# CS230 : Lecture 1
# The mathematics of backpropagation

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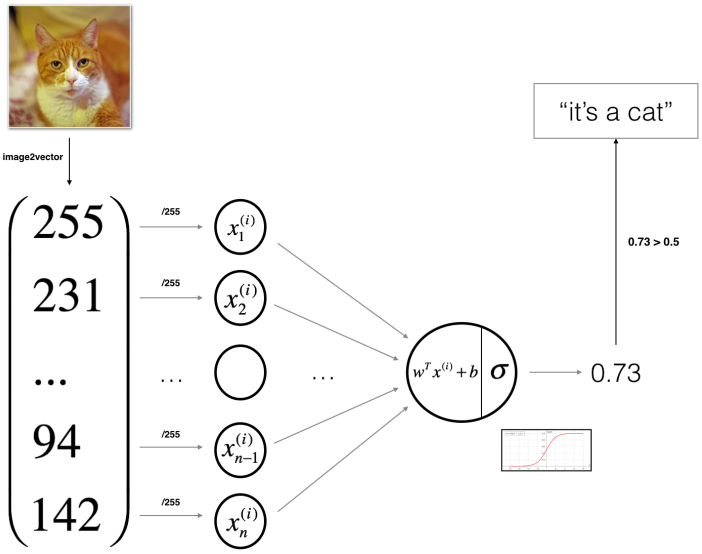
## I) Backpropagation for the Logistic Regression

Let's consider the following neural network :




### A) Warm-up questions and definitions

- What is a neuron?
- How many parameters does this model have?
- How do we learn the parameters ?
- What is a model?
- How to predict ?

The Optimization Loop:

1.

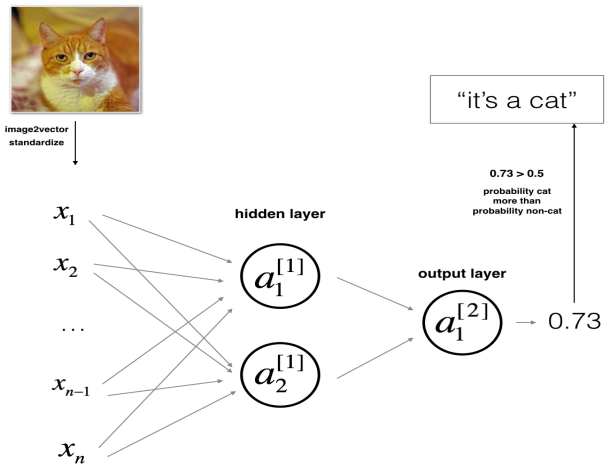
2.
   i)
   ii)
   iii)

### B) Forward propagation

### C) Backward propagation

## II) Backpropagation for a one-hidden layer network

We now add a hidden layer to our network. Here is how it looks like:



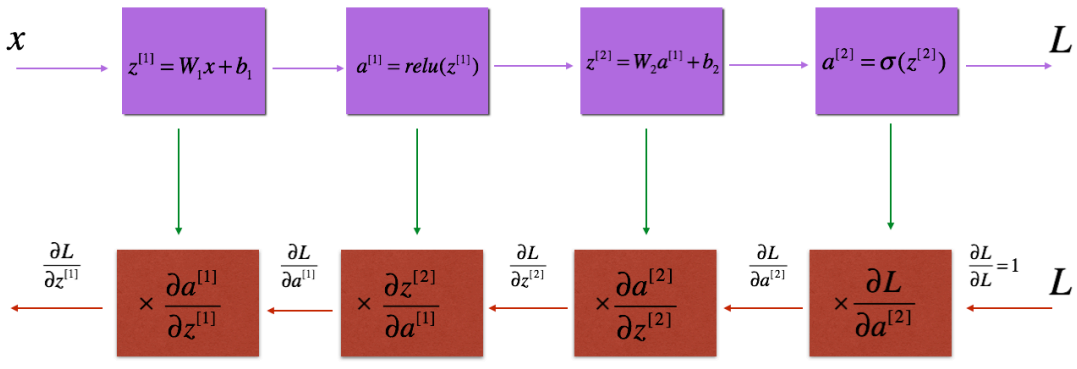

### A) Warm-up questions and definitions

- **Notations**
- **How many parameters? Shape of each weight matrix / bias vector?**
- **How many derivatives to calculate?**

B) Forward propagation

C) Backward propagation

## III) Backpropagation for deep networks




$$\frac{\partial L}{\partial z^{[1]}} = \frac{\partial L}{\partial a^{[2]}} \frac{\partial a^{[2]}}{\partial z^{[2]}} \frac{\partial z^{[2]}}{\partial a^{[1]}} \frac{\partial a^{[1]}}{\partial z^{[1]}} = \frac{\partial L}{\partial a^{[1]}} \frac{\partial a^{[1]}}{\partial z^{[1]}}$$

Method : Multi-layer backpropagation

1.

2.

**Additional notes & Conclusion:**