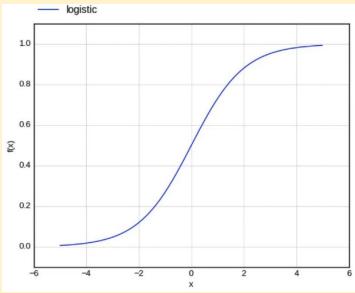
PadhAl: Activation Functions & Initialization Methods

One Fourth Labs

Saturation in logistic neuron

Let's look at the logistic function

1. The following figure illustrates the logistic function



a.
$$f(x) = \frac{1}{1 + e^{-x}}$$

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b. $f'(x) = \frac{\partial f(x)}{\partial x} = f(x) * (1 - f(x))$

- 2. A logistic neuron is said to be saturated when it reaches its peak values when it is given high extremes of positive or negative values as inputs.
 - a. When f(x) = 0
 - b. And hence f'(x) = 0
 - c. In the case where we are calculating the gradient w.r.t a weight associated with a saturated neuron, the saturated neuron's derivative is 0, thus resulting in the entire gradient becoming 0
 - d. This is because the term associated with the saturated neuron in the chain rule for gradient calculation becomes 0, thus making the entire gradient 0
 - e. Due to this, the weights are not updated.
 - f. This is called the Vanishing Gradient Problem, because the gradient vanishes or becomes 0 due to the presence of a saturated neuron.