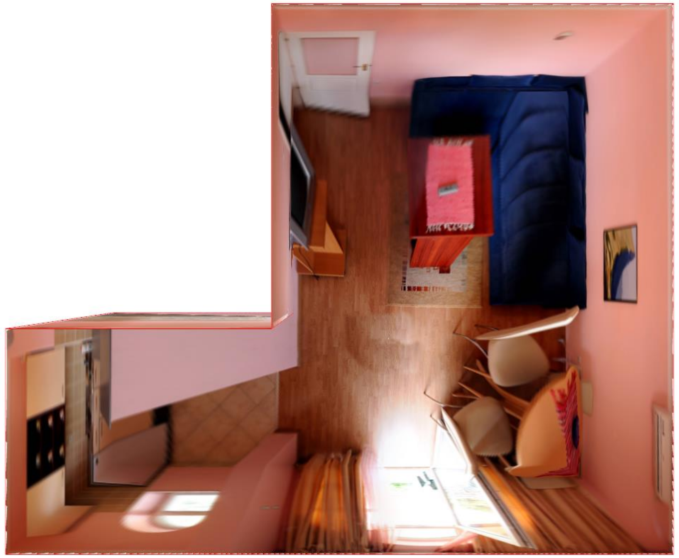
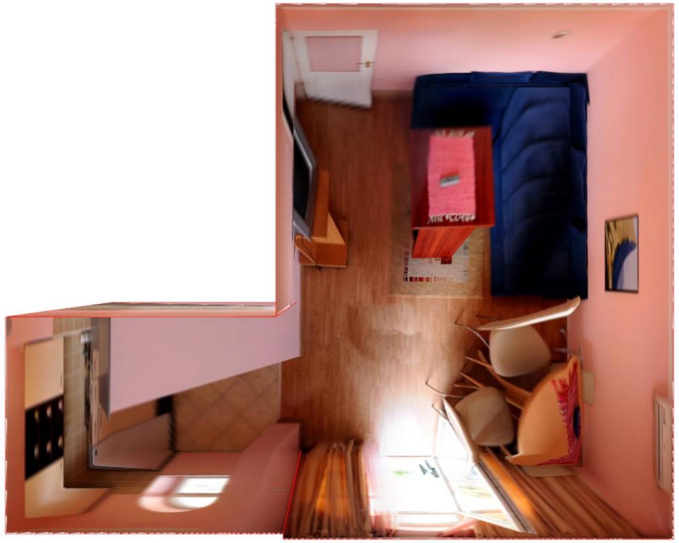
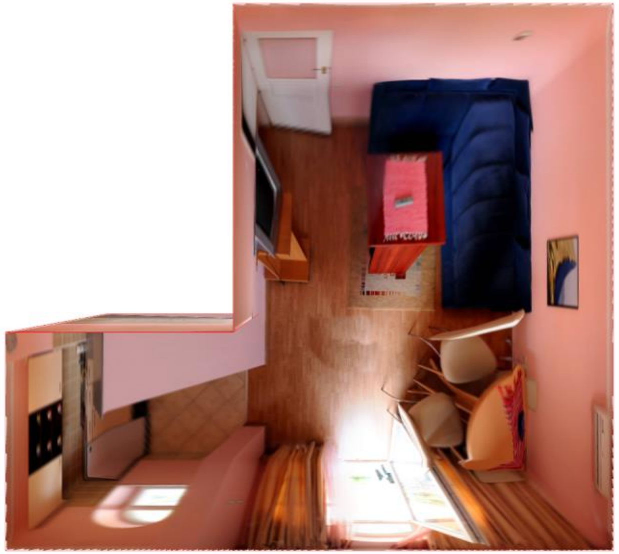
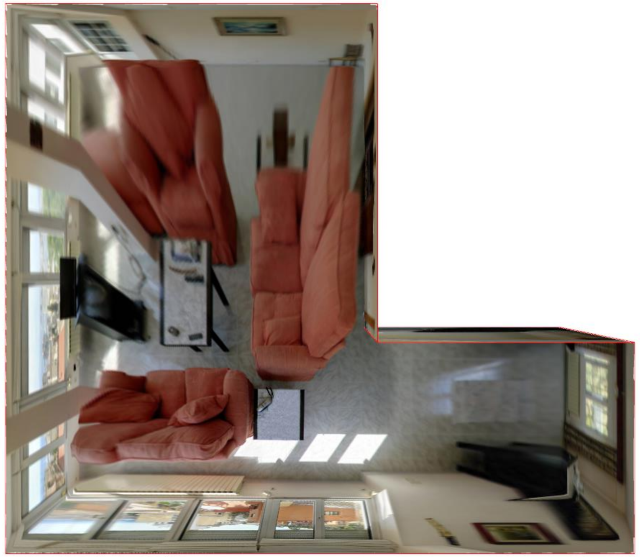
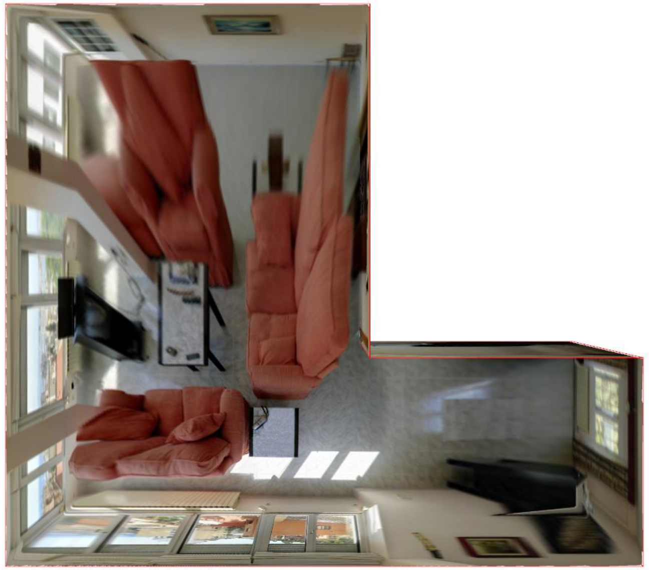
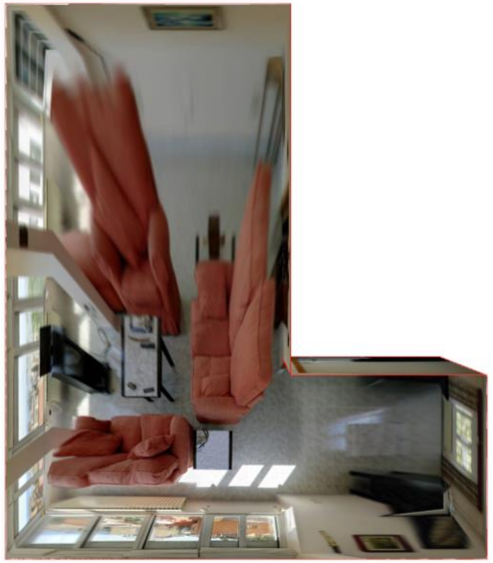
2 결과 분석 - 결과 비교

Img _name	resnet50	resnet101	resnet34
Pano_13			
Pano_15			

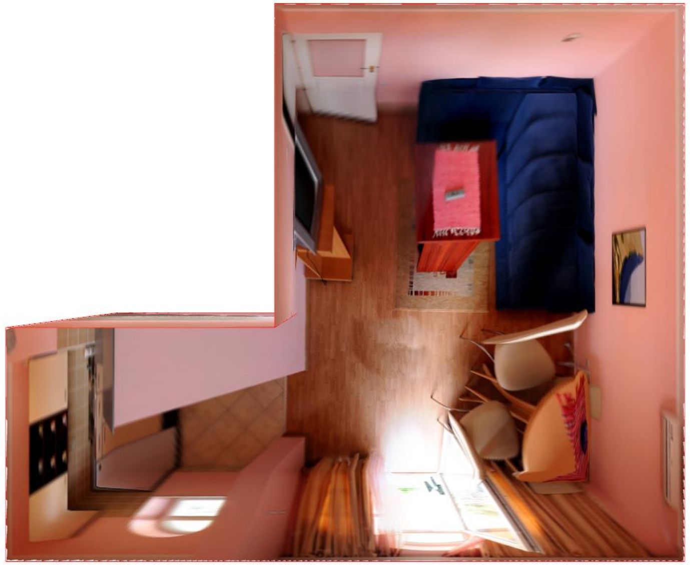
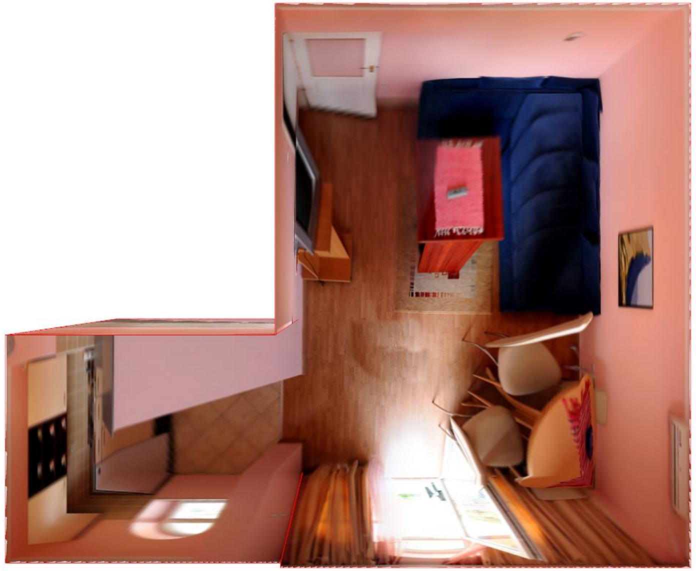
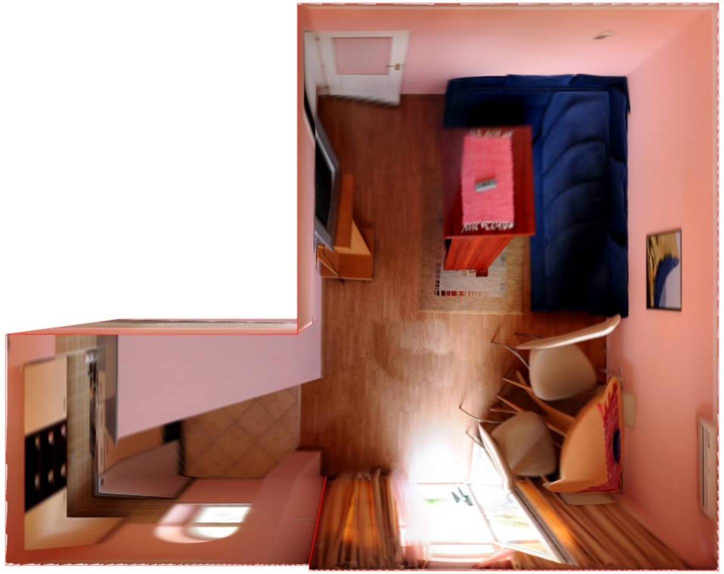
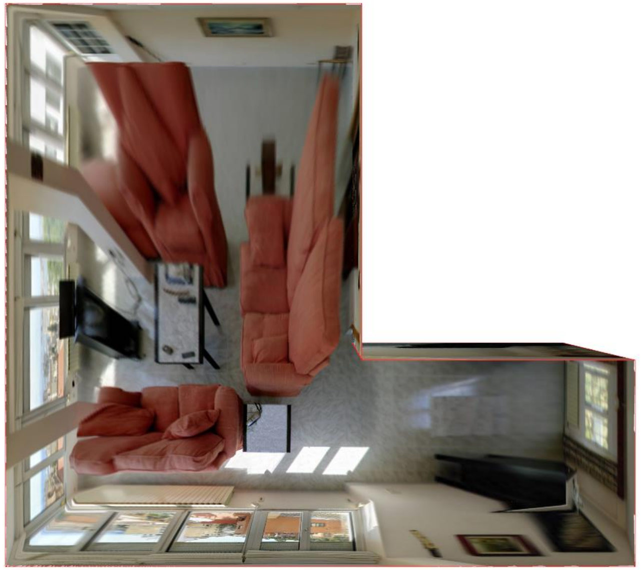
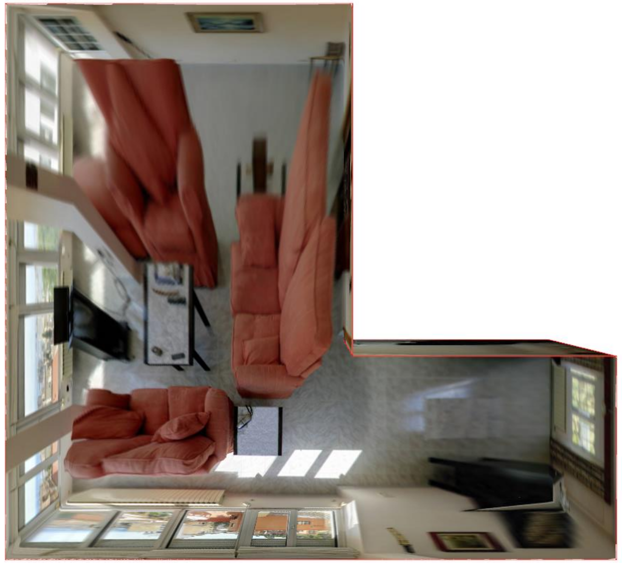
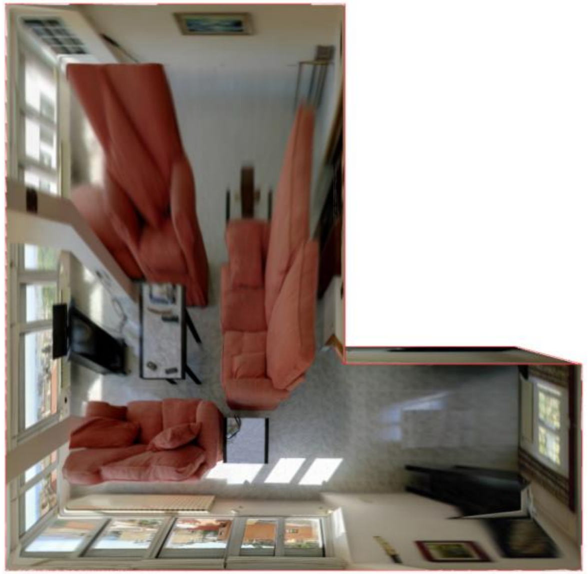
2 결과 분석 - 결과 비교

Img_name	Resnet18	ResNext50_32x4d	DenseNet 121
Pano_13			
Pano_15			

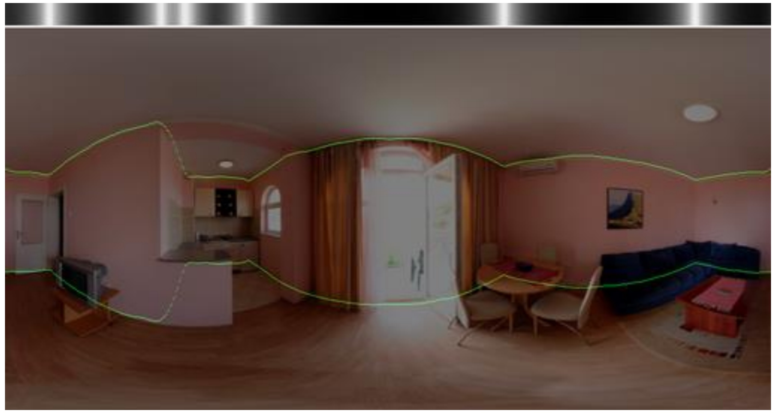
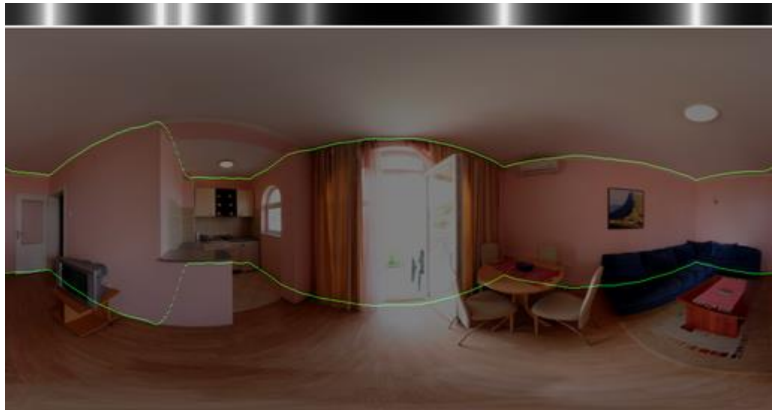
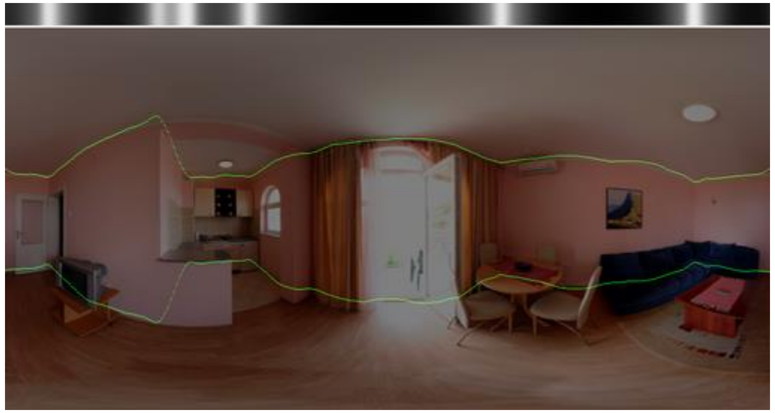
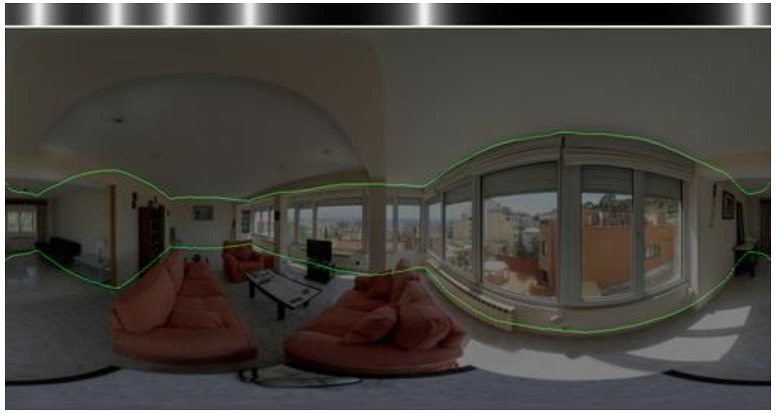
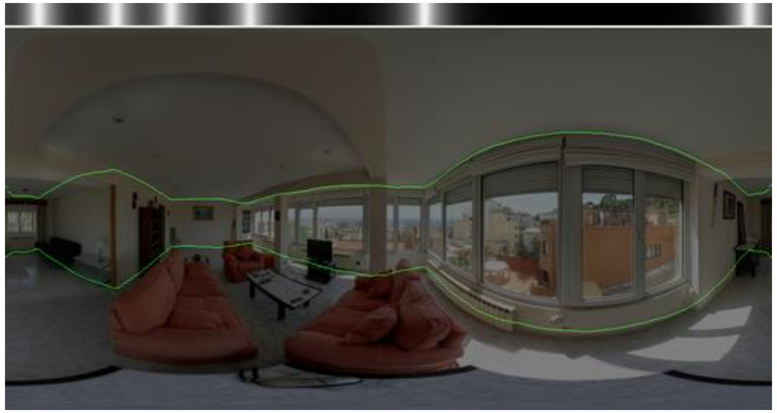
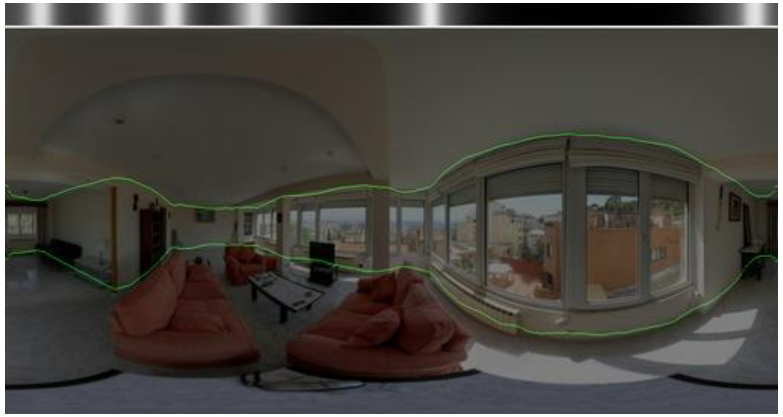
2 결과 분석 - 결과 비교

Img _name	resnet50	resnet101	resnet34
Pano_18			
Pano_20			

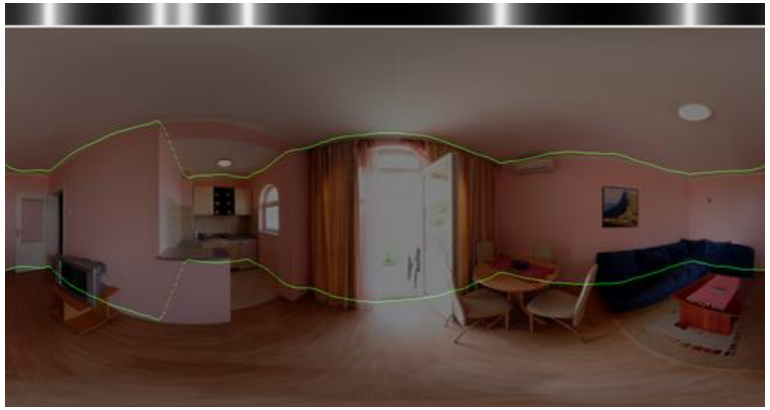
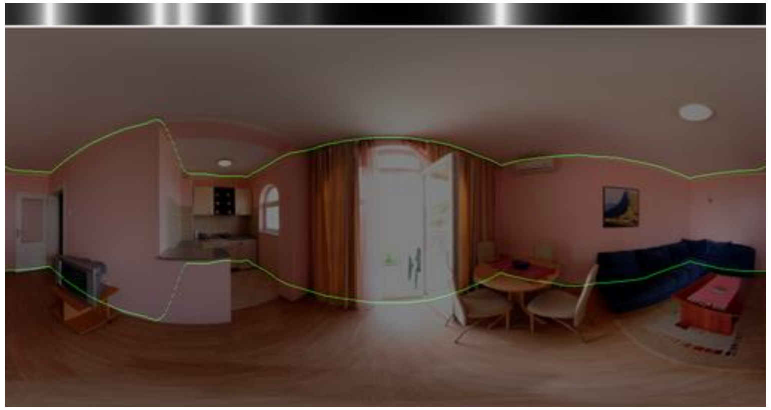
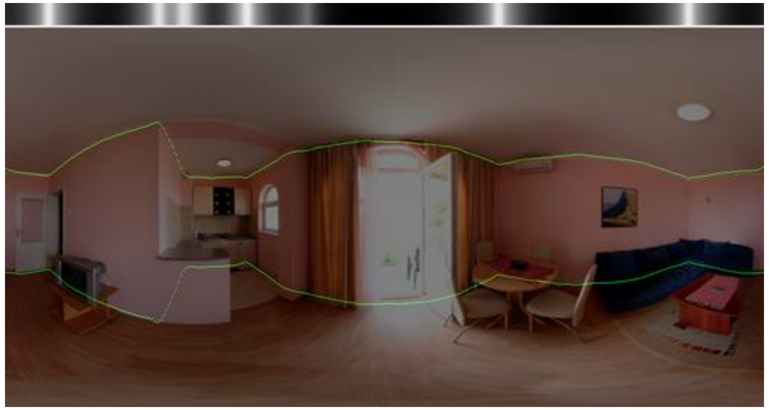
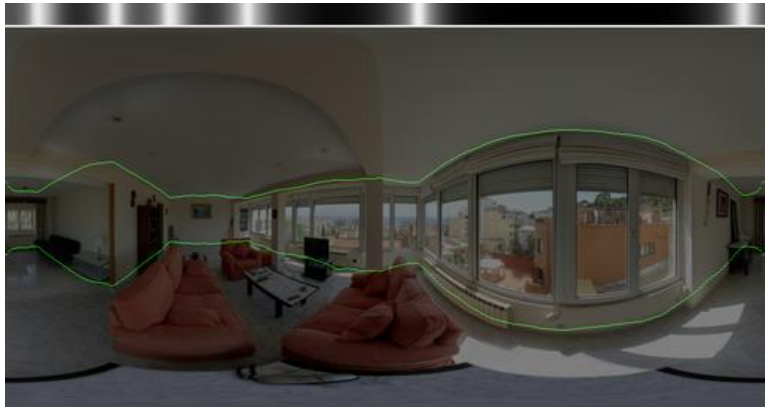
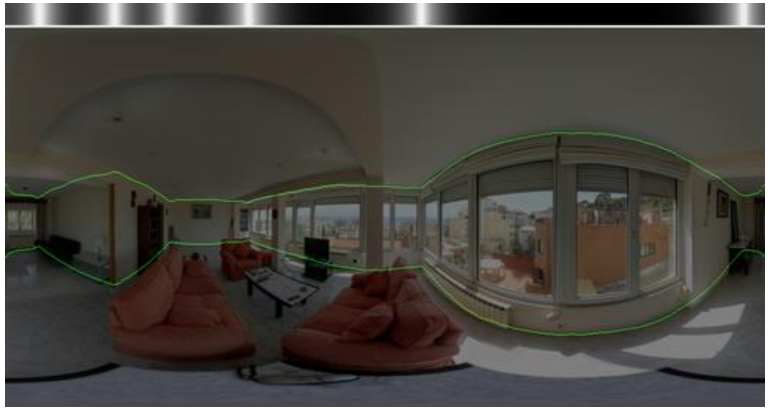
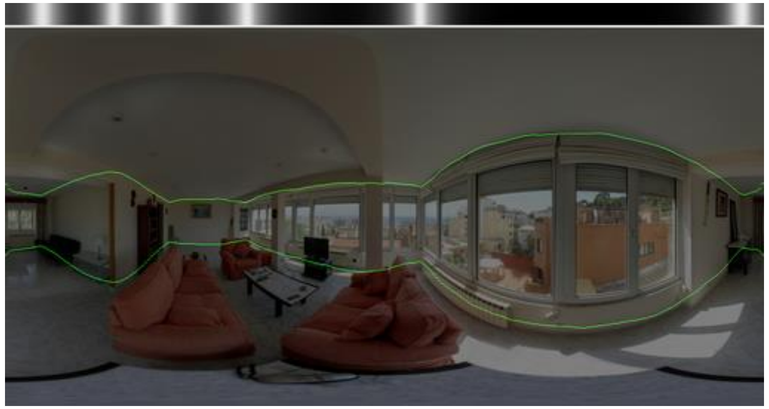
2 결과 분석 - 결과 비교

Img _name	Resnet18	ResNext50_32x4d	DenseNet 121
Pano_18			
Pano_20			

2 결과 분석 - 결과 비교

Img _name	resnet50	resnet101	resnet34
Pano_18			
Pano_20			

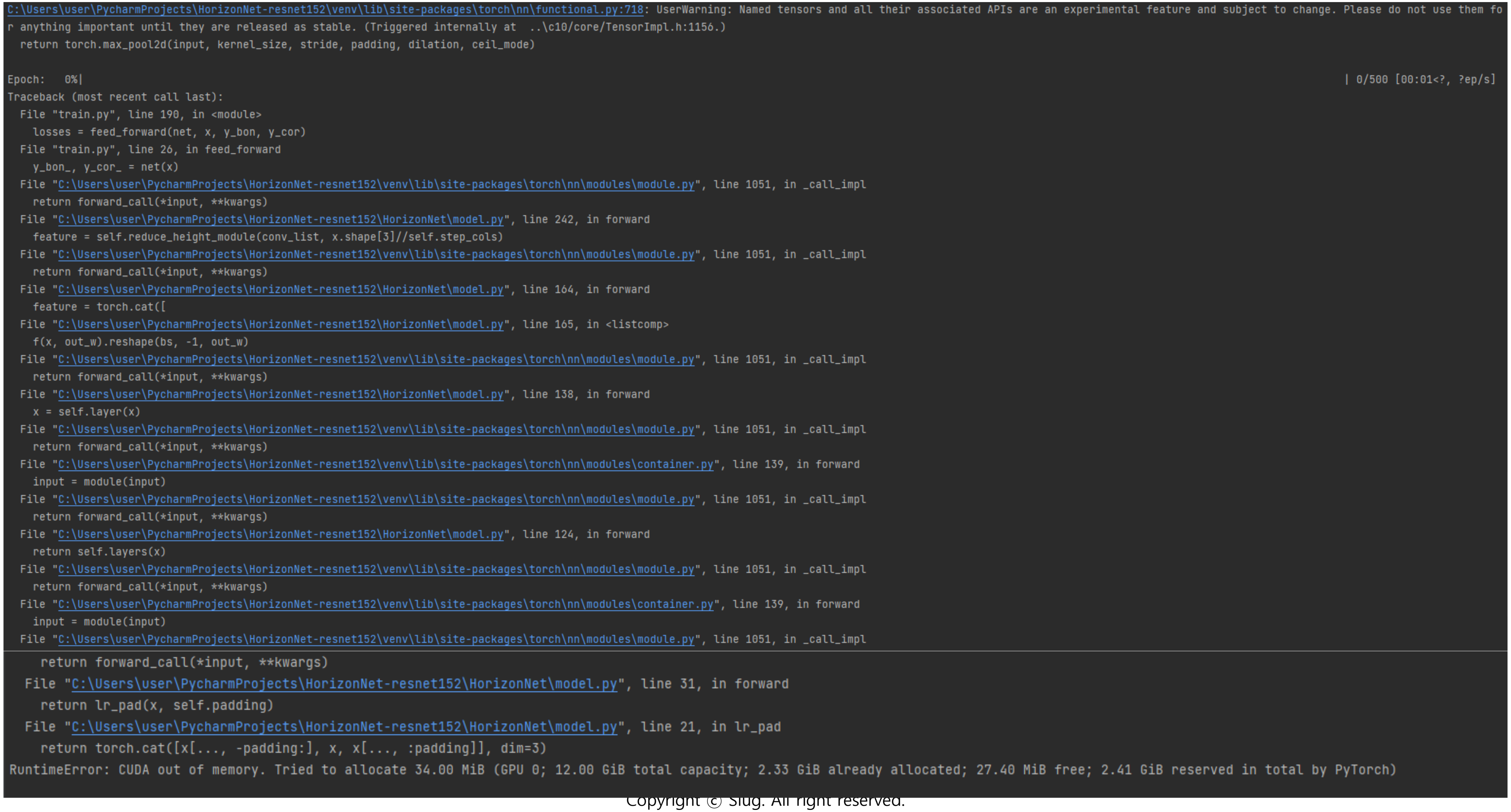
2 결과 분석 - 결과 비교

Img _name	Resnet18	ResNext50_32x4d	DenseNet 121
Pano_18			
Pano_20			

3 오류

3 오류

- 다음의 에러가 발생하여 진행하지 못함. 메모리 문제인가..?😥

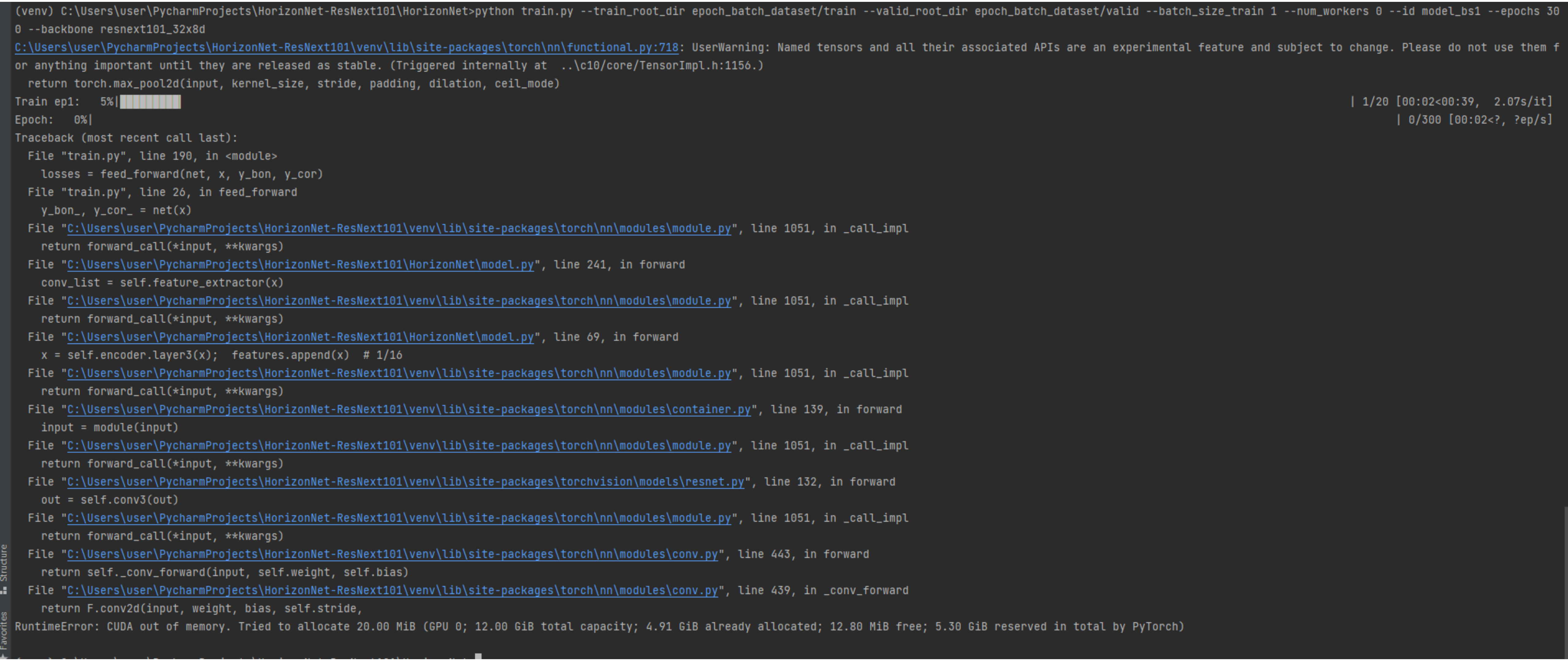


```
C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them fo
r anything important until they are released as stable. (Triggered internally at  ..\c10/core/TensorImpl.h:1156.)
  return torch.max_pool2d(input, kernel_size, stride, padding, dilation, ceil_mode)

Epoch:   0%|                                                                                                                                                     | 0/500 [00:01<?, ?ep/s]
Traceback (most recent call last):
  File "train.py", line 190, in <module>
    losses = feed_forward(net, x, y_bon, y_cor)
  File "train.py", line 26, in feed_forward
    y_bon_, y_cor_ = net(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 242, in forward
    feature = self.reduce_height_module(conv_list, x.shape[3]//self.step_cols)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 164, in forward
    feature = torch.cat([
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 165, in <listcomp>
    f(x, out_w).reshape(bs, -1, out_w)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 138, in forward
    x = self.layer(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\container.py", line 139, in forward
    input = module(input)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 124, in forward
    return self.layers(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\container.py", line 139, in forward
    input = module(input)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 31, in forward
    return lr_pad(x, self.padding)
  File "C:\Users\user\PycharmProjects\HorizonNet-resnet152\HorizonNet\model.py", line 21, in lr_pad
    return torch.cat([x[..., -padding:], x, x[..., :padding]], dim=3)
RuntimeError: CUDA out of memory. Tried to allocate 34.00 MiB (GPU 0; 12.00 GiB total capacity; 2.33 GiB already allocated; 27.40 MiB free; 2.41 GiB reserved in total by PyTorch)
```

3 오류

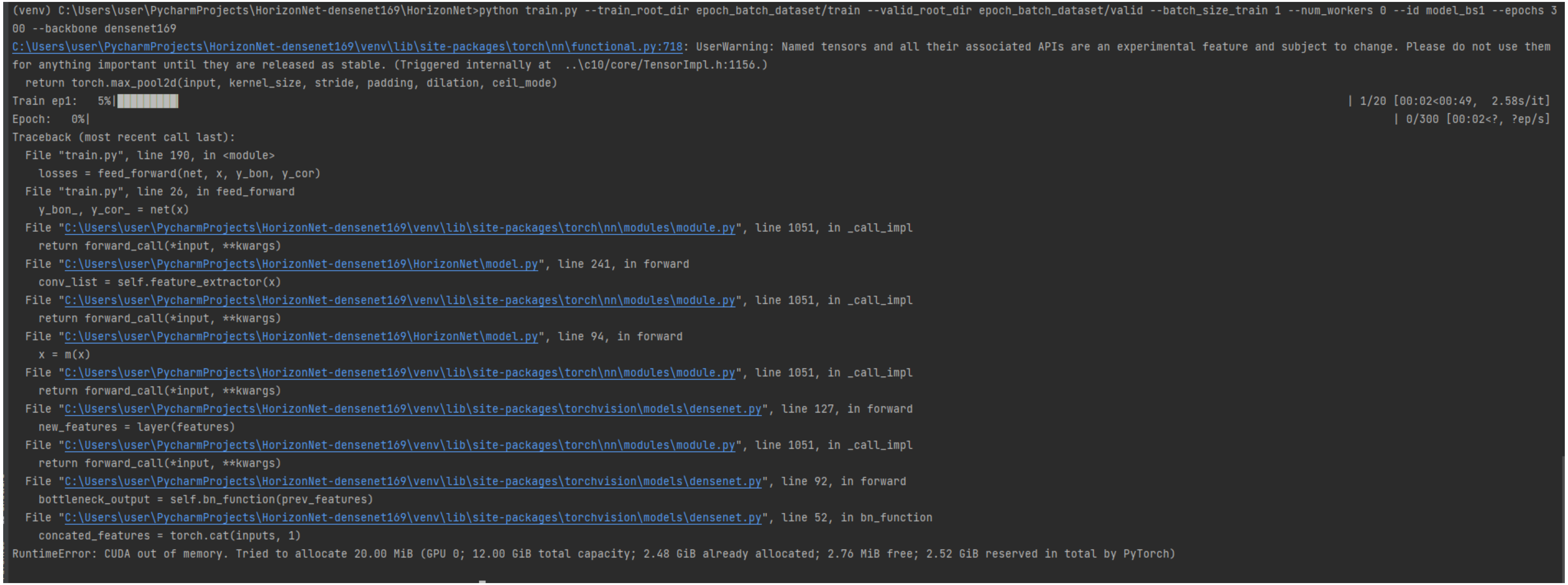
- 다음의 에러가 발생하여 진행하지 못함. 메모리 문제인듯..?😢



```
(venv) C:\Users\user\PycharmProjects\HorizonNet-ResNext101\HorizonNet>python train.py --train_root_dir epoch_batch_dataset/train --valid_root_dir epoch_batch_dataset/valid --batch_size_train 1 --num_workers 0 --id model_bs1 --epochs 30
0 --backbone resnext101_32x8d
C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them f
or anything important until they are released as stable. (Triggered internally at  ..\c10/core/TensorImpl.h:1156.)
  return torch.max_pool2d(input, kernel_size, stride, padding, dilation, ceil_mode)
Train ep1:   5%|█████████                                                                                                                                                                    | 1/20 [00:02<00:39,  2.07s/it]
Epoch:   0%|                                                                                                                                                                                    | 0/300 [00:02<?, ?ep/s]
Traceback (most recent call last):
  File "train.py", line 190, in <module>
    losses = feed_forward(net, x, y_bon, y_cor)
  File "train.py", line 26, in feed_forward
    y_bon_, y_cor_ = net(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\HorizonNet\model.py", line 241, in forward
    conv_list = self.feature_extractor(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\HorizonNet\model.py", line 69, in forward
    x = self.encoder.layer3(x);  features.append(x)  # 1/16
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\container.py", line 139, in forward
    input = module(input)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torchvision\models\resnet.py", line 132, in forward
    out = self.conv3(out)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\conv.py", line 443, in forward
    return self._conv_forward(input, self.weight, self.bias)
  File "C:\Users\user\PycharmProjects\HorizonNet-ResNext101\venv\lib\site-packages\torch\nn\modules\conv.py", line 439, in _conv_forward
    return F.conv2d(input, weight, bias, self.stride,
RuntimeError: CUDA out of memory. Tried to allocate 20.00 MiB (GPU 0; 12.00 GiB total capacity; 4.91 GiB already allocated; 12.80 MiB free; 5.30 GiB reserved in total by PyTorch)
```

3 오류

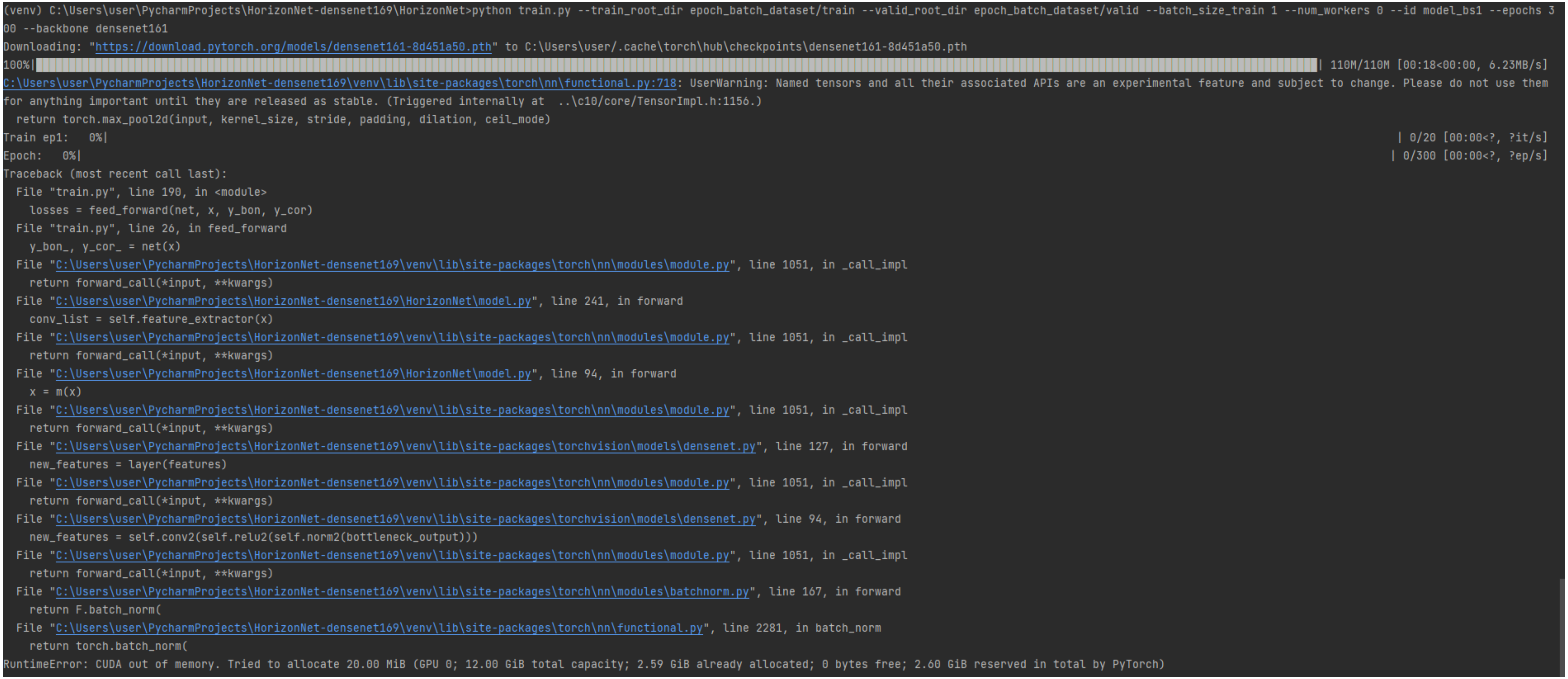
- 다음의 에러가 발생하여 진행하지 못함. 메모리 문제인듯..?😥



```
(venv) C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet>python train.py --train_root_dir epoch_batch_dataset/train --valid_root_dir epoch_batch_dataset/valid --batch_size_train 1 --num_workers 0 --id model_bs1 --epochs 3
00 --backbone densenet169
C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them
for anything important until they are released as stable. (Triggered internally at  ..\c10/core/TensorImpl.h:1156.)
  return torch.max_pool2d(input, kernel_size, stride, padding, dilation, ceil_mode)
Train ep1:   5%|█████████                                                                                                      | 1/20 [00:02<00:49,  2.58s/it]
Epoch:   0%|                                                                                                                          | 0/300 [00:02<?, ?ep/s]
Traceback (most recent call last):
  File "train.py", line 190, in <module>
    losses = feed_forward(net, x, y_bon, y_cor)
  File "train.py", line 26, in feed_forward
    y_bon_, y_cor_ = net(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 241, in forward
    conv_list = self.feature_extractor(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 94, in forward
    x = m(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 127, in forward
    new_features = layer(features)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 92, in forward
    bottleneck_output = self.bn_function(prev_features)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 52, in bn_function
    concated_features = torch.cat(inputs, 1)
RuntimeError: CUDA out of memory. Tried to allocate 20.00 MiB (GPU 0; 12.00 GiB total capacity; 2.48 GiB already allocated; 2.76 MiB free; 2.52 GiB reserved in total by PyTorch)
```

3 오류

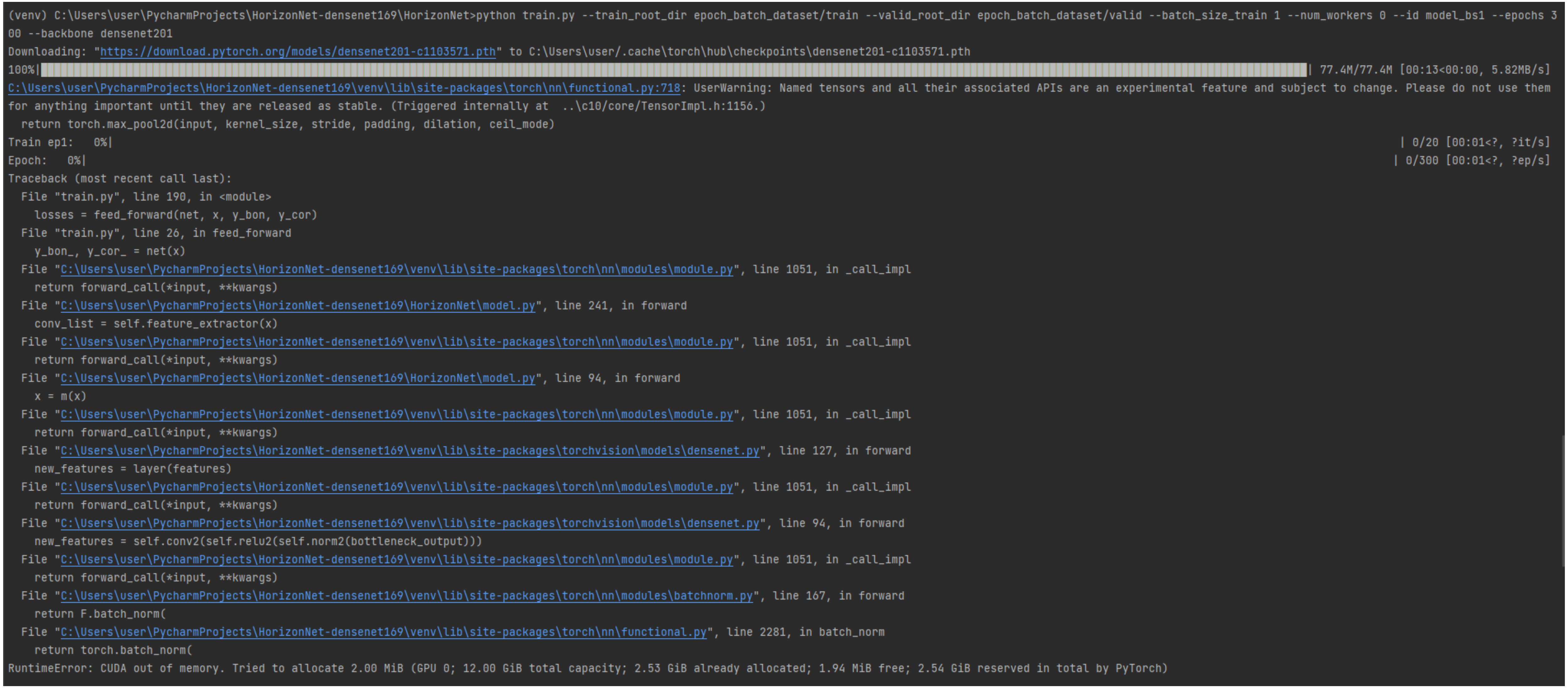
- 다음의 에러가 발생하여 진행하지 못함. 메모리 문제인듯..?😥



```
(venv) C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet>python train.py --train_root_dir epoch_batch_dataset/train --valid_root_dir epoch_batch_dataset/valid --batch_size_train 1 --num_workers 0 --id model_bs1 --epochs 3
00 --backbone densenet161
Downloading: "https://download.pytorch.org/models/densenet161-8d451a50.pth" to C:\Users\user/.cache\torch\hub\checkpoints\densenet161-8d451a50.pth
100%|████████████████████████████████████████████████████████████████████████████████████████████████| 110M/110M [00:18<00:00, 6.23MB/s]
C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them
for anything important until they are released as stable. (Triggered internally at  ..\c10/core/TensorImpl.h:1156.)
  return torch.max_pool2d(input, kernel_size, stride, padding, dilation, ceil_mode)
Train ep1:   0%|                                                                                                      | 0/20 [00:00<?, ?it/s]
Epoch:   0%|                                                                                                         | 0/300 [00:00<?, ?ep/s]
Traceback (most recent call last):
  File "train.py", line 190, in <module>
    losses = feed_forward(net, x, y_bon, y_cor)
  File "train.py", line 26, in feed_forward
    y_bon_, y_cor_ = net(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 241, in forward
    conv_list = self.feature_extractor(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 94, in forward
    x = m(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 127, in forward
    new_features = layer(features)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 94, in forward
    new_features = self.conv2(self.relu2(self.norm2(bottleneck_output)))
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\batchnorm.py", line 167, in forward
    return F.batch_norm(
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\functional.py", line 2281, in batch_norm
    return torch.batch_norm(
RuntimeError: CUDA out of memory. Tried to allocate 20.00 MiB (GPU 0; 12.00 GiB total capacity; 2.59 GiB already allocated; 0 bytes free; 2.60 GiB reserved in total by PyTorch)
```

3 오류

- 다음의 에러가 발생하여 진행하지 못함. 메모리 문제인듯..?😥



```
(venv) C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet>python train.py --train_root_dir epoch_batch_dataset/train --valid_root_dir epoch_batch_dataset/valid --batch_size_train 1 --num_workers 0 --id model_bs1 --epochs 3
00 --backbone densenet201
Downloading: "https://download.pytorch.org/models/densenet201-c1103571.pth" to C:\Users\user/.cache\torch\hub\checkpoints\densenet201-c1103571.pth
100%|████████████████████████████████████████████████████████████████████████████████████████████████| 77.4M/77.4M [00:13<00:00, 5.82MB/s]
C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them
for anything important until they are released as stable. (Triggered internally at  ..\c10/core/TensorImpl.h:1156.)
  return torch.max_pool2d(input, kernel_size, stride, padding, dilation, ceil_mode)
Train ep1:   0%|                                                                                                  | 0/20 [00:01<?, ?it/s]
Epoch:   0%|                                                                                                     | 0/300 [00:01<?, ?ep/s]
Traceback (most recent call last):
  File "train.py", line 190, in <module>
    losses = feed_forward(net, x, y_bon, y_cor)
  File "train.py", line 26, in feed_forward
    y_bon_, y_cor_ = net(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 241, in forward
    conv_list = self.feature_extractor(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\HorizonNet\model.py", line 94, in forward
    x = m(x)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 127, in forward
    new_features = layer(features)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torchvision\models\densenet.py", line 94, in forward
    new_features = self.conv2(self.relu2(self.norm2(bottleneck_output)))
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\module.py", line 1051, in _call_impl
    return forward_call(*input, **kwargs)
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\modules\batchnorm.py", line 167, in forward
    return F.batch_norm(
  File "C:\Users\user\PycharmProjects\HorizonNet-densenet169\venv\lib\site-packages\torch\nn\functional.py", line 2281, in batch_norm
    return torch.batch_norm(
RuntimeError: CUDA out of memory. Tried to allocate 2.00 MiB (GPU 0; 12.00 GiB total capacity; 2.53 GiB already allocated; 1.94 MiB free; 2.54 GiB reserved in total by PyTorch)
```

THANK YOU

The End