

Introduction to Machine Learning

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1) Function : $x \rightarrow f(x)$

Given $f(x) = 2x + 1$

Input	x	$x=1$	$x=2$...	$x=10$
output	$f(x)$	$f(x)=3$	$f(x)=5$...	$f(x)=21$

2) If we are only given :

x	$x=1$	$x=2$	...	$x=10$
$f(x)$	$f(x)=3$	$f(x)=5$	...	$f(x)=21$

What is $f(x)=?$

3) The world is complicated, usually, the data is like the following:

x	$x=1$	$x=2$	...	$x=10$
$f(x)$	$f(x)=3.2$	$f(x)=4.9$	...	$f(x)=20.9$

What is $f(x)=?$

4) Now, we introduce the Vector.


E.g. $x = (x_1, x_2)$, $f(x) = 2x_1 + 3x_2 - 1$


If we are given the following table:

$x = (x_1, x_2)$	$(1, 1)$	$(1, 2)$	...	$(4, 3)$
$f(x) = f(x_1, x_2)$	$f(x) = 4.1$	$f(x) = 6.9$	...	$f(x) = 15.8$

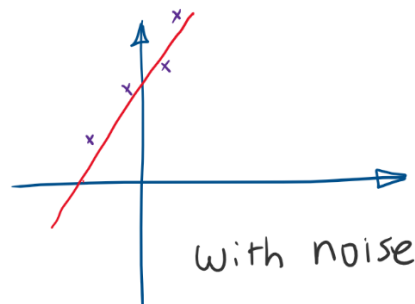
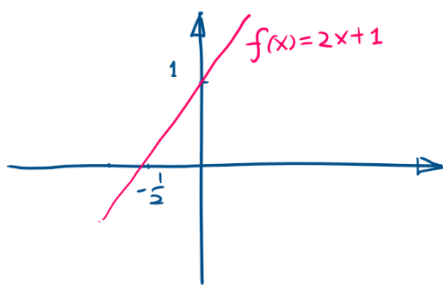
Q: What is $f(x) = f(x_1, x_2) = ?$

5) Given an image:  It can be represented by a vector $(x_1, x_2 \dots x_n)$ we need to learn a function

$$f(\text{) = f(x_1, x_2 \dots x_n) = \text{Dog}$$

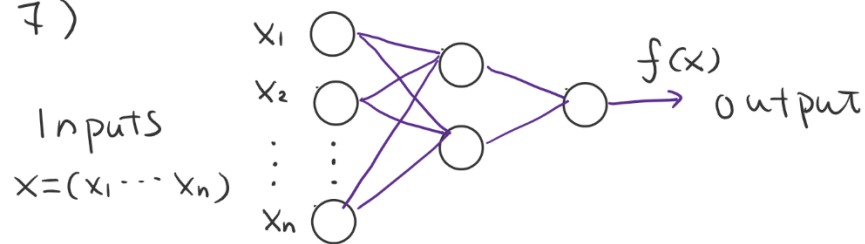
$$f(\text{) = f(x_1, x_2 \dots x_n) = \text{Cat}$$

6) Some functions are easy, some are hard.

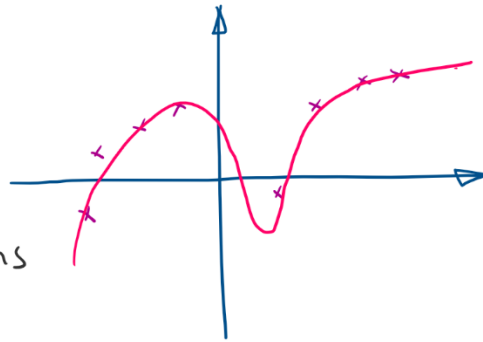


For complicated case like map a vector of an image, we may not find an existing function. we may need a model which can approximate any functions. Artificial Neural Network is such a model.

7)



For Complicated cases
we need to use a
NN to approximate
the underlying relations



8) The function is **learned** from given **training Data**,
the function can be linear, can be probabilistic,
or a neural network with a large Capacity.