Real Valued Features of Cell Nuclei obtained by Pathologists

Dropout

Fully Connected Layer

Flatten

Output node

0 - Benign, 1 - Malignant

Max pooling ×2

Dropout

Convolution

Max pooling ×2

Dropout

Convolution

* Convolutional layer corresponds to apply the convolutional operation on the input values. Specifcally, the input to this layer is a matrix and convolved with ‘K’ learnable flters (or kernels) to generate ‘K’ new feature maps. A feature map is the summation of the dot product between the flter value and input value along with an added bias.
* In the Activation layer, the generated feature map is mapped to a nonlinear value by using non-linear activation functions. In CNN, rectifed linear unit (ReLU) has been the most widely used activation function. It returns zero if the input value is less than zero else the input value is returned. Usually, convolutional layer and activation layer are used in combination.
* In pooling layer, input values are down-sampled with focus on extracting relevant and important features. This layer benefts in reducing the computational complexity by performing the spatial dimensionality reduction of the given input values. Generally, there are two types of pooling layers, namely average pooling and max-pooling, out of which max-pooling is the most popular one. In max-pooling, maximum value from a region of input is fltered out by placing a kernel (usually of size 2×2) over the considered region
* In Dropout layer, a set of neurons are randomly de-activated which results in generating zero output while training the CNN. The main reason of this layer is to avoid over-ftting and generalizing the model.
* The neuron of Fully connected layer is connected to every neuron of the previous layer which is conventional to the hidden layer of a multi-layer neural network.

**Proposed Convolutional Neural Network**

Performance Evaluation

Deep CNN

Feature Scaling/Normalization

Encode the labels [B,M] to [0,1]