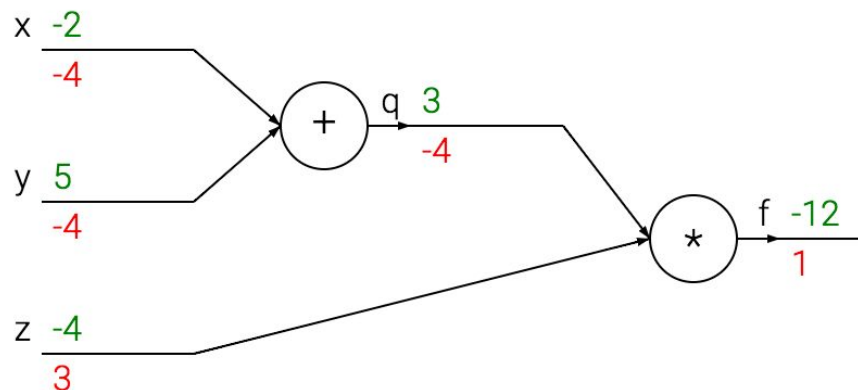# GPU-Accelerated Deep Convolutional Neural Network for Object Recognition

Guan Sun

Milestone 1
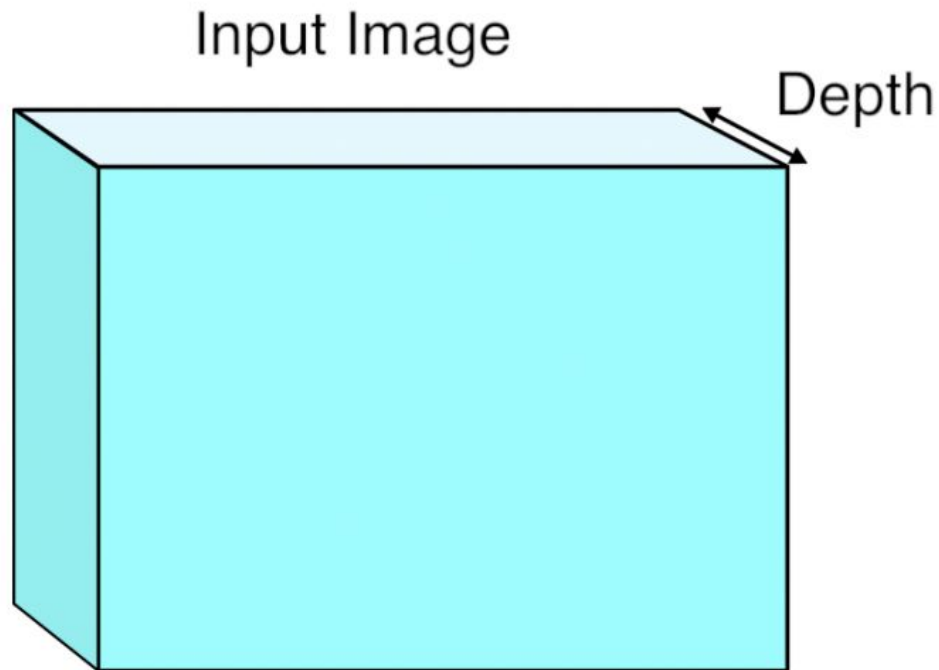
Implement the computation for Convolutional layer and Pooling layer
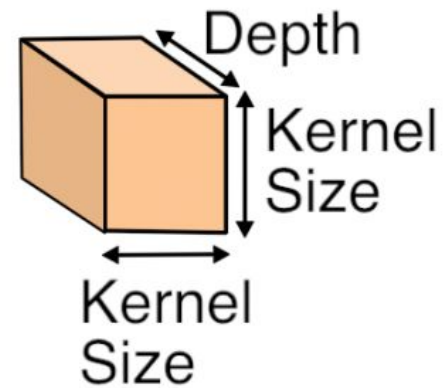

Forward Pass
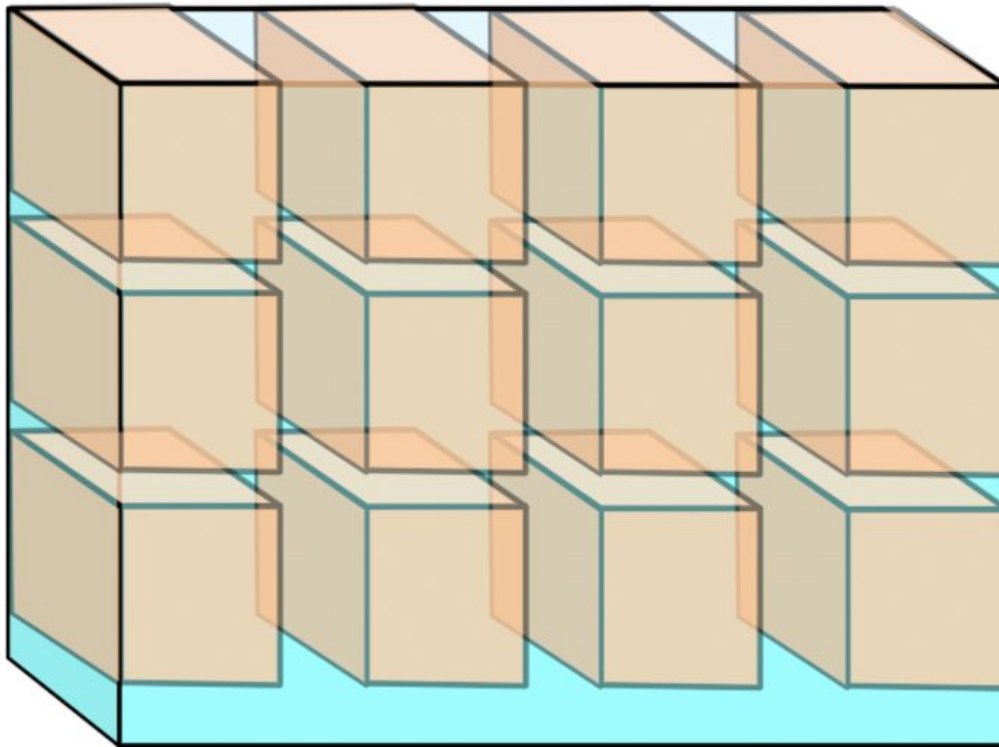
Backward Pass

Convolutional Layer

Input Image

Depth

Convolution Kernel

Depth

Kernel Size

Kernel Size

Convolutional Layer

Output

Convolutional Layer

Input Image

im2col
=>

Patch 1
Patch 2
...
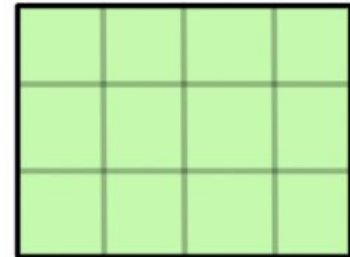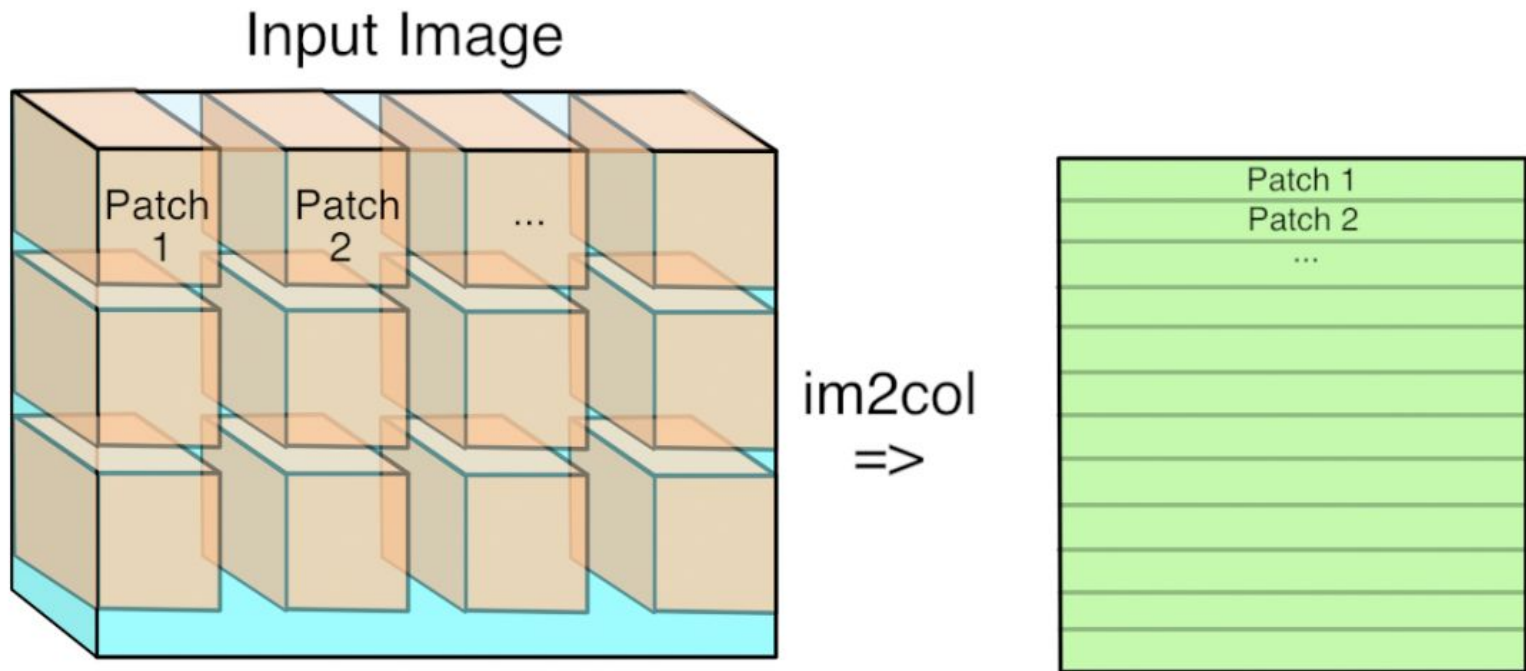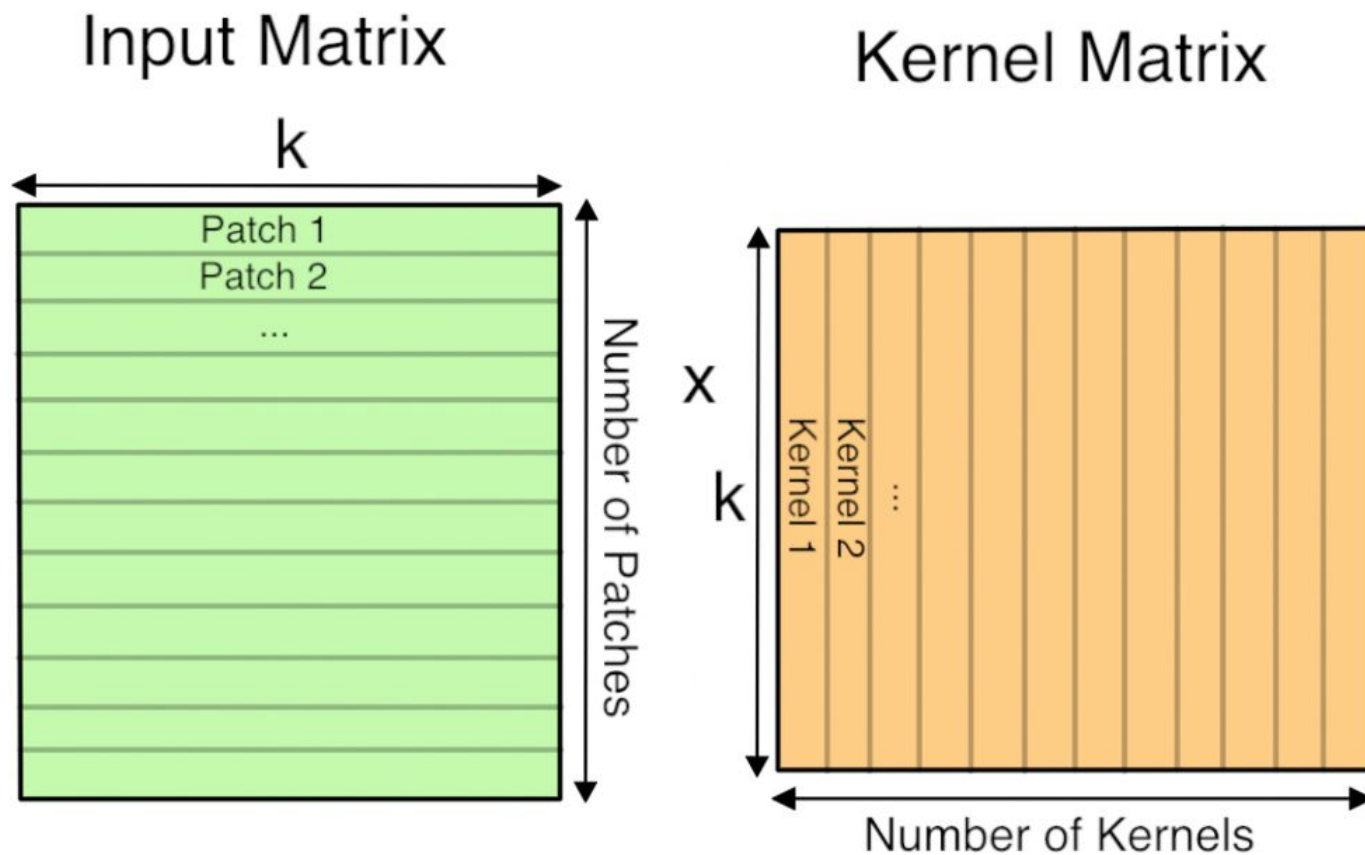
Convolutional Layer

Matrix Multiplication

void cublasSgemm (char transa, char transb,

                int m, int n, int k, float alpha,

                const float *A, int lda, const float *B, int ldb,

                float beta, float *C, int ldc)

C = alpha * op(A) * op(B) + beta * C

where op(X) = X or op(X) = transpose(X)

Test Results

```
[----------] 12 tests from ConvolutionLayerTest/0, where TypeParam = N5caffe9CPUDeviceIfEE
[ RUN      ] ConvolutionLayerTest/0.TestSimpleConvolution
[       OK ] ConvolutionLayerTest/0.TestSimpleConvolution (0 ms)
[ RUN      ] ConvolutionLayerTest/0.TestNDAgainst2D
[       OK ] ConvolutionLayerTest/0.TestNDAgainst2D (332 ms)
[ RUN      ] ConvolutionLayerTest/0.TestSimple3DConvolution
[       OK ] ConvolutionLayerTest/0.TestSimple3DConvolution (2 ms)
[ RUN      ] ConvolutionLayerTest/0.Test1x1Convolution
[       OK ] ConvolutionLayerTest/0.Test1x1Convolution (0 ms)
[ RUN      ] ConvolutionLayerTest/0.TestGradient3D
[       OK ] ConvolutionLayerTest/0.TestGradient3D (564 ms)
[ RUN      ] ConvolutionLayerTest/0.TestSetup
[       OK ] ConvolutionLayerTest/0.TestSetup (0 ms)
[ RUN      ] ConvolutionLayerTest/0.TestGradient
[       OK ] ConvolutionLayerTest/0.TestGradient (92 ms)
[ RUN      ] ConvolutionLayerTest/0.TestGradientGroup
[       OK ] ConvolutionLayerTest/0.TestGradientGroup (34 ms)
[ RUN      ] ConvolutionLayerTest/0.TestSimpleConvolutionGroup
[       OK ] ConvolutionLayerTest/0.TestSimpleConvolutionGroup (0 ms)
[ RUN      ] ConvolutionLayerTest/0.Test1x1Gradient
[       OK ] ConvolutionLayerTest/0.Test1x1Gradient (664 ms)
[ RUN      ] ConvolutionLayerTest/0.Test0DConvolution
[       OK ] ConvolutionLayerTest/0.Test0DConvolution (0 ms)
[ RUN      ] ConvolutionLayerTest/0.TestSobelConvolution
[       OK ] ConvolutionLayerTest/0.TestSobelConvolution (0 ms)
[----------] 12 tests from ConvolutionLayerTest/0 (1688 ms total)
```

```
[  FAILED  ] ConvolutionLayerTest/2.TestGradient, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.Test0DConvolution, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.Test1x1Convolution, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestSobelConvolution, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestSimpleConvolution, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestSimpleConvolutionGroup, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.Test1x1Gradient, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestGradientGroup, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestSimple3DConvolution, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestGradient3D, where TypeParam = N5caffe9GPUDeviceIfEE
[  FAILED  ] ConvolutionLayerTest/2.TestNDAgainst2D, where TypeParam = N5caffe9GPUDeviceIfEE
```

Pooling Layer
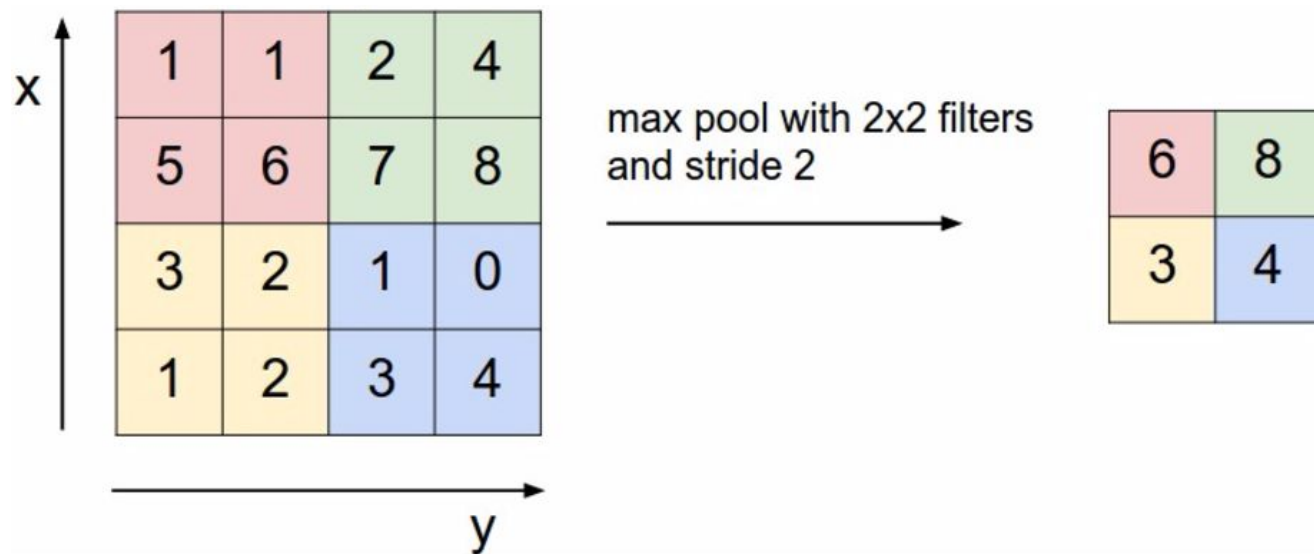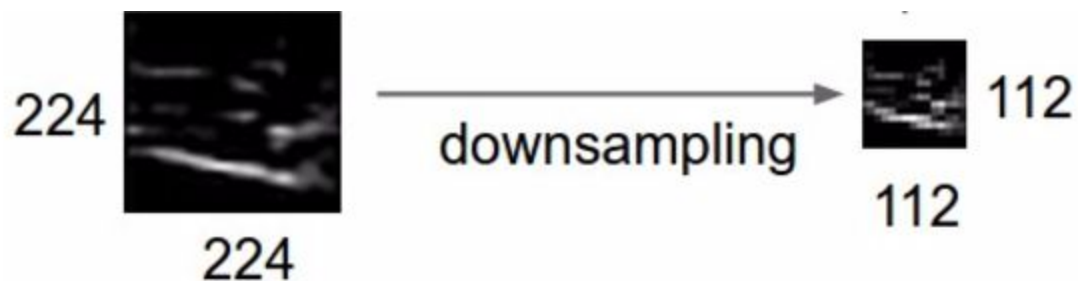
Test Results

```
[----------] 11 tests from PoolingLayerTest/1, where TypeParam = N5caffe9CPUDeviceIdEE
[ RUN      ] PoolingLayerTest/1.TestSetup
[       OK ] PoolingLayerTest/1.TestSetup (0 ms)
[ RUN      ] PoolingLayerTest/1.TestGradientAve
[       OK ] PoolingLayerTest/1.TestGradientAve (236 ms)
[ RUN      ] PoolingLayerTest/1.TestForwardMaxPadded
[       OK ] PoolingLayerTest/1.TestForwardMaxPadded (2 ms)
[ RUN      ] PoolingLayerTest/1.TestSetupPadded
[       OK ] PoolingLayerTest/1.TestSetupPadded (0 ms)
[ RUN      ] PoolingLayerTest/1.TestForwardAve
[       OK ] PoolingLayerTest/1.TestForwardAve (1 ms)
[ RUN      ] PoolingLayerTest/1.TestGradientAvePadded
[       OK ] PoolingLayerTest/1.TestGradientAvePadded (1012 ms)
[ RUN      ] PoolingLayerTest/1.TestForwardMaxTopMask
[       OK ] PoolingLayerTest/1.TestForwardMaxTopMask (2 ms)
[ RUN      ] PoolingLayerTest/1.TestGradientMax
[       OK ] PoolingLayerTest/1.TestGradientMax (651 ms)
[ RUN      ] PoolingLayerTest/1.TestSetupGlobalPooling
[       OK ] PoolingLayerTest/1.TestSetupGlobalPooling (2 ms)
[ RUN      ] PoolingLayerTest/1.TestForwardMax
[       OK ] PoolingLayerTest/1.TestForwardMax (1 ms)
[ RUN      ] PoolingLayerTest/1.TestGradientMaxTopMask
[       OK ] PoolingLayerTest/1.TestGradientMaxTopMask (752 ms)
[----------] 11 tests from PoolingLayerTest/1 (2661 ms total)
```

Milestone 2

Fix the bug

LeRU layer, Inner product layer and Softmax layer

Thanks!