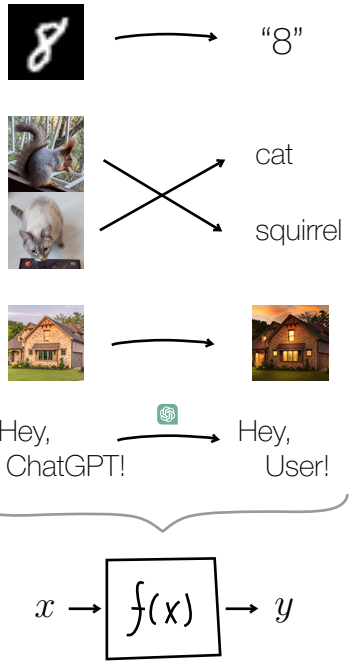
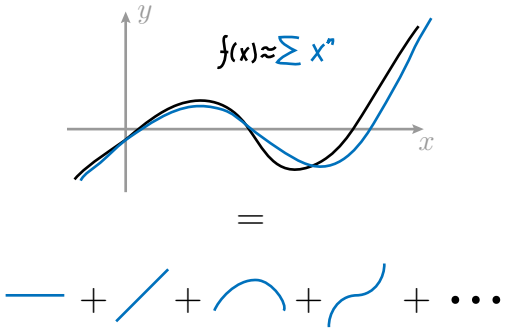
Constructing functions

Function problems



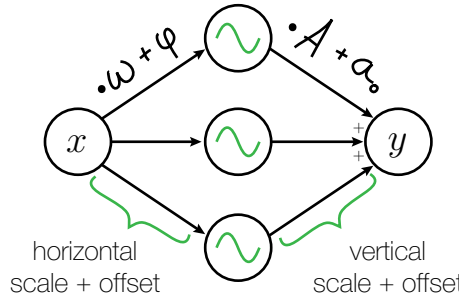
Taylor series

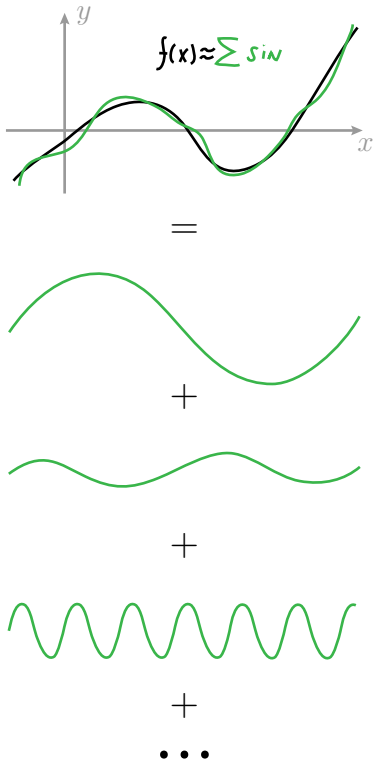
$$f(x) = a_0 + a_1 x + a_2 x^2 + \dots$$



Fourier series

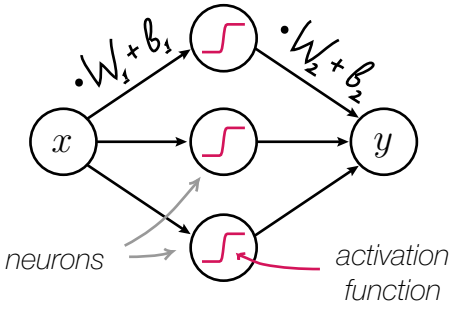
$$f(x) = \sum A \sin(\omega x + \varphi) + a_0$$

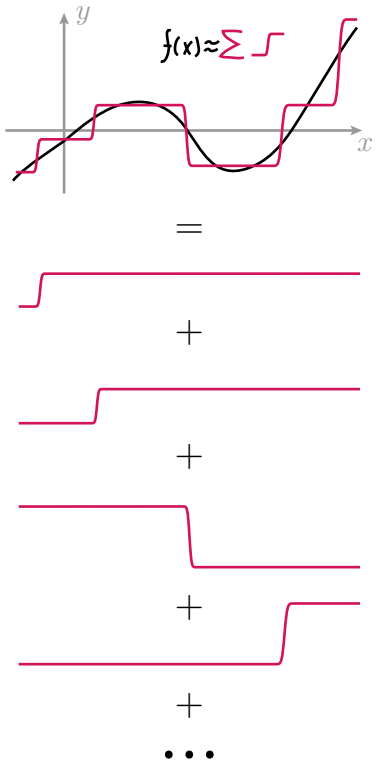




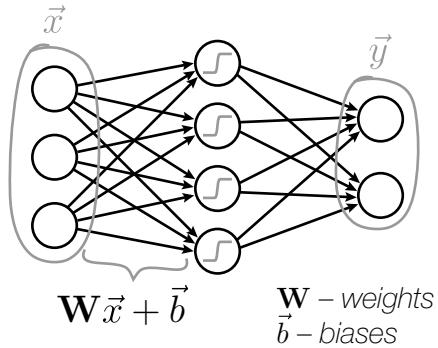
Single-layer neural network

$$f(x) = \sum W_2 \sigma(W_1 x + b_1) + b_2$$



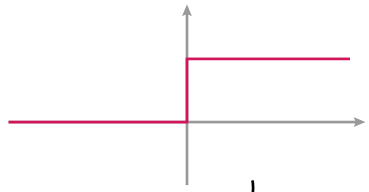


Multiple dimensions



[1] Universal approximation theorem (Cybenko)

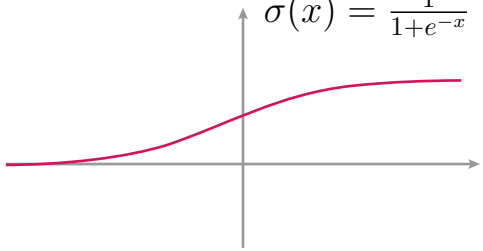
Unit step function



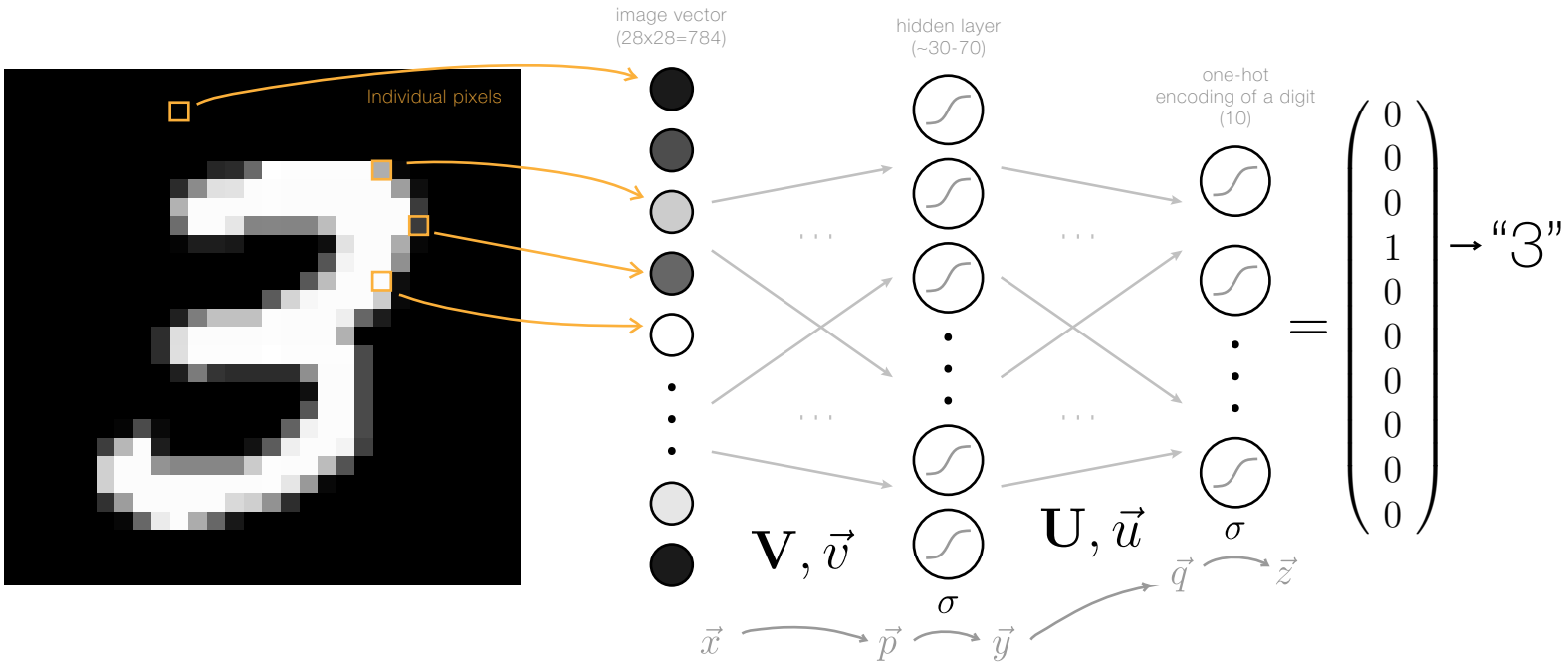
+ smoothing

Sigmoid

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



Classification neural network



Forward Pass

image vector

$$\vec{p} = \mathbf{V}\vec{x} + \vec{v}$$

$$\vec{y} = \sigma(\vec{p})$$

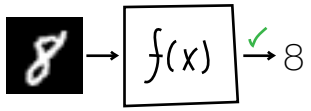
element-wise

$$\vec{q} = \mathbf{U}\vec{y} + \vec{u}$$

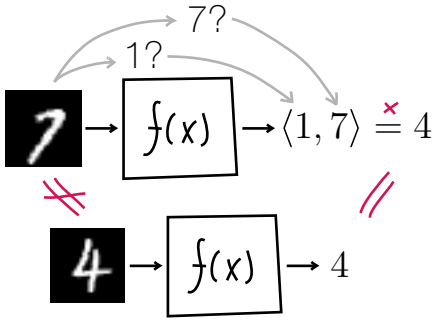
$$\vec{z} = \sigma(\vec{q})$$

encoding of a digit

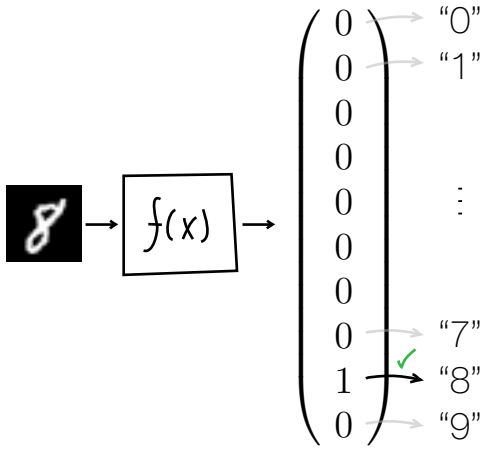
Digit itself ✗



Edge case



One-hot encoding ✓



Edge case