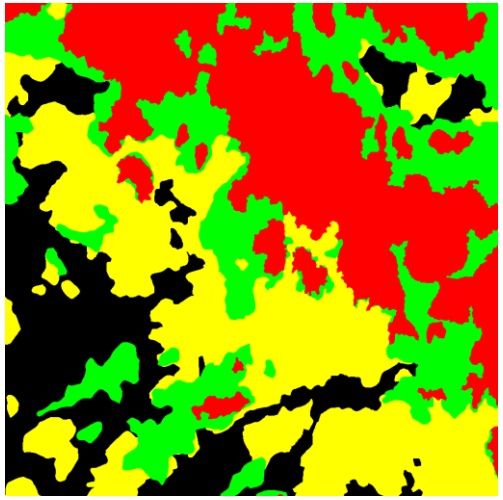
CV_텀 프로젝트 (구름 탐지)

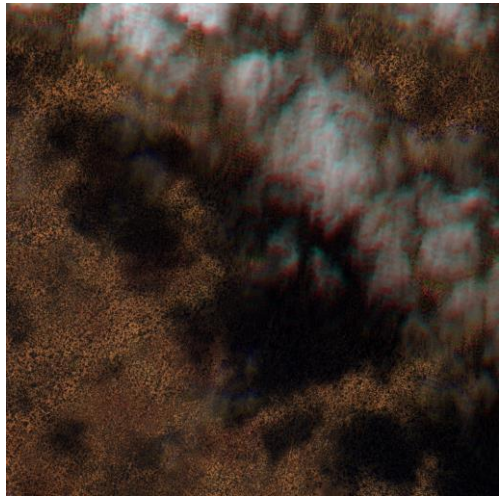
Hyoungwon Seo

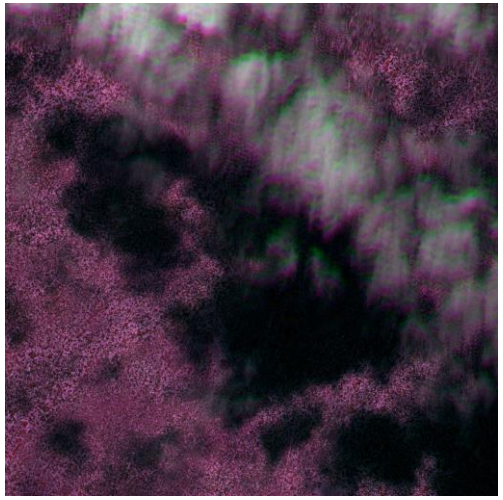
CONTENTS

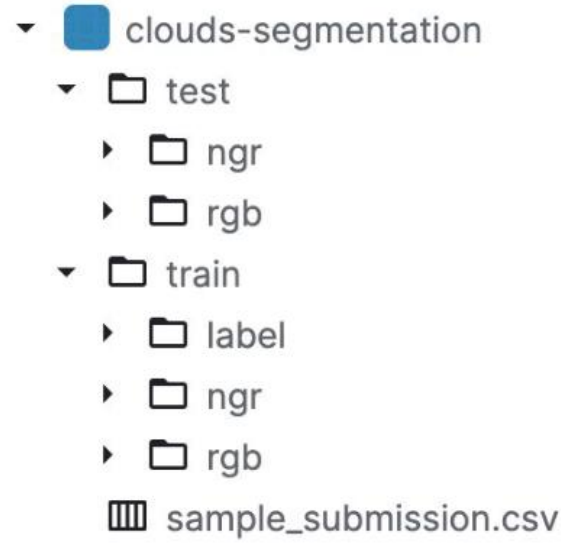
- **Task: 3종류의 구름 Semantic Segmentation**

- **데이터셋**
  - label: 구름 레이블 정보 (1000x1000)
  - rgb: RGB 채널 영상 (1000x1000)
  - ngr: NIR+GR 채널 영상 (1000x1000)



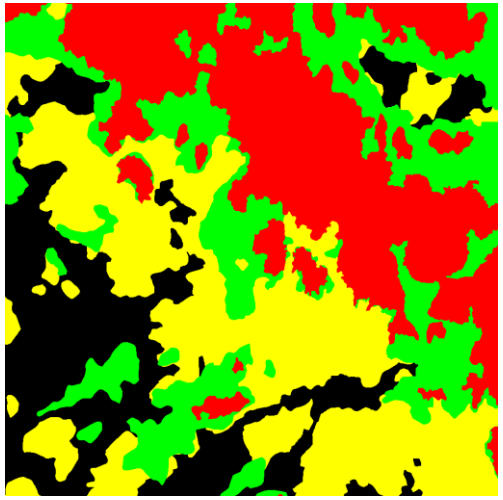


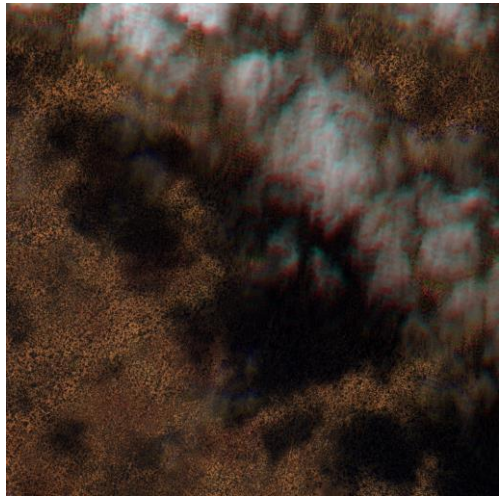


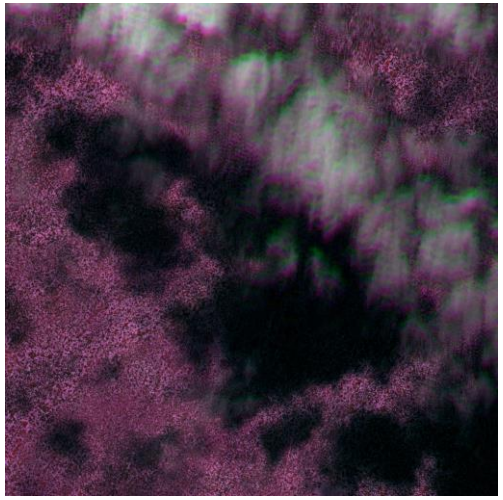


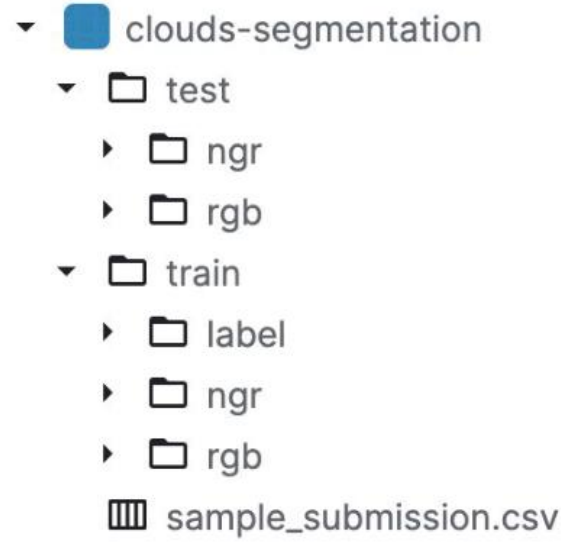
- **Task: 3종류의 구름 Semantic Segmentation**

- **레이블**
  - 빨간색 (255, 0, 0): 짙은 구름
  - 초록색 (0, 255, 0): 옅은 구름
  - 노란색 (255, 255, 0): 구름 그림자

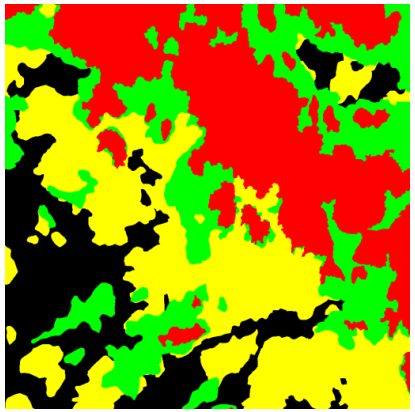


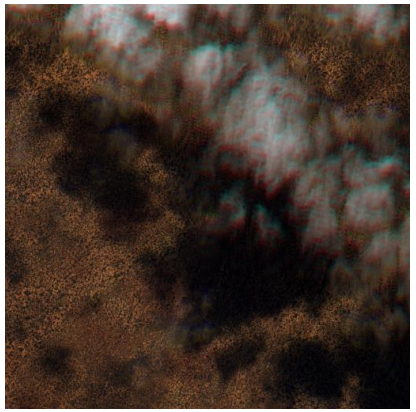


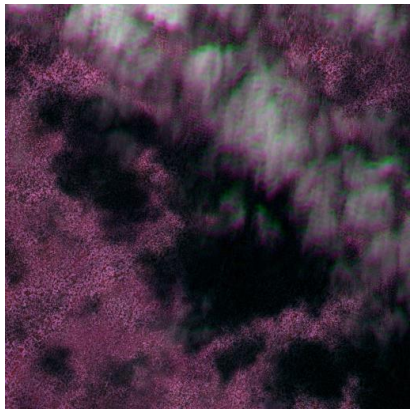


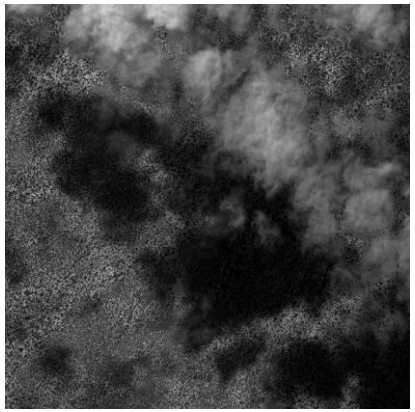


- 채널에 따른 이미지


label

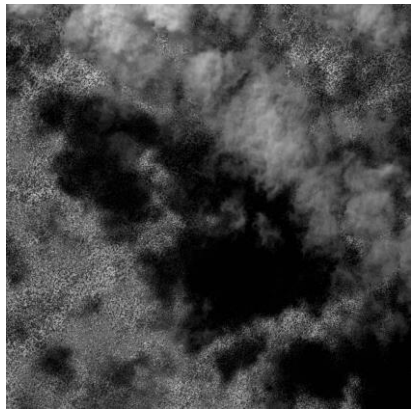

RGB


NGR

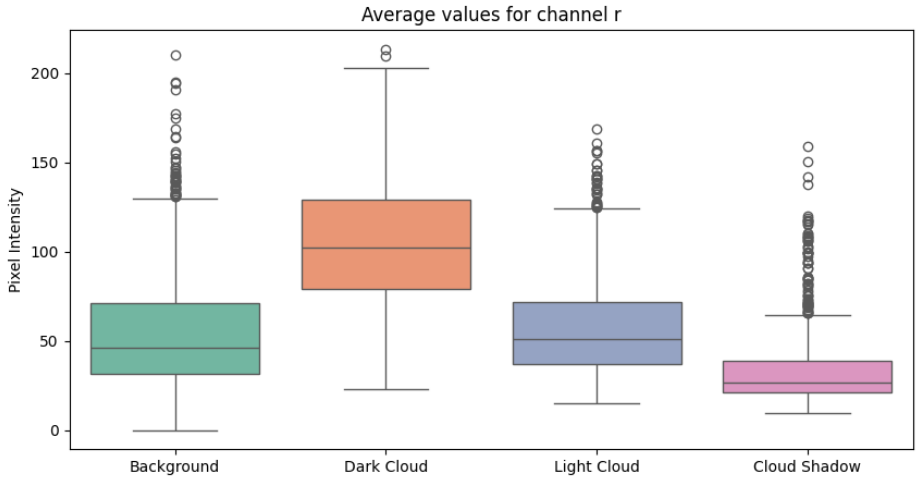

R

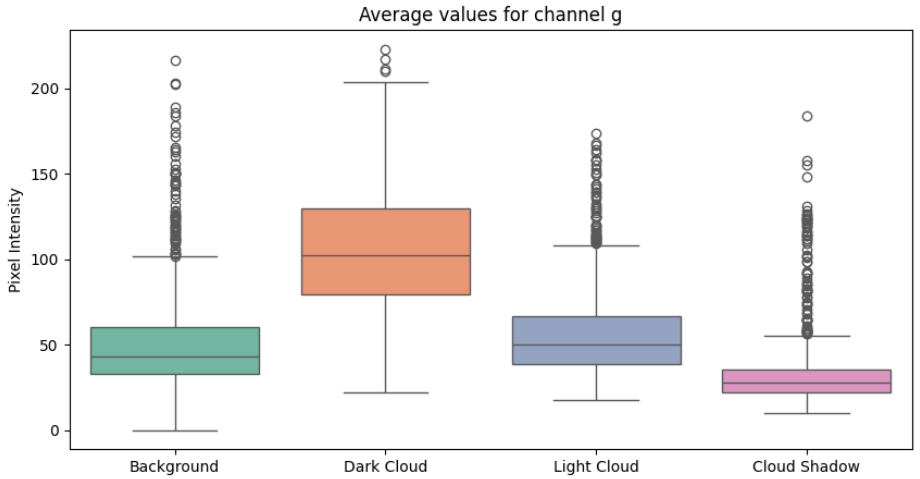

G

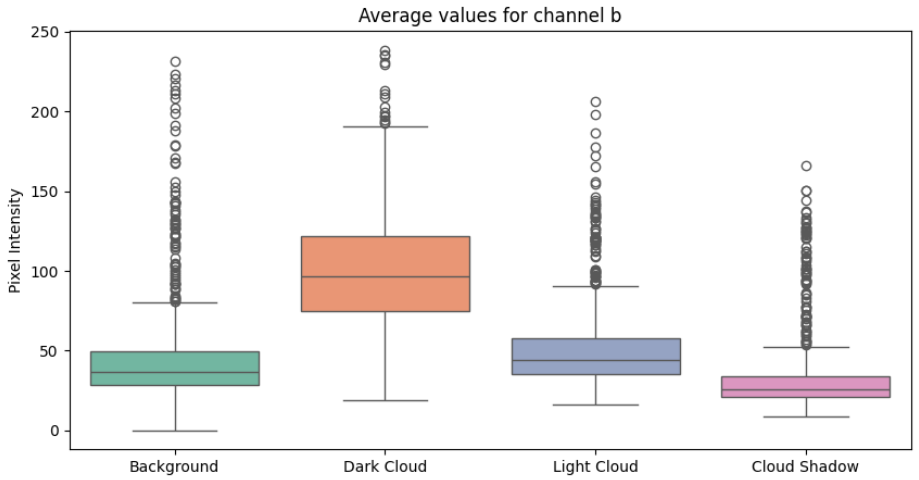

B

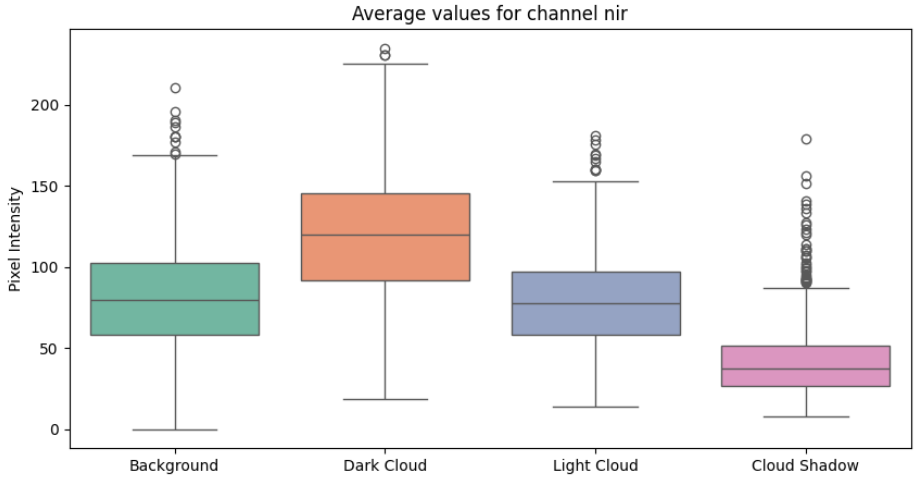

NIR

- 채널에 따른 레이블 픽셀값

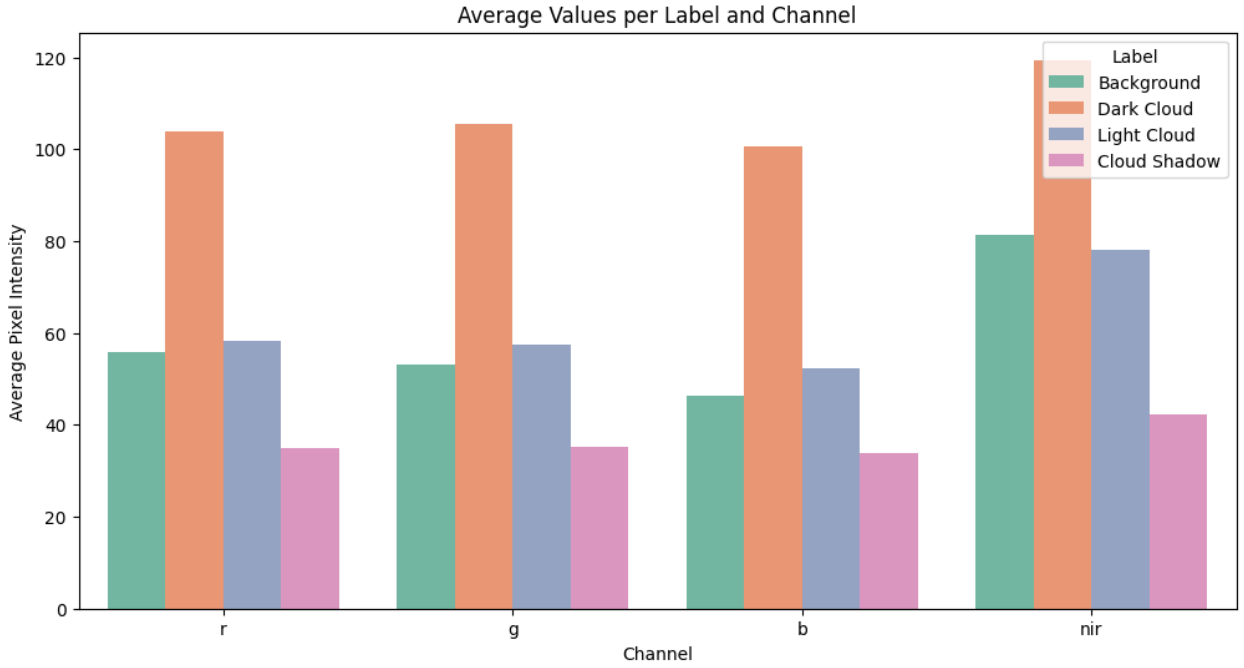


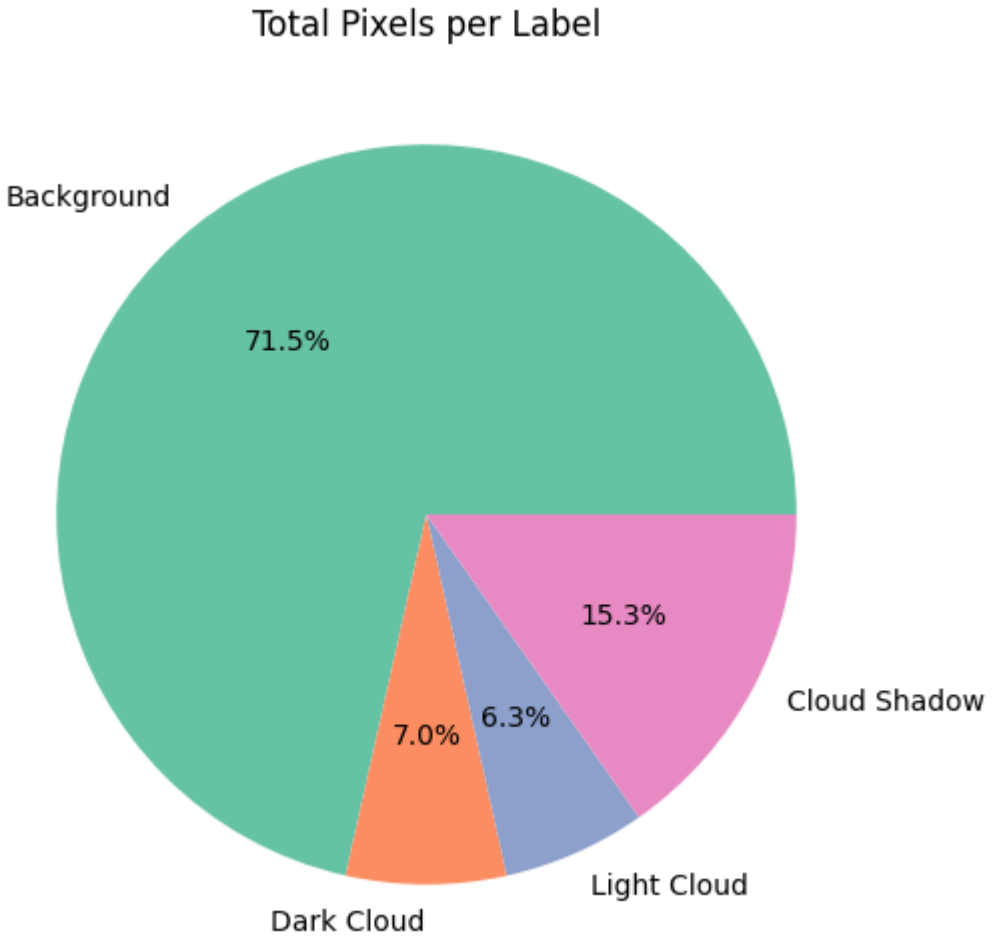




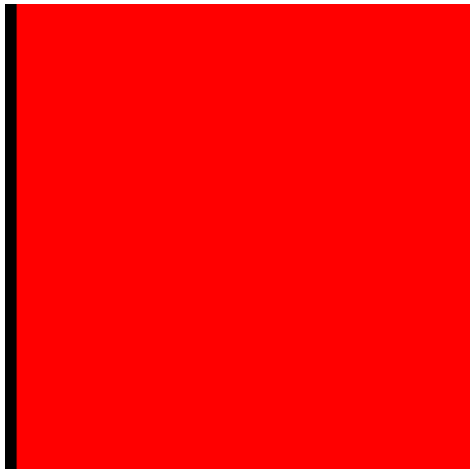
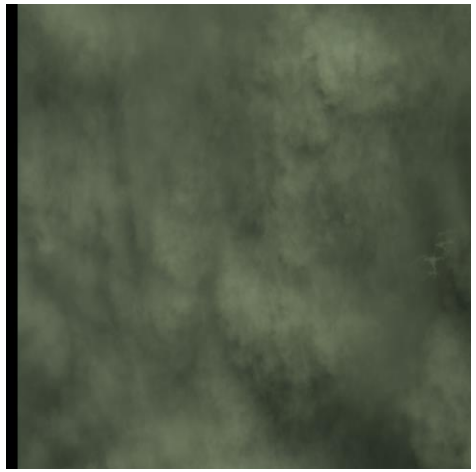


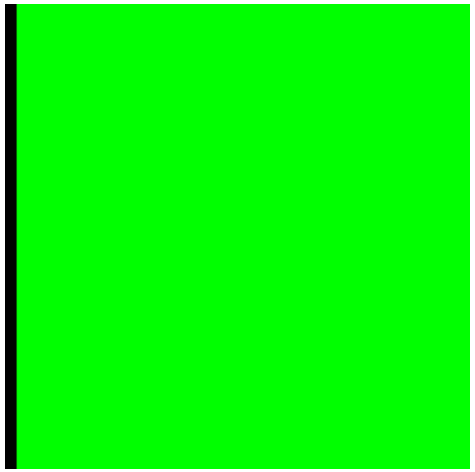
- 채널에 따른 레이블 평균 픽셀 및 비율

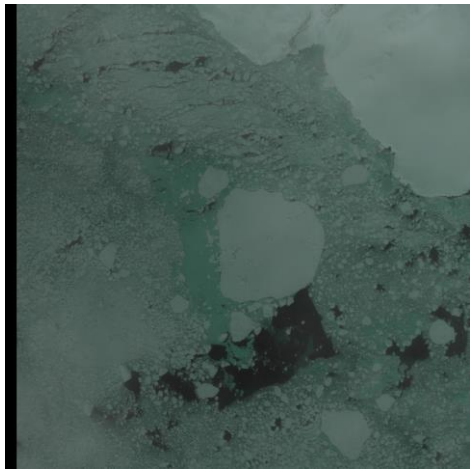




- **Segmentation 어려운 이미지**

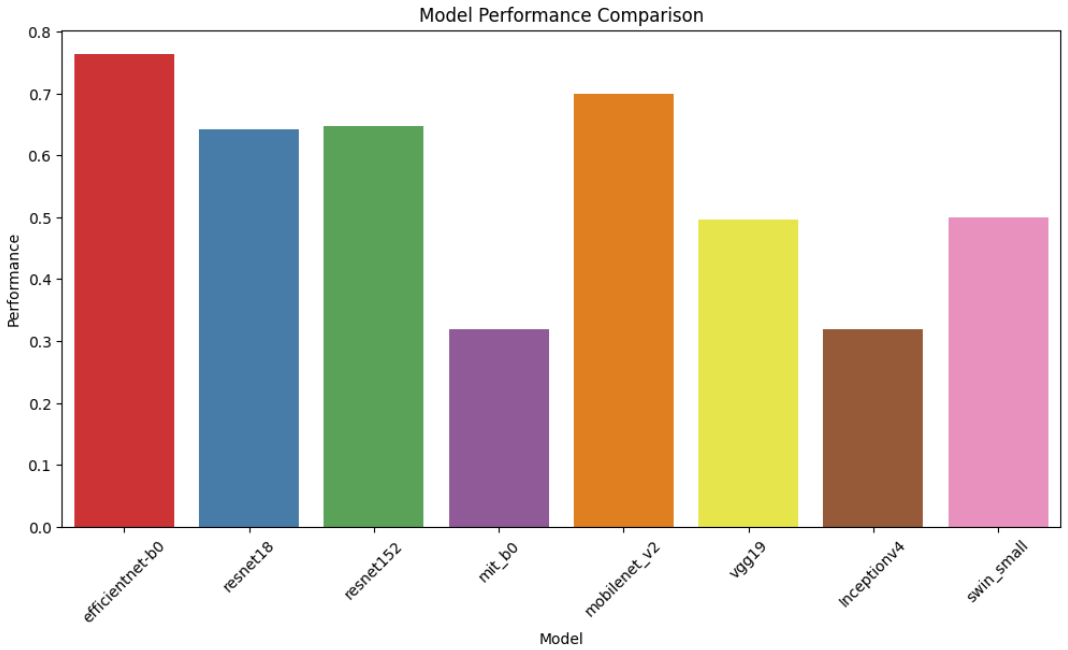




- **Segmentation 모델 인코더 탐색**
  - **SMP (segmentation_models.pytorch)**

  - **FPN**, patch_size: 224 x 224, stride: 194, NGR,
    5 epochs(30 min), batch_size: 32, lr: 0.001, weight: “imagenet”

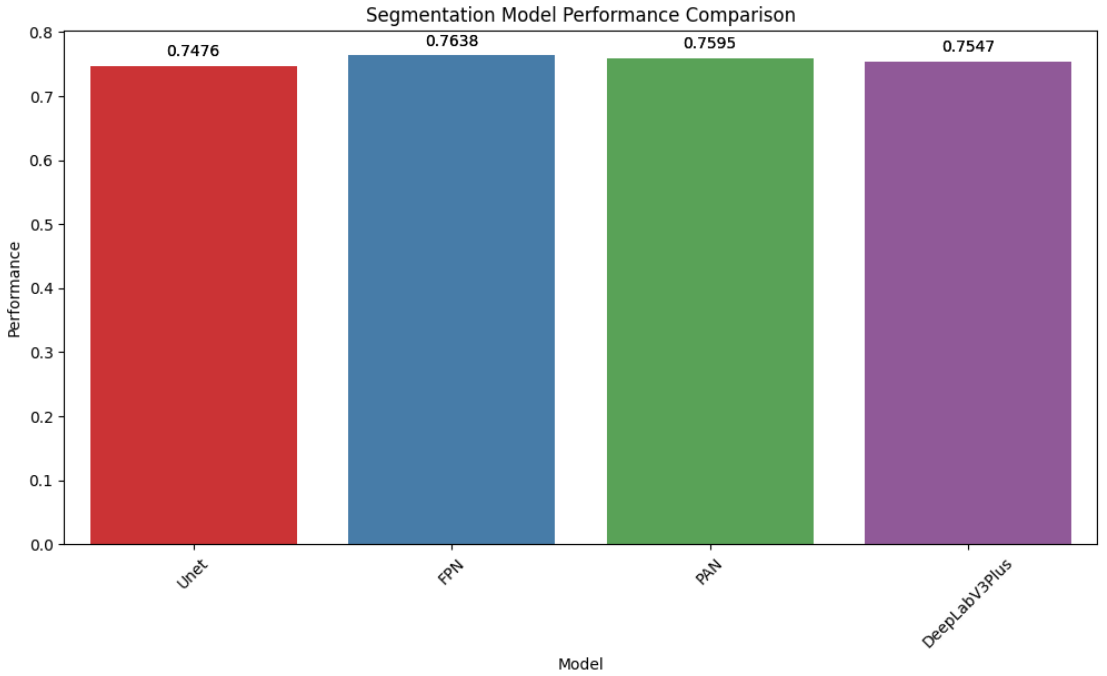
1) **efficientnet-b0 [4M]**
2) **resnet18 [11M]**
3) **resnet152 [58M]**
4) **mit_b0 (Mix Vision Transformer) [3M]**
5) **mobilenet_v2 [2M]**
6) **vgg19 [20M]**
7) **Inceptionv4 [41M]**
8) **swin_small [50M]**



- **Segmentation 모델 구조 탐색**
  - **SMP (segmentation_models.pytorch)**

  - **efficientnet-b0**, patch_size: 224 x 224, stride: 194, NGR,
    5 epochs(30 min), batch_size: 32, lr: 0.001, weight: “imagenet”

1) **Unet**
2) **FPN**
3) **PAN**
4) **DeepLabV3Plus**



• Input Data Channel 탐색

- **FPN, efficientnet-b0**, patch_size: 224 x 224, stride: 194, 5 epochs(30 min), batch_size: 32, lr: 0.001

1) **RGB [weight: “imagenet”]**
2) **NGR [weight: “imagenet”]**
3) **RGBN [weight: None]**

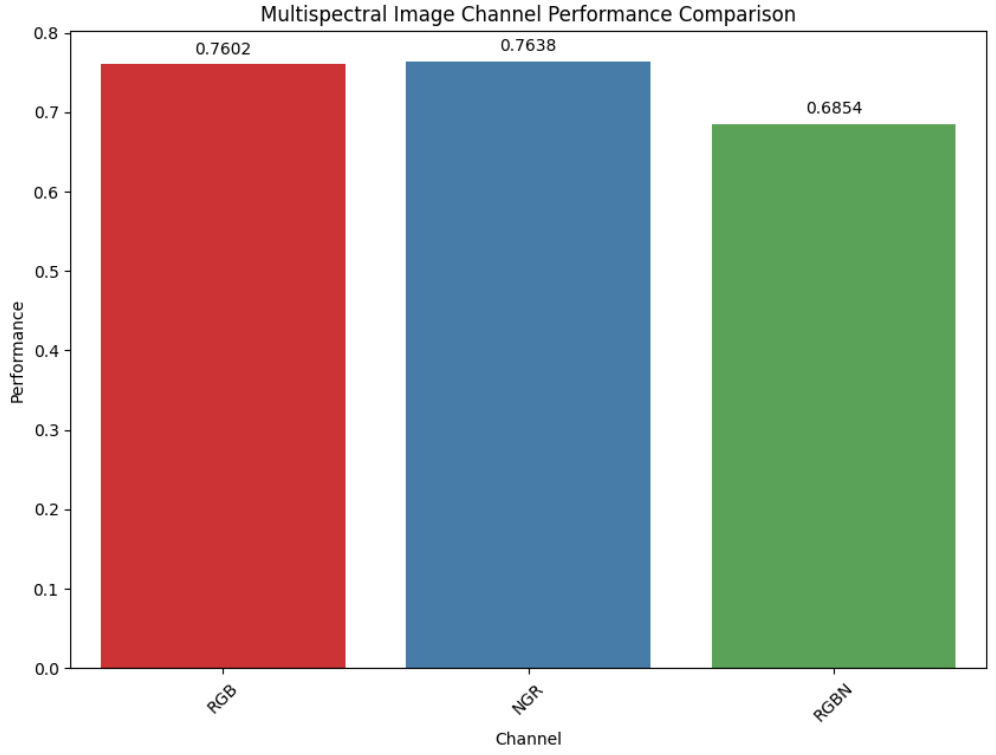
```python
def custom_preprocessing(image, **kwargs):
    # 이미지 정규화 (0-1 범위로 스케일링)
    image = image / 255.0

    # ImageNet 평균 및 표준편차
    """
    각 채널별 정규화된 mean, std 값:
    r 채널 - mean: 0.2487, std: 0.1555
    g 채널 - mean: 0.2466, std: 0.1571
    b 채널 - mean: 0.2287, std: 0.1561
    nir 채널 - mean: 0.3163, std: 0.1691
    """

    mean = np.array([0.2487, 0.2466, 0.2287, 0.3163])  # 4채널 이미지의 평균값
    std = np.array([0.1555, 0.1571, 0.1561, 0.1691])   # 4채널 이미지의 표준편차

    # 정규화
    image = (image - mean) / std

    return image
```



• Input Data Size 탐색

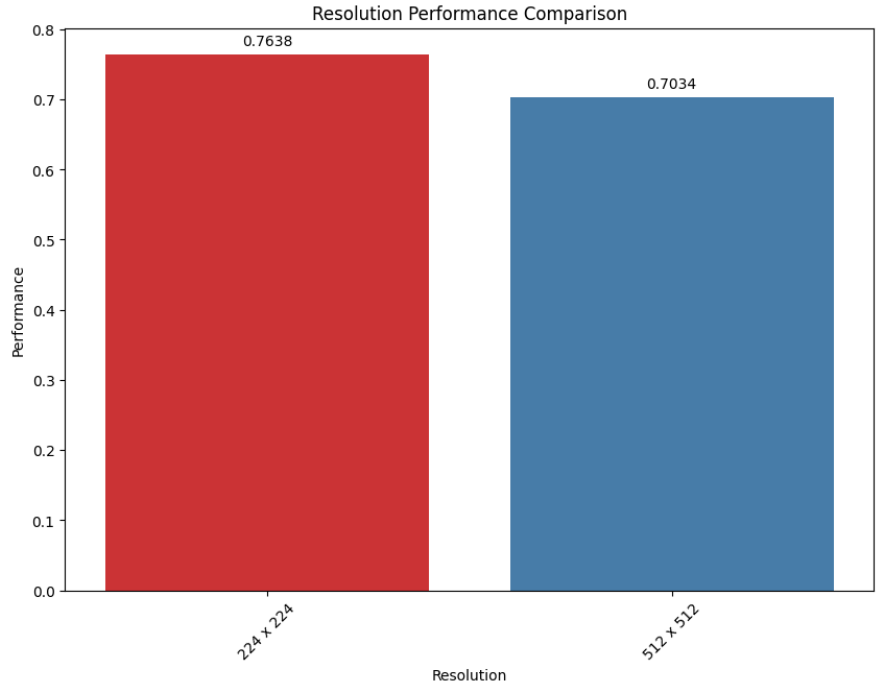
- **FPN, efficientnet-b0,** NGR,
  5 epochs(30 min), batch_size: 32, lr: 0.001

1) Patch_size: 224 x 224, Stride: 194

- 1000 x 1000 → patch 5x5장

1) Patch_size: 512 x 512, Stride: 488

- 1000 x 1000 → patch 2x2장



• Augmentation 탐색

- **FPN, efficientnet-b0**, patch_size: 224 x 224, stride: 194, NGR, 5 epochs(30 min), batch_size: 32, lr: 0.001, weight: “imagenet”

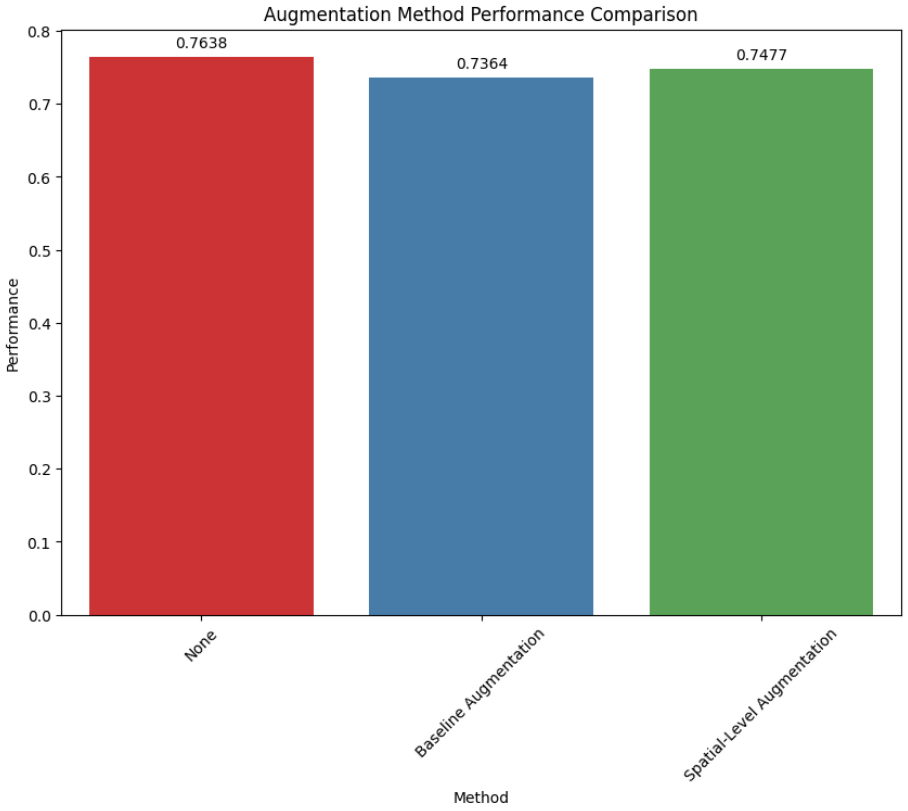
1) None

2) Baseline Augmentation

- HorizontalFlip(always_apply=False, p=0.5)
- VerticalFlip(always_apply=False, p=0.5)
- ShiftScaleRotate(...)
- RandomBrightnessContrast(...)

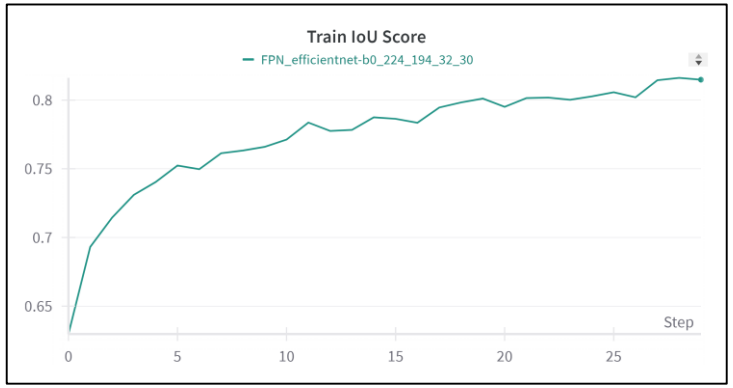
3) Spatial-Level Augmentation

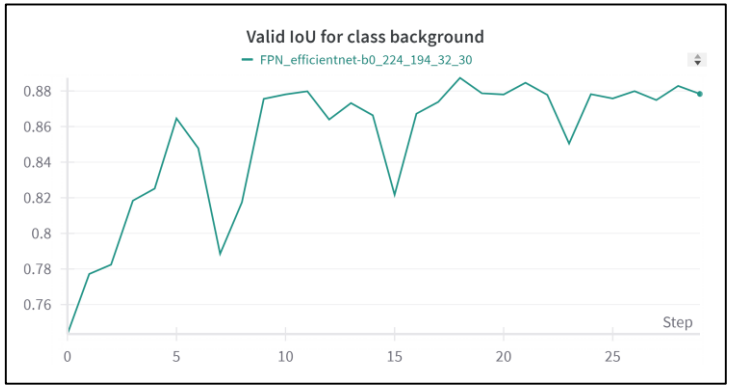
- HorizontalFlip(always_apply=False, p=0.5)
- VerticalFlip(always_apply=False, p=0.5)
- RandomRotate90(always_apply=False, p=0.5)

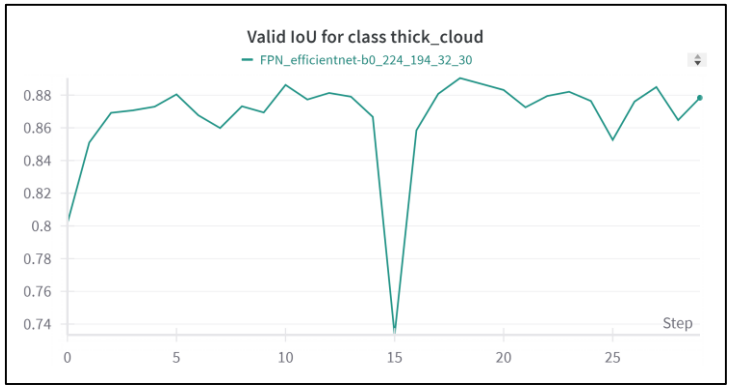


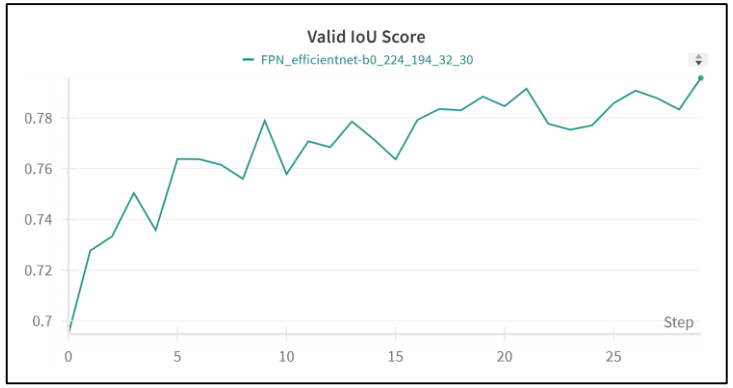
- 학습 경향 확인

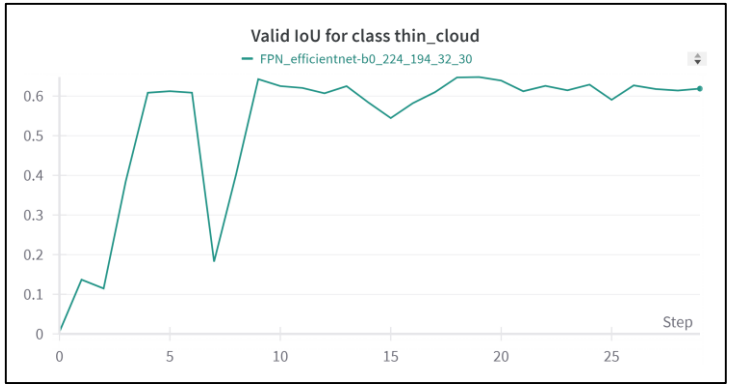
  - **FPN, efficientnet-b0, Augmentation = None**, patch_size: 224 x 224, NGR, stride: 194, 30 epochs(3 h), batch_size: 32, lr: 0.001, weight: “imagenet”

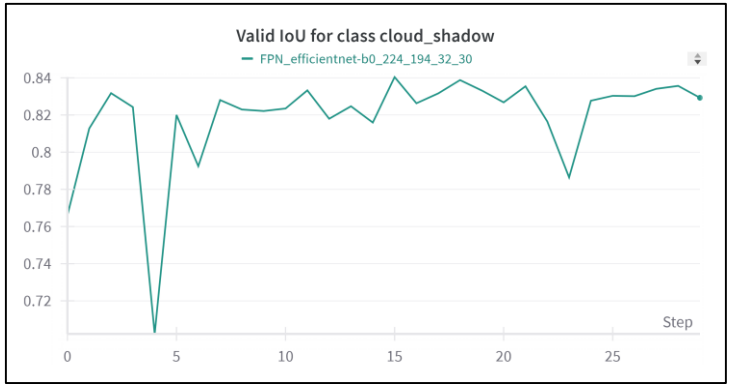










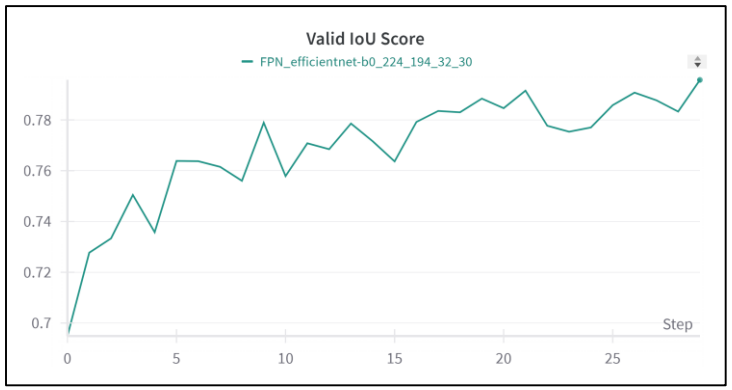


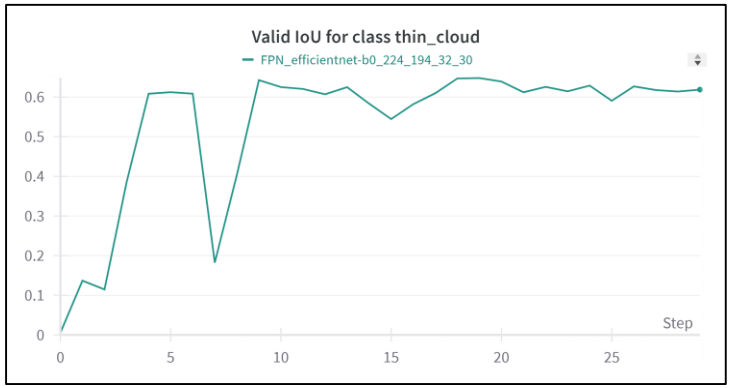
- **학습 경향 확인**

  - **FPN, efficientnet-b0, Augmentation = None**, patch_size: 224 x 224, NGR, stride: 194, 30 epochs(3 h), batch_size: 32, lr: 0.001, weight: “imagenet”

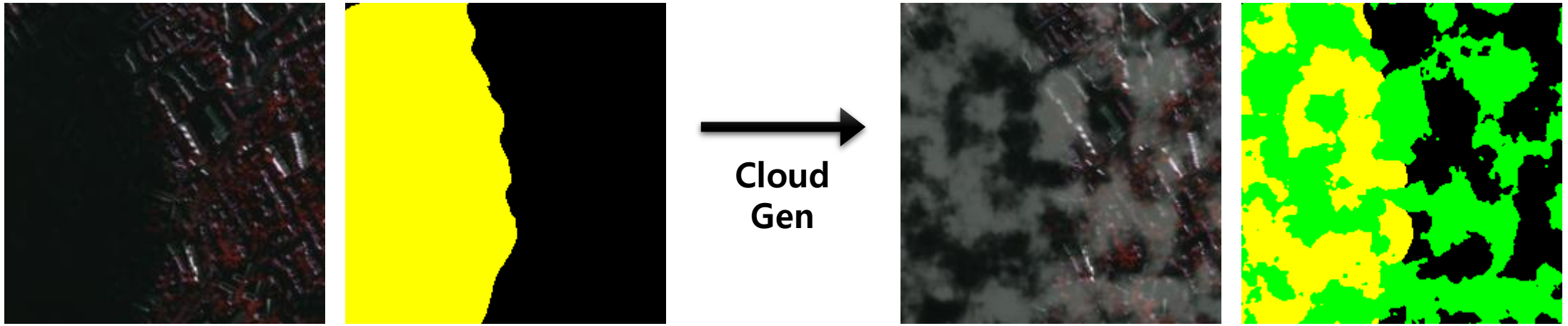
  1) 옅은 구름 class에 대한 Score가 상대적으로 낮음

  2) 수렴이 충분히 되지 않음

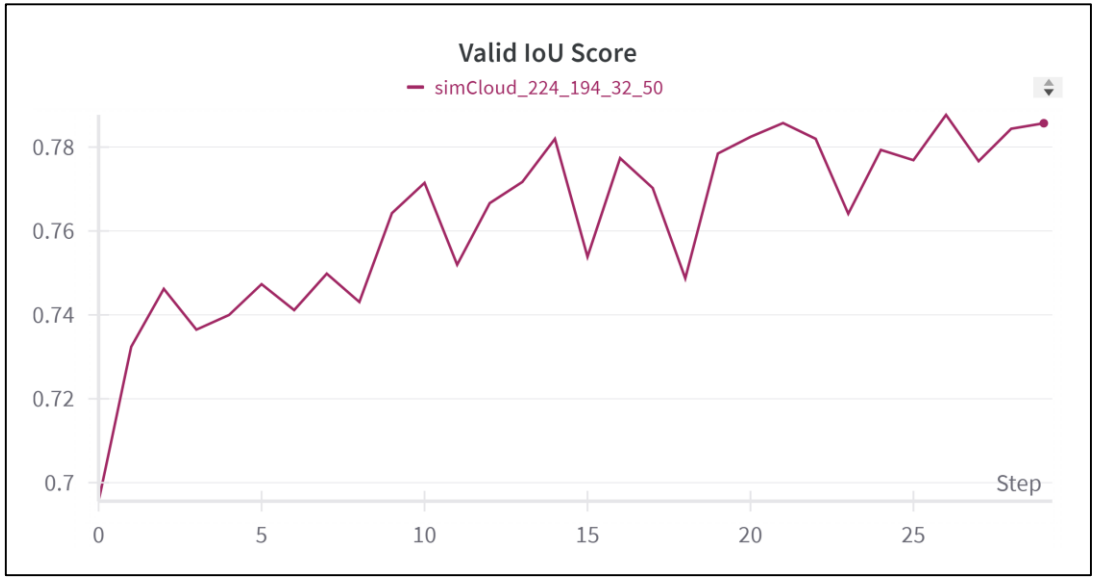


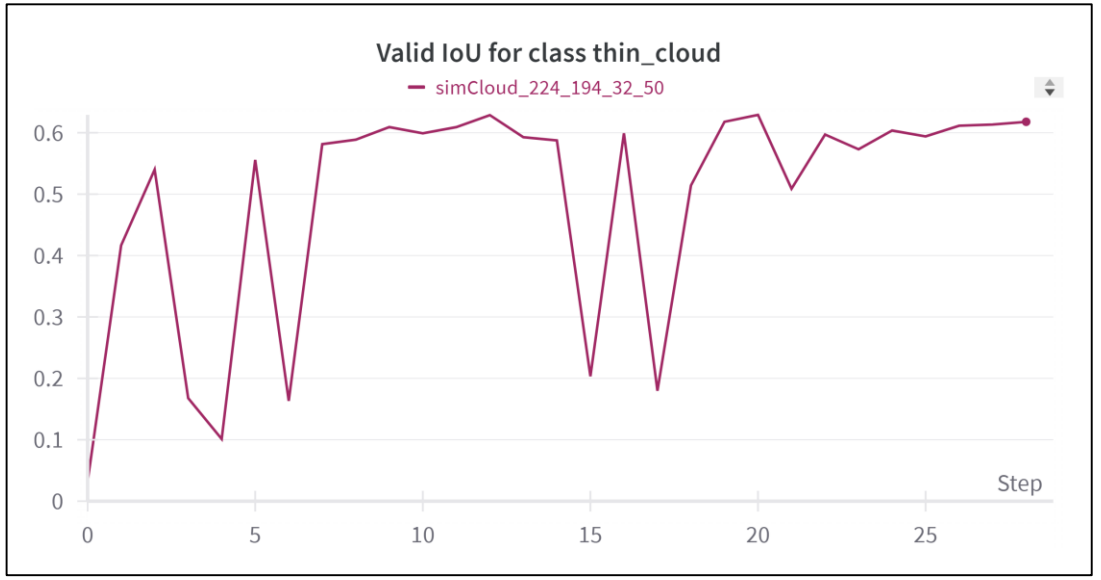


- **Satellite Cloud Generator** **(https://github.com/strath-ai/SatelliteCloudGenerator/tree/main)**
  - IoU 0.6의 옅은 구름을 제외한 Label은 0.8~0.9 정도의 IoU
  - Cloud Label이 [0, 0, 0](배경), [255, 255, 0](구름 그림자)만 존재하는 Cropped Image에 대해 50% 확률로 인공적인 옅은 구름 생성



- **Satellite Cloud Generator** **(https://github.com/strath-ai/SatelliteCloudGenerator/tree/main)**
  - **FPN, efficientnet-b0, Augmentation = None**, patch_size: 224 x 224, NGR, stride: 194, 30 epochs(3 h), batch_size: 32, lr: 0.001, weight: “imagenet”





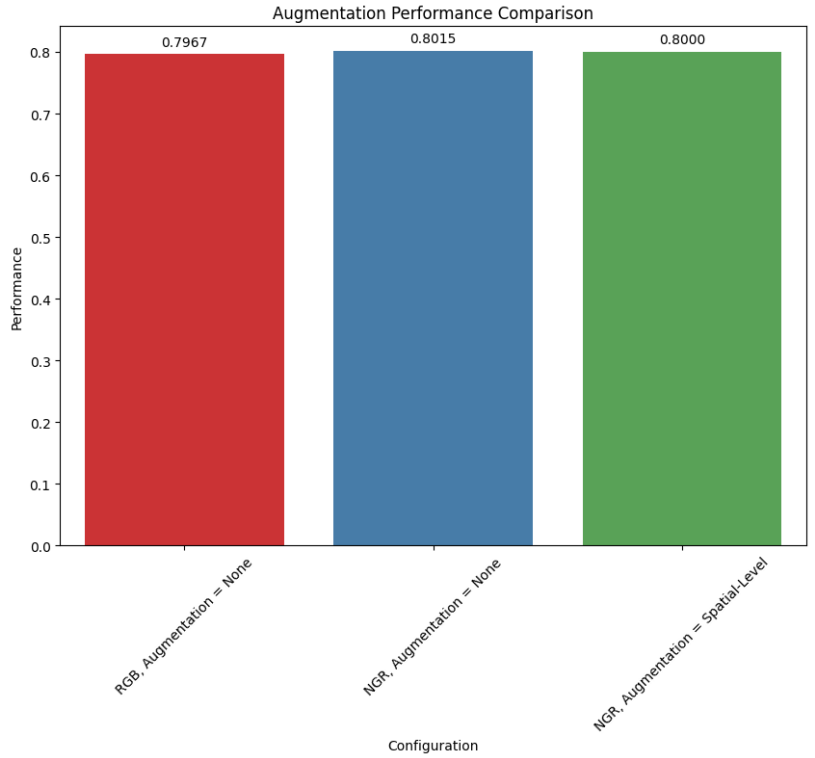
- **Long Train**

  - **FPN, efficientnet-b0**, patch_size: 224 x 224, stride: 194,
    50 epochs(5 h), batch_size: 32, lr: 0.001, weight: “imagenet”

1) RGB, Augmentation = None

2) NGR, Augmentation = None

3) NGR, Augmentation = Spatial-Level



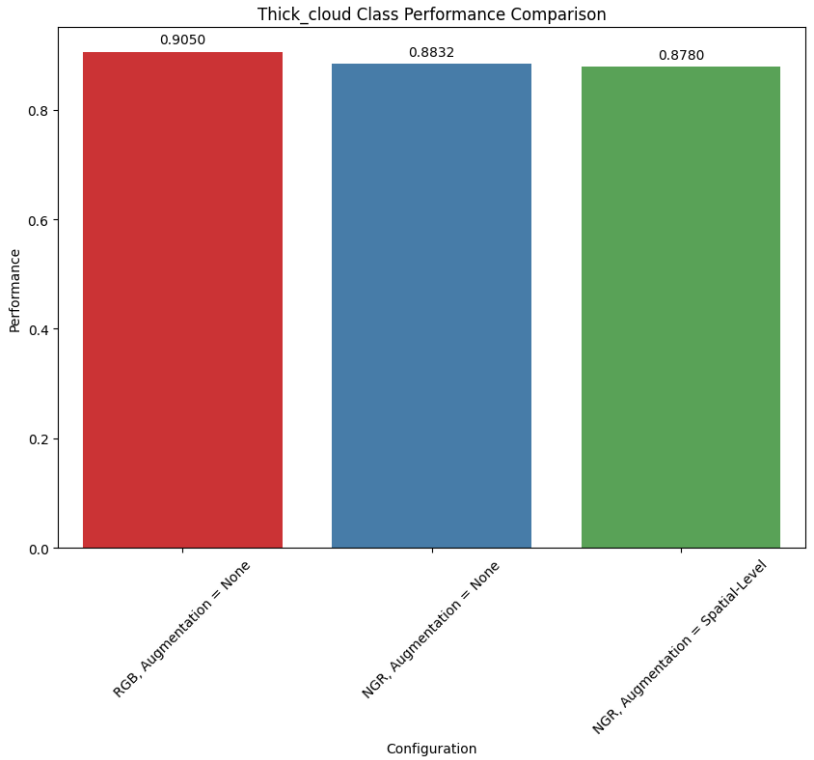
- **Long Train (Thick_cloud Class)**

  - **FPN, efficientnet-b0**, patch_size: 224 x 224, stride: 194,
    50 epochs(5 h), batch_size: 32, lr: 0.001, weight: “imagenet”

1) RGB, Augmentation = None

2) NGR, Augmentation = None

3) NGR, Augmentation = Spatial-Level



- **실험 세팅: FPN, efficientnet-b0**, patch_size: 224 x 224, stride: 194, 50 epochs(5 h), batch_size: 32, lr: 0.001, weight: “imagenet”

- Test 이미지는 1000 x 1000
  - Patch Size: 224 x 224, Stride: 97로 patch 9x9장의 이미지를 만들어 겹치는 부분은 예측 값의 평균으로 사용

Model	Public Score	Private Score
NGR	**0.8187**	0.8366
NGR + RGB Ensemble*	0.8075	0.8408
None_Aug + Aug Ensemble	0.8156	**0.8473**

* NGR base로 두고, RGB로 예측한 짙은 구름 class만 사용

Thank You

Question & Answer