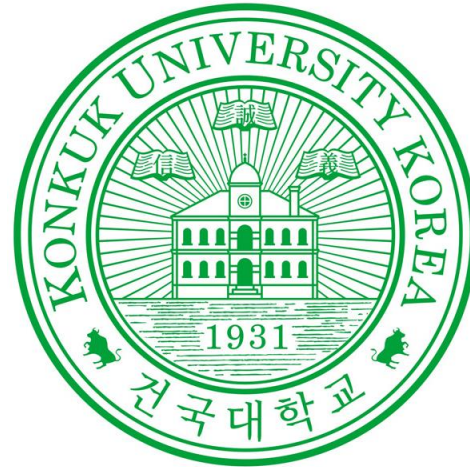


Introduction to Data Science

Final Project – CNN



Date

2020-12-16

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Table

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Pre-processing

배포된 이미지 데이터 셋에서
분류에 맞지 않는 일부 이미지 재 분류

Interior \Rightarrow Food



Interior : 14982

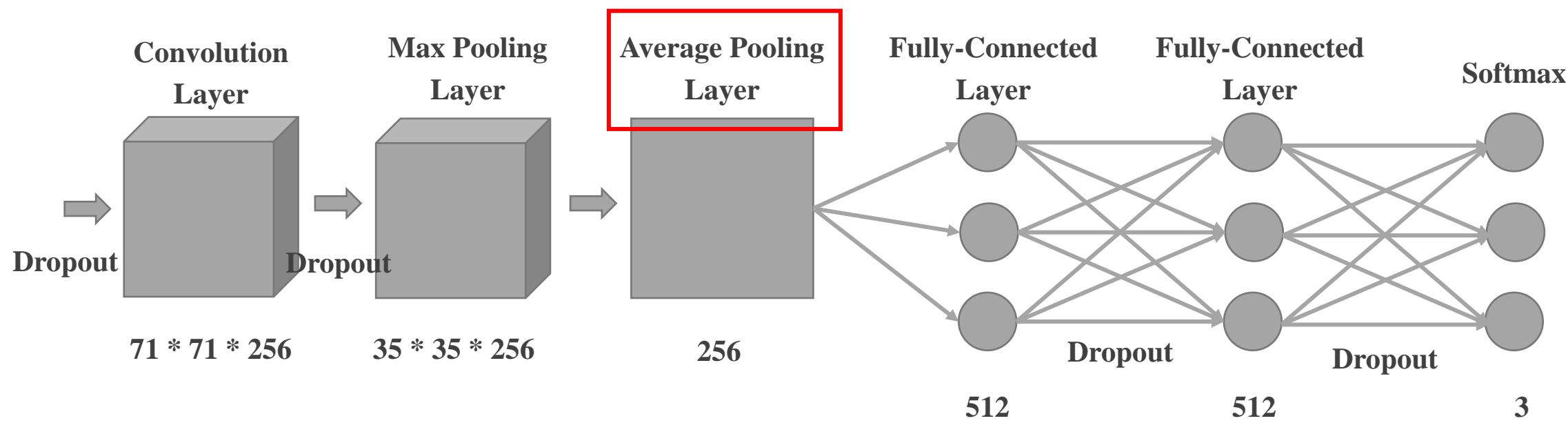
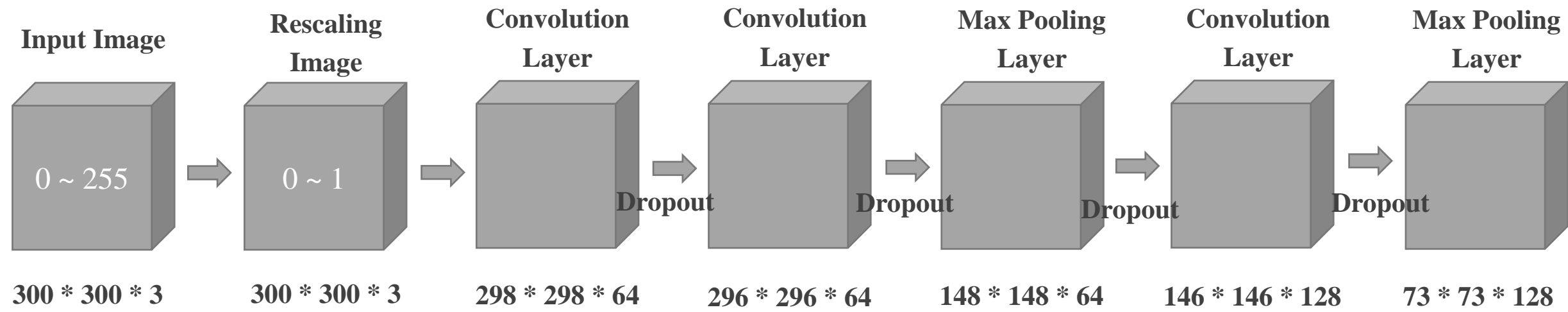
Exterior : 10001

Food : 20017

Interior \Rightarrow Exterior



Model Structure



Model Structure

```
def train_model(X_train, X_test, y_train, y_test, config):  
    model = tf.keras.Sequential([  
        Input(shape=(300,300,3), name='Input_layer'),  
        Rescaling(1. / 255),  
        Conv2D(64, 3, activation='relu', name='Conv_1'),  
        Dropout(0.25),  
        Conv2D(64, 3, activation='relu', name='Conv_2'),  
        Dropout(0.25),  
        MaxPooling2D(),  
        Conv2D(128, 3, activation='relu', name='Conv_3'),  
        Dropout(0.25),  
        MaxPooling2D(),  
        Conv2D(256, 3, activation='relu', name='Conv_4'),  
        Dropout(0.25),  
        MaxPooling2D(),  
        GlobalAveragePooling2D(),  
        Dense(512, activation='relu'),  
        Dropout(0.3),  
        Dense(512, activation='relu'),  
        Dropout(0.3),  
        Dense(config["num_class"], activation='softmax')  
    ])
```

Loss : 0.2694
Accuracy : 90.16%



Layer (type)	Output Shape	Param #
rescaling (Rescaling)	(None, 300, 300, 3)	0
Conv_1 (Conv2D)	(None, 298, 298, 64)	1792
dropout (Dropout)	(None, 298, 298, 64)	0
Conv_2 (Conv2D)	(None, 296, 296, 64)	36928
dropout_1 (Dropout)	(None, 296, 296, 64)	0
max_pooling2d (MaxPooling2D)	(None, 148, 148, 64)	0
Conv_3 (Conv2D)	(None, 146, 146, 128)	73856
dropout_2 (Dropout)	(None, 146, 146, 128)	0
max_pooling2d_1 (MaxPooling2D)	(None, 73, 73, 128)	0
Conv_4 (Conv2D)	(None, 71, 71, 256)	295168
dropout_3 (Dropout)	(None, 71, 71, 256)	0
max_pooling2d_2 (MaxPooling2D)	(None, 35, 35, 256)	0
global_average_pooling2d (GlobalAveragePooling2D)	(None, 256)	0
dense (Dense)	(None, 512)	131584
dropout_4 (Dropout)	(None, 512)	0
dense_1 (Dense)	(None, 512)	262656
dropout_5 (Dropout)	(None, 512)	0
dense_2 (Dense)	(None, 3)	1539
Total params: 803,523		
Trainable params: 803,523		
Non-trainable params: 0		

Epoch 20/30
1688/1688 [=====] - ETA: 0s - loss: 0.2133 - accuracy: 0.9202
Epoch 00020: val_loss improved from 0.28228 to 0.26942, saving model to ./modelW20-0.2694.hdf5
1688/1688 [=====] - 739s 438ms/step - loss: 0.2133 - accuracy: 0.9202 - val loss: 0.2694 - val accuracy: 0.9016

Average Pooling Layer

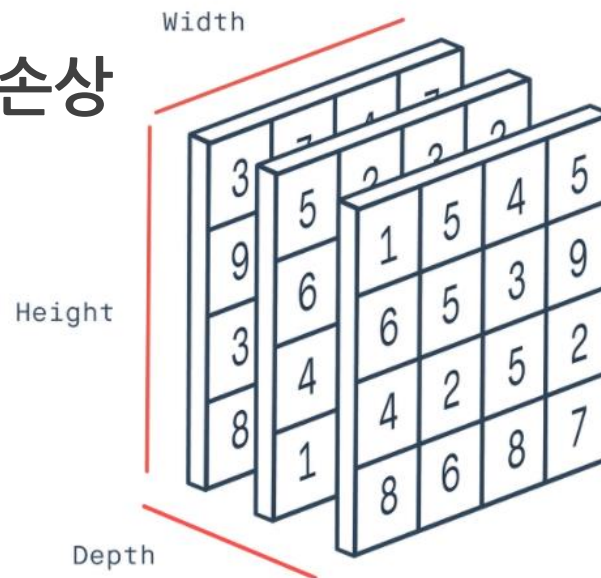
Flatten – Fully Connected Layer의
단점을 보완하기 위해 Classifier로 주로 이용

마지막 Filter에는 지역적인 정보 포함

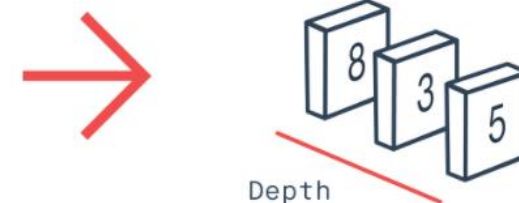
⇒ Flatten하면서 지역적인 정보 손상

❶ 지역적인 정보 보존

❷ 파라미터 수 감소



Height x Width x Depth



1 x 1 x Depth

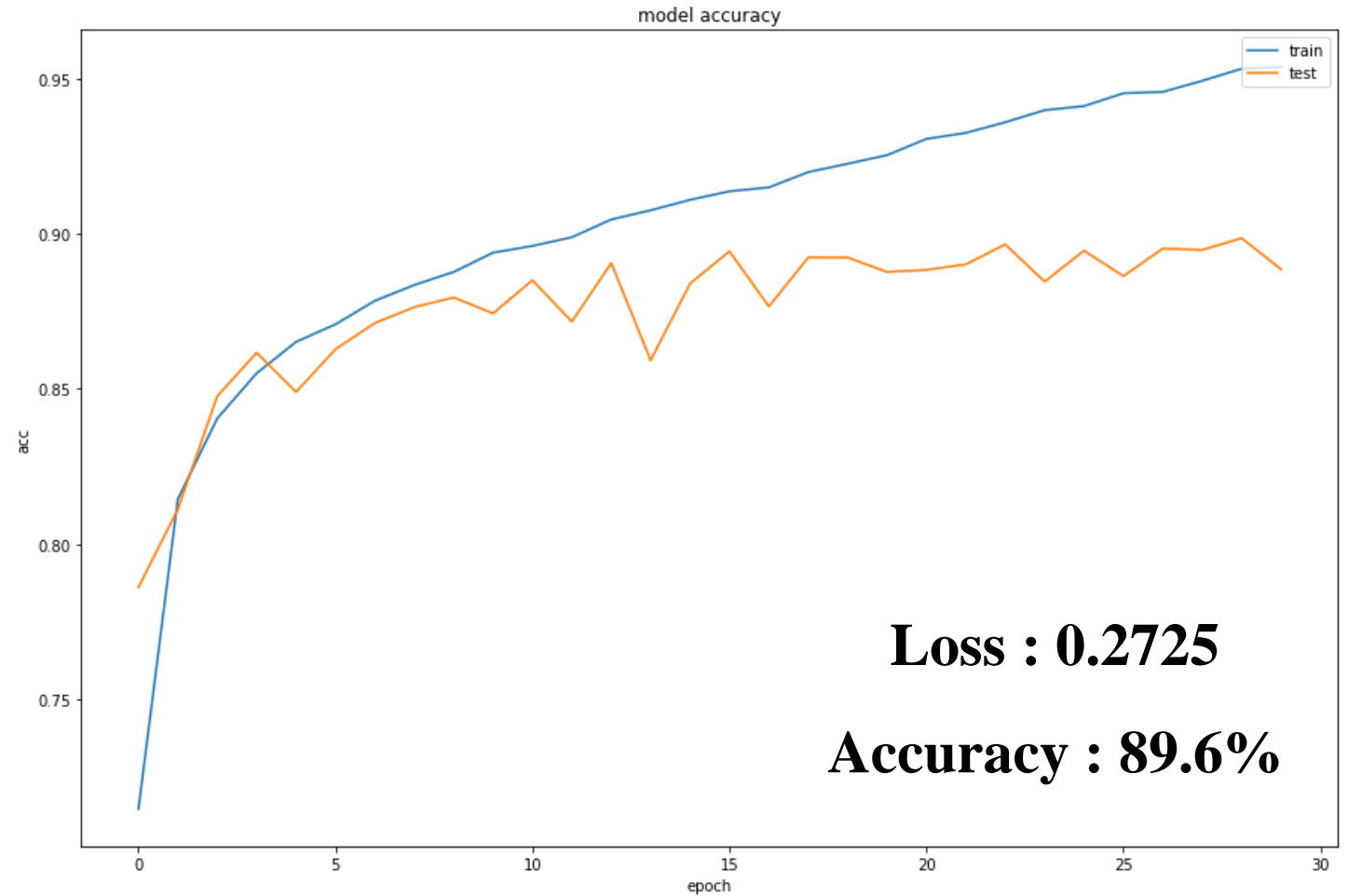
Model Selection

1. Global Average Pooling \Rightarrow FCL
2. Global Average Pooling \Rightarrow Softmax
3. Layer의 수 증가 540,000 \Rightarrow 1,400,000
4. Dropout \Rightarrow BatchNormalization

Model Selection

Layer (type)	Output Shape	Param #
rescaling_3 (Rescaling)	(None, 300, 300, 3)	0
Conv_1 (Conv2D)	(None, 298, 298, 64)	1792
dropout_18 (Dropout)	(None, 298, 298, 64)	0
Conv_2 (Conv2D)	(None, 296, 296, 128)	73856
dropout_19 (Dropout)	(None, 296, 296, 128)	0
max_pooling2d_9 (MaxPooling2D)	(None, 148, 148, 128)	0
Conv_3 (Conv2D)	(None, 146, 146, 256)	295168
dropout_20 (Dropout)	(None, 146, 146, 256)	0
max_pooling2d_10 (MaxPooling2D)	(None, 73, 73, 256)	0
Conv_4 (Conv2D)	(None, 71, 71, 256)	590080
dropout_21 (Dropout)	(None, 71, 71, 256)	0
max_pooling2d_11 (MaxPooling2D)	(None, 35, 35, 256)	0
global_average_pooling2d_3 (GlobalAveragePooling2D)	(None, 256)	0
dense_9 (Dense)	(None, 512)	131584
dropout_22 (Dropout)	(None, 512)	0
dense_10 (Dense)	(None, 512)	262656
dropout_23 (Dropout)	(None, 512)	0
dense_11 (Dense)	(None, 3)	1539
Total params: 1,356,675		
Trainable params: 1,356,675		
Non-trainable params: 0		

Layer의 수 증가 540,000 \Rightarrow 1,400,000



Epoch 23/30

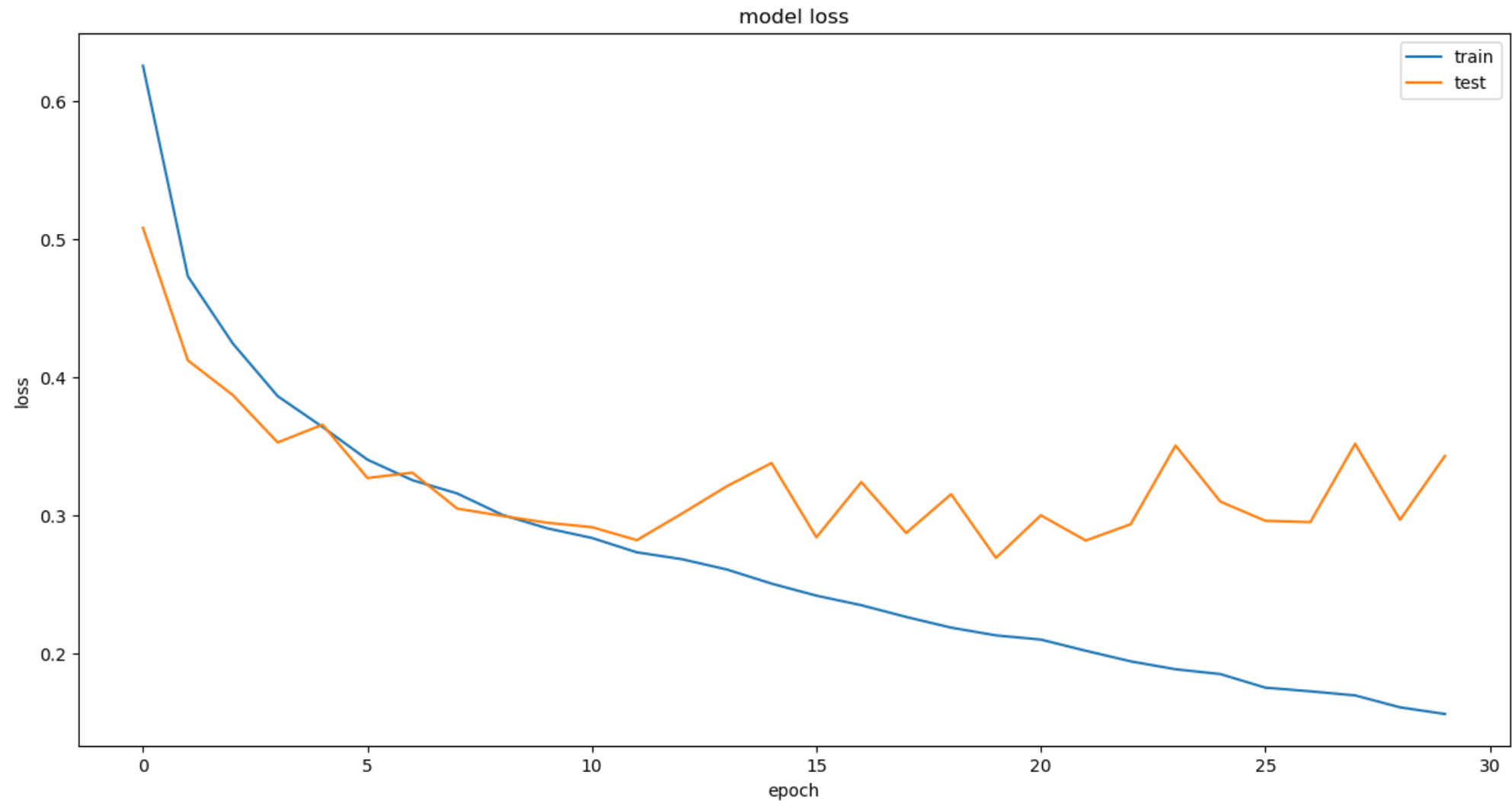
881/881 [=====] - ETA: 0s - loss: 0.1754 - accuracy: 0.9358

Epoch 00023: val_loss improved from 0.27360 to 0.27252, saving model to ./model/23-0.2725.hdf5

881/881 [=====] - 572s 649ms/step - loss: 0.1754 - accuracy: 0.9358 - val_loss: 0.2725 - val_accuracy: 0.8964

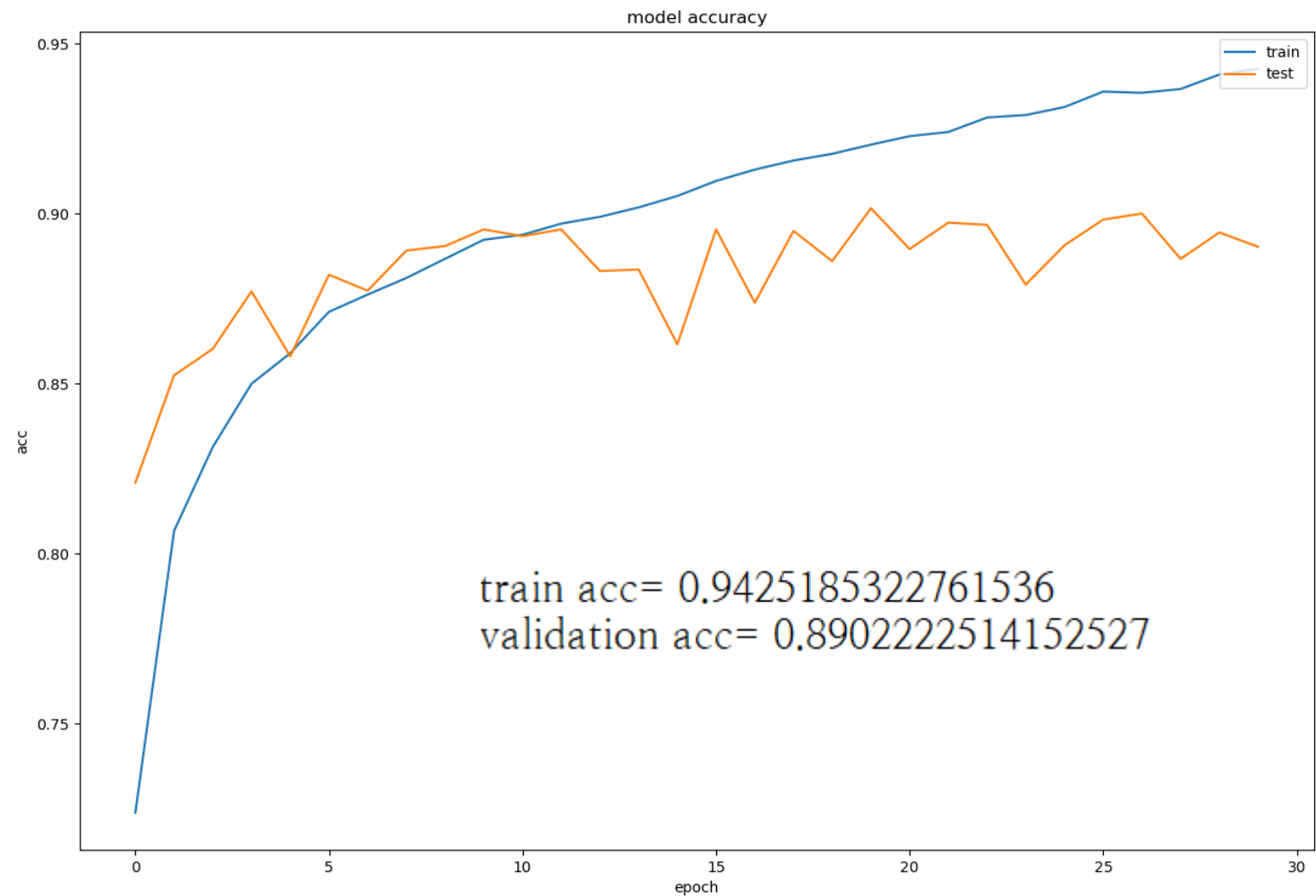
Accuracy & Loss Analysis

Loss Graph (Train & Validation)



Accuracy & Loss Analysis

Accuracy Graph (Train & Validation)



Measures

클래스별 성능 지표

	precision	recall	f1-score	support
food	0.94	0.95	0.95	1933
interior	0.87	0.85	0.86	1528
exterior	0.86	0.88	0.87	1039
micro avg	0.90	0.90	0.90	4500
macro avg	0.89	0.89	0.89	4500
weighted avg	0.90	0.90	0.90	4500
samples avg	0.90	0.90	0.90	4500

Sample prediction

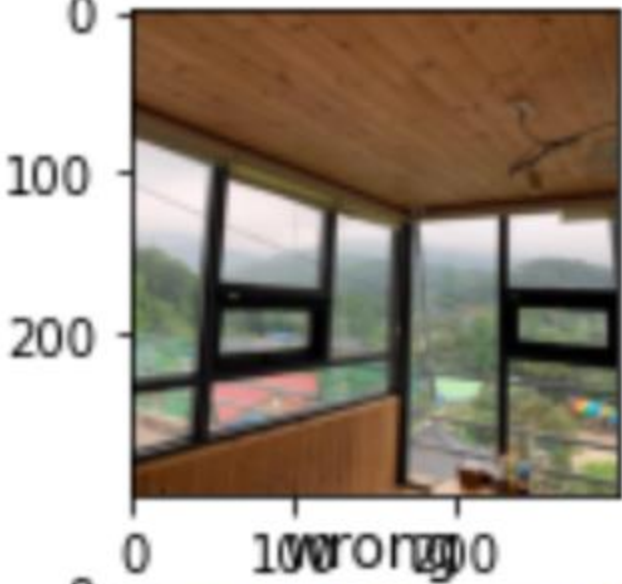
correct

INTERIOR ⇒
INTERIOR

correct

EXTERIOR ⇒
EXTERIOR

정확한 예측



잘못된 예측



(array([0., 1., 0.]))
INTERIOR ⇒
EXTERIOR



(array([0., 0., 1.]))
INTERIOR ⇒
EXTERIOR

(array([0., 1., 0.]), array([0., 0., 1.])) (array([0., 1., 0.]), array([0., 0., 1.]))