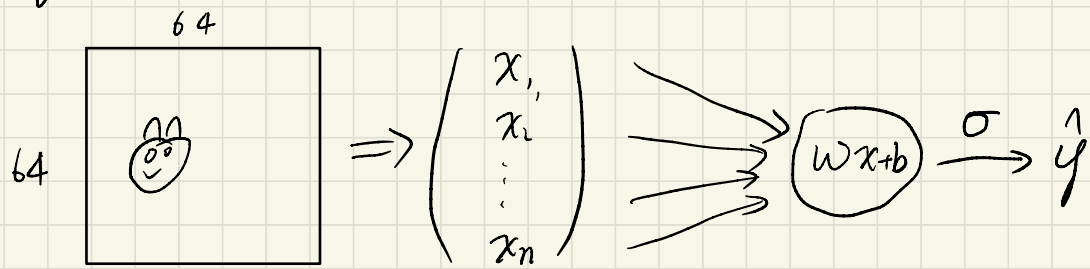
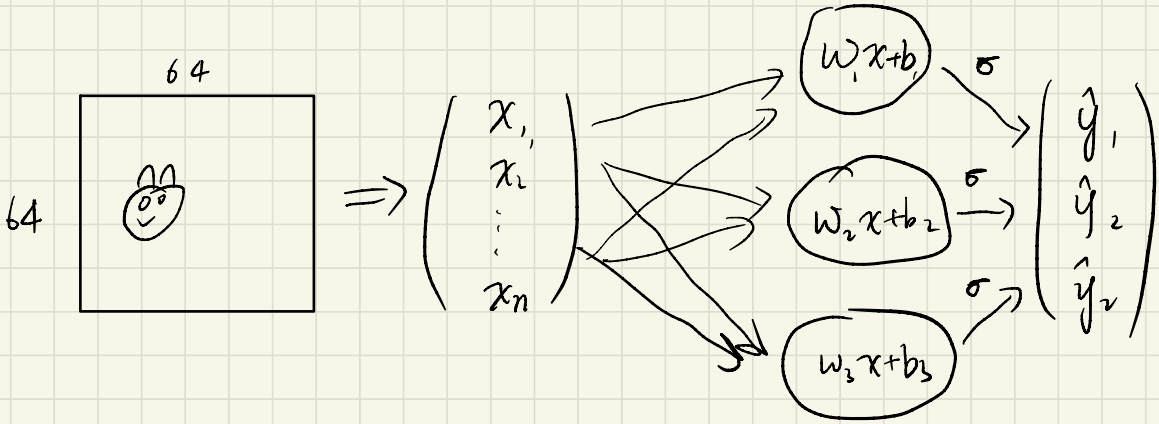
Logistic Regression



① neuron : linear + activation

② model : architecture

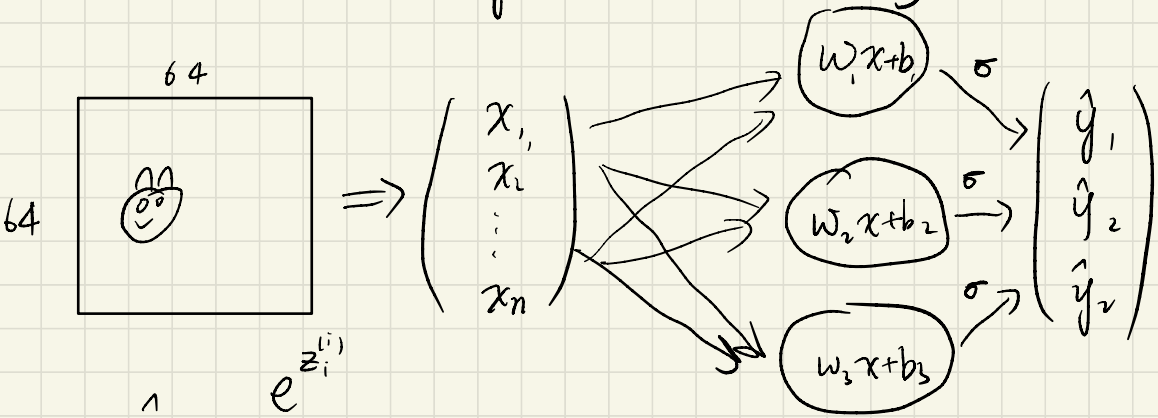
$\Rightarrow$ Find cat/lion/iguana



$$\mathcal{L}_{3N} = -\sum_{k=1}^{3}\left[y_k \log \hat{y}_k + (1-y_k)\cdot \log \hat{y}_k \right]$$

Softmax:

constraint: unique animal on an image.



$$\hat{y}_1 = \frac{e^{z_1^{(i)}}}{\sum_{i=0}^{n} e^{z_i^{(i)}}}$$

cross-entropy-loss

$$\mathcal{L} = -\sum_{k=1}^{3} y_k \log \hat{y}_k.$$

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how to predict the age of the Cat?

Rectified Linear units — (ReLu).

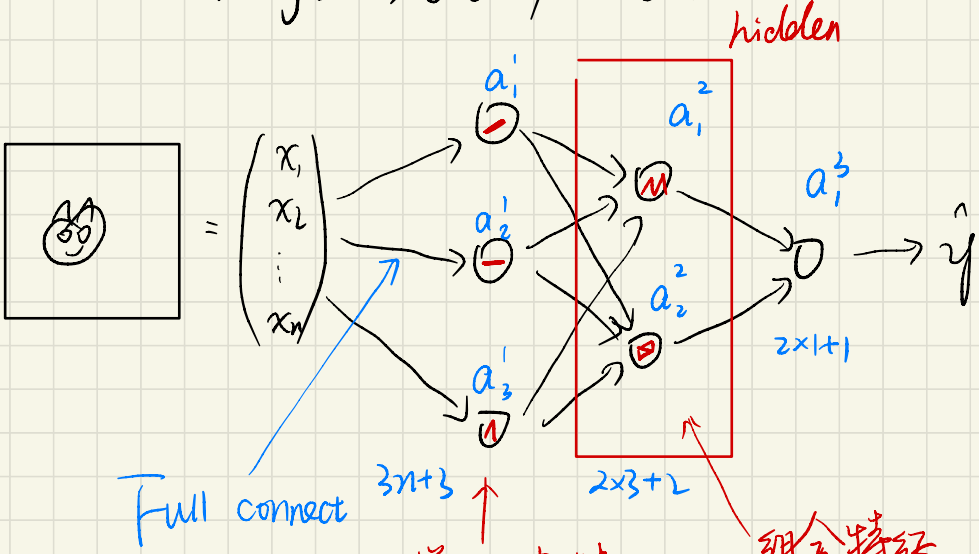
Linear.

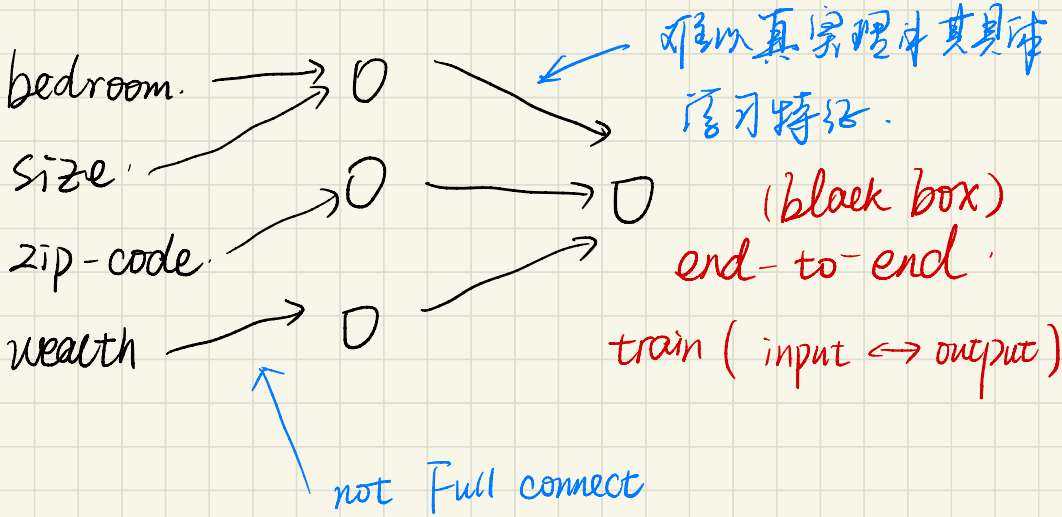
$$|\hat{y} - y| \quad , \quad \|\hat{y} - y\|_2^2$$

Classification. Regression.

N.N.

Goal: image ⇒ cat (1) / no cat (0)





Forward propagation

$$z^{[1]} = w^{[1]}x + b^{[1]} \qquad X = \begin{pmatrix} | & | & & | \\ x^{(1)} & x^{(2)} & \cdots & x^{m} \\ | & | & & | \end{pmatrix}$$

$$a^{[1]} = \sigma(z^{[1]})$$

$$z^{[2]} = w^{[2]}a^{[1]} + b^{[2]} \Rightarrow z^{[1]} = w^{[1]}x + b^{[1]}$$

$$a^{[2]} = \sigma(z^{[2]}) \qquad \Downarrow \qquad = \begin{bmatrix} | & & | \\ z^{[1](1)} & \cdots & z^{[1](m)} \\ | & & | \end{bmatrix}$$

$$z^{[3]} = w^{[3]}a^{[2]} + b^{[3]}$$

$$a^{[3]} = \sigma(z^{[3]})$$

Loss (Back propagation) : Optimizing .....

1个样本

cost

多个样本

batch gradiant

$$J(\hat{y}, y) = \frac{1}{m}\sum_{i=1}^{m} \mathcal{L}^{(i)}$$

$$\mathcal{L}^{(i)} = -\left[y^{(i)} \cdot \log \hat{y}^{(i)} + (1 - y^{(i)}) \cdot \log(1 - \hat{y}^{(i)})\right]$$

B.P.

$$\forall\, l \in 1, \cdots, n \qquad \begin{cases} w^{[i]} = w^{[i]} - \alpha \dfrac{\partial J}{\partial w^{[l]}} \\ b^{[i]} = b^{[i]} - \alpha \dfrac{\partial J}{\partial b^{[i]}} \end{cases}$$

计算的方式：从顶层向下：

$$z^{[1]} = w^{[1]}x + b^{[1]}$$

$$a^{[1]} = \sigma(z^{[1]})$$

$$z^{[2]} = w^{[2]}a^{[1]} + b^{[2]}$$

$$a^{[2]} = \sigma(z^{[2]})$$

$$z^{[3]} = w^{[3]}a^{[2]} + b^{[3]}$$

$$a^{[3]} = \sigma(z^{[3]})$$

$$\hat{y} = a^{[3]}$$

$$\frac{\partial J}{\partial w^{[3]}} = \boxed{\frac{\partial J}{\partial a^{[3]}} \cdot \frac{\partial a^{[3]}}{\partial z^{[3]}}} \cdot \frac{\partial z^{[3]}}{\partial w^{[3]}}$$

$$\frac{\partial J}{\partial w^{[2]}} = \frac{\partial J}{\partial z^{[3]}} \cdot \frac{\partial z^{[3]}}{\partial a^{[2]}} \cdot \frac{\partial a^{[2]}}{\partial z^{[2]}} \cdot \frac{\partial z^{[2]}}{\partial w^{[2]}}$$