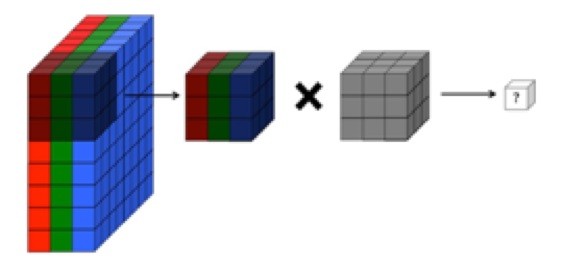
CNN

# Feature maps

Feature maps are created when filters are applied to an input image

# Filters/Kernels



Filter (kernel) block example

[

RED

[[9.2354e-02, -9.7195e-02, -2.1159e-02],  
 [3.2631e-01, 8.1481e-02, -1.6014e-01],  
 [1.6712e-01, -3.5161e-02, -3.0931e-02]],  
 GREEN  
 [[-2.5078e-01, 4.7979e-02, 6.4916e-02],  
 [1.9681e-01, 2.5223e-02, 1.4562e-01],  
 [6.2600e-02, -8.7942e-02, -1.4529e-01]],  
 BLUE  
 [[-1.7421e-01, -1.2751e-01, -6.5980e-02],  
 [-2.3356e-02, -7.6533e-02, 1.3368e-01],  
 [-1.7803e-01, 6.7640e-02, 1.9665e-01]]],

Example of Conv2d-1:

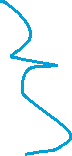
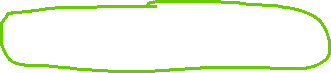
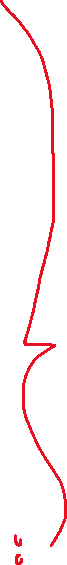


Shape: torch.Size([16, 3, 3, 3])



Example of eights from Conv2d-1:

tensor([[[[-1.4388e-01, -1.6890e-01, 1.2520e-01],  
 [-9.0498e-02, -1.8643e-01, -3.6900e-02],  
 [2.8734e-01, -5.4372e-02, -2.8697e-02]],  
  
 [[-3.3895e-01, -2.7036e-01, 5.9932e-02],  
 [-5.0672e-02, -1.6160e-01, 4.9590e-02],  
 [-9.3095e-02, 2.0135e-01, 2.3972e-02]],  
  
 [[-1.3475e-01, -2.1443e-01, -5.2250e-02],  
 [-2.0573e-01, 1.5108e-01, -6.4922e-03],  
 [-5.9522e-02, -7.5625e-02, 1.6675e-01]]],  
  
 [[[9.2354e-02, -9.7195e-02, -2.1159e-02],  
 [3.2631e-01, 8.1481e-02, -1.6014e-01],  
 [1.6712e-01, -3.5161e-02, -3.0931e-02]],  
  
 [[-2.5078e-01, 4.7979e-02, 6.4916e-02],  
 [1.9681e-01, 2.5223e-02, 1.4562e-01],  
 [6.2600e-02, -8.7942e-02, -1.4529e-01]],  
  
 [[-1.7421e-01, -1.2751e-01, -6.5980e-02],  
 [-2.3356e-02, -7.6533e-02, 1.3368e-01],  
 [-1.7803e-01, 6.7640e-02, 1.9665e-01]]],  
  
 [[[3.8484e-03, 2.2452e-01, 1.8150e-01],  
 [-9.7994e-02, 4.5760e-02, 3.8924e-02],  
 [-2.3253e-01, 7.3562e-02, -6.2187e-02]],  
  
 [[1.1907e-02, -4.4763e-02, -2.4093e-01],  
 [-2.0532e-02, 9.1969e-02, 1.9590e-02],  
 [-1.1594e-01, 2.1759e-01, -1.2366e-01]],  
  
 [[-3.5924e-02, -2.0719e-01, -1.5864e-01],  
 [7.7414e-02, 1.8856e-01, -1.6054e-01],  
 [9.0539e-02, 1.7660e-01, 3.8213e-02]]],  
  
 [[[-1.3271e-01, -5.6434e-02, -1.2265e-01],  
 [1.8242e-02, 1.1966e-01, -1.1428e-01],  
 [1.8268e-01, 9.8001e-02, 1.5741e-02]],  
  
 [[1.0108e-01, -1.3714e-01, -4.4270e-02],  
 [-2.5222e-02, -4.6378e-02, -9.2605e-02],  
 [-1.7493e-02, -3.1317e-02, -1.5408e-01]],  
  
 [[3.3724e-01, 1.7329e-01, 1.6202e-01],  
 [2.7598e-01, 4.0429e-02, 1.3582e-02],  
 [-1.6271e-01, -4.8050e-03, -6.7190e-02]]],  
  
 [[[9.4063e-02, -5.2261e-02, 4.1707e-02],  
 [1.1694e-01, 1.1884e-01, 9.5042e-02],  
 [-9.2157e-02, -1.5470e-01, -4.9469e-02]],  
  
 [[-1.5626e-01, -1.0064e-01, 1.7669e-02],  
 [-6.7783e-02, -3.9627e-02, 9.1054e-02],  
 [-1.8768e-01, 9.4100e-02, -1.0443e-01]],  
  
 [[-1.2380e-01, 1.1414e-01, 2.0704e-01],  
 [-9.0454e-02, 2.1624e-01, 3.2790e-02],  
 [-2.5292e-01, 2.1011e-01, 7.5261e-02]]],  
  
 [[[-2.3059e-01, 3.2211e-02, 1.9722e-01],  
 [-2.5420e-01, -2.0007e-01, -1.1947e-01],  
 [-1.9676e-01, -1.0245e-01, -2.3624e-02]],  
  
 [[1.7692e-01, 9.7674e-04, -8.0423e-03],  
 [-1.2179e-01, -7.8662e-02, -7.9709e-02],  
 [9.2473e-02, 4.5614e-02, -5.7219e-03]],  
  
 [[7.9692e-03, 2.1874e-01, -3.3307e-02],  
 [1.0607e-01, 8.5359e-02, -3.2809e-02],  
 [3.5011e-02, -7.4742e-02, 9.4643e-02]]],  
  
 [[[-9.7339e-02, -4.2546e-02, 9.8612e-02],  
 [-5.8062e-02, 2.8332e-01, -2.4201e-02],  
 [1.1442e-02, -1.4249e-02, 7.0030e-02]],  
  
 [[-9.0311e-02, -2.2861e-01, -5.8689e-02],  
 [-7.1537e-02, -1.2521e-01, -4.1988e-02],  
 [-1.9827e-02, -2.2626e-03, -8.2484e-02]],  
  
 [[-1.0931e-01, -1.2860e-02, -3.5841e-02],  
 [2.0677e-01, 3.2197e-01, 1.2077e-01],  
 [4.0300e-02, 1.7693e-01, -1.1022e-01]]],  
  
 [[[3.7873e-02, 1.1300e-01, 1.8662e-01],  
 [-4.6955e-02, 2.6383e-01, 7.9796e-02],  
 [-1.0352e-01, -6.4700e-02, 4.3660e-02]],  
  
 [[-3.7712e-02, -1.1741e-01, 6.4653e-02],  
 [-3.0376e-01, -1.1497e-01, -7.5062e-02],  
 [1.2735e-01, -1.8628e-01, 1.6513e-01]],  
  
 [[6.7869e-02, 1.2044e-01, -2.0117e-01],  
 [-1.1903e-01, 4.6144e-02, -1.0528e-01],  
 [-1.2733e-01, -7.1758e-02, 1.1292e-01]]],  
  
 [[[6.7164e-02, -9.7006e-02, 6.7338e-02],  
 [1.2691e-03, -9.4758e-02, -2.3556e-01],  
 [2.0805e-01, -1.8940e-01, -8.8499e-02]],  
  
 [[1.2362e-01, 2.5192e-01, -1.9609e-01],  
 [-2.4111e-03, -1.5623e-01, -5.7713e-02],  
 [-5.7131e-02, 2.4946e-02, 1.9586e-01]],  
  
 [[-4.3750e-02, 2.5830e-01, 2.0632e-01],  
 [-2.0186e-01, 8.6494e-02, 1.2894e-01],  
 [6.5429e-02, -1.4183e-01, -3.2007e-02]]],  
  
 [[[1.2910e-01, 2.4719e-01, 1.6002e-01],  
 [5.3051e-02, 1.9075e-01, -1.8603e-01],  
 [1.0439e-01, -1.1565e-01, -1.0180e-01]],  
  
 [[-2.4896e-02, -1.1172e-01, -1.0499e-01],  
 [-1.0341e-01, 3.4875e-02, -1.7749e-01],  
 [-2.0183e-01, -1.6627e-01, 1.2962e-01]],  
  
 [[-1.1557e-01, -7.4115e-02, -9.9931e-02],  
 [1.6451e-01, 1.9510e-01, 8.3656e-02],  
 [2.1553e-02, 9.5182e-02, -3.1099e-02]]],  
  
 [[[-1.2153e-01, -9.8028e-02, -1.5329e-02],  
 [-2.0793e-02, 3.4259e-01, -2.8037e-02],  
 [-4.4361e-03, 9.3052e-02, -1.5362e-01]],  
  
 [[6.1142e-02, 4.7514e-02, -8.5508e-02],  
 [9.7099e-02, 3.9166e-01, 5.8787e-02],  
 [-1.9401e-01, 9.3796e-03, -1.9414e-01]],  
  
 [[-1.3330e-01, 2.9999e-02, 2.0315e-01],  
 [1.8583e-03, -1.3430e-01, -8.7559e-02],  
 [8.1603e-02, -4.4593e-02, -7.8755e-02]]],  
  
 [[[-2.3862e-04, 2.6694e-02, 4.4267e-02],  
 [1.8756e-02, 6.7709e-02, 2.3254e-01],  
 [-1.5006e-01, -1.6633e-01, 4.1211e-02]],  
  
 [[-6.4897e-02, -5.4978e-02, -1.6079e-01],  
 [1.4033e-01, -1.0436e-01, -3.6767e-02],  
 [1.8058e-01, 6.2220e-03, 9.8616e-02]],  
  
 [[-4.3452e-02, 1.1284e-01, 7.2105e-02],  
 [1.6999e-01, -2.0297e-01, -1.8502e-01],  
 [1.2447e-02, -4.1667e-02, -2.6135e-02]]],  
  
 [[[5.9499e-02, -4.0643e-03, -2.0209e-01],  
 [-2.4379e-01, 5.7644e-02, 6.2904e-02],  
 [-1.3341e-01, 5.5559e-02, 1.8779e-01]],  
  
 [[1.7609e-01, 4.4955e-02, 1.1865e-01],  
 [-2.2473e-01, 1.2552e-01, 1.9975e-01],  
 [6.2175e-02, -6.1223e-02, -1.8420e-01]],  
  
 [[1.0131e-01, -5.4293e-02, 4.6417e-02],  
 [-2.2017e-01, 1.8354e-01, -7.3852e-02],  
 [6.0822e-02, -1.5736e-01, 5.3075e-03]]],  
  
 [[[1.6717e-01, 7.2301e-02, -2.6217e-01],  
 [-8.1137e-02, 1.4908e-01, 1.0319e-02],  
 [6.3769e-02, 2.3240e-01, 3.0025e-01]],  
  
 [[9.1322e-02, 2.0558e-01, 1.2171e-01],  
 [1.5707e-01, 2.0928e-01, 7.2639e-02],  
 [-6.7891e-02, -1.1437e-01, 1.5980e-01]],  
  
 [[-1.6111e-01, 1.8764e-01, -1.3070e-01],  
 [-1.5695e-02, 7.7217e-04, -4.2202e-02],  
 [1.0072e-01, -3.5691e-02, -1.2301e-01]]],  
  
 [[[4.1237e-02, 5.9253e-03, -1.4711e-01],  
 [-7.6758e-02, 2.8602e-01, -1.4679e-01],  
 [5.8154e-02, -1.0693e-01, 1.2221e-01]],  
  
 [[9.4739e-02, 8.2076e-02, 9.7239e-02],  
 [-8.9605e-02, 2.7777e-01, -8.7198e-02],  
 [-3.2558e-01, -7.3633e-02, -1.9459e-02]],  
  
 [[-1.3427e-01, -5.9496e-02, -1.6933e-01],  
 [-6.6127e-03, 1.6503e-01, 1.0186e-01],  
 [1.4033e-01, 2.5793e-01, 4.7254e-02]]],  
  
 [[[8.4770e-02, 7.7125e-02, -1.1259e-01],  
 [-1.7032e-01, 4.7821e-02, -5.7307e-02],  
 [1.6266e-01, -2.0354e-01, -5.4747e-02]],  
  
 [[3.9177e-02, 1.2789e-01, -2.4485e-02],  
 [1.7253e-01, 1.5519e-01, 1.8140e-01],  
 [1.5018e-01, 1.8949e-02, -3.4043e-02]],  
  
 [[3.1836e-02, -1.4419e-01, 1.1752e-01],  
 [-2.1957e-01, -7.3605e-02, -8.8766e-02],  
 [-1.1960e-01, -1.0588e-01, -4.2259e-02]]]], device='cuda:0',  
 requires\_grad=*True*)



Output shape: [-1, 16, 32, 32] -> feature map size = 32x32 and 16 feature map inputs to the next layer instead of 3?