CNN(Convolution Neural Network) - 합성곱 신경망

학습 내용

- CNN의 기본 이해
- CNN을 실습을 통해 알아보기

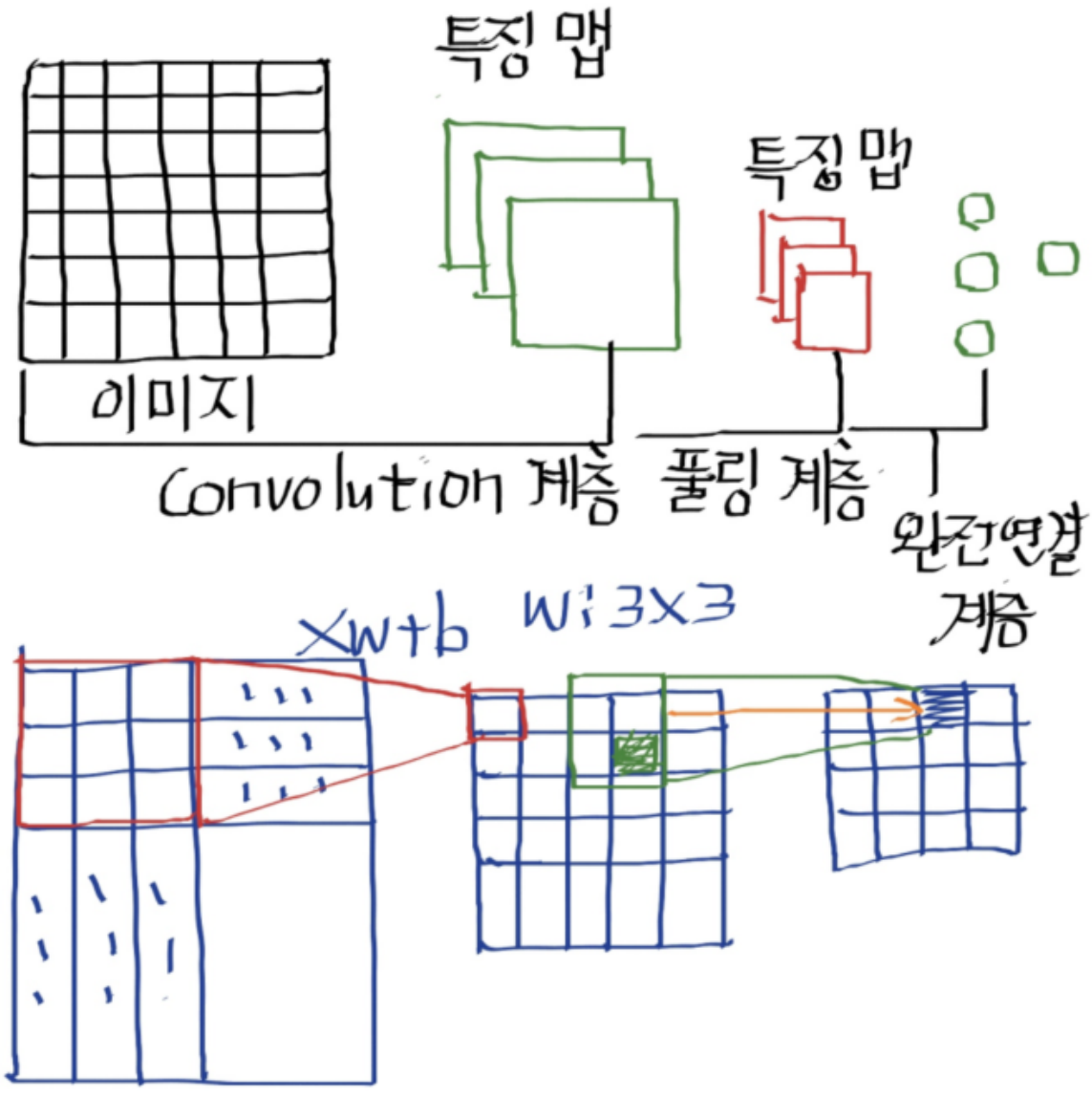
In [1]:

```
from IPython.display import display, Image
import os, warnings

warnings.filterwarnings(action='ignore')
```

In [2]:

```
display(Image(filename="img/cnn.png"))
```



01 합성망 신경망 알아보기

In [10]:

```
import tensorflow as tf
from tensorflow.keras import models
from tensorflow.keras import layers

# tf 2.5.x 버전 local에서 error 발생
#from keras import layers
#from keras import models

print(tf.__version__)
```

2.5.1

- Conv :3x3 필터, 32개의 필터개수, 입력 이미지 (28, 28, 1)
- Maxpooling (2,2)
- 3x3 필터, 64개의 필터개수
- Maxpooling (2,2)
- 3x3 필터, 64개의 필터개수

```
tf.keras.layers.Conv2D(
    filters, kernel_size, strides=(1, 1), padding='valid',
    data_format=None, dilation_rate=(1, 1), groups=1, activation=None,
    use_bias=True, kernel_initializer='glorot_uniform',
    bias_initializer='zeros', kernel_regularizer=None,
    bias_regularizer=None, activity_regularizer=None, kernel_constraint=None,
    bias_constraint=None, **kwargs
)
```

```
tf.keras.layers.MaxPool2D(
    pool_size=(2, 2), strides=None, padding='valid', data_format=None,
    **kwargs
)
```

In [12]:

```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3),
                        activation='relu', input_shape=(28, 28, 1)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
```

컨브넷 구조 알아보기

In [13]:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_3 (Conv2D)            (None, 26, 26, 32)        320
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 13, 13, 32)        0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 11, 11, 64)        18496
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 5, 5, 64)          0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 3, 3, 64)          36928
=================================================================
Total params: 55,744
Trainable params: 55,744
Non-trainable params: 0
_________________________________________________________________
```

- (height, width, channels)크기의 3D텐서
- 높이와 넓이 차원은 네트워크가 깊어질수록 작아지는 경향이 있다.
- 채널의 수는 Conv2D층에 전달된 첫번째 매개변수에 의해 조절된다.
- (3,3,64)를 완전 연결 네트워크에 펼쳐 연결한다.

분류기 추가

In [14]:

```
model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(10, activation='softmax'))
```

In [15]:

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_3 (Conv2D)            (None, 26, 26, 32)        320
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 13, 13, 32)        0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 11, 11, 64)        18496
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 5, 5, 64)          0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 3, 3, 64)          36928
_________________________________________________________________
flatten (Flatten)            (None, 576)               0
_________________________________________________________________
dense (Dense)                (None, 64)                36928
_________________________________________________________________
dense_1 (Dense)              (None, 10)                650
=================================================================
Total params: 93,322
Trainable params: 93,322
Non-trainable params: 0
_________________________________________________________________
```

02 데이터 준비하기

- MNIST 데이터 셋 준비

In [17]:

```
#from keras.datasets import mnist
#from keras.utils import to_categorical
from tensorflow.keras.datasets import mnist
from tensorflow.keras.utils import to_categorical

(train_images, train_labels), (test_images, test_labels) = mnist.load_data()
```

In [18]:

```
train_images = train_images.reshape((60000, 28, 28, 1))
train_images = train_images.astype('float32') / 255

test_images = test_images.reshape((10000, 28, 28, 1))
test_images = test_images.astype('float32') / 255

train_labels = to_categorical(train_labels)
test_labels = to_categorical(test_labels)
```

02 CNN 계층 구성

비용함수, 최적화 함수 구성

- 비용함수와 최적화 함수 지정
- 비용함수 : categorical_crossentropy
- 최적화 함수 : rmsprop

In [19]:

```
%%time

model.compile(optimizer='rmsprop',
              loss='categorical_crossentropy',
              metrics=['accuracy'])
model.fit(train_images, train_labels, epochs=5, batch_size=64)
```

```
Epoch 1/5
938/938 [==============================] - 37s 39ms/step - loss: 0.1756 - accuracy:
0.9448
Epoch 2/5
938/938 [==============================] - 39s 41ms/step - loss: 0.0480 - accuracy:
0.9853
Epoch 3/5
938/938 [==============================] - 33s 35ms/step - loss: 0.0326 - accuracy:
0.9900
Epoch 4/5
938/938 [==============================] - 38s 41ms/step - loss: 0.0243 - accuracy:
0.9925
Epoch 5/5
938/938 [==============================] - 38s 41ms/step - loss: 0.0202 - accuracy:
0.9939
Wall time: 3min 6s
```

Out[19]:

```
<tensorflow.python.keras.callbacks.History at 0x2820c50f880>
```

In [20]:

```
test_loss, test_acc = model.evaluate(test_images, test_labels)
print(test_acc)
```

```
313/313 [==============================] - 2s 6ms/step - loss: 0.0297 - accuracy: 0.
9905
0.9904999732971191
```

실습 01

- 10epochs를 돌려보기
- conv를 하나 삭제 해보기
- conv를 하나 추가 해보기