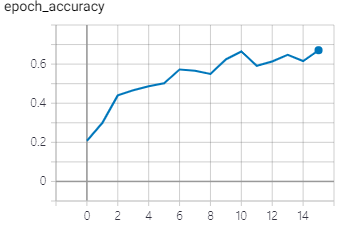
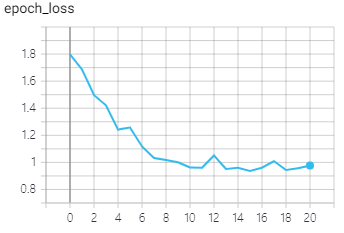
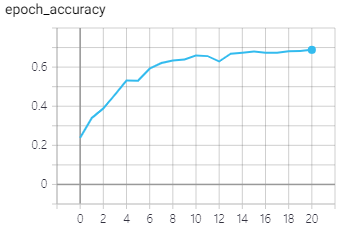
**기존 학습 그래프**



validation accuracy 0.6711 을 기록하고 epoch\_loss가 불안정하게 하강하는 모습을 볼 수 있다.

**Hyperparameter Tuning 이후 그래프**



+validation accuracy 0.6883+ 을 기록하고 epoch\_loss가 비교적 안정적으로 하강하는 모습이다.

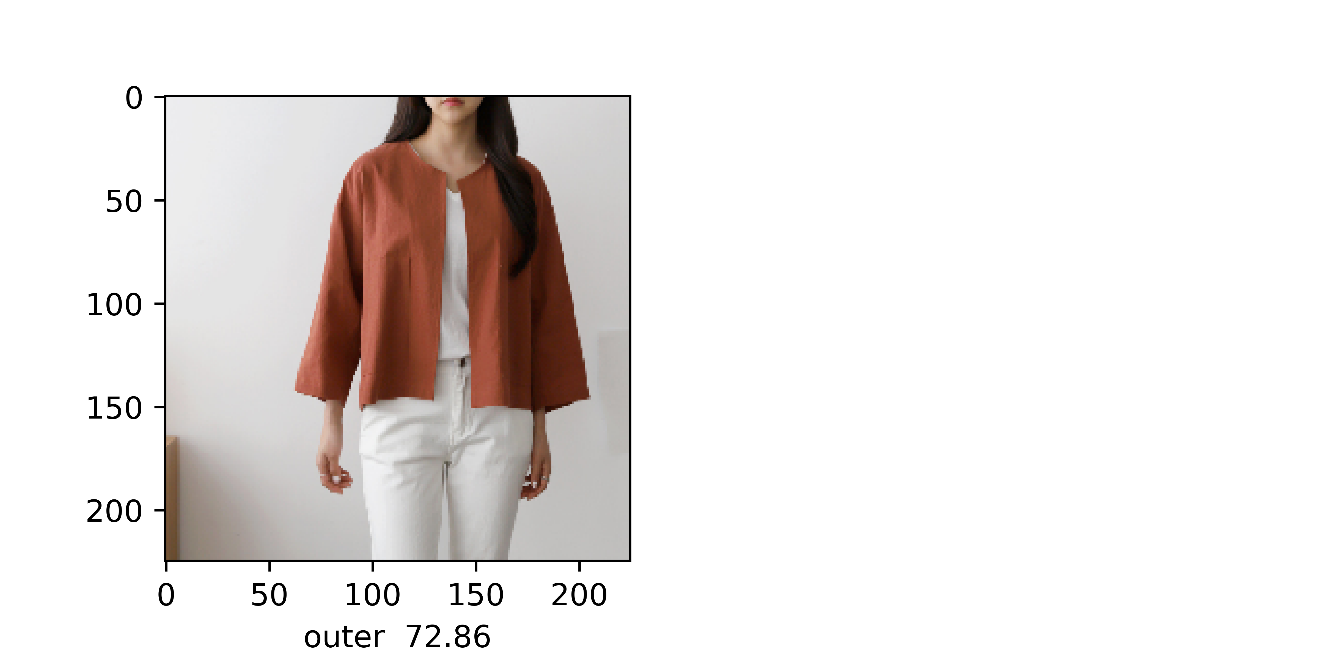
깊이 2048의 합성곱 신경망 레이어를 추가하고 오버피팅을 방지하기 위해 이미지 배치 사이즈를 4로 조정, earlystopping을 민감하게 반응하도록 조정하여 학습 시간이 증가하였지만 오버피팅이 발생하지 않고 loss 그래프가 안정적으로 하강하였다.

**기존 모델의 예측 결과**



아우터를 top으로 인식하는 문제 발생

**Hyperparameter tuning 업데이트 된 모델의 예측 결과**



아우터 이미지를 정상적으로 인식

**해당 모델의 데모 API**

<http://121.140.112.233/>

**Model Layer 구성**

Model: "model"

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Layer (type) Output Shape Param # Connected to

==================================================================================================

input\_1 (InputLayer) [(None, 225, 225, 3) 0

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sequential (Sequential) (None, 225, 225, 3) 0 input\_1[0][0]

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rescaling (Rescaling) (None, 225, 225, 3) 0 sequential[0][0]

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conv2d (Conv2D) (None, 113, 113, 32) 896 rescaling[0][0]

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batch\_normalization (BatchNorma (None, 113, 113, 32) 128 conv2d[0][0]

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activation (Activation) (None, 113, 113, 32) 0 batch\_normalization[0][0]

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conv2d\_1 (Conv2D) (None, 113, 113, 64) 18496 activation[0][0]

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batch\_normalization\_1 (BatchNor (None, 113, 113, 64) 256 conv2d\_1[0][0]

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activation\_1 (Activation) (None, 113, 113, 64) 0 batch\_normalization\_1[0][0]

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activation\_2 (Activation) (None, 113, 113, 64) 0 activation\_1[0][0]

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separable\_conv2d (SeparableConv (None, 113, 113, 128 8896 activation\_2[0][0]

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batch\_normalization\_2 (BatchNor (None, 113, 113, 128 512 separable\_conv2d[0][0]

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activation\_3 (Activation) (None, 113, 113, 128 0 batch\_normalization\_2[0][0]

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separable\_conv2d\_1 (SeparableCo (None, 113, 113, 128 17664 activation\_3[0][0]

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batch\_normalization\_3 (BatchNor (None, 113, 113, 128 512 separable\_conv2d\_1[0][0]

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max\_pooling2d (MaxPooling2D) (None, 57, 57, 128) 0 batch\_normalization\_3[0][0]

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conv2d\_2 (Conv2D) (None, 57, 57, 128) 8320 activation\_1[0][0]

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add (Add) (None, 57, 57, 128) 0 max\_pooling2d[0][0]

conv2d\_2[0][0]

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activation\_4 (Activation) (None, 57, 57, 128) 0 add[0][0]

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separable\_conv2d\_2 (SeparableCo (None, 57, 57, 256) 34176 activation\_4[0][0]

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batch\_normalization\_4 (BatchNor (None, 57, 57, 256) 1024 separable\_conv2d\_2[0][0]

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activation\_5 (Activation) (None, 57, 57, 256) 0 batch\_normalization\_4[0][0]

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separable\_conv2d\_3 (SeparableCo (None, 57, 57, 256) 68096 activation\_5[0][0]

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batch\_normalization\_5 (BatchNor (None, 57, 57, 256) 1024 separable\_conv2d\_3[0][0]

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max\_pooling2d\_1 (MaxPooling2D) (None, 29, 29, 256) 0 batch\_normalization\_5[0][0]

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conv2d\_3 (Conv2D) (None, 29, 29, 256) 33024 add[0][0]

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add\_1 (Add) (None, 29, 29, 256) 0 max\_pooling2d\_1[0][0]

conv2d\_3[0][0]

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activation\_6 (Activation) (None, 29, 29, 256) 0 add\_1[0][0]

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separable\_conv2d\_4 (SeparableCo (None, 29, 29, 512) 133888 activation\_6[0][0]

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batch\_normalization\_6 (BatchNor (None, 29, 29, 512) 2048 separable\_conv2d\_4[0][0]

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activation\_7 (Activation) (None, 29, 29, 512) 0 batch\_normalization\_6[0][0]

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separable\_conv2d\_5 (SeparableCo (None, 29, 29, 512) 267264 activation\_7[0][0]

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batch\_normalization\_7 (BatchNor (None, 29, 29, 512) 2048 separable\_conv2d\_5[0][0]

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max\_pooling2d\_2 (MaxPooling2D) (None, 15, 15, 512) 0 batch\_normalization\_7[0][0]

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conv2d\_4 (Conv2D) (None, 15, 15, 512) 131584 add\_1[0][0]

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add\_2 (Add) (None, 15, 15, 512) 0 max\_pooling2d\_2[0][0]

conv2d\_4[0][0]

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activation\_8 (Activation) (None, 15, 15, 512) 0 add\_2[0][0]

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separable\_conv2d\_6 (SeparableCo (None, 15, 15, 728) 378072 activation\_8[0][0]

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batch\_normalization\_8 (BatchNor (None, 15, 15, 728) 2912 separable\_conv2d\_6[0][0]

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activation\_9 (Activation) (None, 15, 15, 728) 0 batch\_normalization\_8[0][0]

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separable\_conv2d\_7 (SeparableCo (None, 15, 15, 728) 537264 activation\_9[0][0]

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batch\_normalization\_9 (BatchNor (None, 15, 15, 728) 2912 separable\_conv2d\_7[0][0]

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max\_pooling2d\_3 (MaxPooling2D) (None, 8, 8, 728) 0 batch\_normalization\_9[0][0]

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conv2d\_5 (Conv2D) (None, 8, 8, 728) 373464 add\_2[0][0]

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add\_3 (Add) (None, 8, 8, 728) 0 max\_pooling2d\_3[0][0]

conv2d\_5[0][0]

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separable\_conv2d\_8 (SeparableCo (None, 8, 8, 1024) 753048 add\_3[0][0]

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batch\_normalization\_10 (BatchNo (None, 8, 8, 1024) 4096 separable\_conv2d\_8[0][0]

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activation\_10 (Activation) (None, 8, 8, 1024) 0 batch\_normalization\_10[0][0]

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separable\_conv2d\_9 (SeparableCo (None, 8, 8, 2048) 2108416 activation\_10[0][0]

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batch\_normalization\_11 (BatchNo (None, 8, 8, 2048) 8192 separable\_conv2d\_9[0][0]

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activation\_11 (Activation) (None, 8, 8, 2048) 0 batch\_normalization\_11[0][0]

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global\_average\_pooling2d (Globa (None, 2048) 0 activation\_11[0][0]

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dropout (Dropout) (None, 2048) 0 global\_average\_pooling2d[0][0]

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dense (Dense) (None, 6) 12294 dropout[0][0]

==================================================================================================

Total params: 4,910,526

Trainable params: 4,897,694

Non-trainable params: 12,832

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