Introduction to Machine Learning

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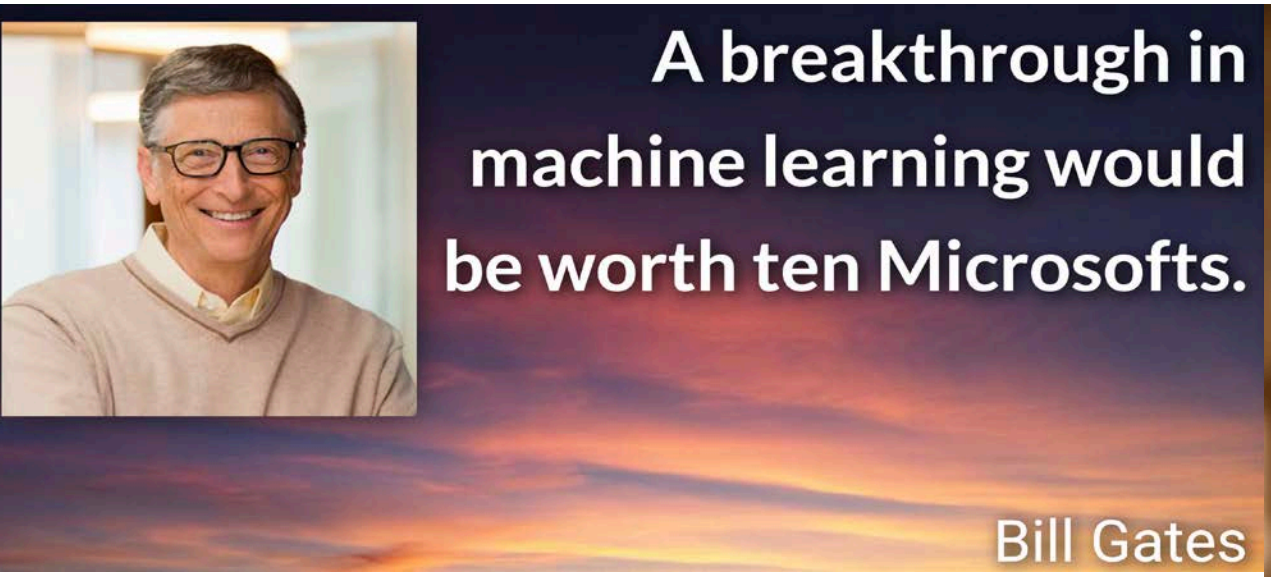
Why study Machine Learning?

-- It is changing the World



"Machine learning is the hot new thing"
(John Hennessy, President, Stanford)

Roadmap

- What is Machine Learning?
- History of Machine Learning.
- Types of Machine Learning.
- Applications of Machine Learning.

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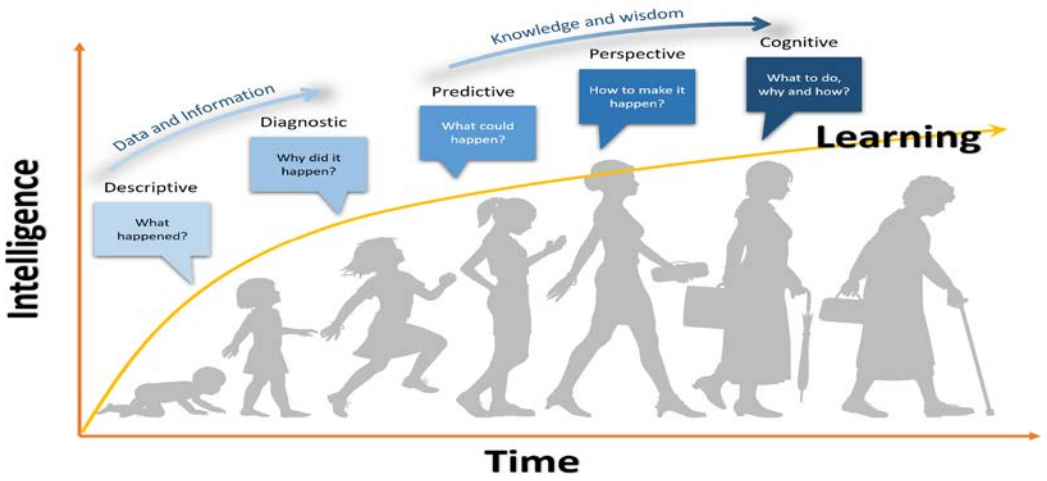
What is Learning?

"The activity or process of gaining knowledge or skill by studying, practicing, being taught, or experiencing something."

--- From Merriam Webster dictionary



What is Machine Learning?

"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

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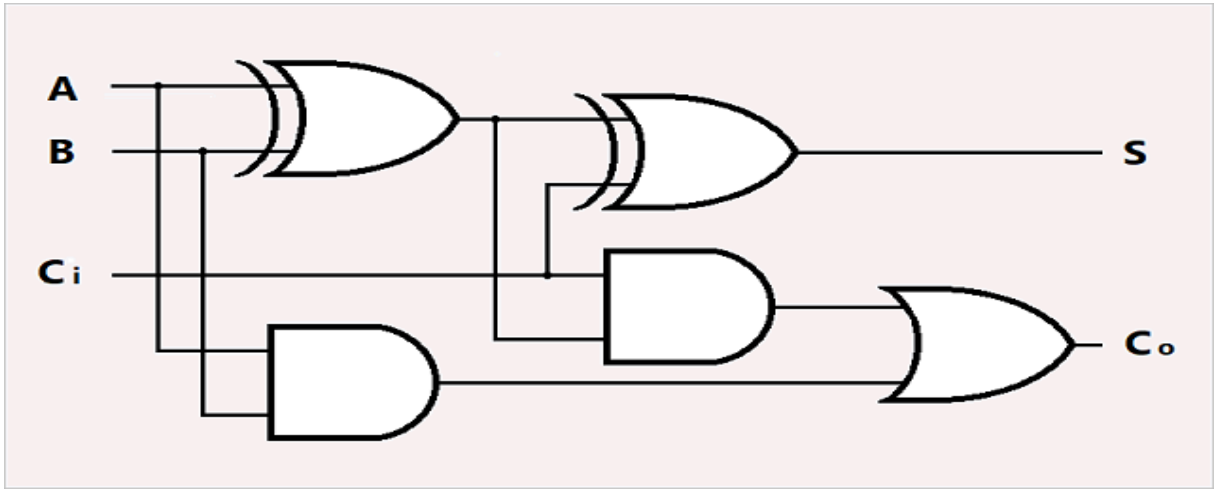
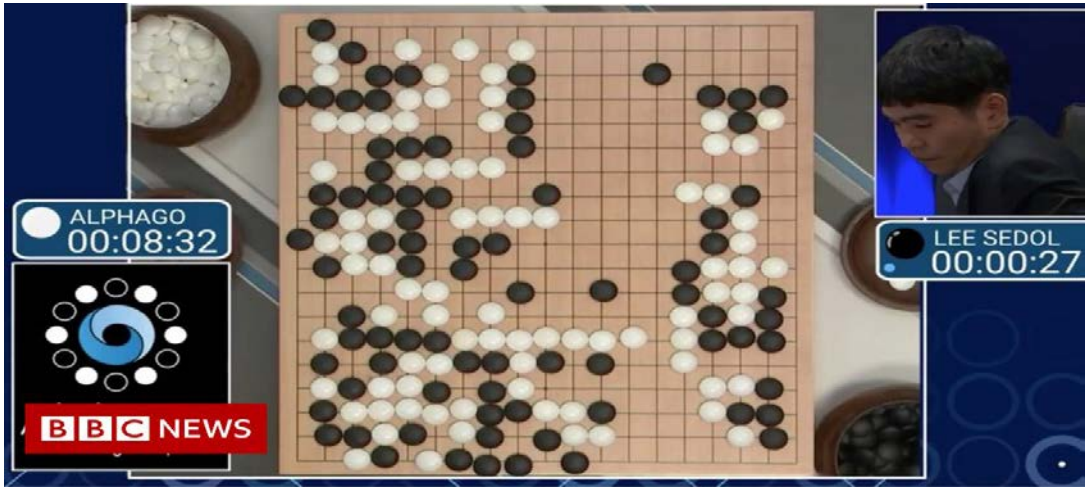
History of Machine Learning

- 1957 – Perceptron algorithm (implemented as a circuit !)
- 1959 – Arthur Samuel's checkers program
- 1969 – Minsky and Papert's book Perceptrons
- 1980s – Some foundational ideas (backpropagation etc.)

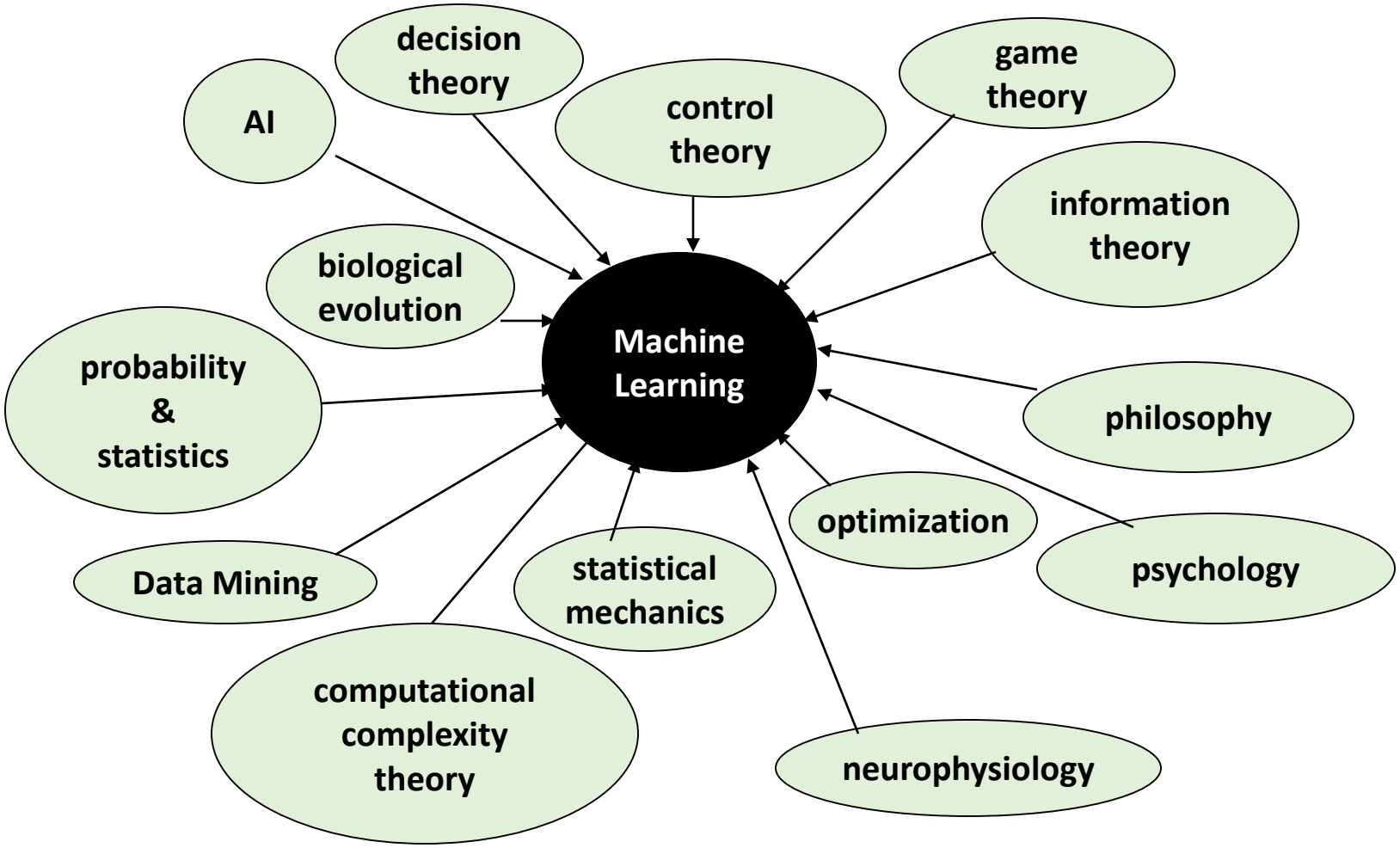


History of Machine Learning

- 1990s – “AI Winter”, a time of pessimism
- 2000s – Applied ML in vision, NLP, etc.
- 2010s – Deep learning.
  - 2016 AlphaGO defeated the human GO champion
  - 2022 DALL·E 2 from OpenAI



Related Disciplines



From N. Intrator

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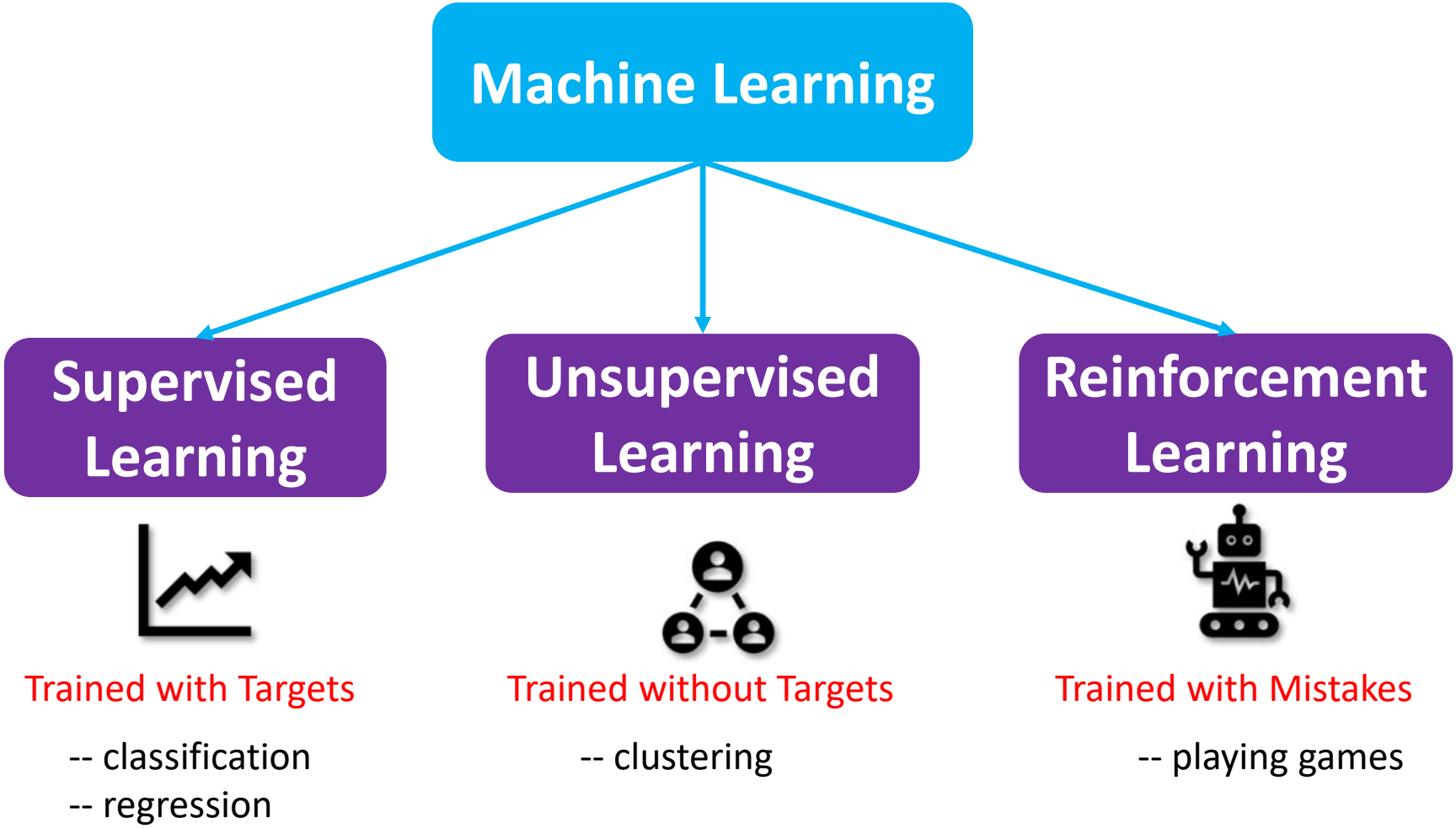
Types of Machine Learning



Types of Machine Learning

Supervised Learning

Training images with categorical labels

cat

bird

ball

car

test image ?

Types of Machine Learning

Supervised Learning

Training samples with continuous labels

Gender	Height (m)	Age (year)	Body Weight (kg)
Male	1.75	20	68
Female	1.64	25	65
Female	1.72	40	55
Male	1.60	42	50

Test data:

Male	**1.73**	**42**	?

Types of Machine Learning

Unsupervised Learning

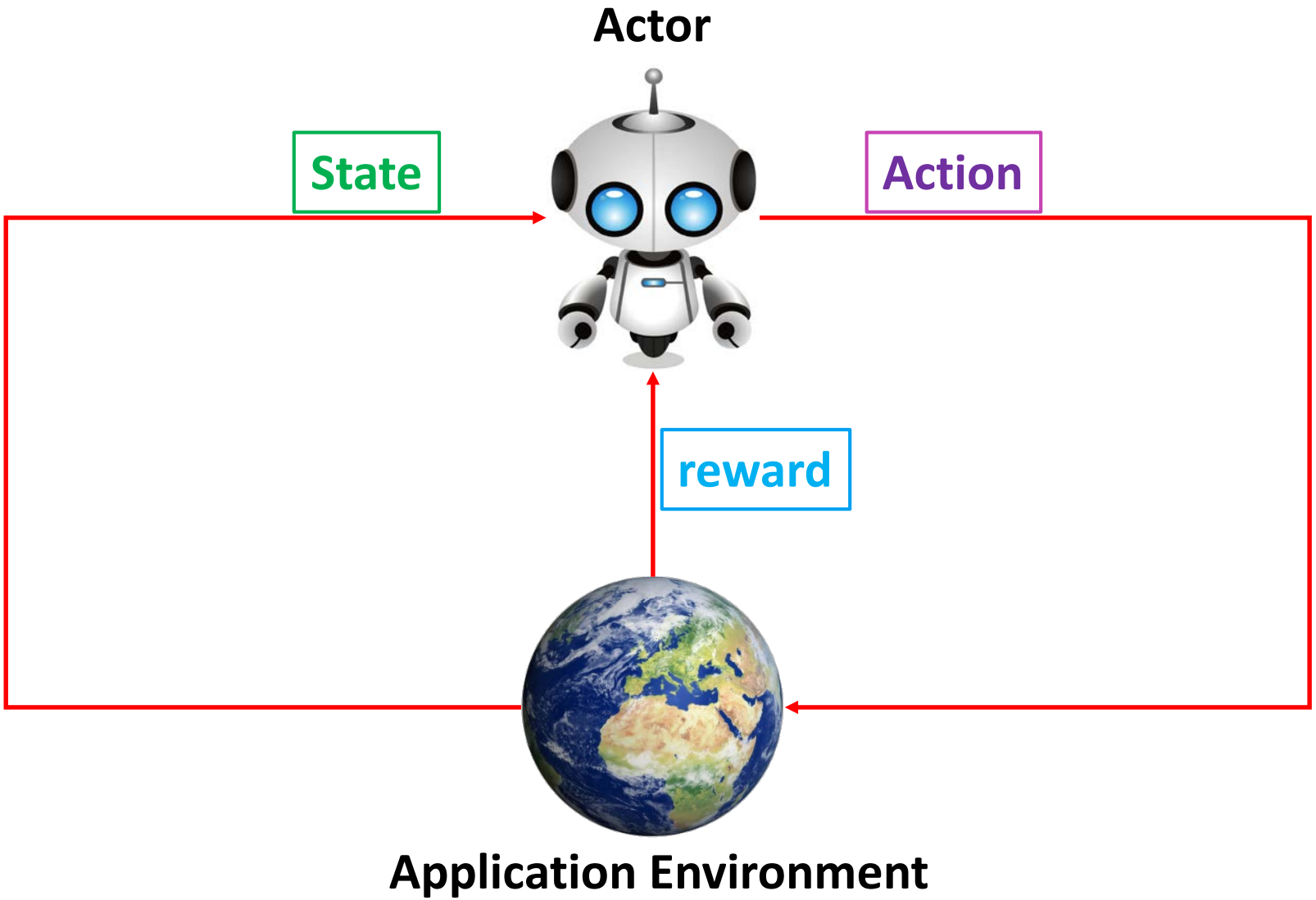
Training samples without labels

Tasks:

- Clustering (K-means);
- Dimension Reduction (PCA, Autoencoder);
- Density Estimation *(Generative Model)*;

Types of Machine Learning

Reinforcement Learning



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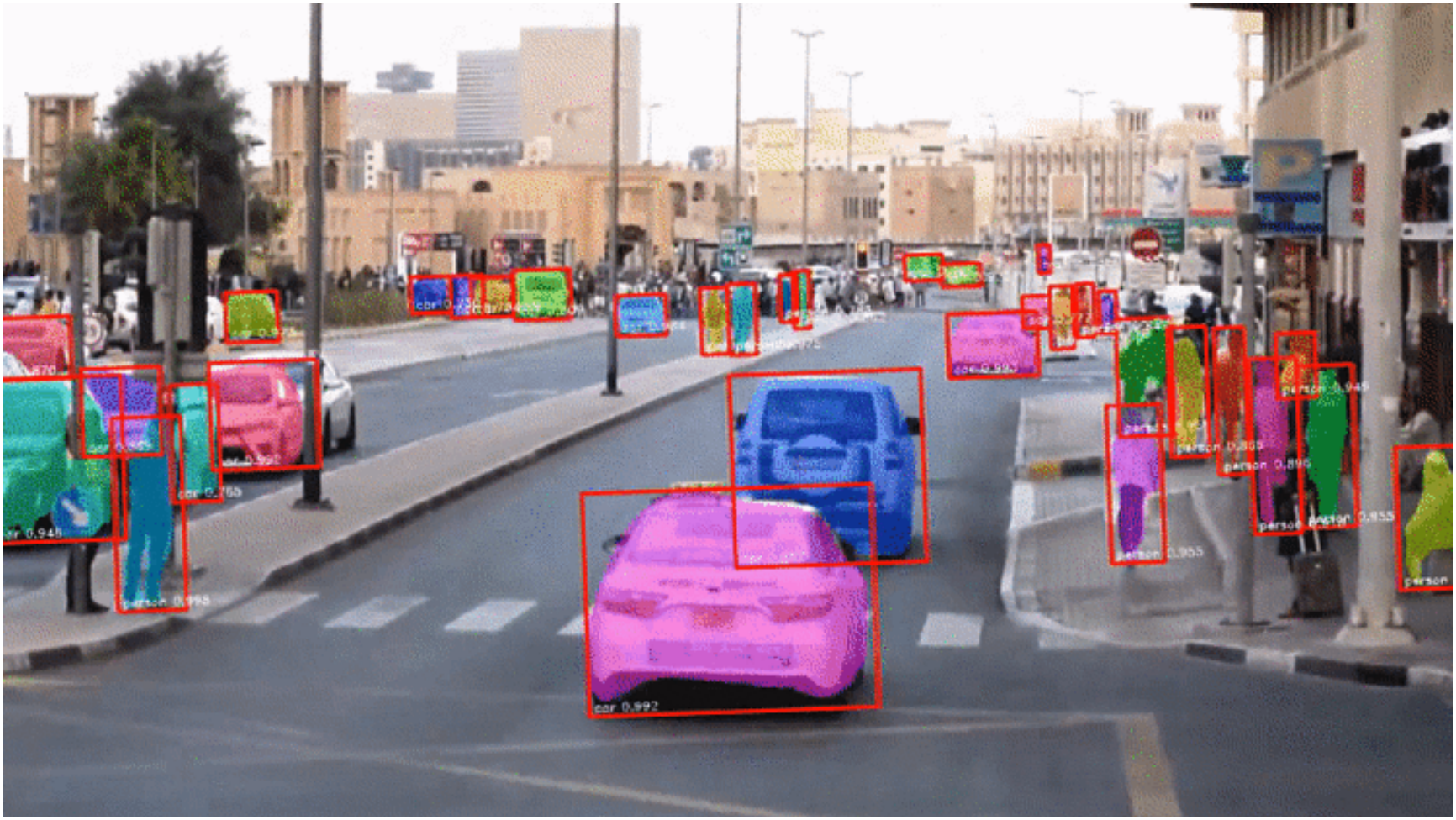
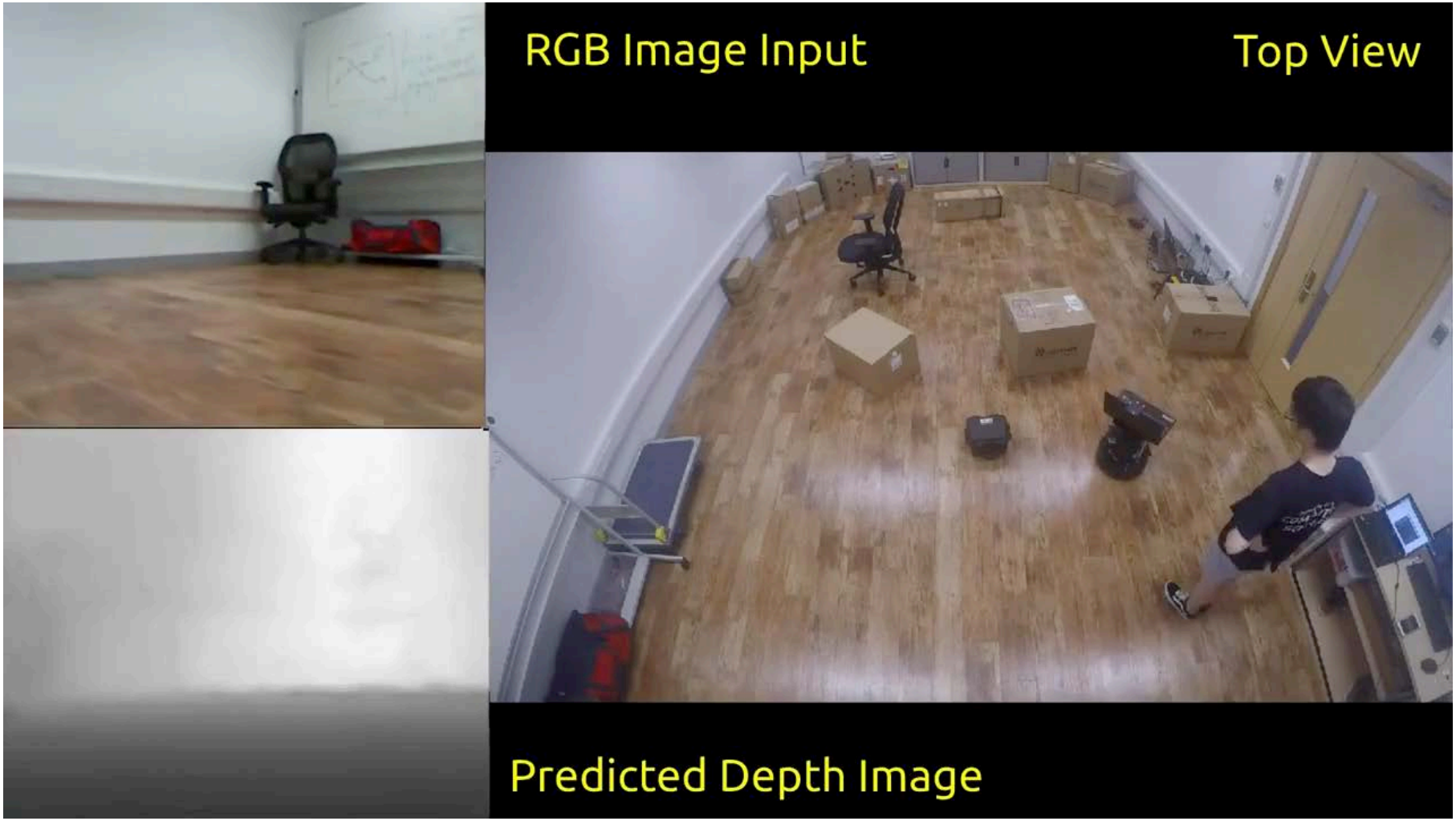
Applications of Machine Learning



Applications of Machine Learning

From CycleGAN

Applications of Machine Learning



A slide to take away

- **Machine learning** aims to solve tasks from experience and improve its performance.
- **Machine learning** generally has three types of models: supervised learning, unsupervised learning, and reinforcement learning.
- **Machine learning** has a wide range of real-world applications, including computer vision, natural language processing, robotics, etc.

- **Machine learning** is changing the world!