Assignment 1

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Assignment Objectives

- Part 1: Data Curation
  - notMNIST dataset에 대한 이해
  - 실제 데이터에 딥 러닝을 적용할 지 결정
    할 때 거치는 과정에 대한 이해 및 실습

- Part 2: Implementing Neural Networks from Scratch
  - 가장 기초적인 딥 러닝 모델 구현
  - 딥 러닝 학습에 대한 이해

- Part 3: Neural Networks with TensorFlow
  - Hyperparameters의 역할 이해
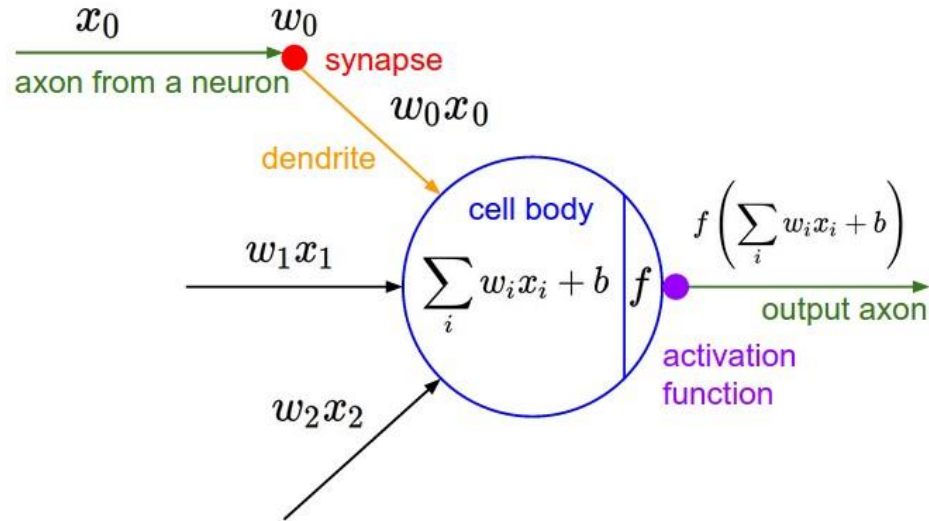 - TensorFlow 사용법 익히기

notMNIST dataset

- Consists of characters rendered in a variety of fonts on a 28x28 image

- 10 classes, with letters A-J

- Training set: notMNIST_large (uncleaned, 500k instances)

- Test set: notMNIST_small (hand-cleaned, about 19k instances)
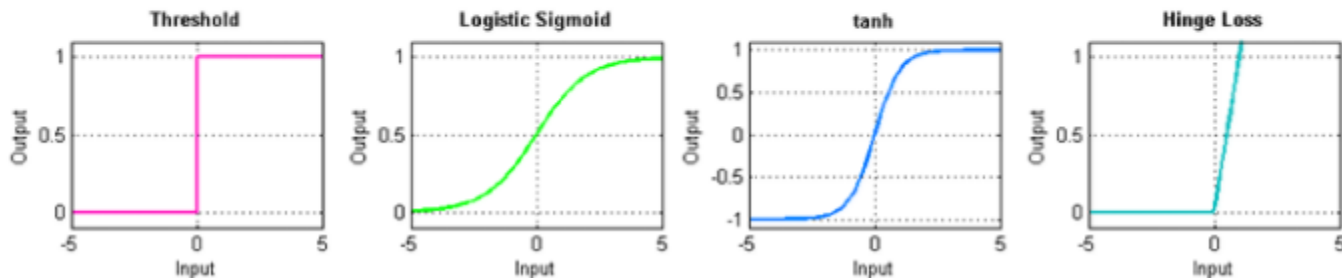
Training a Neural Network
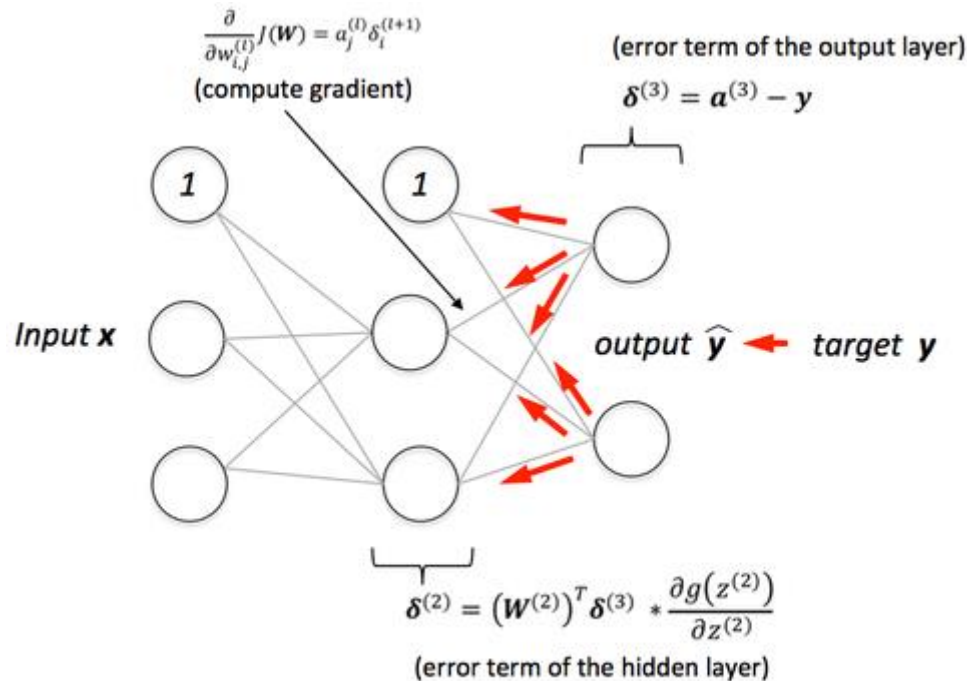
- Artificial Neuron

- Activation Functions

$$\text{sigmoid: } \sigma(x) = \frac{1}{1+e^{-x}}$$
$$\text{tanh: } \sigma(x) = \frac{e^x - e^x}{e^x + e^x}$$
$$\text{ReLU: } \sigma(x) = max(0, x)$$

Training a Neural Network

$$\frac{\partial}{\partial w_{i,j}^{(l)}} J(W) = a_j^{(l)} \delta_i^{(l+1)}$$

(compute gradient)

(error term of the output layer)

$$\delta^{(3)} = a^{(3)} - y$$

Input x

output $\widehat{y}$ ◄— target y

$$\delta^{(2)} = \left(W^{(2)}\right)^T \delta^{(3)} * \frac{\partial g\left(z^{(2)}\right)}{\partial z^{(2)}}$$

(error term of the hidden layer)

- BackPropagation
  - Correct parameter weights by calculating the derivatives of the cost function w.r.t. each parameter of the NN.
  - Optimized with (mini-batch, stochastic) gradient descent

Hyperparameters

- Hyperparameters

  - Learning rate

  - Mini-batch size

  - Number of training iterations

  - Momentum

  - Weight initialization

  - ...

- Choosing a set of optimal hyperparameters

  - Difficult

  - Relies on experiences

How to install assignment files

- Assignment files

  - data/ (empty)

  - Assignment1-1_Data_Curation.ipynb

  - Assignment1-2_NN_from_scratch.ipynb

  - Assignment1-3_NN_with_TF.ipynb

  - CollectSubmission.sh

- Install assignment files

  - tar zxvf assignment1.tar.gz

  - sudo chmod 755 CollectSubmission.sh

  - jupyter notebook

- Open the notebooks on your browser and get started

Important Notes

- Team project (3 people 1 team)

- Due: 10/1 23:59 – We do not accept late submission!

- PLEASE read the notes on the notebooks carefully

- Google first before mailing TAs

- Submitting your work

    - DO NOT clear the final outputs

    - After you are done **all three parts**

        - ✓ $ ./CollectSubmission.sh team_#

        - ✓ Upload the team_#.tar.gz on ETL

        - ✓ You may upload once per team using any account

- TA email: deeplearning.snu@gmail.com