CNTK 101: Lab

Mithun Prasad, PhD
miprasad@Microsoft.com

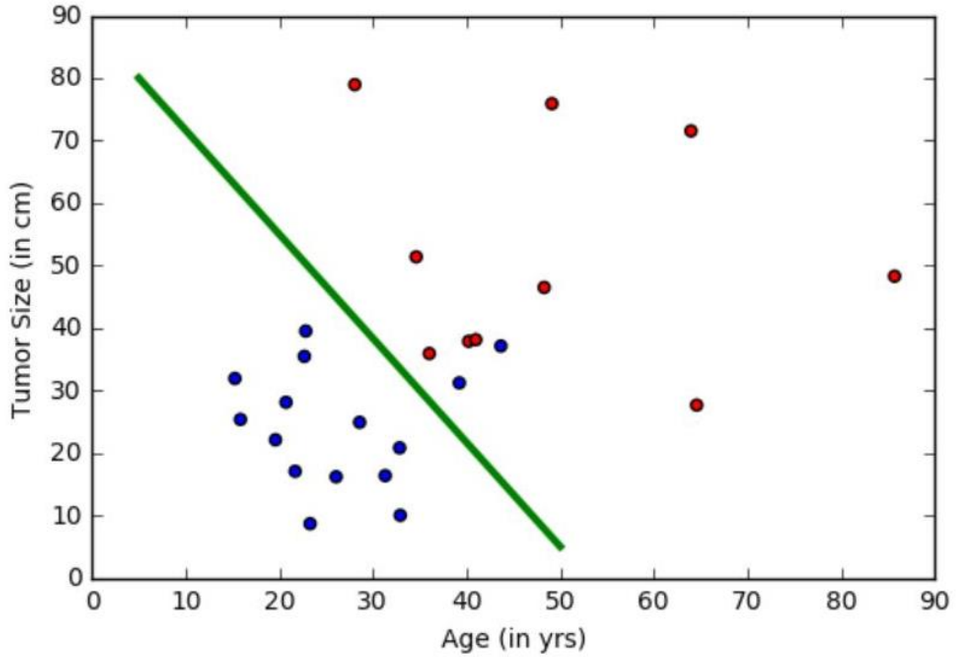
Goals

- Train a simple machine learning model using CNTK
- Create a random dataset
- Learn how to setup a network
- Configure training
- Perform training / evaluation

Problem

- Determine if a patient has a fatal malignant cancer vs. a benign growth.
- Given age and the size of the tumor.

Aim - Learn a classifier to label any patient into either benign or malignant category given two features (age and tumor size)



Microsoft

Data Generation

- Generate synthetic data emulating the cancer example using numpy.
- Each observation in the training data has a label (blue or red) corresponding to each observation.

numpy.random.randint(low, high=None, size=None, dtype='l')

Return random integers from low (inclusive) to high (exclusive).

Sigmoid Function

- A mathematical function having an "S" shaped curve (sigmoid curve).
- Special case of the logistic function.

$$S(t) = \frac{1}{1 + e^{-t}}$$

Score	-∞	-2	0.0	+2	+∞
Sigmoid (Score)	$\frac{1}{1+e^{\infty}}$ $= \frac{1}{1+\infty}$ $= 0$	0.12	Sigmoid(0) $= \frac{1}{1+e^{0}}$ $= \frac{1}{1+1}$ $= 0.5$	0.88	$\frac{1}{1+e^{-\infty}}$ $= 1$

Logistic Regression

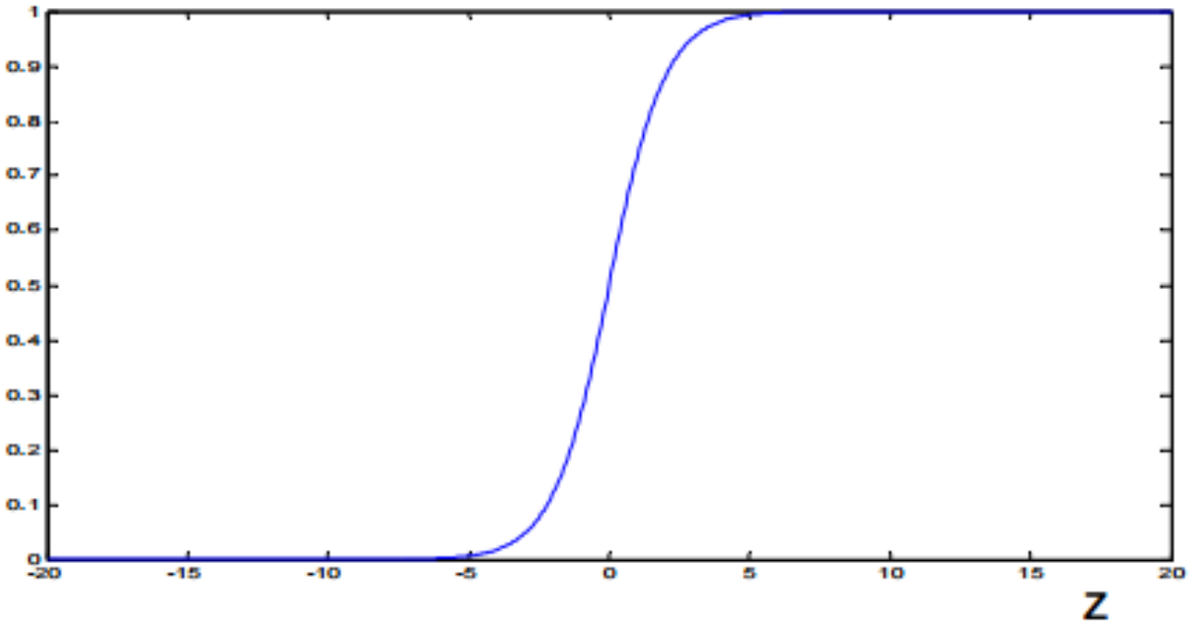
- Logistic regression is actually a classification method.
- LR introduces an extra non-linearity over a linear classifier, $f(x) = w^T X + b$, by using a logistic (or sigmoid) function, $\sigma()$.
- The LR classifier is defined as

$$\sigma\left(f(x_i)\right) \begin{cases} \geq 0.5 y_i = +1 \\ < 0.5 y_i = -1 \end{cases}$$

where $\sigma(f(x)) = \frac{1}{1+e^{-f(x)}}$

The logistic function or sigmoid function

$$\sigma(z) = \frac{1}{1+e^{-z}}$$



- As z goes from $-\infty$ to $\infty, \sigma(z)$ goes from 0 to 1, a "squashing function".
- It has a "sigmoid" shape (i.e. S-like shape)
- $\sigma(0) = 0.5$, and if $z = w^T x + b$ then $\left\| \frac{d\sigma(z)}{dx} \right\| z = 0 = \frac{1}{4} \|w\|$