Linear Regression

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$y = -ax + b$

Average training duration: 4 hours 00 minute

Outline

Machine learning overview	→	15 min
Linear regression: theory	→	45 min
Linear regression: use case	→	01.30 h
Model deployment	→	01.30 h

Machine learning overview

AI

what can we do with it?

Natural Language Processing
Computer Vision
Signal Processing
⋮

Machine learning overview

Content summary of one or more documents
Translation from one language to another
Code generation
⋮

OpenAI-ChatGPT
DeepSeek
GitHub Copilot
Cursor | Codex

Natural Language Processing
Computer Vision
Signal Processing
⋮

Visual content generation
Medical image classification
Agricultural Image Classification
Object detection
⋮

Midjourney
Canva
Aidoc
IA Agri
AgriHyphen AI

Weather forecast
Disease and mortality forecasts/predictions
Stock market forecasts
Electricity consumption forecasts
Anomaly detection (cybersecurity)
⋮

AWS SageMaker – DeepAR
Nixtla-TimeGPT
Meta-Prophet
Zindi Africa
Amini

A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, L. Jones, A. N. Gomez,L. Kaiser, I. Polosukhin, Attention is all you need, Advances in neural information processing systems 30 (2017).
J. Redmon, S. Divvala, R. Girshick, A. Farhadi, You only look once: Unified, real-time object detection, in: Proceedings of the IEEE conference on computer vision and pattern recognition, 2016, pp. 779–788.
N. Bignoumba, N. Mellouli, S. B. Yahia, A new efficient alignment-driven neural network for mortality prediction from irregular multivariate time series data, Expert Systems with Applications 238 (2024) 122148.

Machine learning overview

AI

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Natural Language Processing Computer Vision Signal Processing
⋮

With what type of algorithms?

Machine Learning

Deep Learning

Machine learning overview

K-NN

Logistic Regression

K-Means

Support Vector Machines

Decision Trees

Gradient Boosting Machines

Random Forest

Linear Regression

Principal Component Analysis

Machine Learning

...

Deep Learning

Generative Adversarial Neural Network

Varational Autoencoder

Feed Forward Neural Network

Autoencoder

State Space Model

Word Embeddings

Graph Neural Network

Diffusion Model

Neural Ordinary Differential Equations

Neural Radiance Field

Recurrent Neural Network

Transformer

Normalizing Flows

...

Machine learning overview

IA

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With what type of algorithms?

Machine Learning

Deep Learning

How do they work ?

Supervised
Non-Supervised
Self-Supervised
⋮

Machine learning overview

Observation

Target

$x \rightarrow y$

e

The error that the model seeks to minimize.

Model

$\hat{y}$

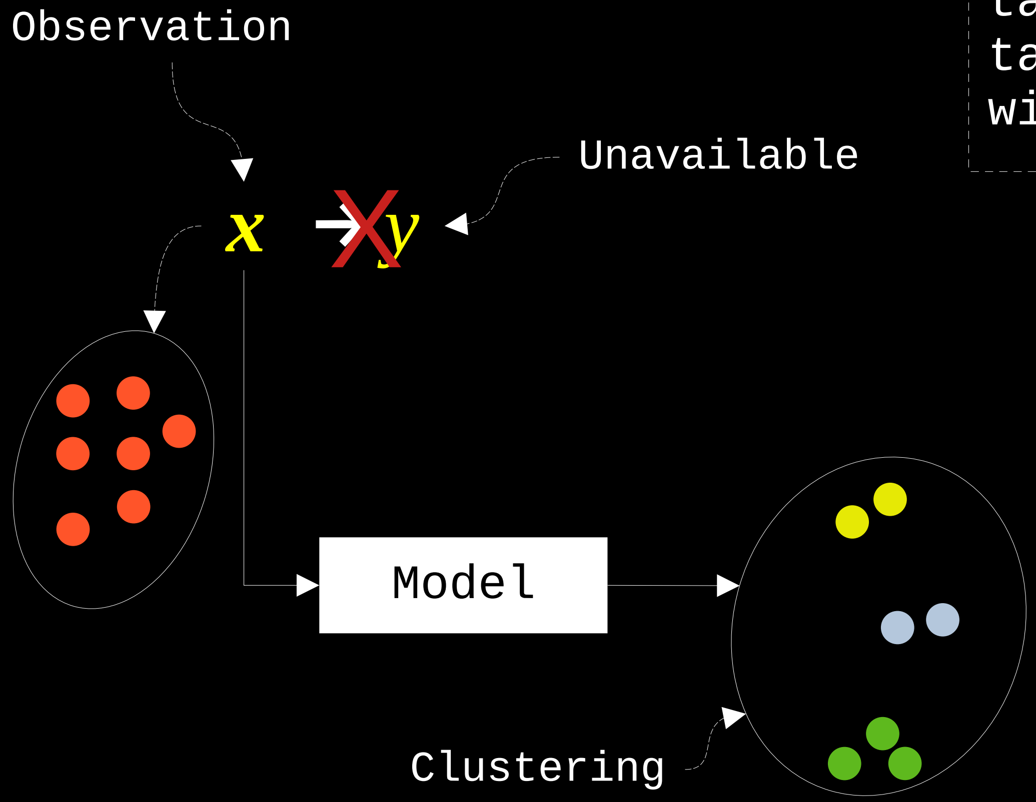
Prediction

Let's have the dataset **Xs** and its corresponding target **ys**. The model will use **X** to predict **ŷ**, **modèle(X)=ŷ**. Then, **ŷ** will be compared to **y** to calculate the error **e** made by the model, **|y-ŷ|=e**. This error serves to **refine the model parameters** so that it can predict a value **ŷ** very close to **y**.

Supervised
Non-Supervised
Self-Supervised
⋮

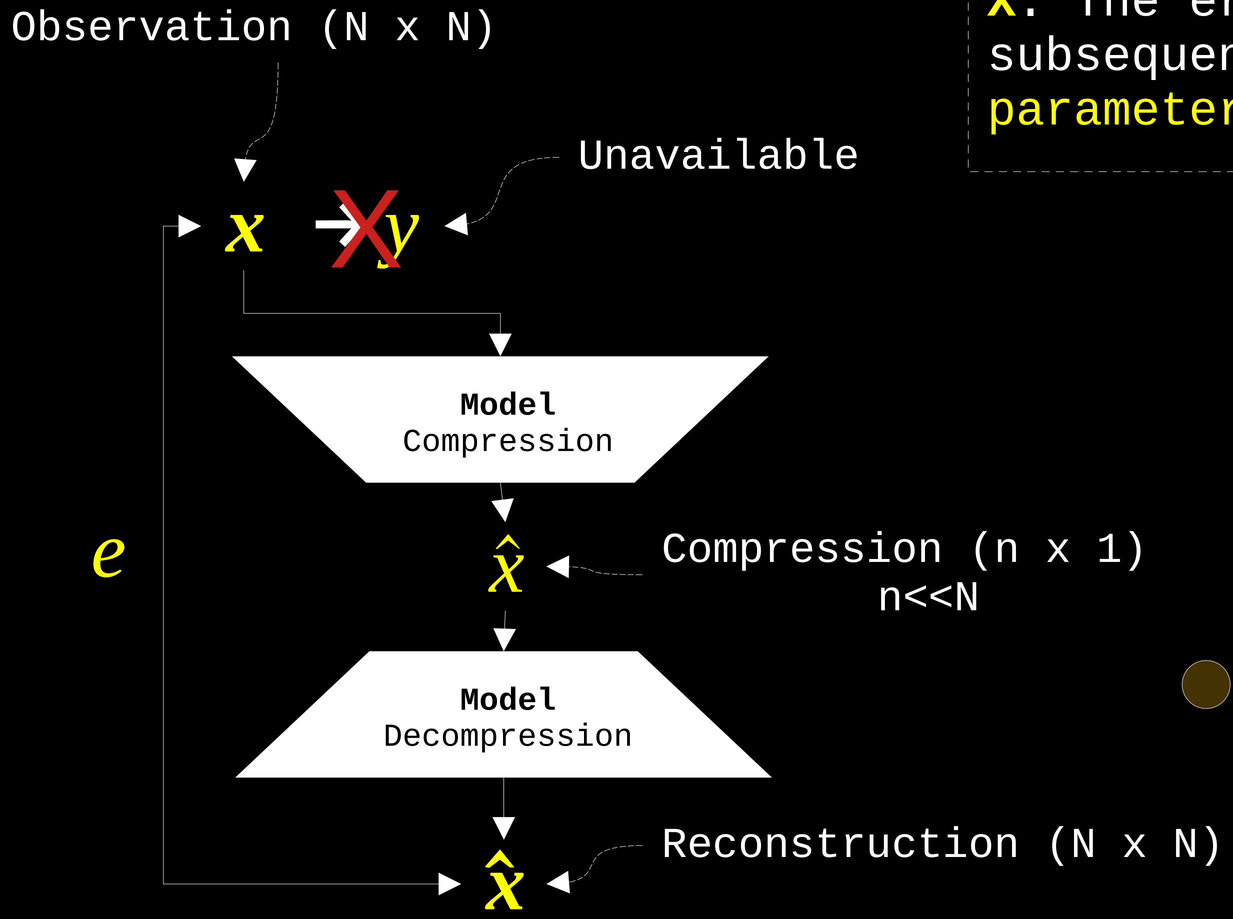
Machine learning overview

We only have **Xs** data. No matching **y** targets are available.The model will leverage data **similarities** and **co-occurrences** to perform the assigned task.For example, the clustering task, which consists of grouping data with similar patterns.



Supervised
Non-Supervised
Self-Supervised
⋮

Machine learning overview



We only have the training dataset **Xs**. The model takes an observation **X** as input, **model(X)=X̂**, and compares its prediction **X̂** to this same observation **X**. The error **|X-X̂|=e**, will subsequently be used to fit the model parameters.

Supervised
Non-Supervised
Self-Supervised
⋮

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