Machine learning

an introduction

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November 2022

The fundamentals

$y = mx + b$

predicts some value of y given values of x

Predictive models are not always 100% correct. The measure of how incorrect it is the loss

The goal of machine learning it to take a training set to minimize the loss function

For example, suppose m = 2, x = 3, and b = 2. Then our predicted value of y = 2 * 3 + 2 = 8. But our actual observed value is 10. The loss is 10 – 8 = 2.

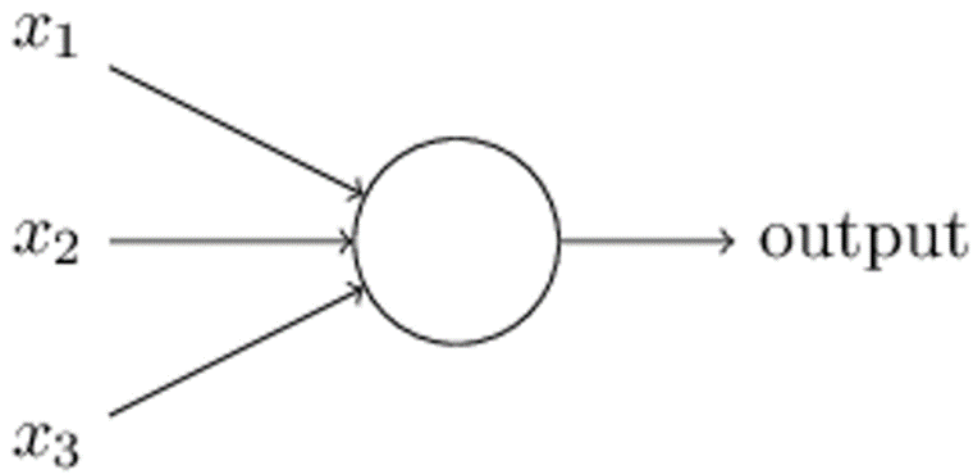
Michael Nielsen, http://neuralnetworksanddeeplearning.com/

The fundamentals

In a neural network, we have the same basic principle, except the inputs are binary and the outputs are binary. The objects that do the calculations are perceptrons.

They adjust themselves to minimize the loss function until the model is very accurate

All of these inputs (x1, x2, x3) are fed into a perceptron. That then makes a yes or no decision and passes it onto the next perceptron for the next decision. This process repeats until the final perceptron. At which point we know what the handwriting is or whose face we are looking at.



Michael Nielsen, http://neuralnetworksanddeeplearning.com/

Machine learning and NOVA environmental engineering students

Input

Environmental Enginnering students 1982-2019

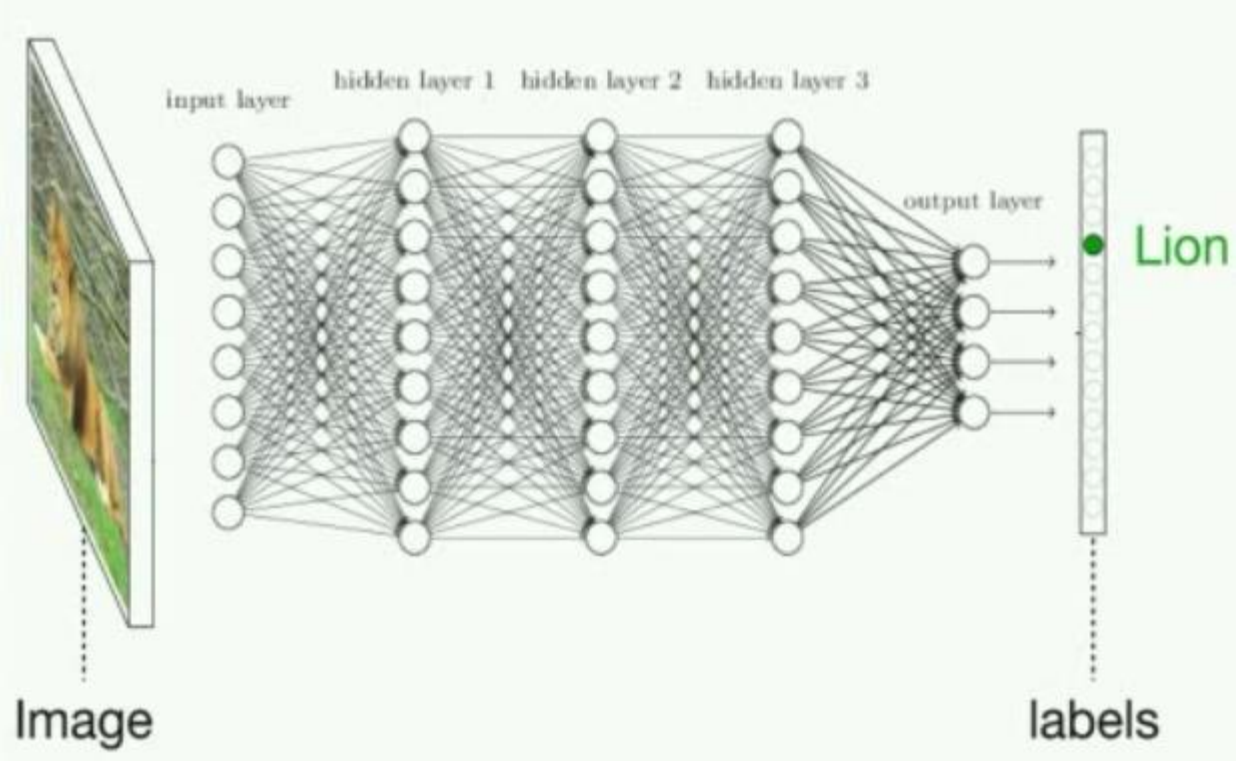
Output

Success (conventional, craftsmanship, societal) 1982-2019

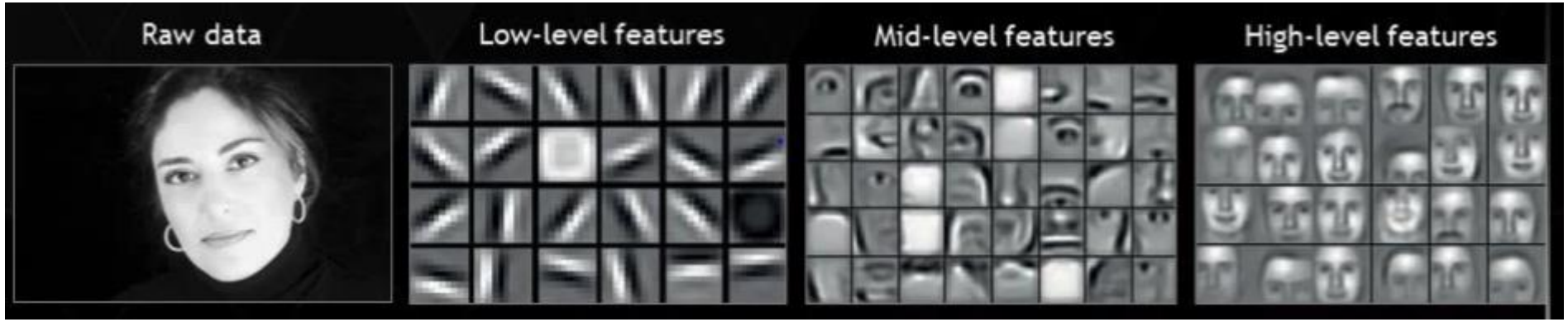
Hidden nodes

Accounting for *F in Output= F (Input)*

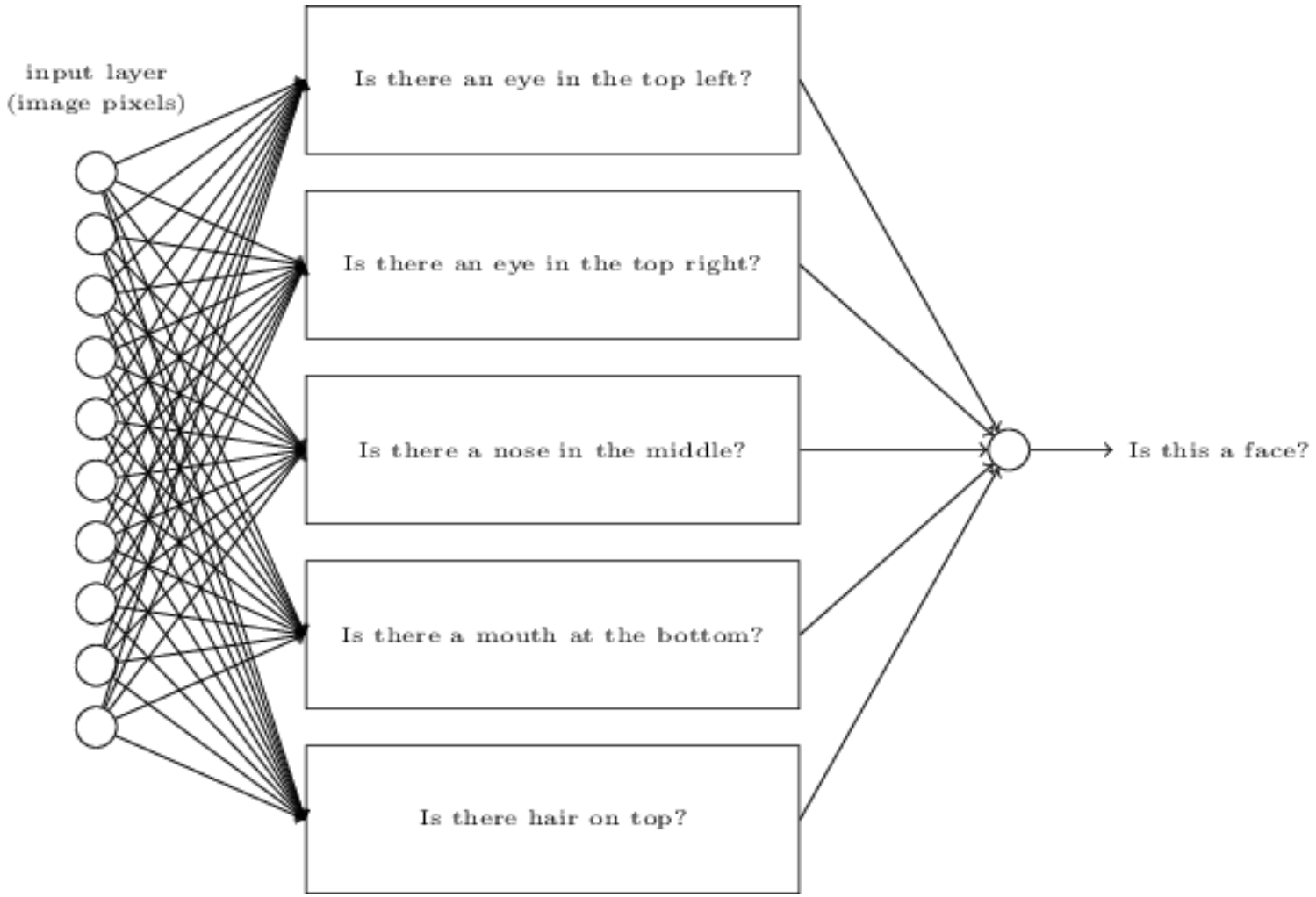
Neural networks



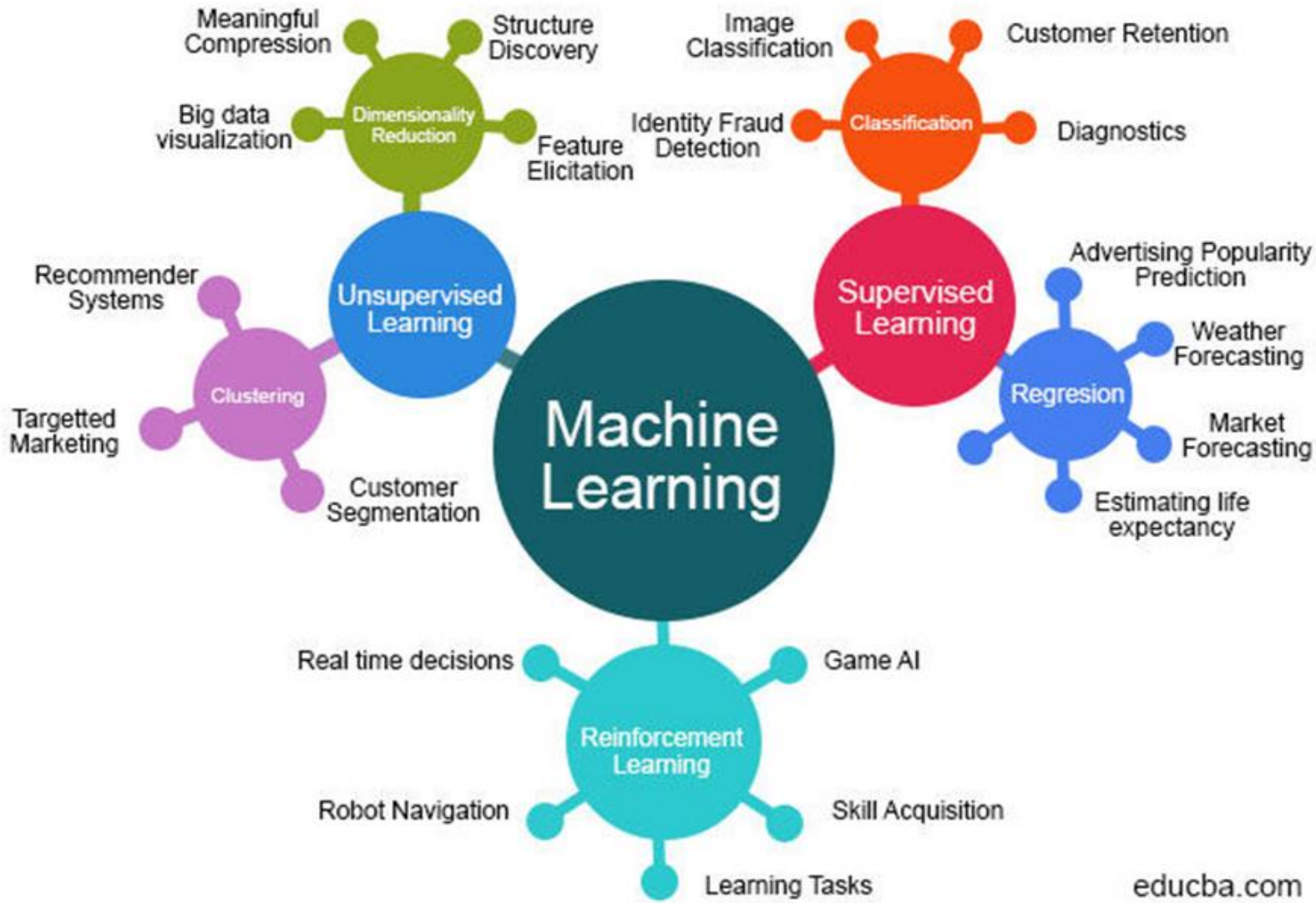
Neural networks



Neural networks



Machine Learning Algorithms



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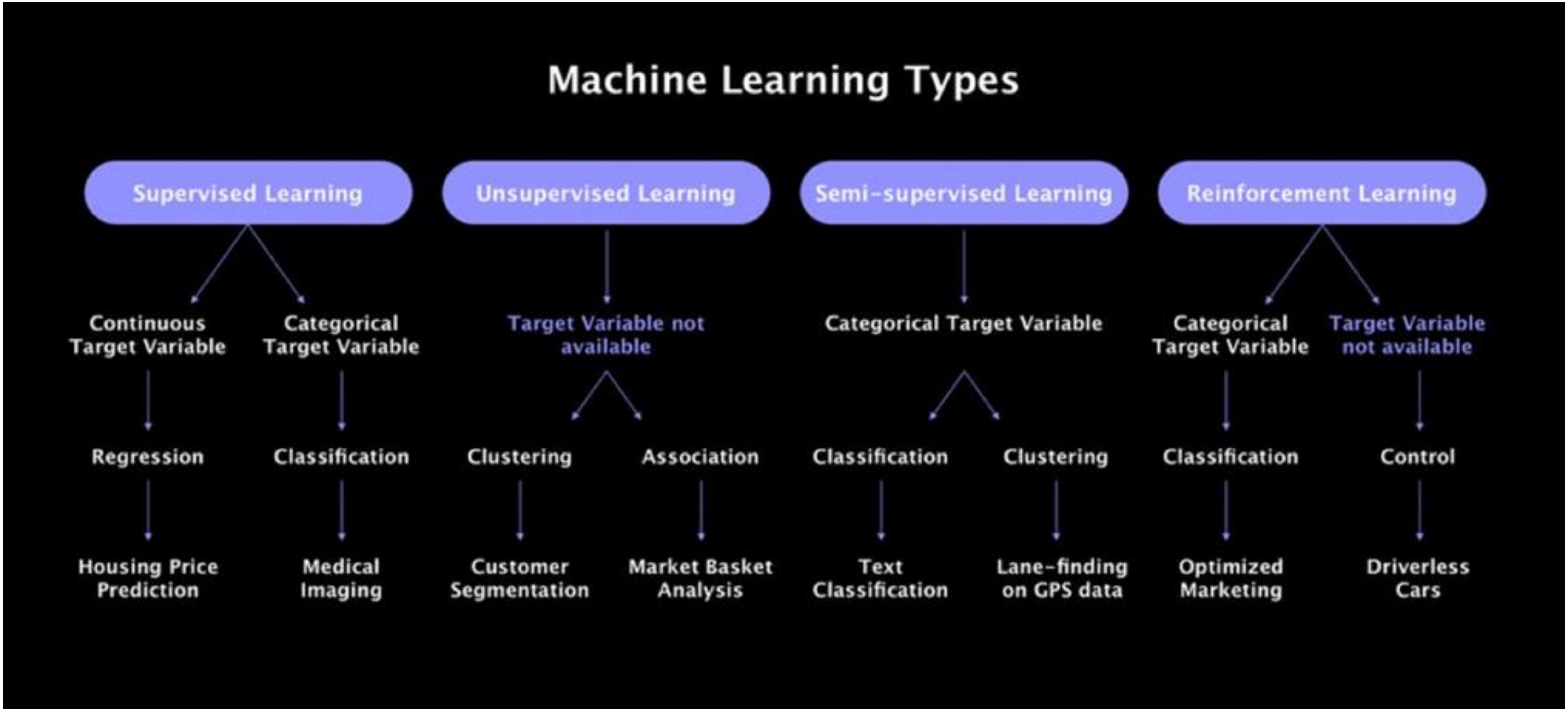
Machine Learning Types
Supervised Learning
Unsupervised Learning
Semi-supervised Learning
Reinforcement Learning
Continuous Target Variable
Categorical Target Variable
Target Variable not available
Categorical Target Variable
Categorical Target Variable
Target Variable not available
Regression
Classification
Clustering
Association
Classification
Clustering
Classification
Control
Housing Price Prediction
Medical Imaging
Customer Segmentation
Market Basket Analysis
Text Classification
Lane-finding on GPS data
Optimized Marketing
Driverless Cars

Explore Machine Learning fundamentals

Machine learning at Stanford- cheat sheet

One stop shop for educational resources

JP Morgan’s Machine Learning Guide

Useful links

Which machine learning algorithm?

Machine learning for humans

A neural network playground

Environmental applications

A learning surrogate LCA model for integrated product design. a pioneer example of machine learning as applied to ecological design by Inês Sousa, a former Environmental Engineering student at NOVA, when she was at MIT. She is now a senior environmental manager at Google

Intelligent Waste Sorting Using Deep Neural Networks

AI and environmental modelling

Tensor Flow and air quality

Tensor Flow and water quality

Environmental applications

Tackling Air Pollution with Urban AI

Machine learning and SNIRH

Machine learning and traffic forecast

Study on pollutant emissions of mixed traffic flow in cellular automaton

Collective Intelligence for Deep Learning: A Survey of Recent Developments