Machine Learning

Understanding the Foundations of Intelligent Systems

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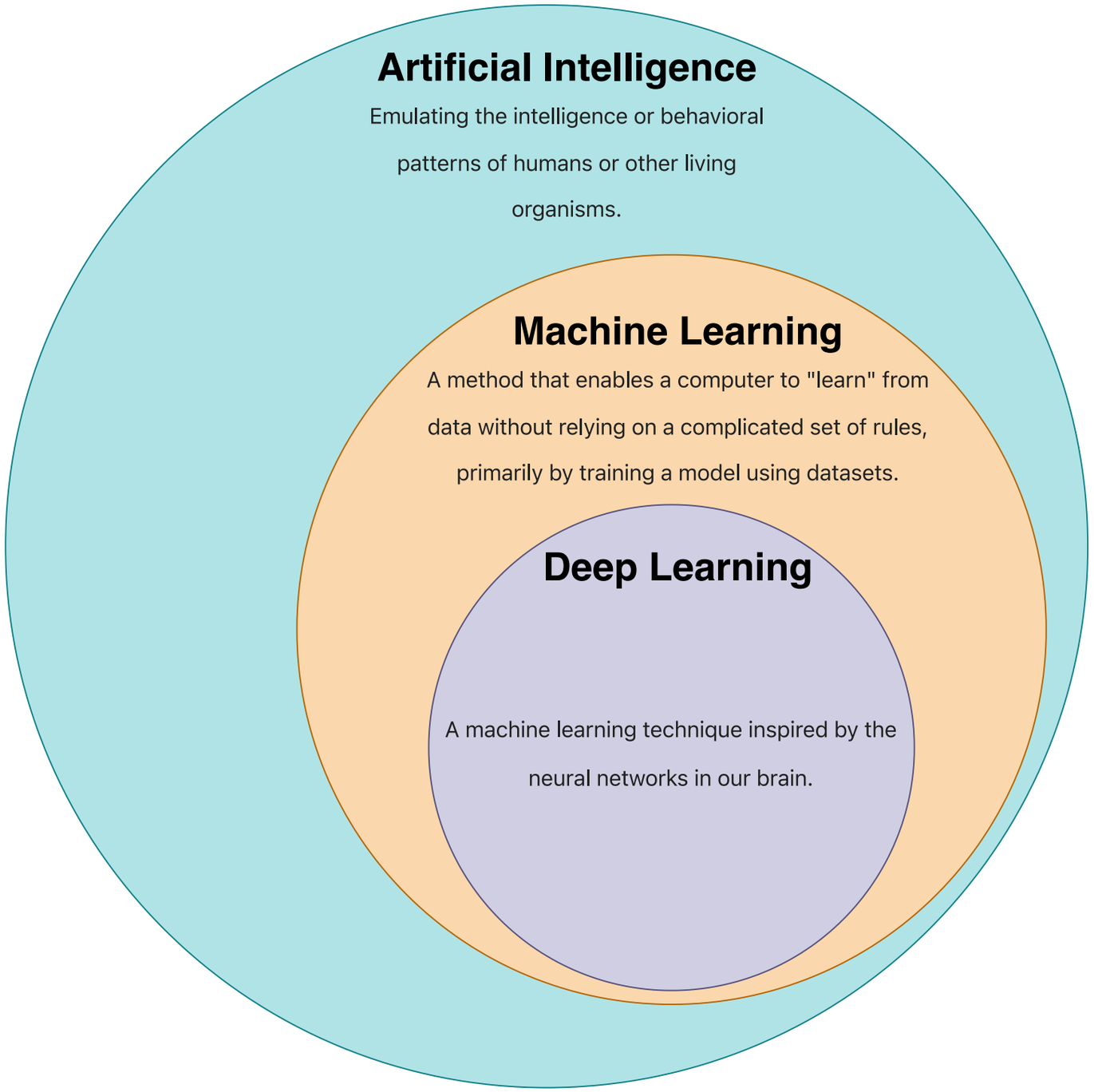
Outline

- Definition
- Types of Machine Learning
  - Supervised Learning
  - Unsupervised Learning
  - Reinforcement Learning
- History
- Basic Problem-Solving Approaches
- Challenges and Opportunities

Definition

- Machine Learning is a subset of artificial intelligence that enables systems to learn and improve from experience without being explicitly programmed

- Purpose: Automatically learning patterns from data



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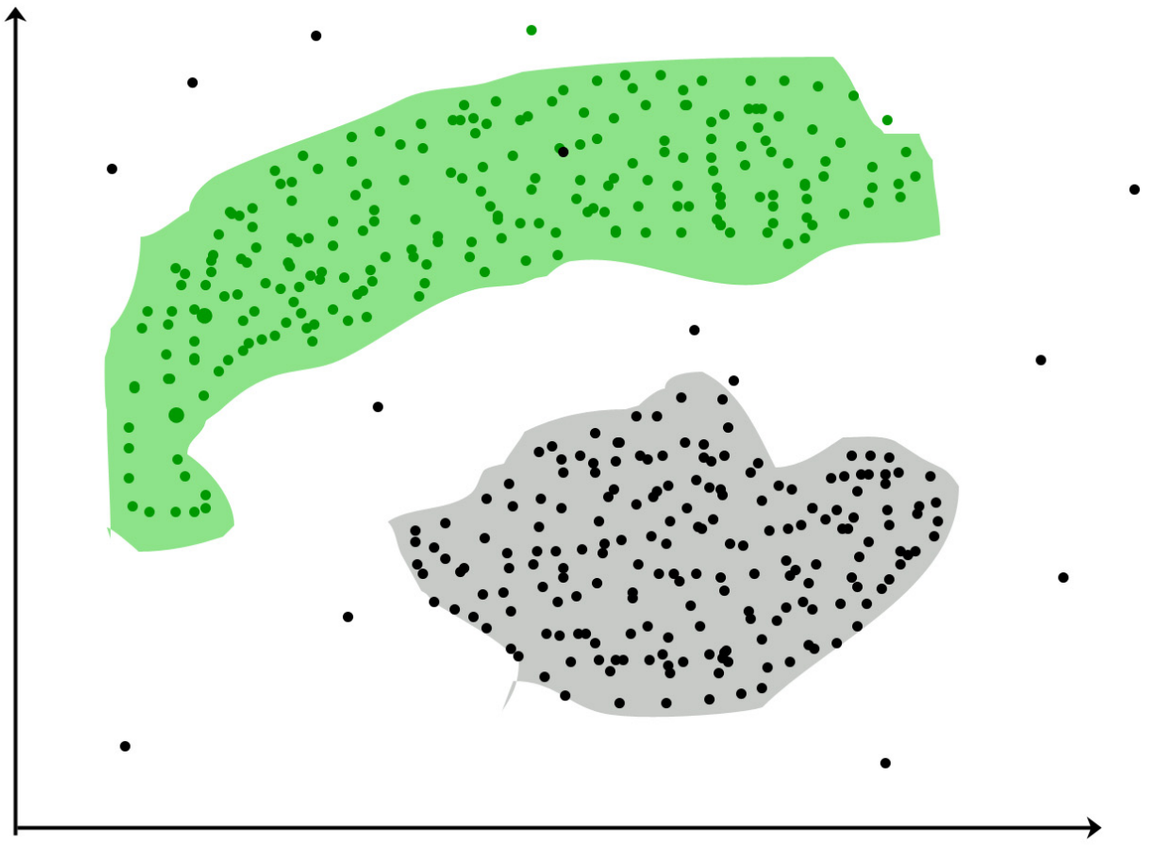
Types of Machine Learning

Supervised Learning

- Learning from labeled training data
  - Image classification
  - Spam email detection
  - Price prediction
- Simply saying, we do regression (i.e. Linear Regression) but more complex.

UnSupervised Learning

- Finding hidden patterns in unlabeled data
  - Customer segmentation
  - Anomaly detection
  - Dimensionality reduction



https://www.geeksforgeeks.org/clustering-in-machine-learning/

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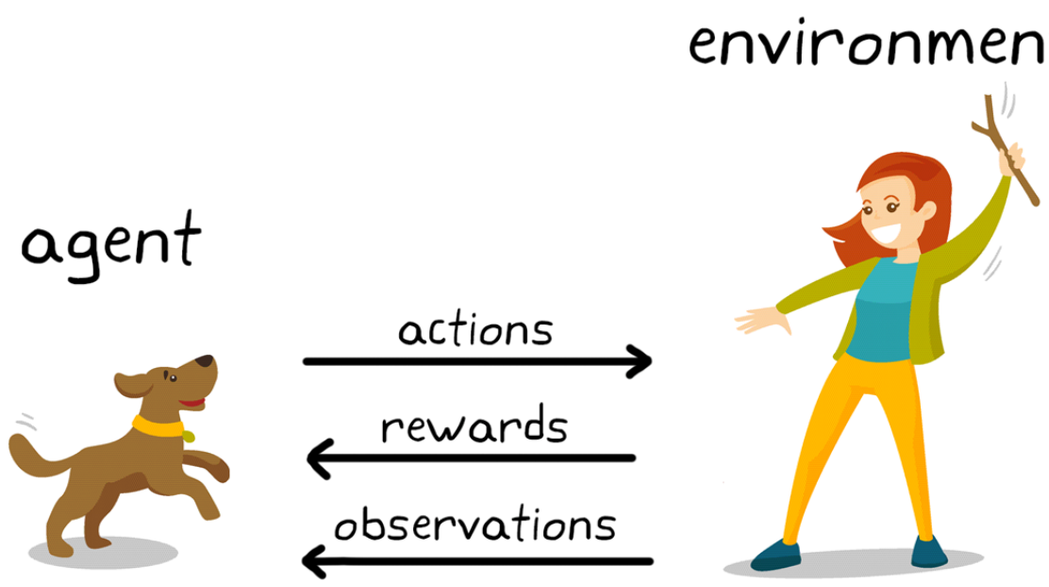
Reinforcement Learning

- Learning through interaction with an environment
  - Game playing AI
  - Robot navigation
  - Autonomous driving



https://www.mathworks.com/discovery/reinforcement-learning.html

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History

1943
Electric Brain
McCulloch & Pitts

1949
Neural Learning
Hebb

1958
Perceptron
Rosenblatt

1969
XOR Problem
Minsky & Papert

1974
Backpropagation
Werbos

1982
Hopfield Network
Hopfield

1985
Boltzamnn Machine
Hinton & Sejnowski

1986
Multi Layer Perceptron
Rummelhart et al.

1997
RNN
Rummelhart,

LSTM
Hochreiter et al.

1998
LeNet
LeCun

2006
Deep Belief Network
Hinton

2009
Deep Boltzman Machine

2012
AlexNet
Krizhevsky

2014
GAN
Goodfellow

2015
ResNet
He

2015
U-Net
Ronneberger

2017
CapsuleNet
Hinton et al.

Transformer
Google Brain

2018
BERT
Devlin

2020
GPT-3
OpenAI

2022
Stable Diffusion
CompVis

CharGPT
OpenAI

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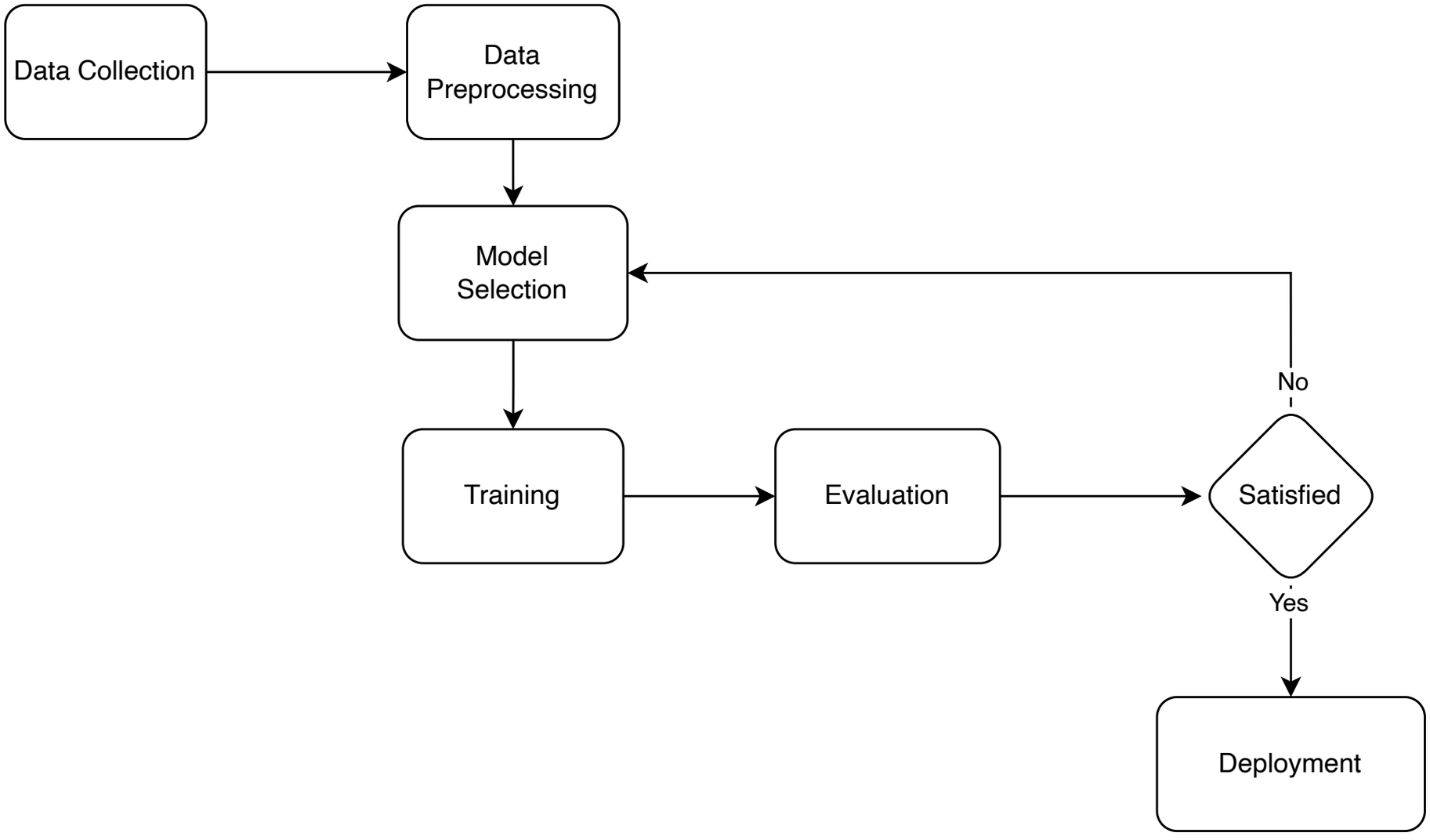
Problem Solving Steps



Challenges and Opportunities

- Key Challenges
  - Data quality
  - Computational requirements
  - Bias and fairness

- Opportunities
  - Solving complex problems
  - Automation
  - Predictive insights