1 random notes

Don't use sigmoid as an activation function. Tanh is generally superior, as it has a mean of zero (sigmoid has a mean of 0.5). Nonzero mean can make training more difficult in subsequent layers. Tanh has a mean of zero. May want a sigmoid as a final activation function (that is, in the output layer) when doing a binary classification problem.

relu is generally good.

2 notation

3 logstic loss

loss function is the loss/error associated with a single training example Cost function is the loss computed over all examples

logistic loss

Think of $\hat{y}$ as the conditional probability $\hat{y}(x) = P(y = 1|x)$. The probability $y = 0$ is then $P(y = 0|x) = 1 - \hat{y}$. These two outcomes can be summarised as

$$P(y|x) = \hat{y}^y(1 - \hat{y})^{(1-y)} \tag{1}$$

The above is for a single example. The likelihood (of parameters) for a given training set would be obtained from the product $\prod_i P(y_i|x_i)$, where $\hat(y)_i$ is a function of x_i.

The expression for logistic loss can then be obtained from the negative log likelihood of $P(y|x)$ above

$$L = \sum_i (y_i - 1)ln(1 - \hat{y}_i) - y_i ln(\hat{y}_i) \tag{2}$$

The log of the product reduces to a sum over logs.

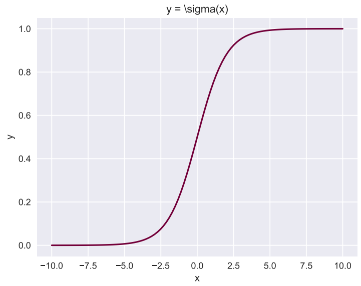
4 activation functions and their derivatives

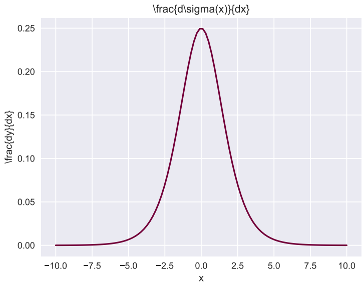
4.1 sigmoid

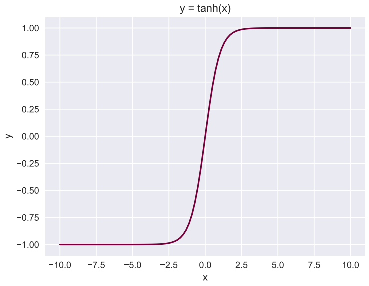
The sigmoid function (or logit function) and its derivative are given by

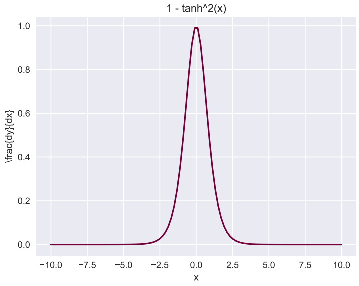
$$\begin{aligned} \sigma(x) &= \frac{1}{1 - e^{-x}} \\ \frac{d\sigma(x)}{dx} &= \sigma(x)(1 - \sigma(x)) \end{aligned}$$

these are plotted below









4.2 tanh

The tanh function (sinh/cosh) and its derivative are given by

$$\begin{aligned} \tanh(x) &= \frac{e^x - e^{-x}}{e^x + e^{-x}} \\ \frac{d\sigma(x)}{dx} &= 1 - \tanh^2(x) \end{aligned}$$

these are plotted below

4.3 ReLu

rectified linear unit

4.4 leaky ReLu

Gradient saturation and such