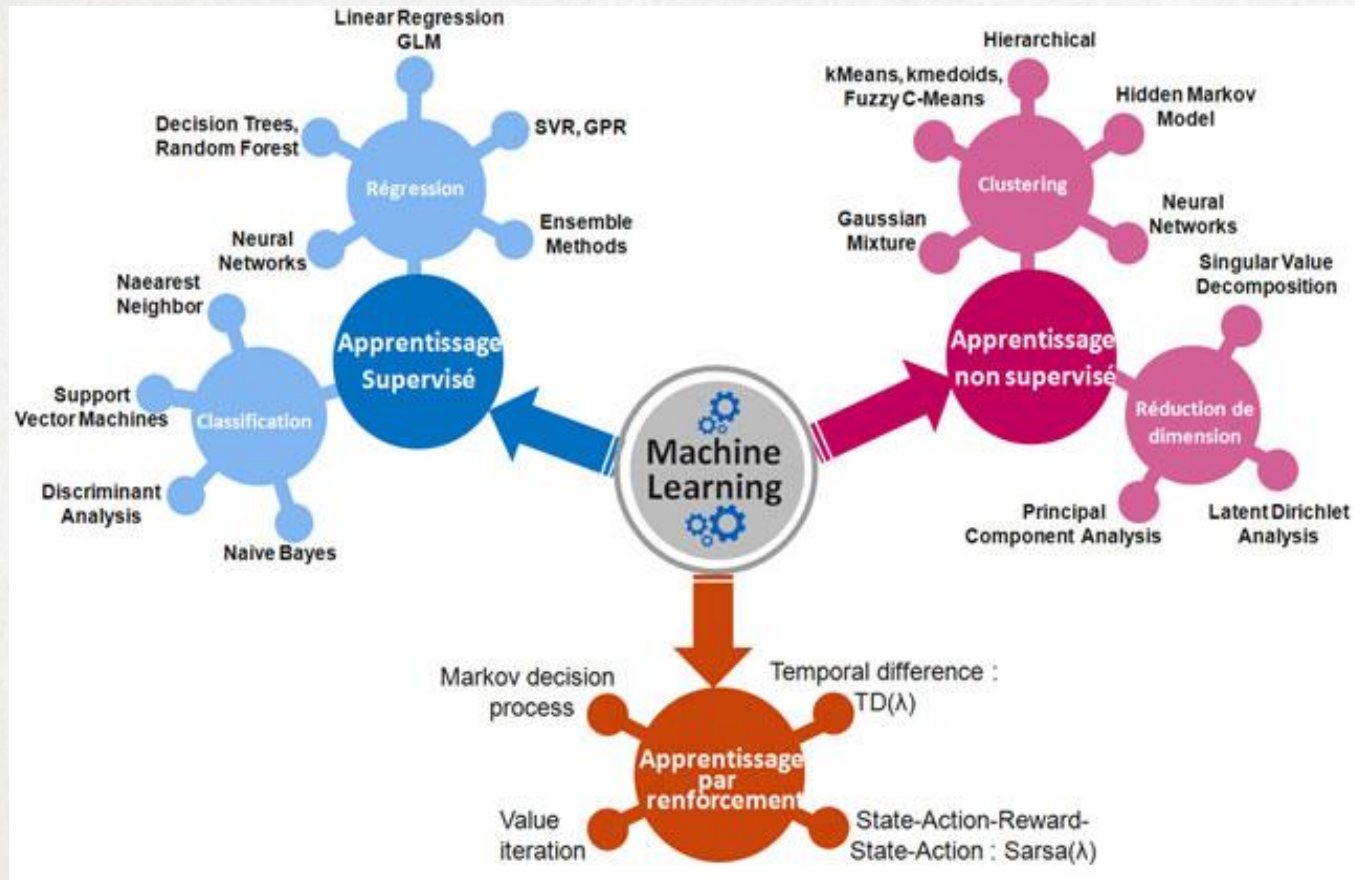# META LEARNING

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CONTENT

- Background

- Concept of Meta Learning

- A typical case of Meta Learning

- Considerations

META LEARNING - BACKGROUND

Why do we need so many algorithms?

META LEARNING - BACKGROUND

Different datasets have different inherent characteristics (e.g., data distribution) and each algorithm can only learn well if its bias matches the learning problem.

A learning algorithm may perform very well in one domain, but not on the next, which leads researchers to create a large number of algorithms.
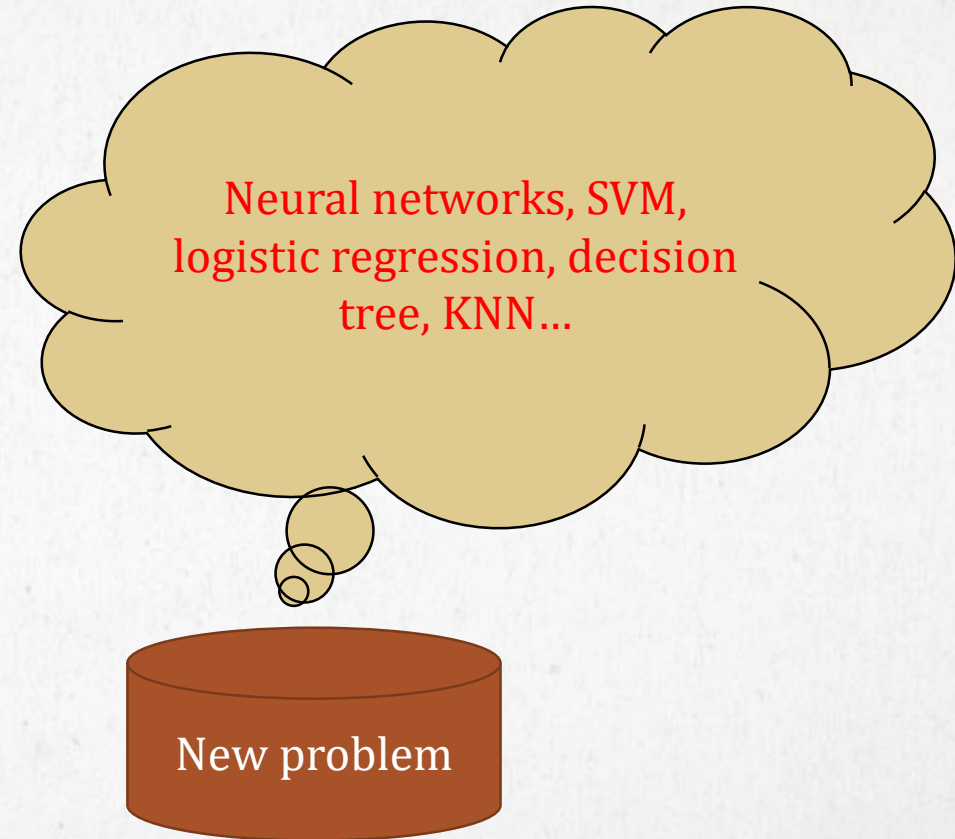
META LEARNING - BACKGROUND

trial and error

↓

a high computational cost

↓

This cost could be reduced if the most suitable algorithm(s) could be recommended.

Meta learning

META LEARNING - CONCEPT

- **The core issue of meta learning**

to study the relationship between the learning problem and the effectiveness of different learning algorithms.

- **Goal**

Algorithm Recommendation and Hyperparameter Recommendation

META LEARNING - CONCEPT

● **Meta data** :

The characterization of the datasets and the performance of the ML algorithms.

● **Meta dataset:**

Each sample corresponds to one of the original datasets;

The attributes of each sample are the meta-features of a dataset;

The label is the predictive performance of the candidate algorithms when applied to a dataset ;

META LEARNING - METHODS

- **Meta features** are able to describe the main aspects of a dataset and usually extracted by two approaches: Statistics and Model-based properties.
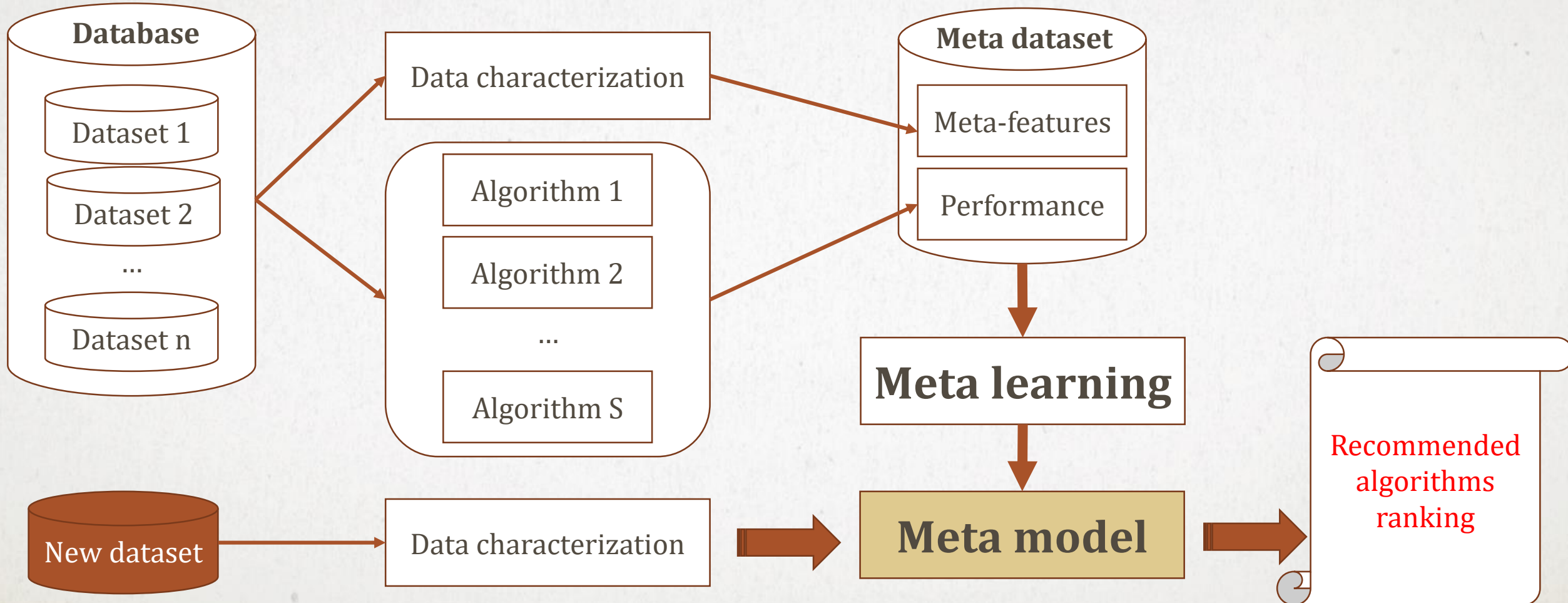
Statistics:

① A function of the dataset size, uses equation $LgE = \log_{10}(n)$, where n is the number of samples;

② The ration between the number of samples (n) and the number of attributes (p): $LgREA = \log_{10}(n/p)$;

③ The percentage of missing values;

④ The complexity of a problem;

⑤ …

Model-based properties: a set of properties of a model

① For example, if a decision tree algorithm is applied to the dataset, statistics about nodes, leaves and branches can be used to describe the dataset.

② For example, if a neural network algorithm is applied to the dataset, statistics about the number of hidden layer and the number of hidden nodes in each layer can be used to describe the dataset.

META LEARNING –CONSIDERATIONS

The construction of Meta dataset

is the key to

the successful use of meta-learning.

META LEARNING

Q & A