COMP2261 ARTIFICIAL INTELLIGENCE / MACHINE LEARNING

Linear Regression
-- Intuition

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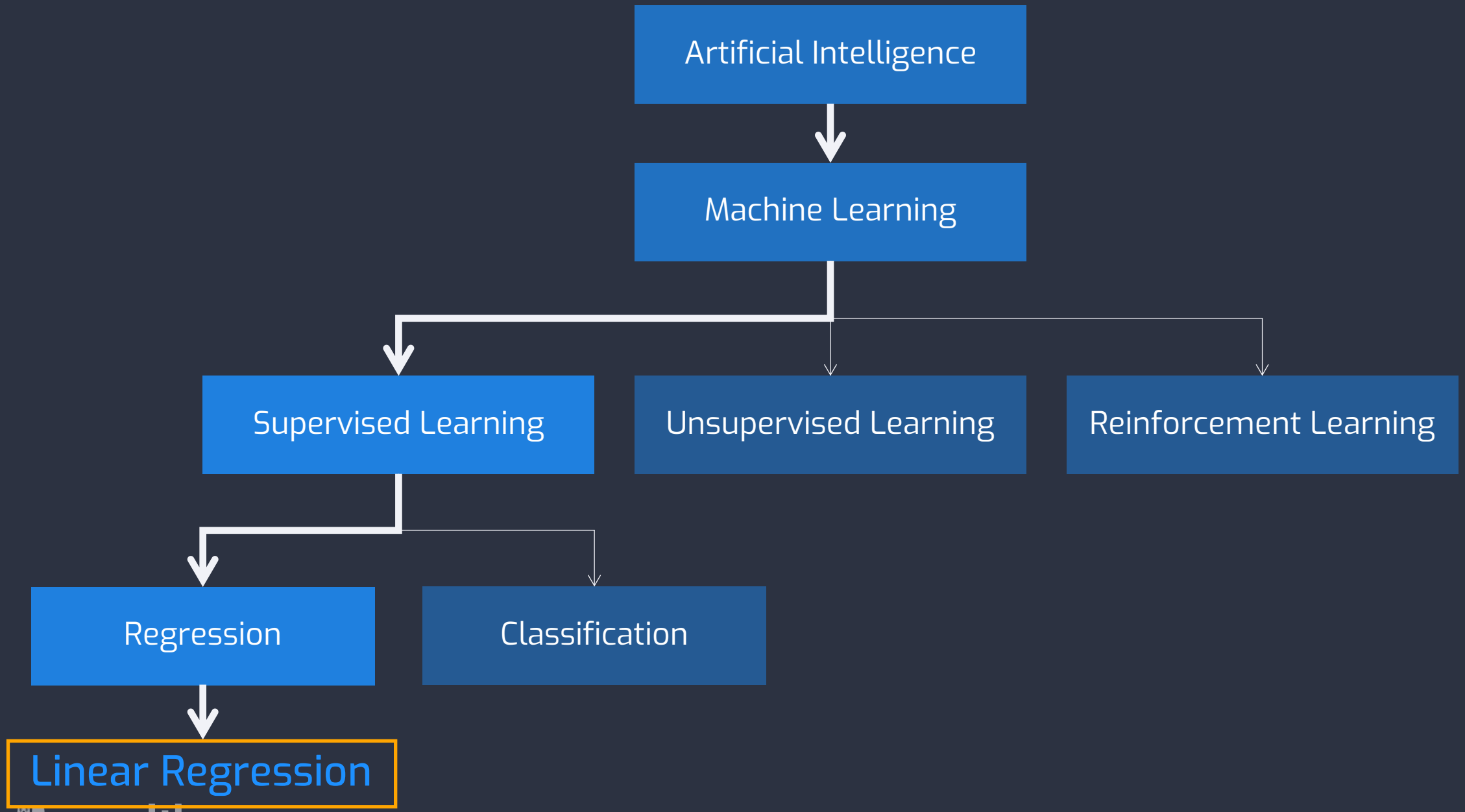
learning lab


Artificial Intelligence
Machine Learning
Supervised Learning
Unsupervised Learning
Reinforcement Learning
Regression
Classification
Linear Regression

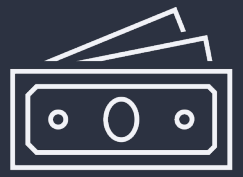
Learning Objectives

- Have an intuition of how linear regression algorithm learns
- Understand the representation of linear regression model

Linear Regression

- Intuition -

EXAMPLE. annual income to predict happiness

given  annual income

to predict  happiness

EXAMPLE. annual income to predict happiness

500 people in Durham

survey

annual income — independent variable

£15k -- £75k

happiness — dependent variable

0 -- 10

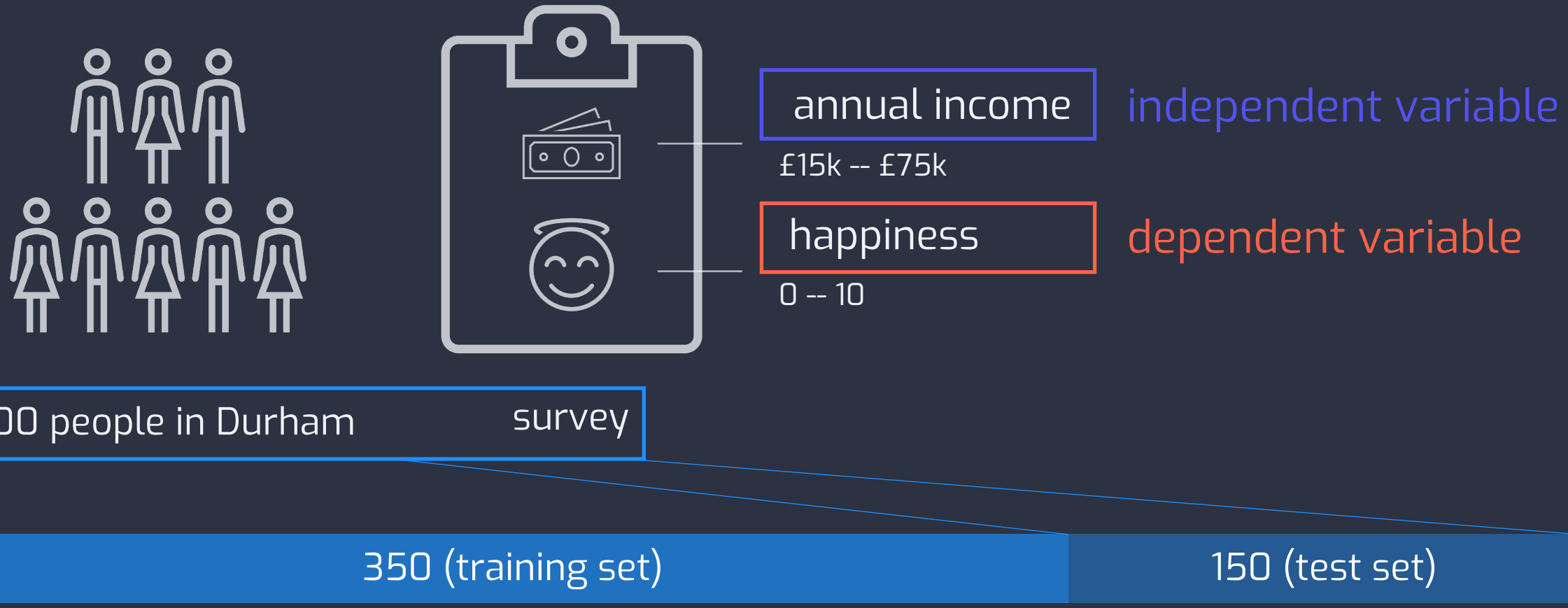
A supervised learning task

-- we know the “right answer”, the correct label i.e. given annual income, we know exact happiness.

A regression task

-- we want to predict a real-valued output i.e. happiness in a continuous scale from 0 to 10.

EXAMPLE. annual income to predict happiness



The task: to train a linear regression (supervised learning) model on the training set and evaluate the trained model on the test set, so that the model can predict happiness of someone in Durham with certain amount of annual income.

Some notions...

m	the number of training instances
x	input/independent variable/feature
y	output/dependent variable, prediction
(x, y)	a single training instance
$(x^{(i)}, y^{(i)})$	the i^{th} training instance (i is the index)

EXAMPLE. annual income to predict happiness

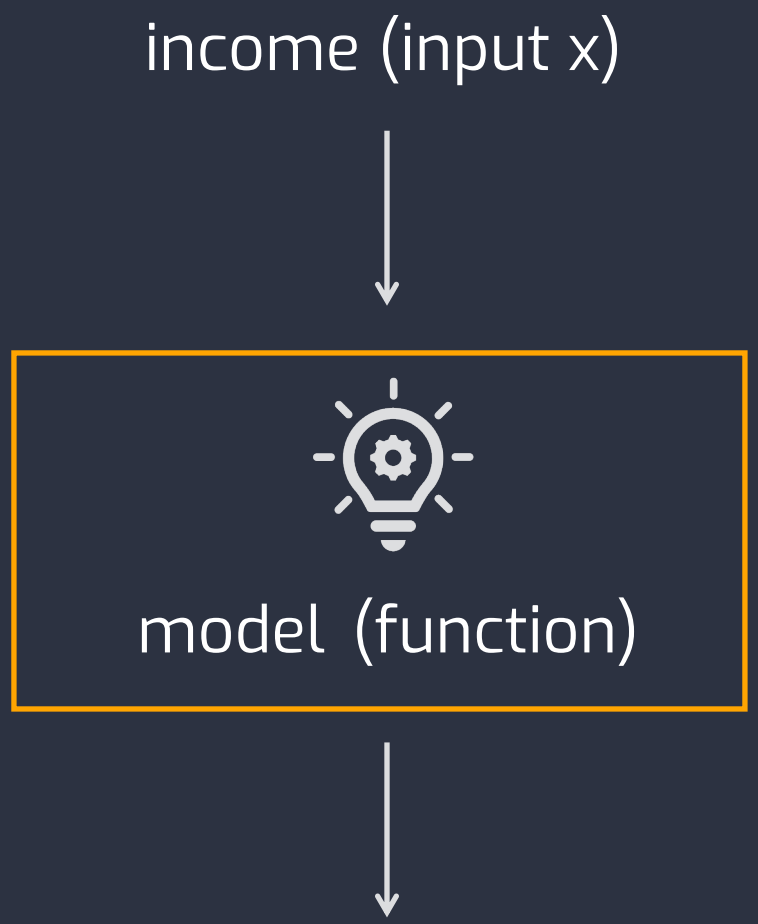
$m = 350$

$\left(x^{(2)}, y^{(2)}\right) = (49.79\ , 3.433)$

	x	y
	income (k)	happiness
1	38.63	2.314
2	49.79	3.433
…	…	…
i	21.18	1.45
…	…	…
350	71.19	5.95

EXAMPLE. annual income to predict happiness

EXAMPLE. annual income to predict happiness



hypothesis

function h, mapping from x to y

EXAMPLE. annual income to predict happiness

hypothesis

function h, mapping from x to y

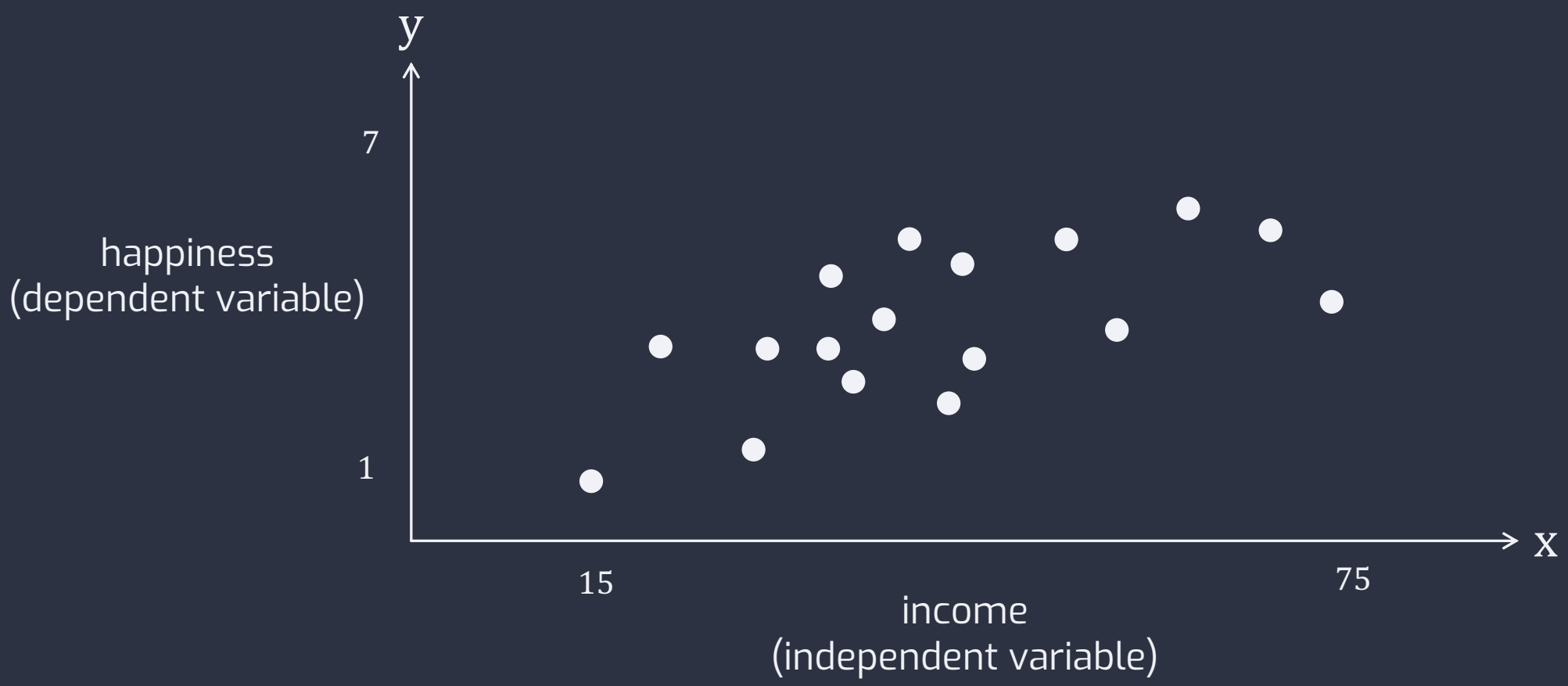
y-intercept, bias

$h_\theta(x) = \theta_0 + \theta_1 x$ or $h(x) = \theta_0 + \theta_1 x$

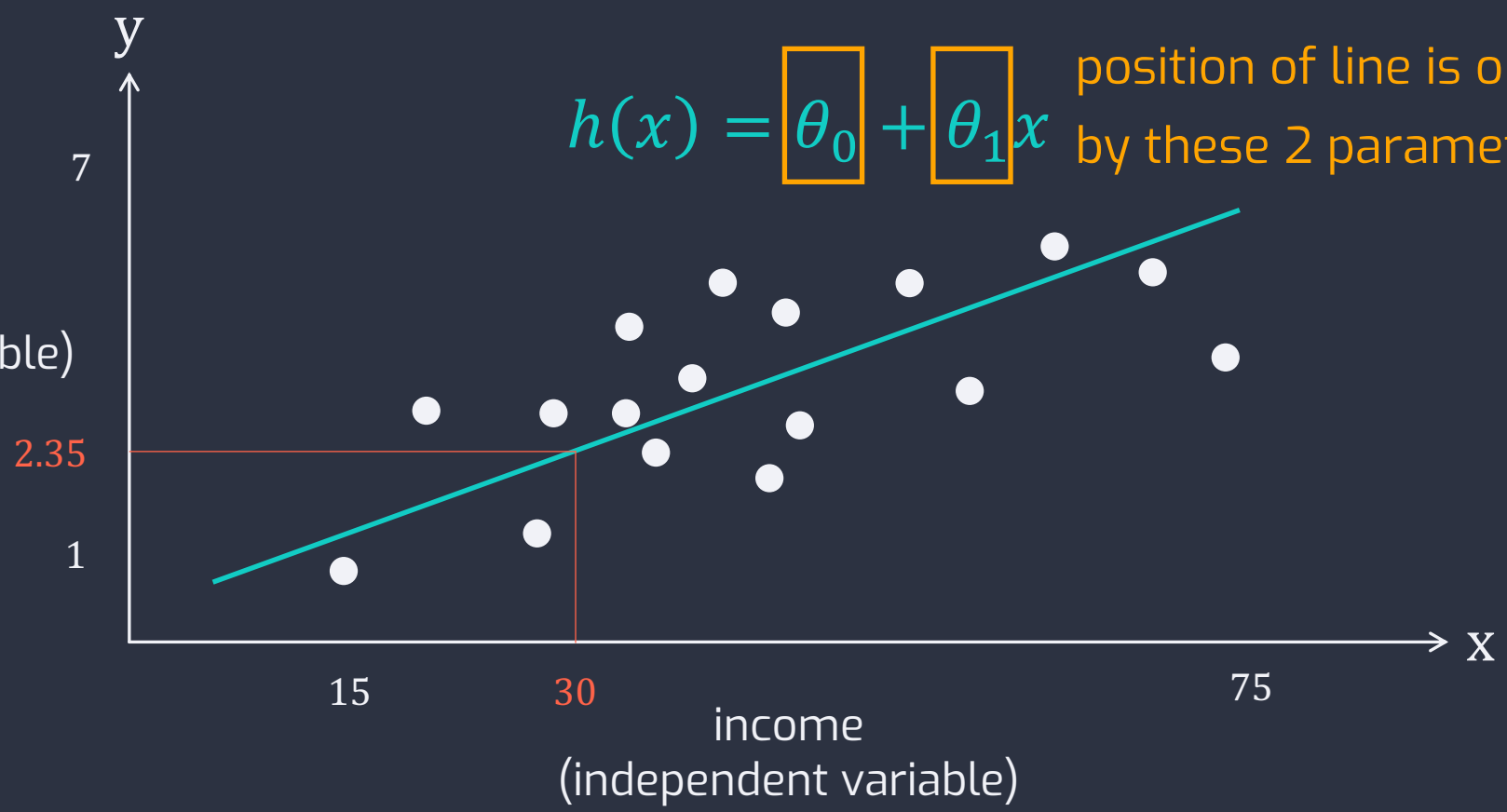
y' : predicted value

slope, weight

EXAMPLE. annual income to predict happiness



EXAMPLE. annual income to predict happiness



$$h(x) = \theta_0 + \theta_1 x$$

position of line is only determined by these 2 parameters

Takeaway Points

- Linear regression model can be represented as $h(x) = \theta_0 + \theta_1 x$
- The shape of linear regression model is only determined by weight (θ_1) and bias (θ_0) parameters
- Linear regression algorithm tries to find θ_0 and θ_1