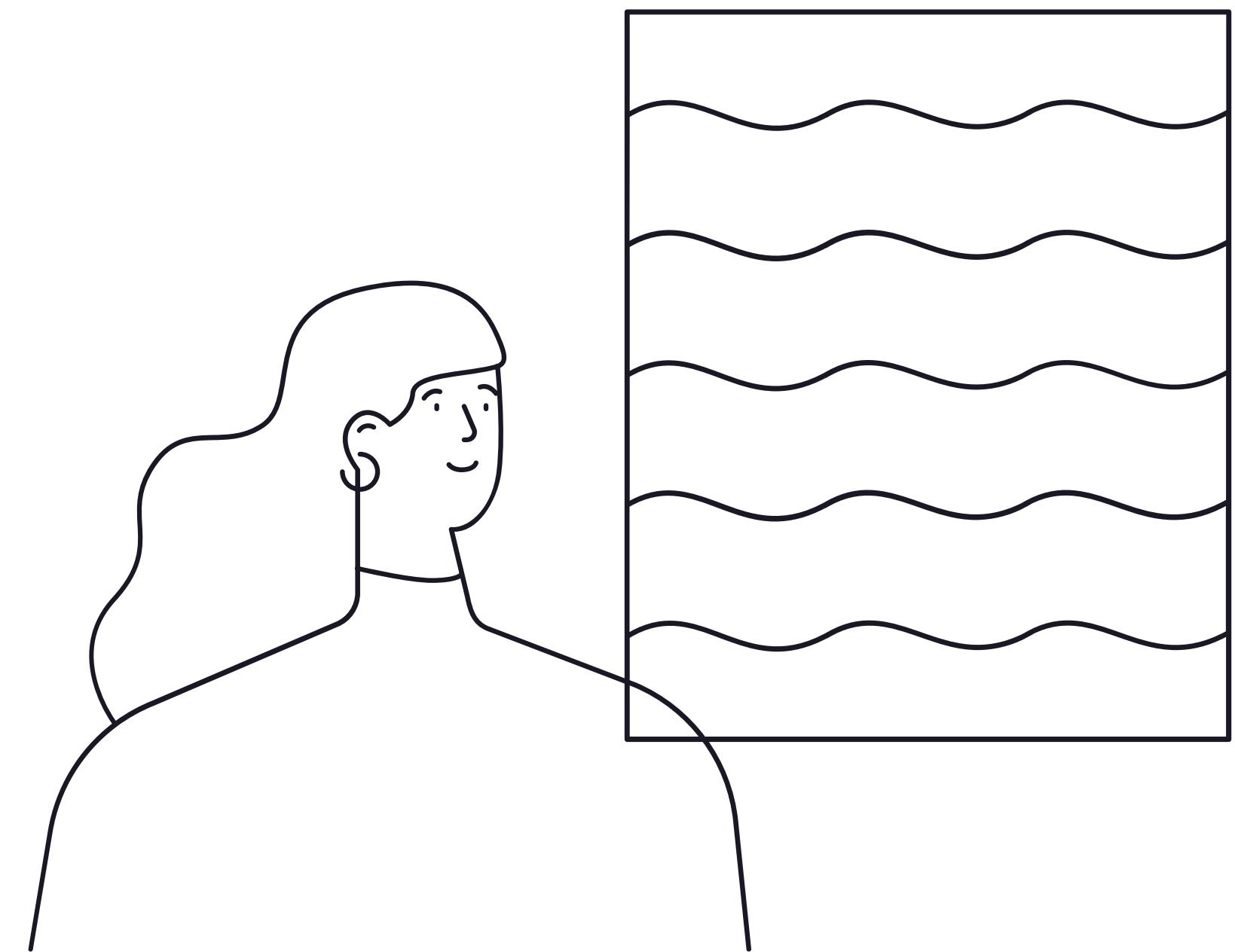


Introduction to Machine Learning



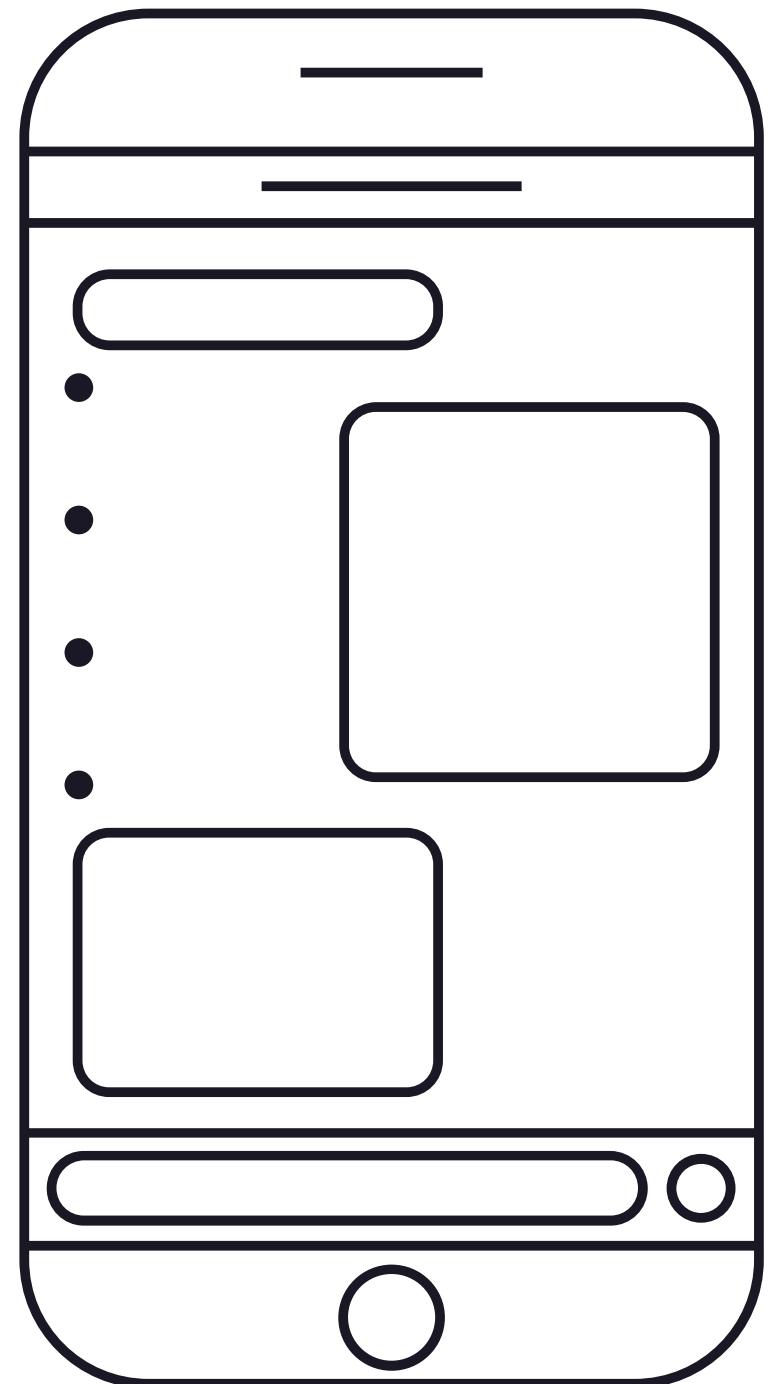
Is Machine Learning all around us?



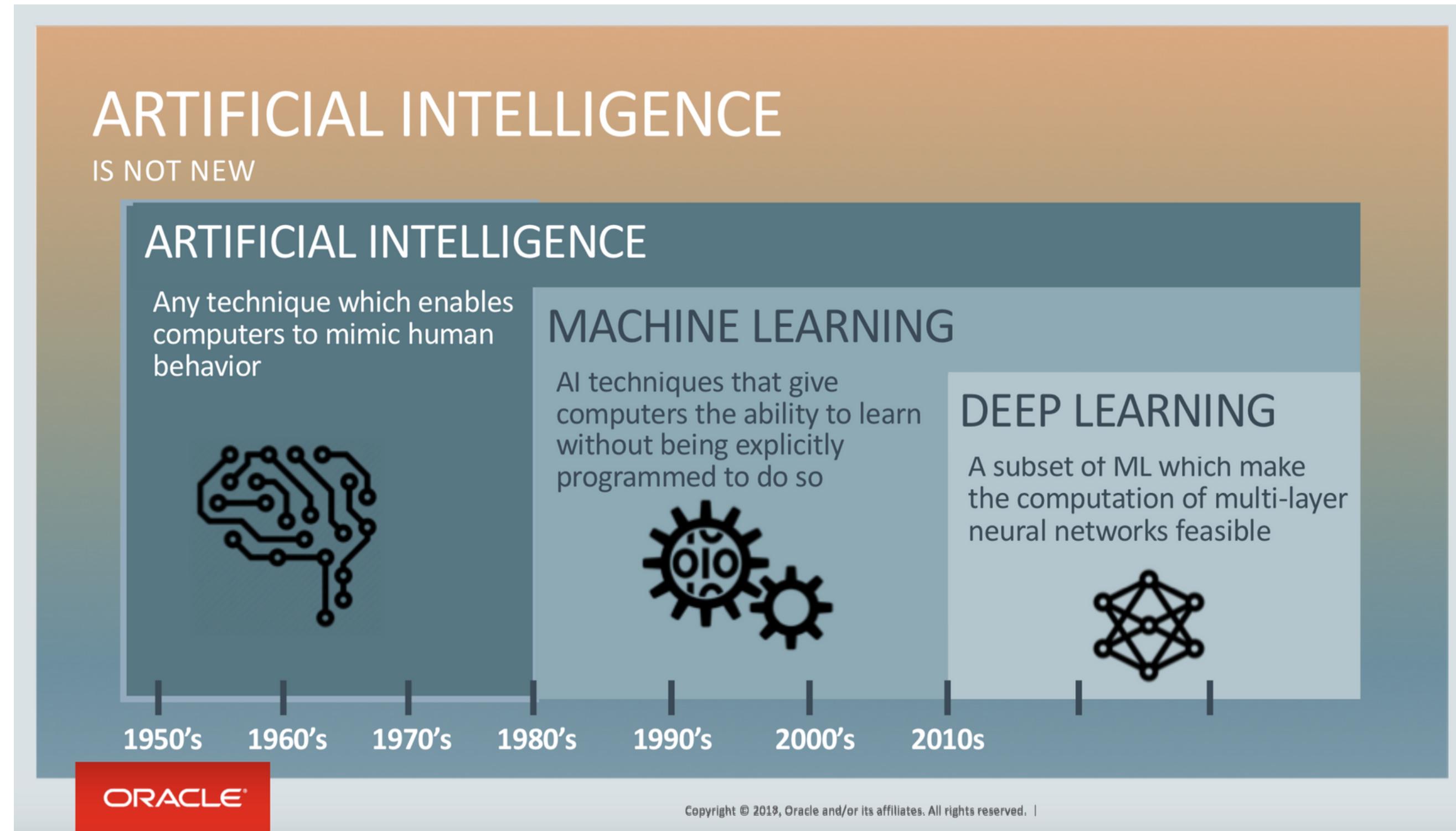
ACTUALLY, IT IS!

- Automatic photo tagging / Image recognition
- Alexa, Siri, Voice and Text Recognition systems
- Fraud Detection
- Google Search
- Medical diagnostics
- Self-driving cars
- even Art...

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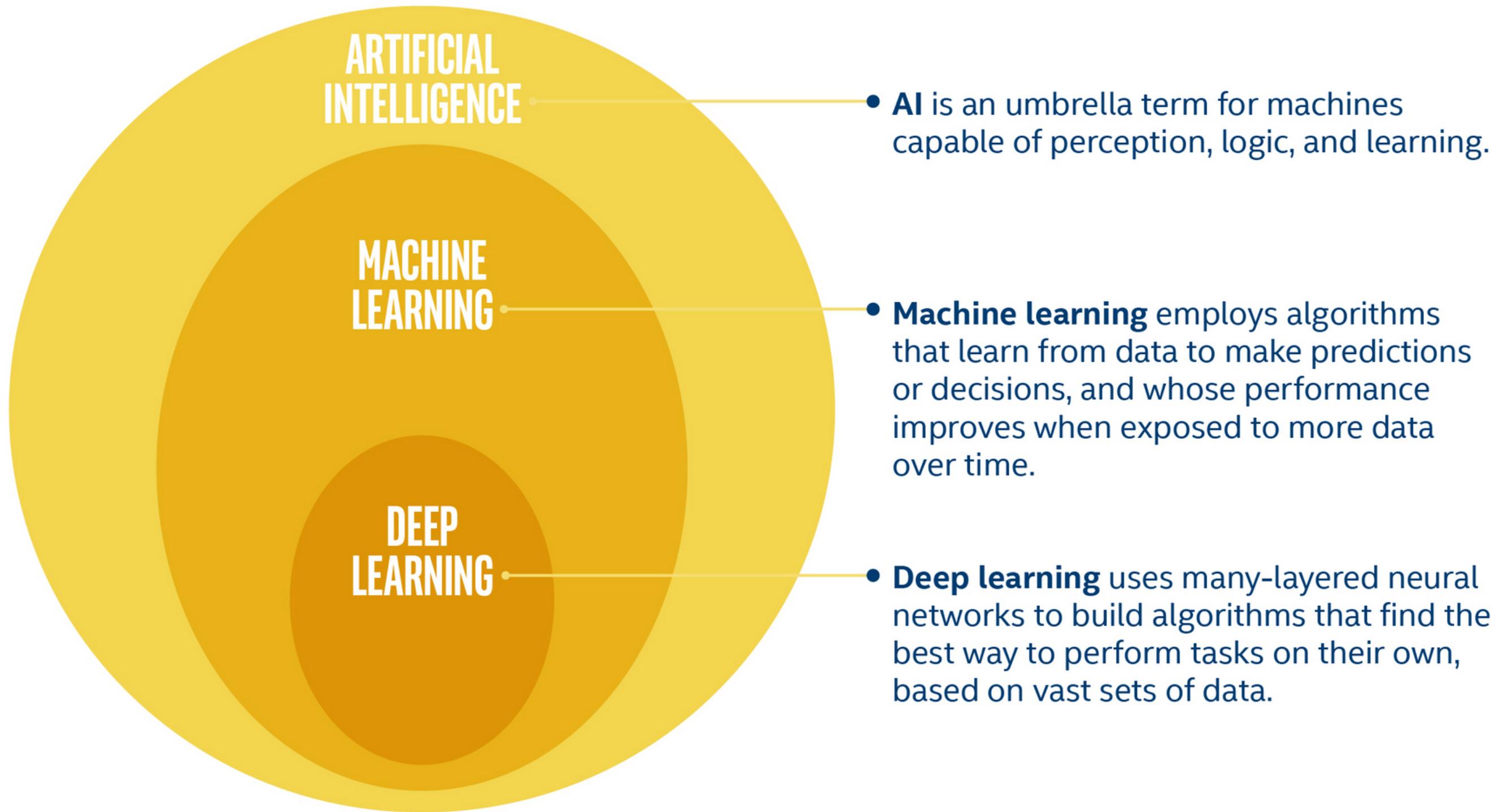


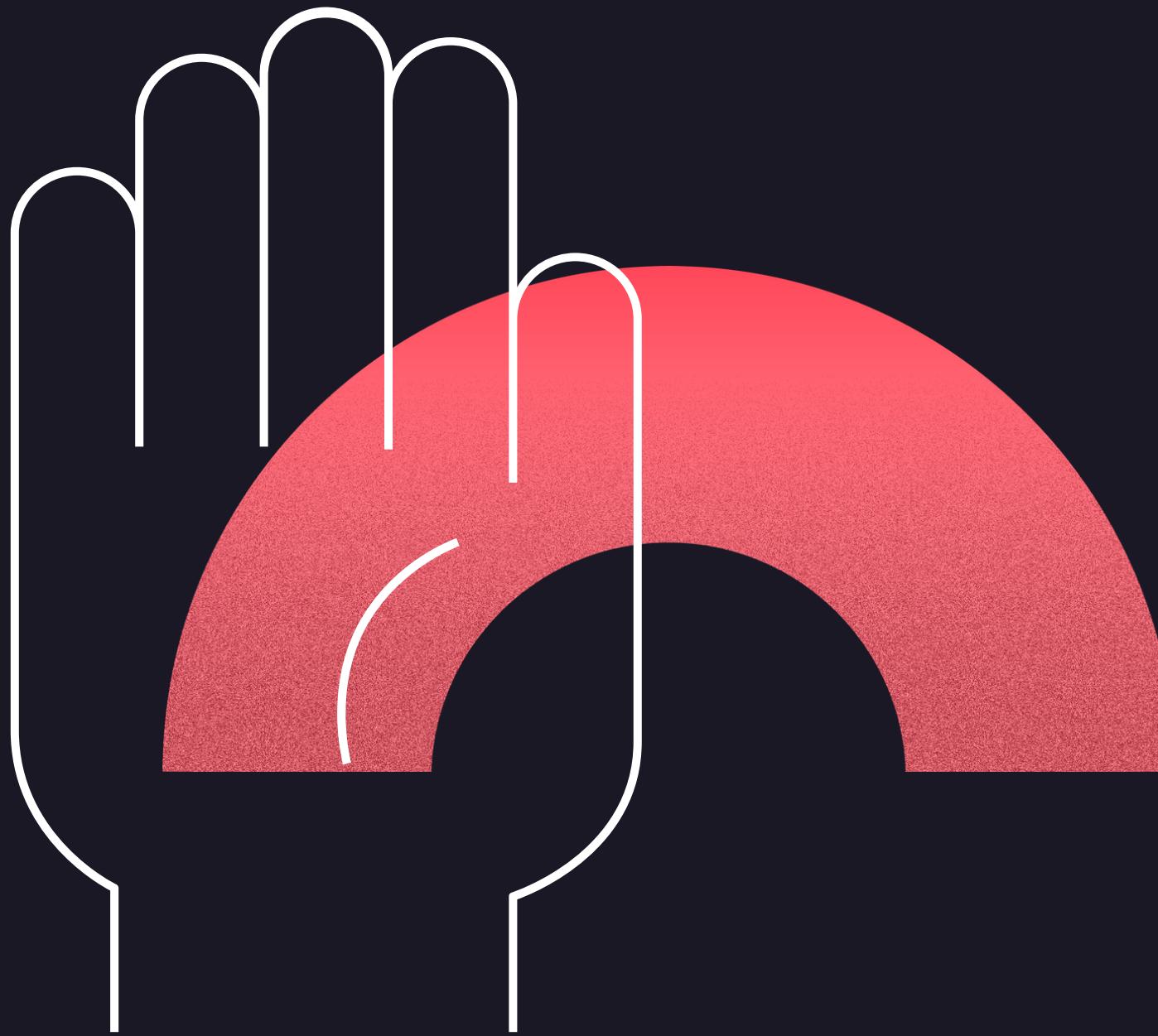
SO, IS IT NEW?



AI / ML / DL

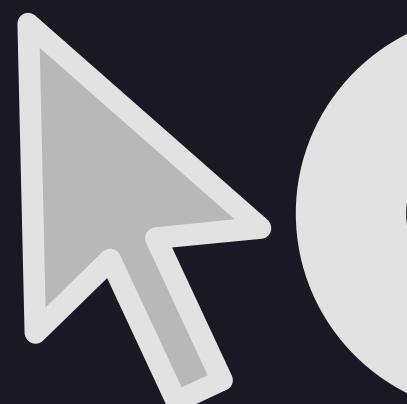
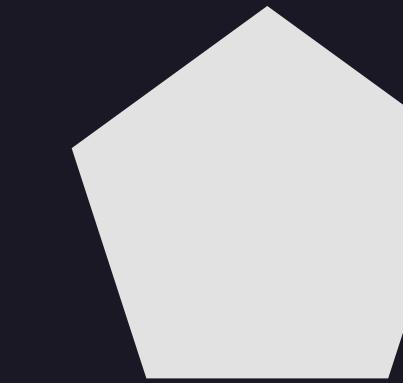
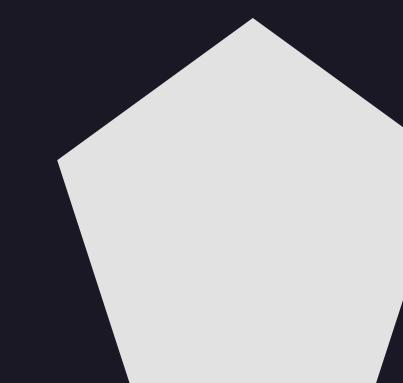
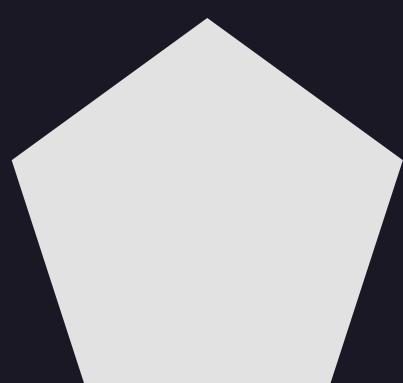
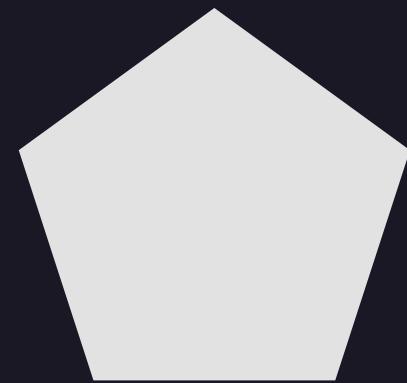
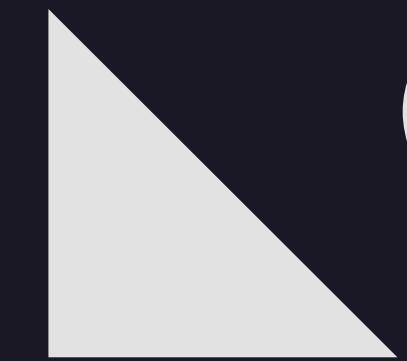
ARTIFICIAL INTELLIGENCE TERMS

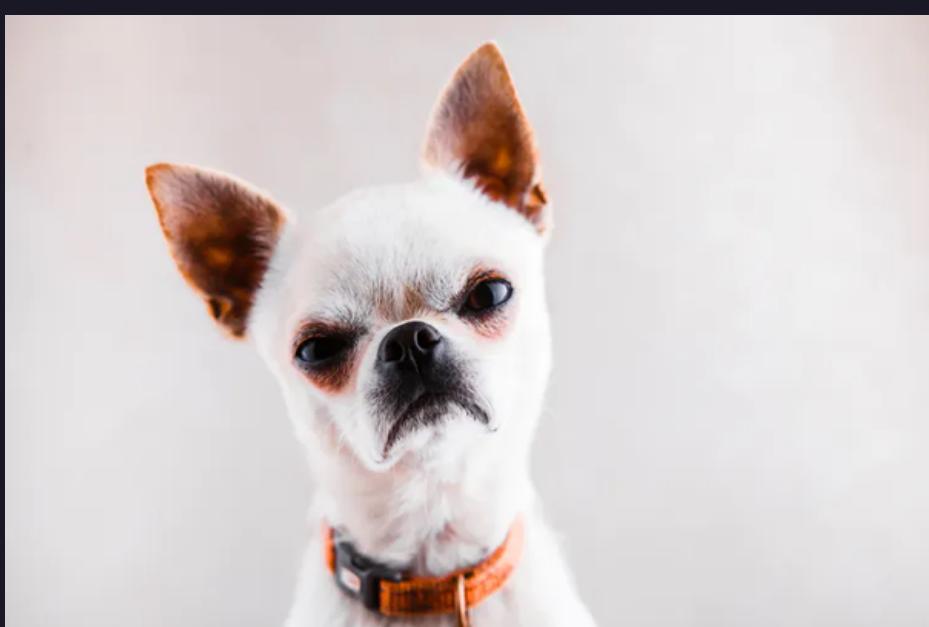
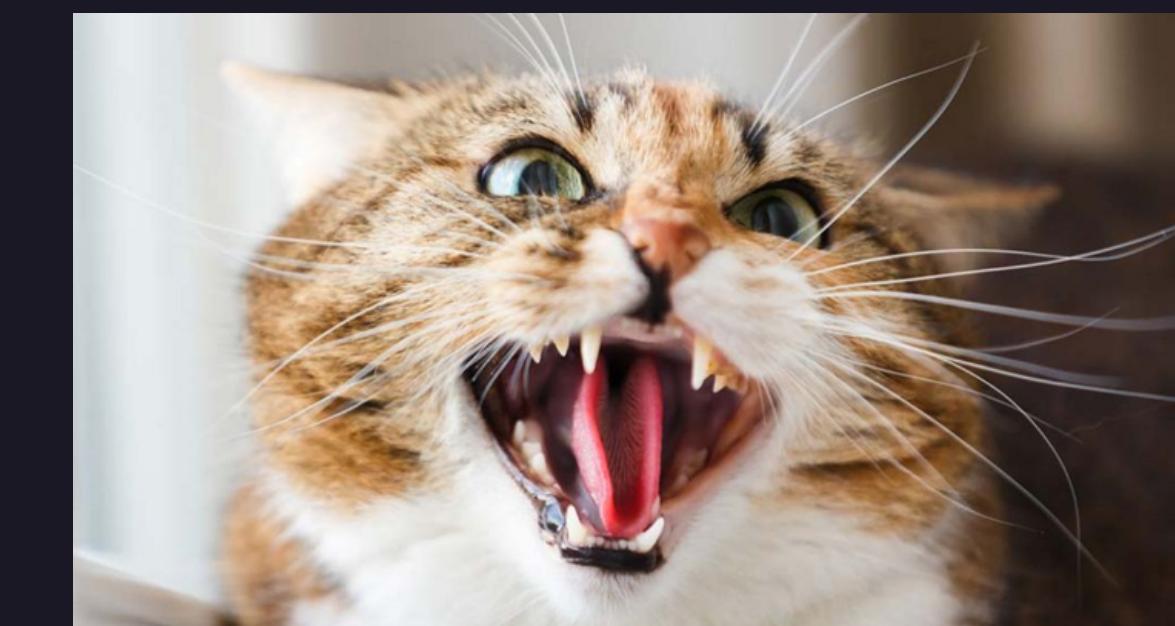
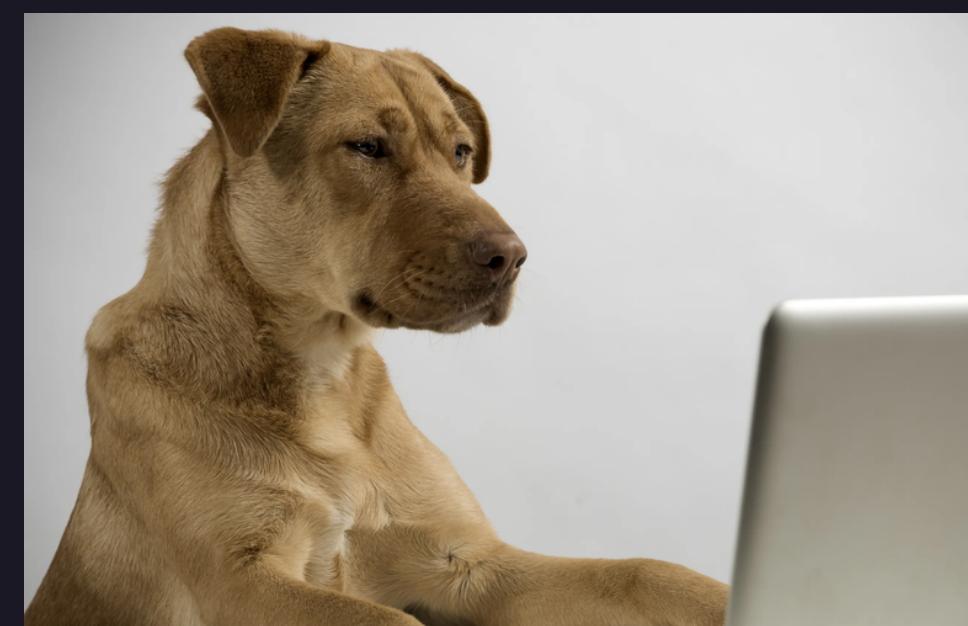




BUT WHAT IS IT?

What does it mean to say a computer learns?
What is learning anyway?







Cat or Dog?

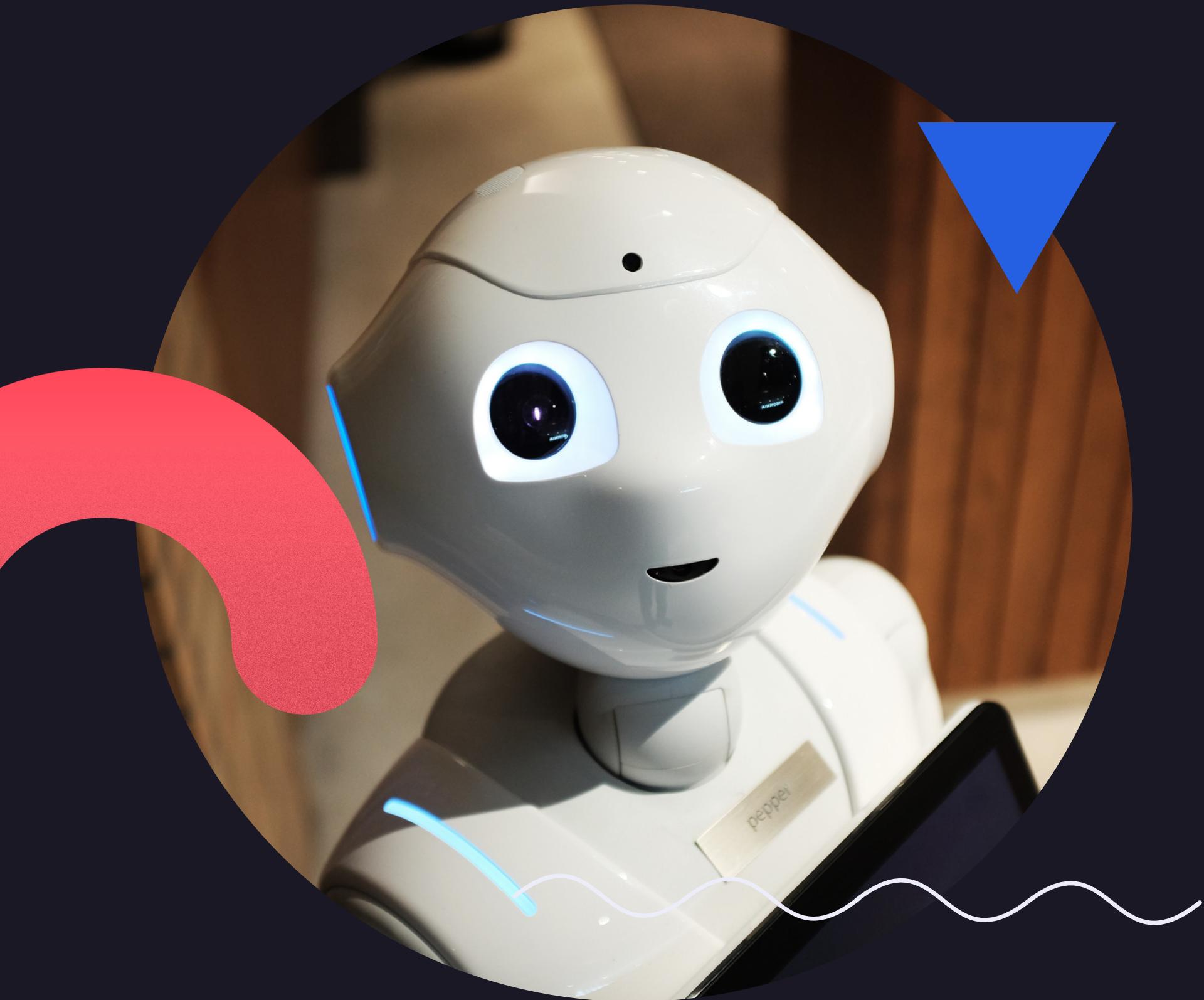
HOW WE LEARN_{VS} HOW COMPUTERS LEARN

Cool Videos:

What is ML?

Teacher bot
can't teach,
teacher bot can
test.

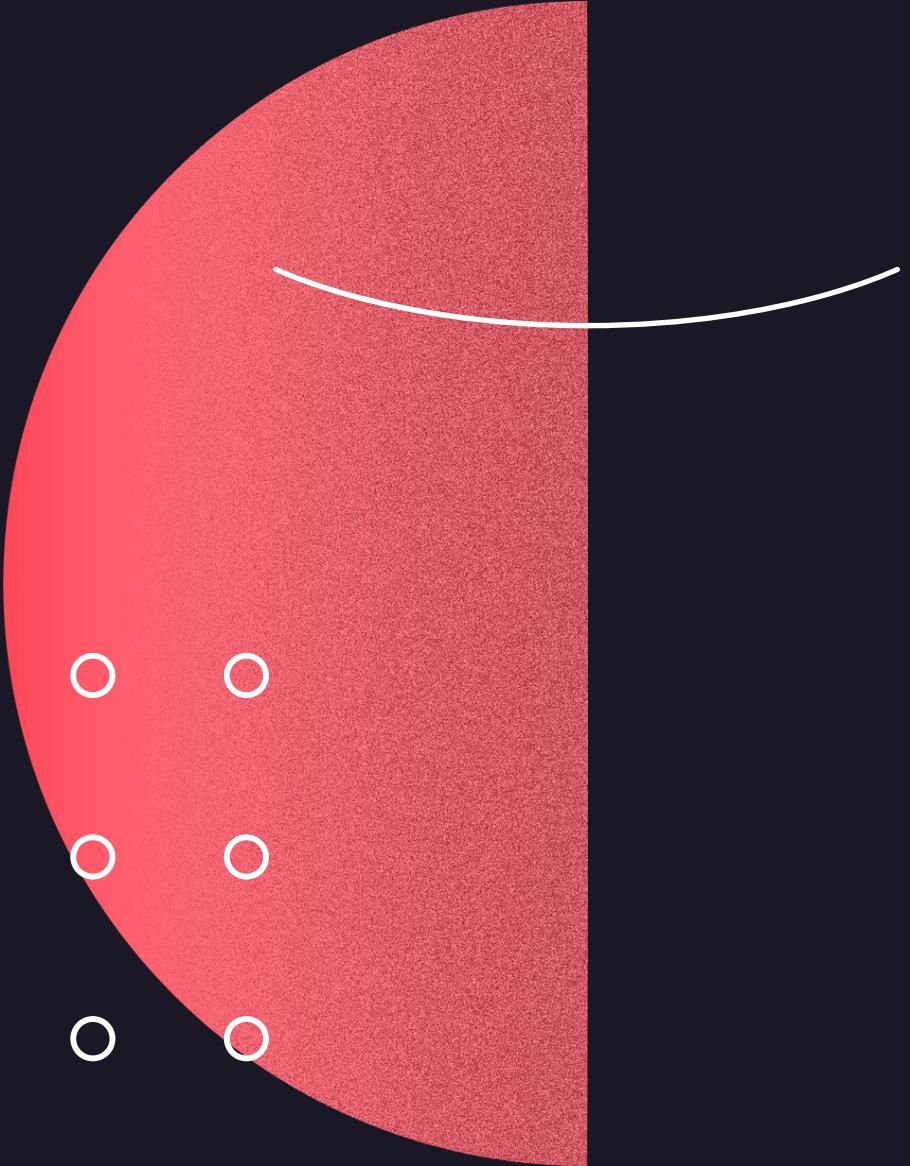




MACHINE LEARNING

"Algorithms that improve automatically through experience."

"Using data to answer questions"

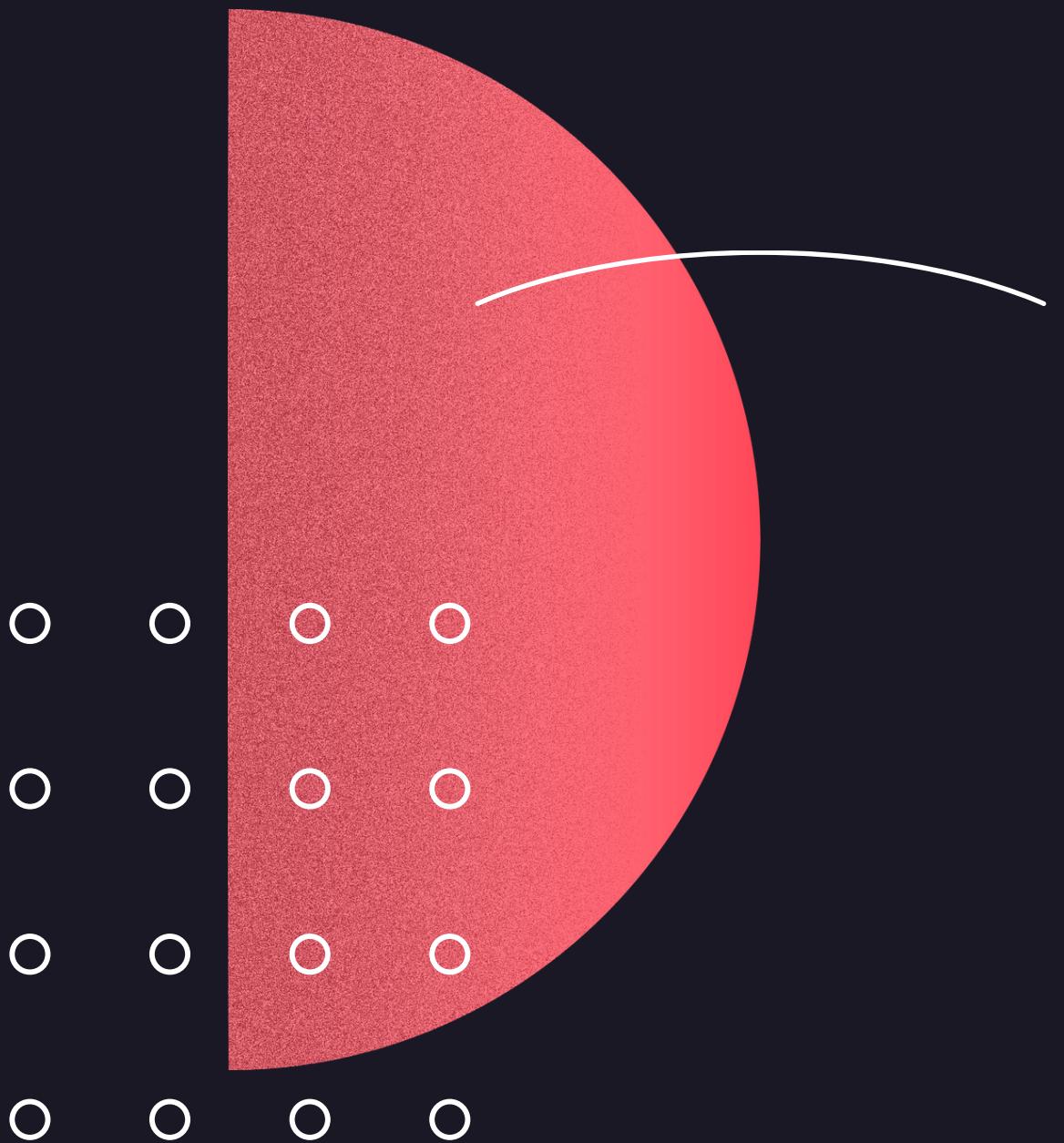
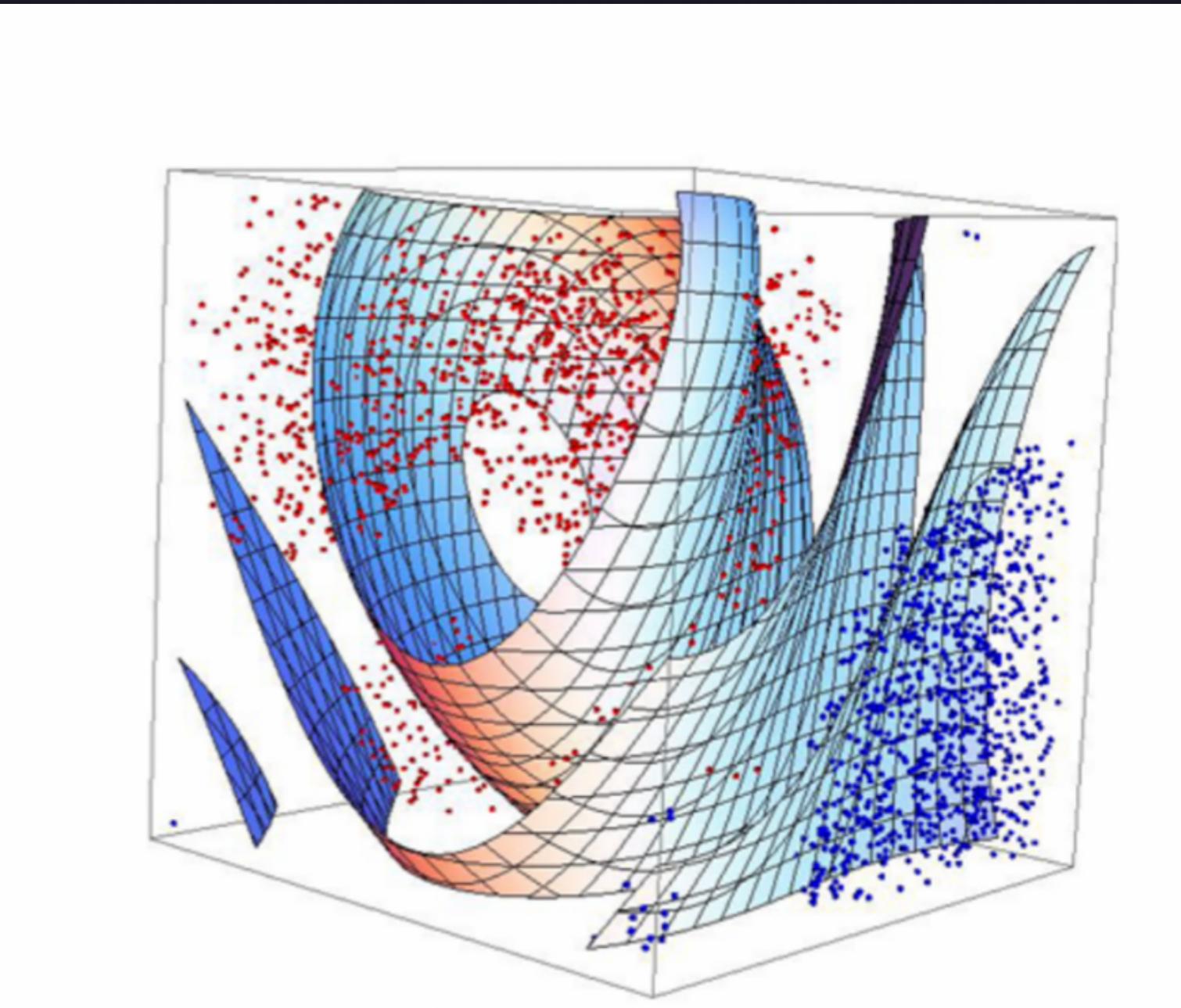


"A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T , as measured by P , improves with experience E "

- Tom Mitchell, 1997

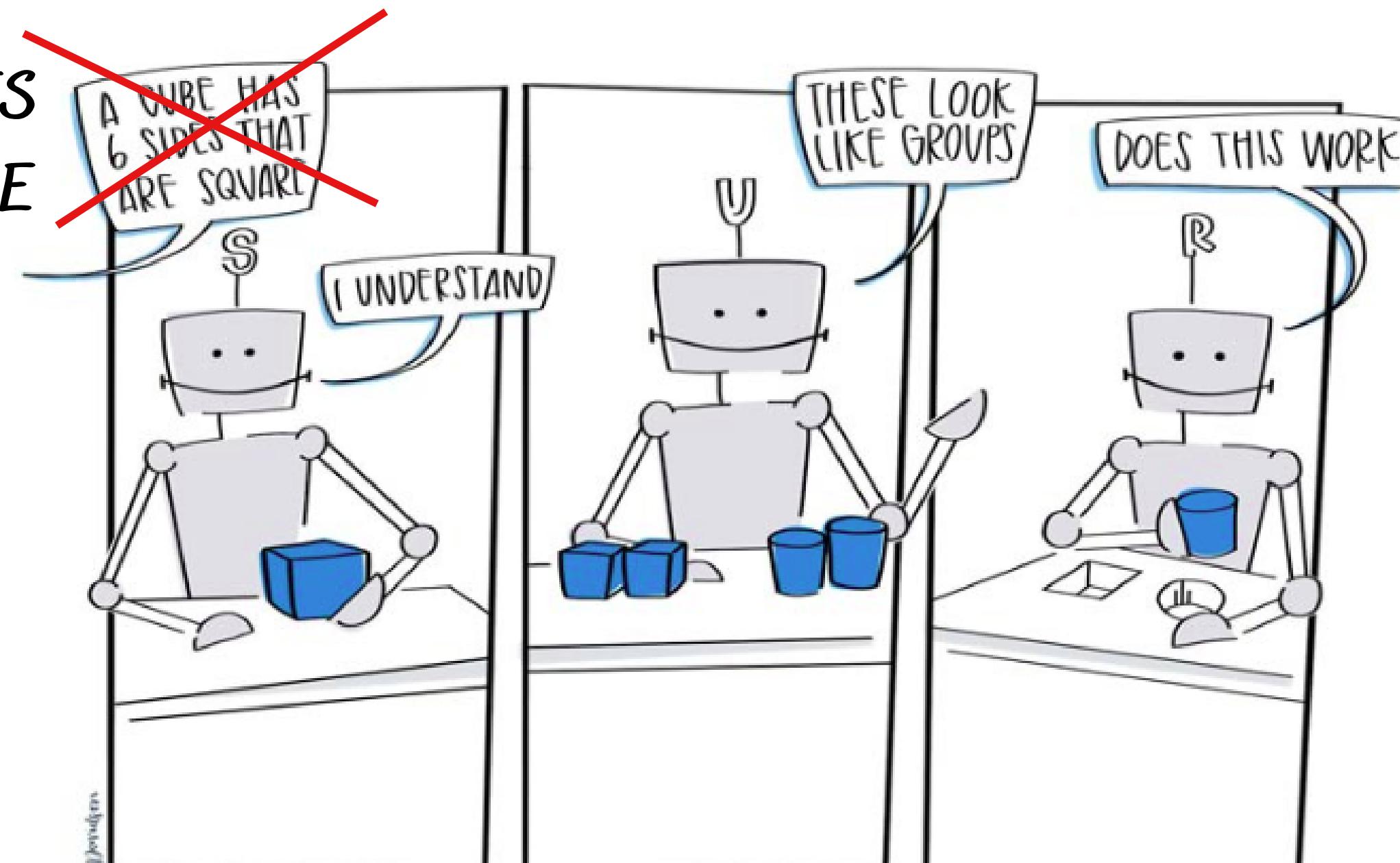
What does ML do?

Discovers hard to find patterns in data.



MACHINE LEARNING

THIS IS
A CUBE



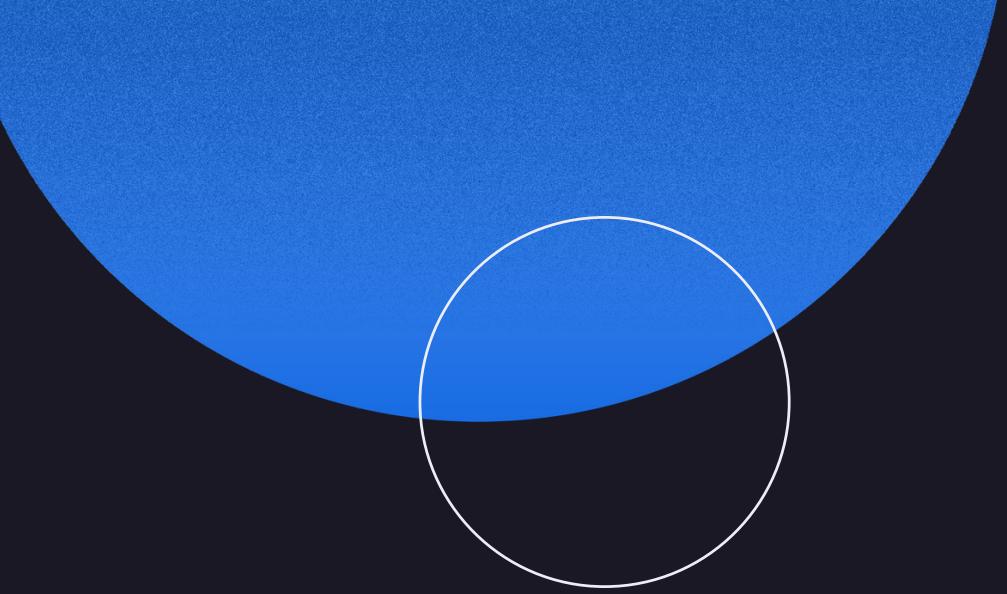
SUPERVISED

UNSUPERVISED

REINFORCEMENT

ML learns by
EXPERIENCE
not by rules

TYPES OF MACHINE LEARNING



Supervised

Model is trained against labeled data, that is, data to which the ground truth is known. When presented with data and a label, model infers patterns.

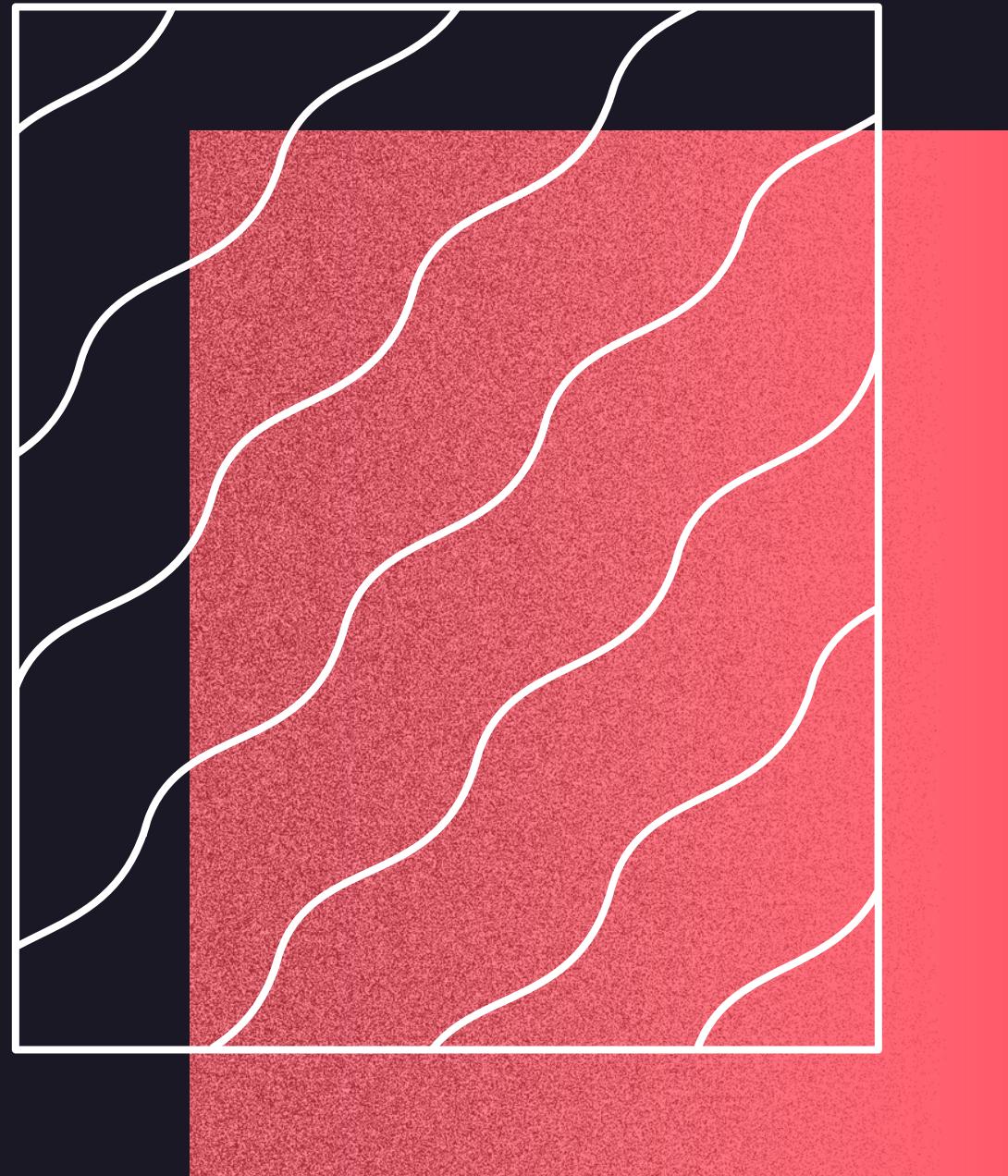
Unsupervised

There is no ground truth. Model looks for previously undetected patterns, with which to separate the different data points into different clusters.

Reinforcement

There is no ground truth either. Model action is valued and a reward or punishment is given accordingly. Model objective is getting the most rewards possible.

SUPERVISED LEARNING



- Regression

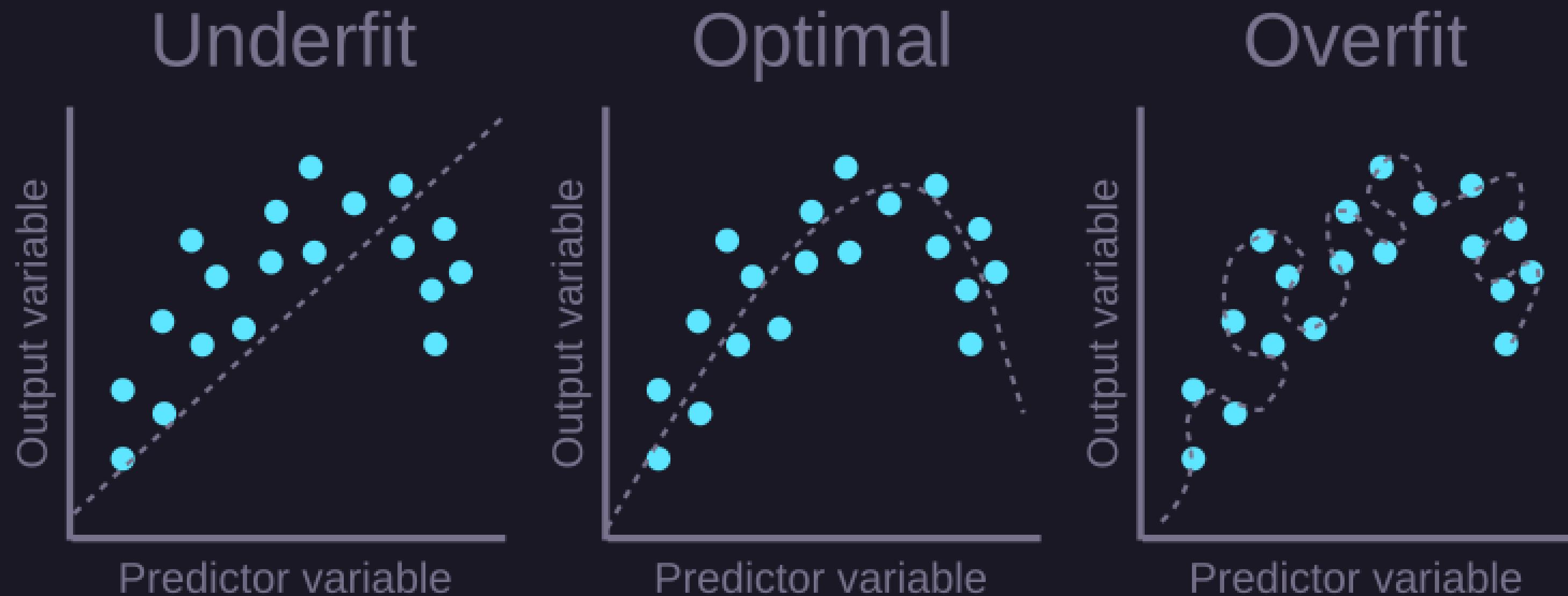
Predicting a quantity on a continuous scale.
May have real or discrete input variables.

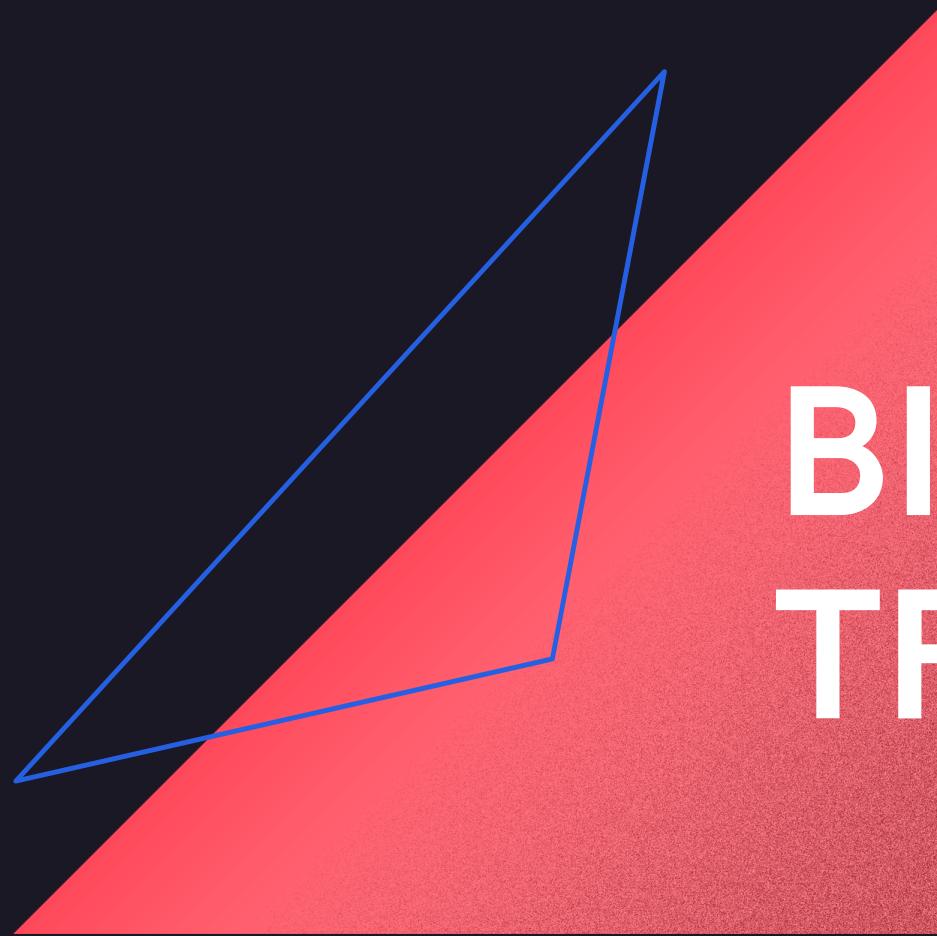
- Classification

Predicting a class or label.
May have real or discrete input variables.

- Two-class / Binary
- Multi-class
- Multi-Label

How fit is my model?





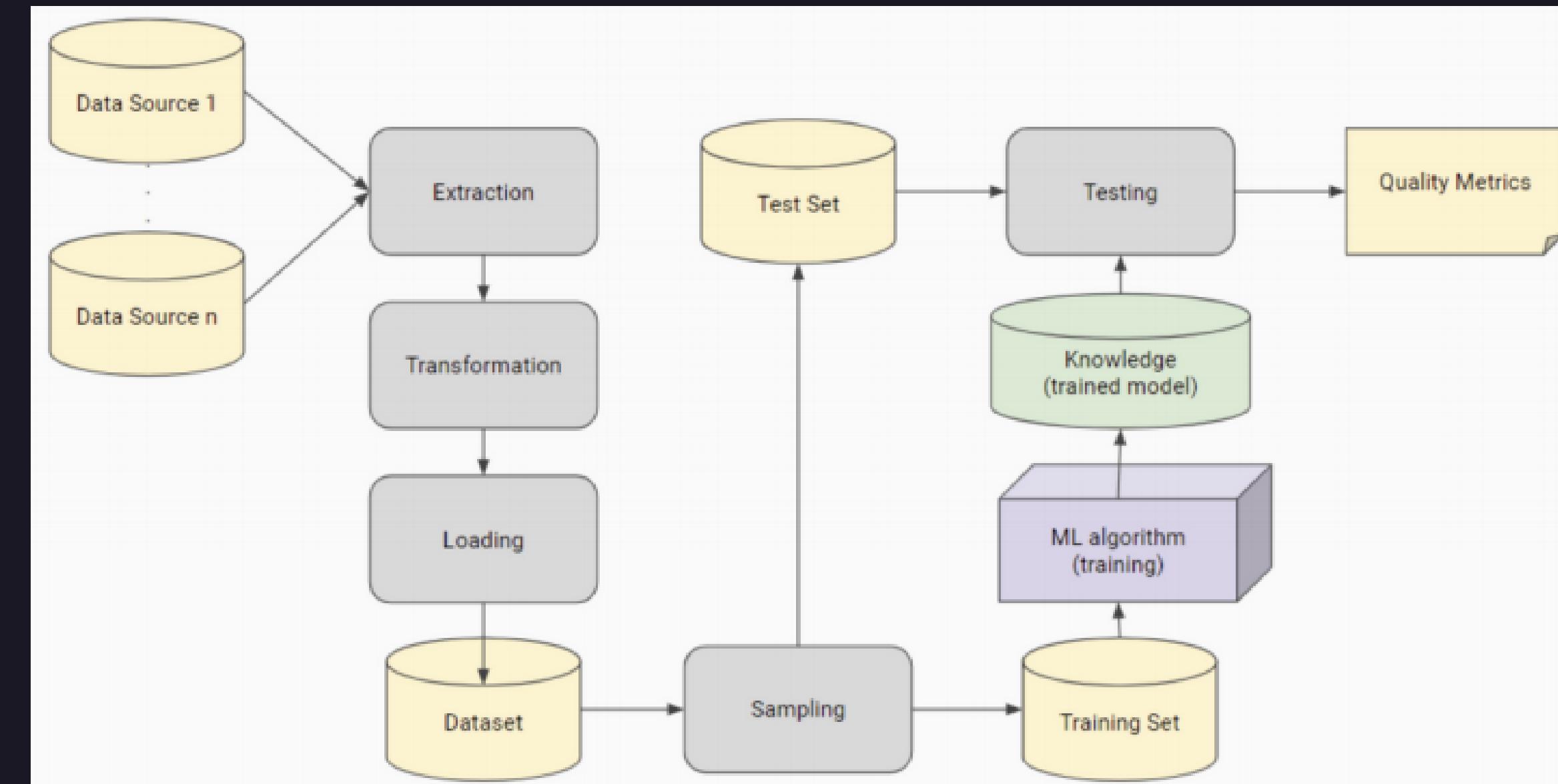
BIAS VARIANCE TRADE-OFF

- Bias
Generalization error due to bad assumptions. High bias tend to underfit.

- Variance
Excessive sensitivity to small variations in data. High variance tend to overfit.

Error = Bias + Variance + Irreducible Error

Supervised Learning Workflow



Machine Learning Data

Features

Features are individual independent variables that act as the input in your system. Prediction models use features to make predictions.

Target

The target is whatever the output of the input variables. It could be the individual classes that the input variables maybe mapped to in case of a classification problem or the output value range in a regression problem.

samples (train)	features				target
	type (category)	# rooms (int)	surface (float m ²)	public trans (boolean)	sold (float k€)
	Apartment	3	50	TRUE	450
	House	5	254	FALSE	430
	Duplex	4	68	TRUE	712
	Apartment	2	32	TRUE	234

Dealing with Features

- Conversion
- Feature Scaling
- Missing Values
- Categorical Data

Human-Readable		Machine-Readable			
Pet		Cat	Dog	Turtle	Fish
Cat		1	0	0	0
Dog		0	1	0	0
Turtle		0	0	1	0
Fish		0	0	0	1
Cat		1	0	0	0