Machine Learning.

— Understand the rules/patterns from the data

Predictions. Iris Dataset

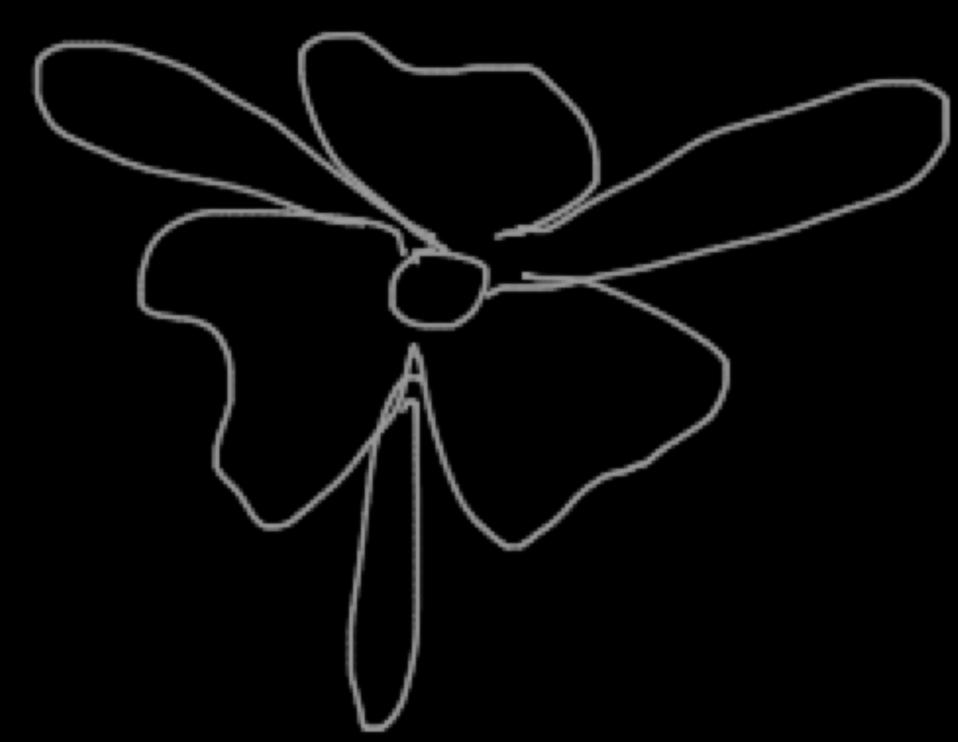
X-Values → (y)

Features / indep-Values — species dependent - Predicted Var -

	SL	SW	PL	PW	species
1	2.3	3.2	4.3	3.5	Setosa
2	1.3	0.8	3.2	2.1	Versicolor
3	–	–	–	–	Setosa
	–	–	–	–	
	–	–	–	–	

→ 3 species.

→ Setosa, Virginica, Versicolor.



→ PL = 4.0 SL = 3.0
PW = 2.5 SW = 1.2

⇒ (Versicolor)

n=1000

(x, y) → Model — Arriving at →

Training the model.

If PL < 4.0 and SL > 3.1.
species = setosa -

if PL < 3.5 and SL > 4.3.
Species = Versicolor

Machine Learning.

Supervised learning.

— train the model by showing both x & y.

(x, y) → Train the model → y

↑ x

1. Regression Models.
   — y is Continuous.

2. Classification Models.
   — y is categorical.

Unsupervised Learning.

x. → Training → Groups of records.

— Model is trained by showing only x. Values

— No predictions can be made.

— Grouping / Clustering

— Customer Segmentation

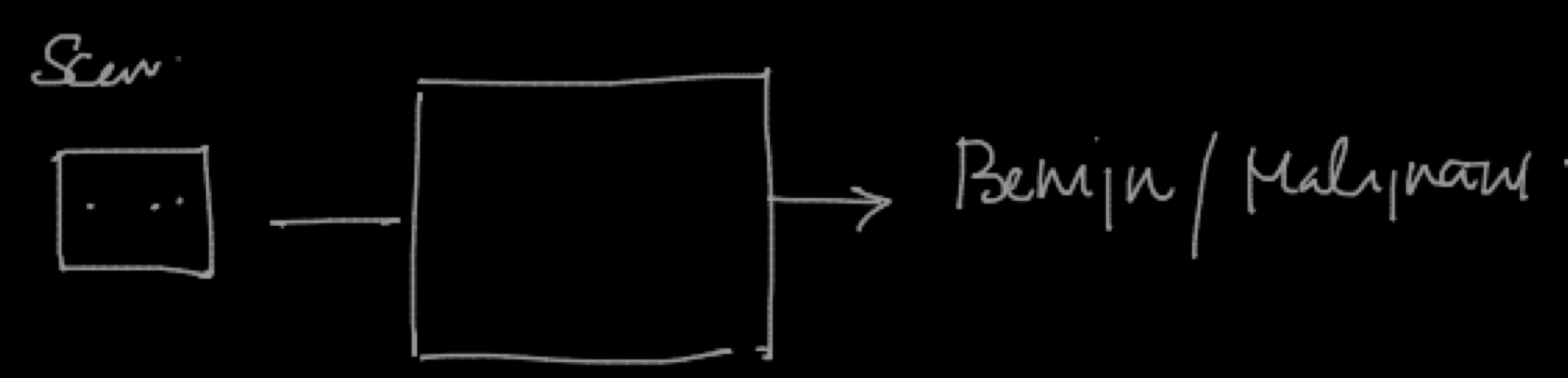
C1 — — — — —
C2 — — — — —
C3 — — — .
C4 .

— Clustering models.

Break.

10.15 am

- More data means better models
- Model is only as good as your data.

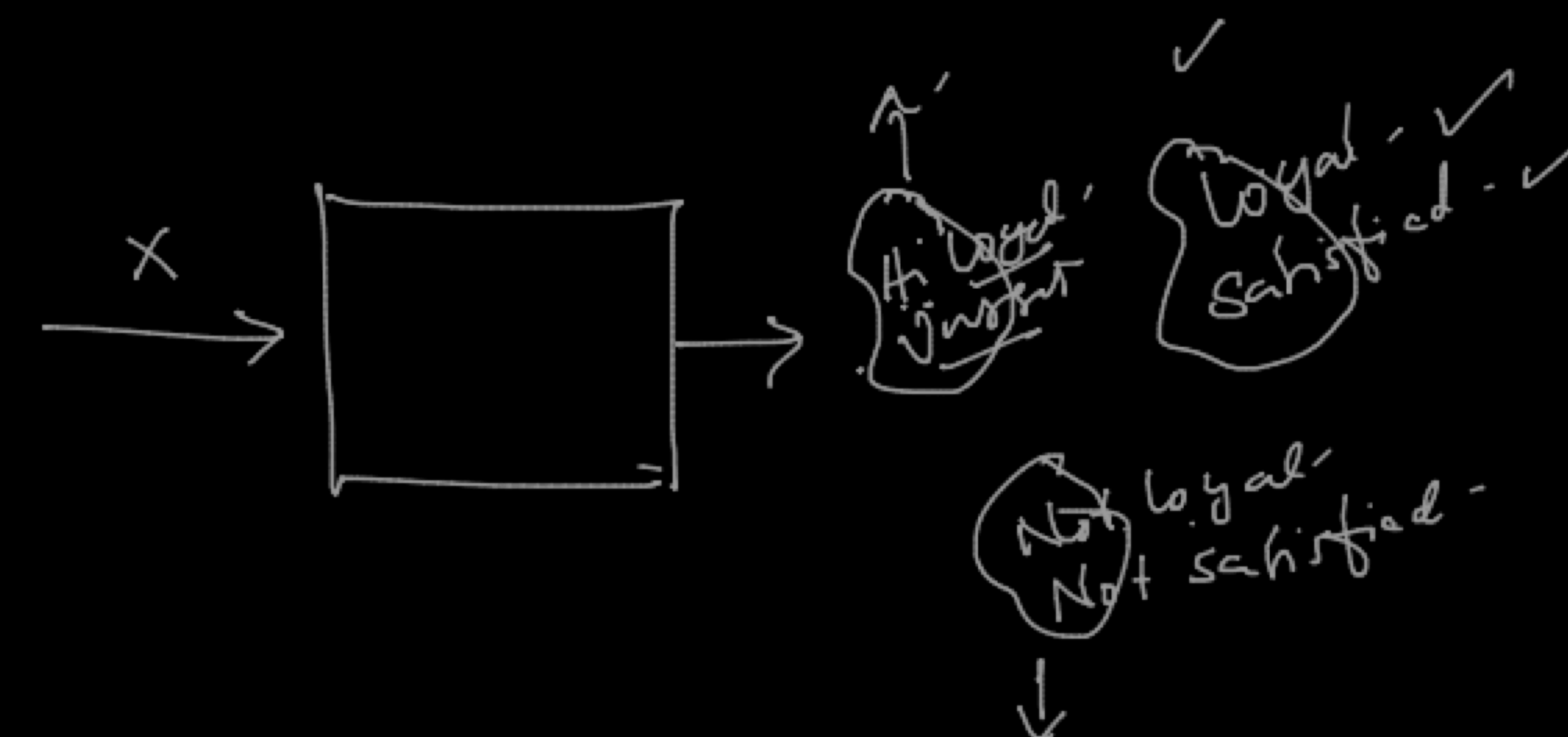


	diam x_1	text x_2	GA x_3	x_4	y
1	–	–	–	–	B
2	–	–	–	–	M
3	–	–	–	–	M
⋮					
$n = 1000$					

Labeled data

Unsupervised Learning

(F1) Loyalty	(F2) Satisfaction
–	–
–	–
–	–
–	–
–	–
–	–



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Supervised Learning -

Regression

→ Predicts.
Continuous data.

- Predicting House price-
- Stock price-
- Marks

Classification-

- Predicts.
Categorical Values.

- Tumor Malignant / Benign
- Default / No default-
- HA / No Heart.
- Cat / Dog / Horse-

6 / 6

Simple Linear Regression.

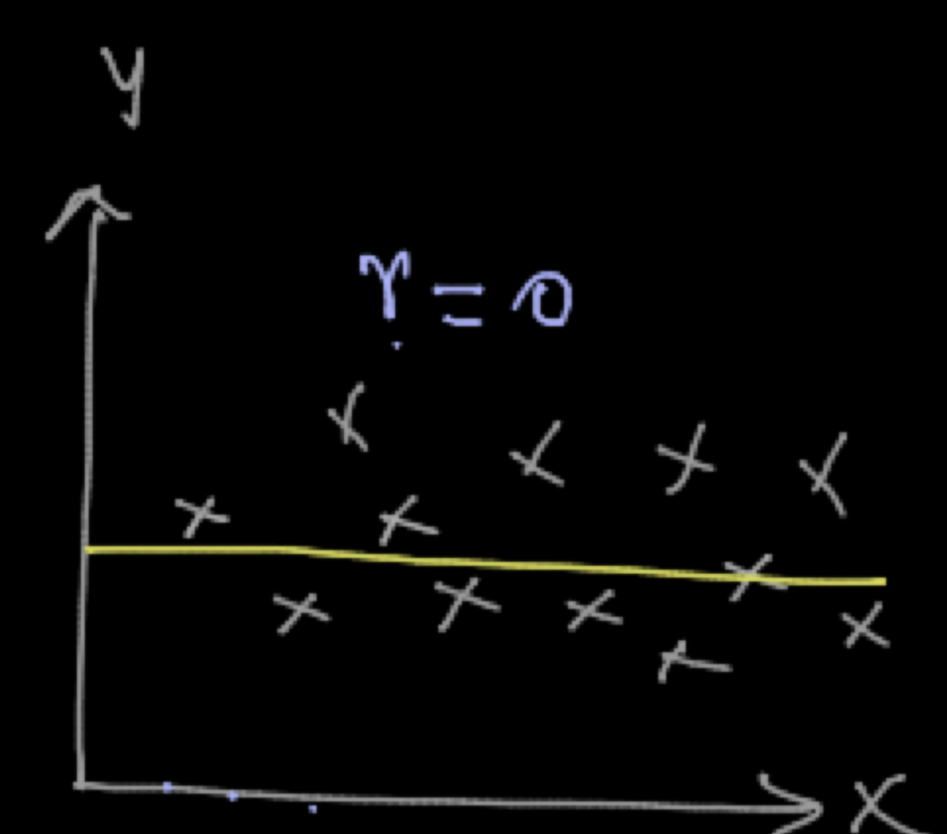
one feature to predict ←

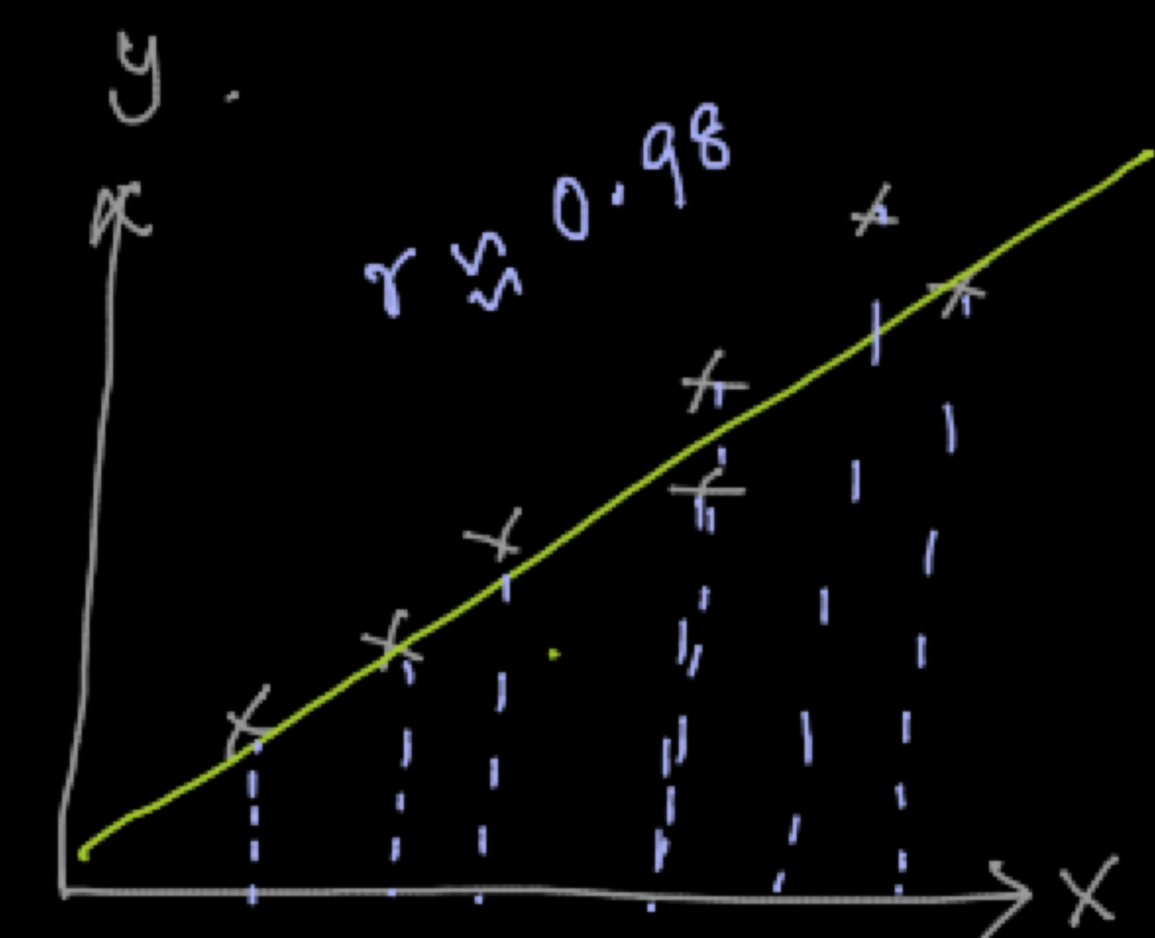
↓ Linear relationship between x & y

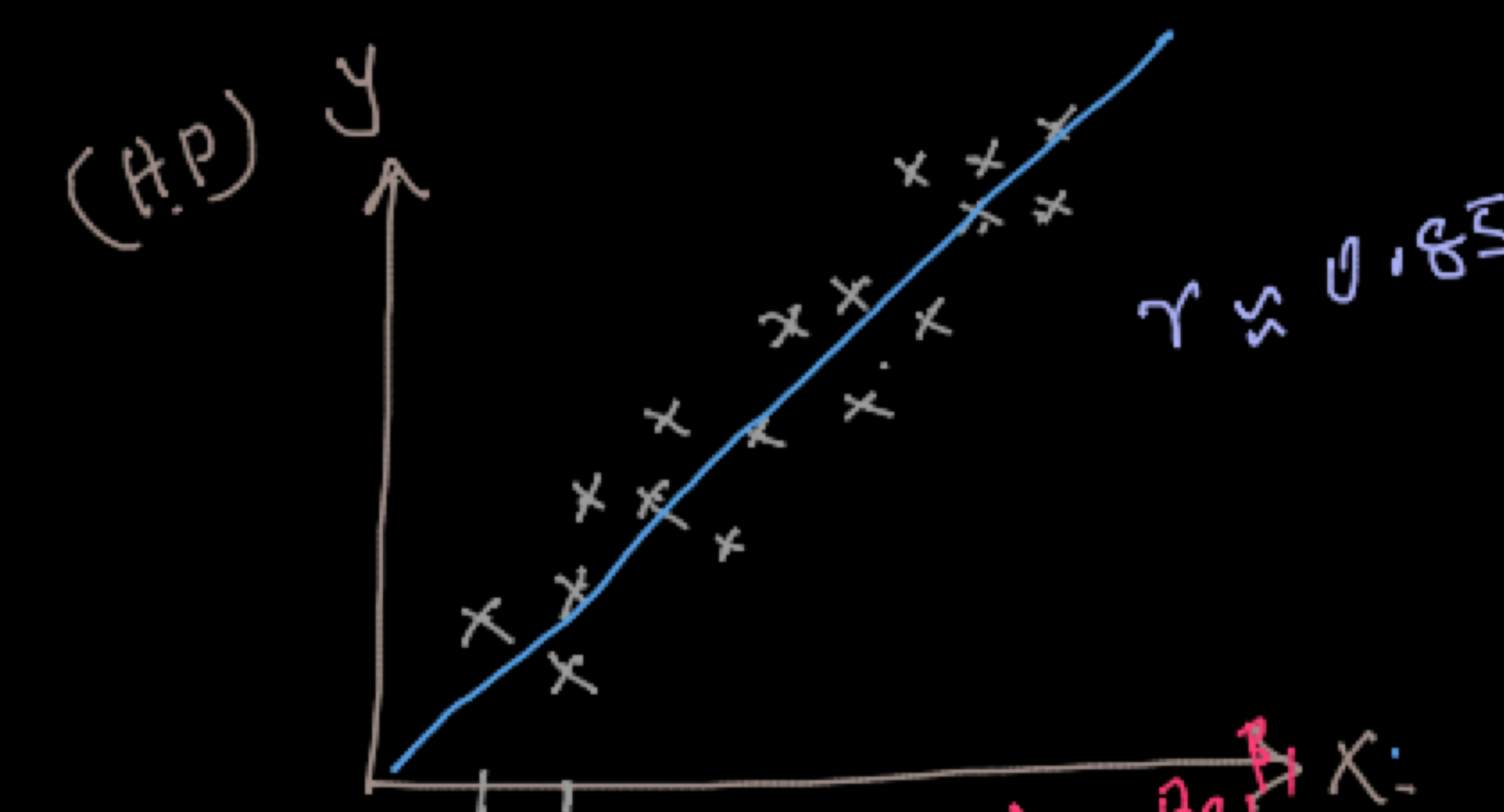
↳ predict y which is continuous.

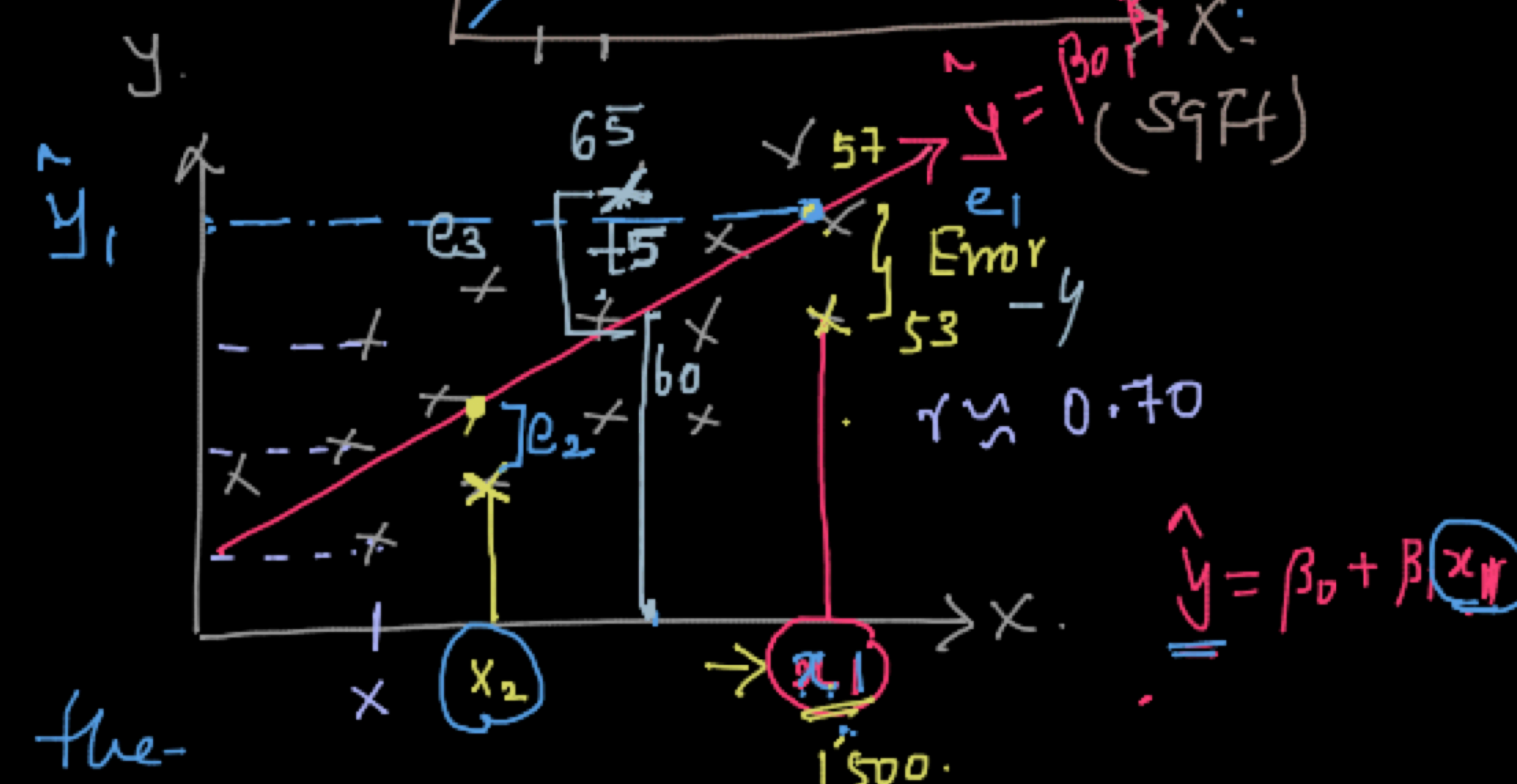
Sqft (x)	House Price (y)
—	—
—	—
—	—
—	—
—	

1. scatter plot.









2. Quantify the strength of the relationship betn x & y.

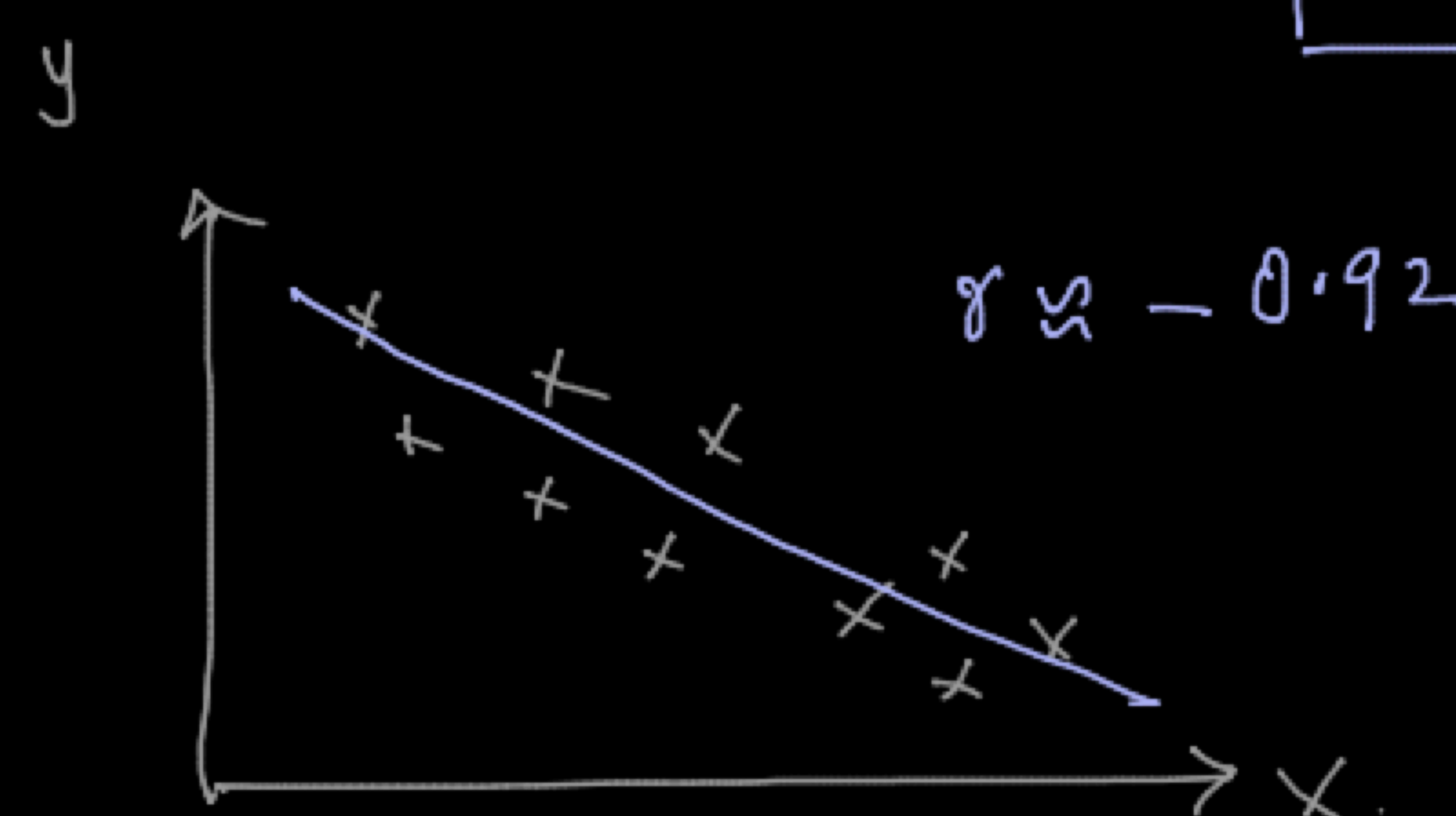
Pearson's Correlation Co-efficient (r) → strength of the LINEAR relationship betn x & y.

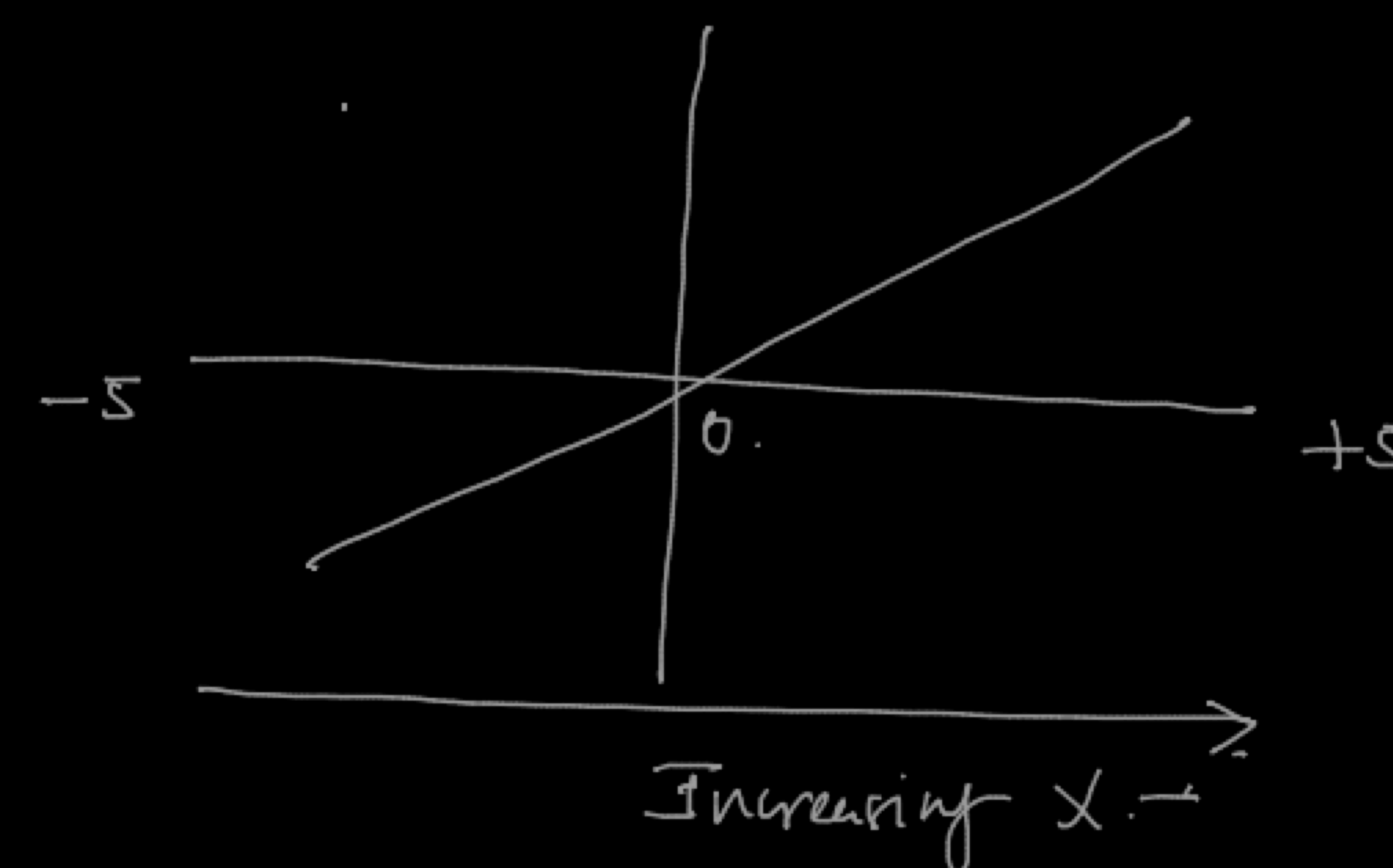
$r \rightarrow$ Cannot predict this relationship.

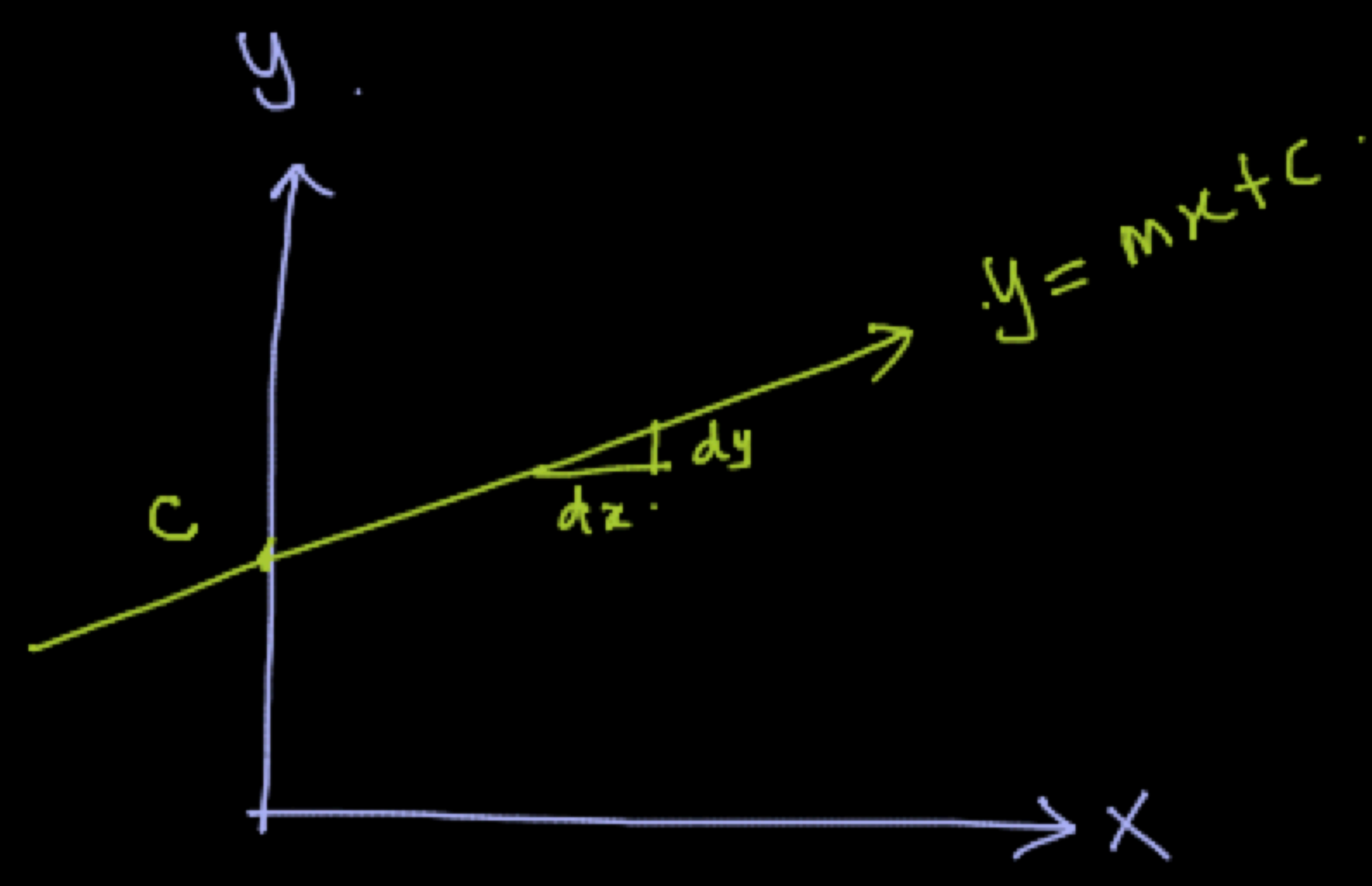
$\boxed{r \geq \pm 0.85}$

↳ We can build a good linear model

$\boxed{r = -1 \text{ to } +1}$







What is a Model.

$$\boxed{y = f(x)} \rightarrow \text{Model}$$

$$y = mx + c \rightarrow \text{Linear Model}$$

$$y = \beta_0 + \beta_1 x$$

$\beta_0, \beta_1 \rightarrow$ Model Parameters.

Parameters

Model Parameters
— Estimated by the model during training

Hyper params
— We decide before building the model

Machine Learning

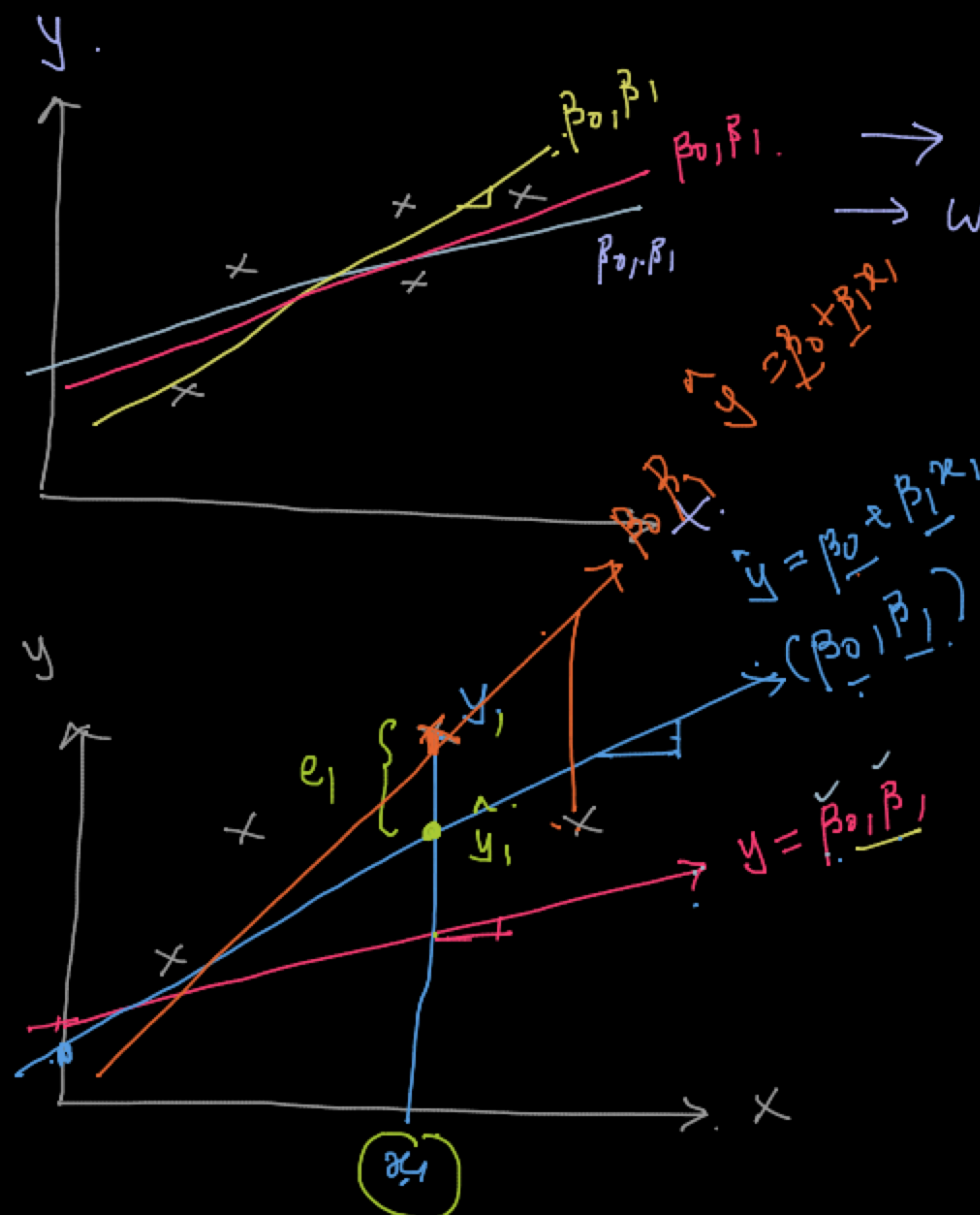
— Machine learns the model parameters from the data

— Gradient Descent

→ Ordinary least squares (OLS).

Training the model

— Model is learning the β's (model parameters) from the data



→ OLS.

→ Which is the best β_0 & β_1 (best line)?

x.	y	$\hat{y} = \beta_0 + \beta_1 x$.	Error
x_1	y_1	$\hat{y}_1$	$e_1 = (y_1 - \hat{y}_1)$ +5
x_2	y_2	$\hat{y}_2$	$e_2 = (y_2 - \hat{y}_2)$ −3
x_3	y_3		$e_3 = y$.
x_n	.	.	.

Model

$$\hat{y} = \beta_0 + \beta_1 x_i$$

↳ Predicted Value of y

Sum of Squared Errors (SSE) $= e_1^2 + e_2^2 + e_3^2 + \cdots e_n^2$ $\quad \beta_0, \beta_1$

$$SSE = e_1^2 + e_2^2 + e_3^2 + \cdots e_n^2 \quad \beta_0 \beta_1$$

$$SSE = e_1^2 + e_2^2 + e_3^2 + \cdots e_n^2 \quad \beta_0, \beta_1$$

Min SSE.

Task: Find those β_0, β_1 s.t. the SSE is minimum.

	x	y	$\hat{y}$	ε
1.	x_1	y_1	$\hat{y}_1$	e_1