Week 5

Sunday, June 28, 2020 3:37 PM

Neural Network

- Neurons are connected to and receive electrical signal from other neurons
- Neuron process input signal and can be activated

Artificial neural network

- **Mathematical model for learning inspired by biological neural networks**

- **Usage :**
  - Model mathematical function from input to output based on
    The structure and parameters of the network
  - Allow for learning the network parameters based on
    Data

- Example for activation function :
  - Logistic sigmoid :
    - g(x) = $\frac{e^x}{e^x+1}$
  - Rectified linear unit (ReLU) :
    - g(x) = max(0, x)

Gradient Descent

Def :

Algorithm for minimizing the loss when training neural network

Sudo Code :

- Start with a random choice of weights
- Repeat :
  - Calculate the gradient based on **all data points** :
    - Which is the Direction that will lead to decreasing loss
  - Update weights according to the gradient

Improvement :

- Stochastic gradient Descent :
  - Use **one data point**(Randomly) instead of all the data
- Mini-batch gradient descent :
  - Use a **one small batch**

Perceptron(the unit) :

- Only capable of learning linearly separable decision boundary

Multilayer neural network :

Artificial neural network with an input layer, output layer and at least one hidden layer

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Backpropagation :

Algorithm for training neural network with hidden layers

Sudo Code :

- Start with random choice of weights
- Repeat :
  - Calculate the error for the output layer
  - For each layer , starting with the output layer,
    And moving inwards towards earliest hidden layer :
    - Propagate the error back one layer
    - Update weights

Deep neural network :

Neural network with multiple hidden layers

Overfitting :

- **Use dropout to avoid overfitting**

- Dropout :
  - Temporarily removing units (selected randomly) from a neural network
    To prevent over-reliance on certain units

Computer vision

Def :

- **Computational methods for analyzing and understanding digital images**

Image convolution :

- Applying a filter that adds each pixel value of an image to its neighbor,
  Weighted according to kernel matrix

Pooling :

Reducing the size of an input by sampling from regions in the inputs

Example :

Max-pooling :

Pooling by choosing the maximum value in each region

Convolution neural network :

Neural network that use convolution,

Usually for analyzing images

Feed-forward neural network :

Neural network that has connections only in one direction

Recurrent neural network:

Generate output that gets fed back into itself as input for future runs of the network

- Has multiple inputs or multiple outputs or both