JESUYE DAVID

12/15/17

FINALS HOMEWORK

1. **Convoluted Neural Networks (ConvNets, CNN**) are a special kind of Neural Networks that is used for image recognition and classification. It involves four stages: convolution, nonlinearity(ReLU, sigmoid, tanh), pooling, and classification(fully connected).
2. CNNs are usually applied in areas like powering vision in robots and autonomous cars, it is also used for identification of traffic signs and faces.

**Convolution**: use of filters to extract features from an input image.

Image

[(1,0,1,1,1,0),

(1,1,1,0,1,0),

(1,0,1,1,1,0),

(1,1,1,1,1,0),

(1,0,1,0,1,1),

(1,0,1,0,1,0)]

Filter1 [(1,0,1),

(0,1,0),

(1,0,1)]

Filter2[(1, 0, -1),

(0,0,0),

(-1, 0, 1)]

Assuming stride=1,

After convolution, feature map1 based on filter1 is:

[(5,3,4,3),

(4,4,5,2),

(5,2,5,3),

(4,3,4,2)]

feature map2 based on filter 2 is:

[(0,0,0,0),

(0,1,0,-1),

(0,0,0,2),

(0,0,0,1)]

**Nonlinearity:** Nonlinearity is used to introduce non linearity (ReLU, sigmoid) to our data set since real world data is mostly non-linear. In this exercise, I’ll be applying ReLU to the feature maps above.

Rectified feature map1:

[(5,3,4,3),

(4,4,5,2),

(5,2,5,3),

(4,3,4,2)]

Rectified feature map2:

[(0,0,0,0),

(0,1,0,0),

(0,0,0,2),

(0,0,0,1)]

**Pooling:** this reduces the dimensionality of each of the above feature map but retains the most important information. I’ll use max pooling with a 2x2 window for this exercise. Therefore,

Feature map1:

[(5,5),

(5,5)]

Feature map2:

[(1,0),

(0,2)]

**Classification:** The result of our feature map is now fed into a fully connected neural network that outputs 1 or 0, as a binary classifier should. We assume that the network has 8 neurons (after flattening the feature maps) in the input layer, 3 hidden layers and 1 output layer.