Machine Learning Techniques

Taxonomy of ML Techniques

Dr. Ashish Tendulkar

IIT Madras

The ML techniques can be categorized based on the following criteria:

- Labels
- Models
- Learning styles

The ML techniques can be categorized based on the following criteria:

- Labels
- Models
- Learning styles

The ML techniques can be categorized based on the following criteria:

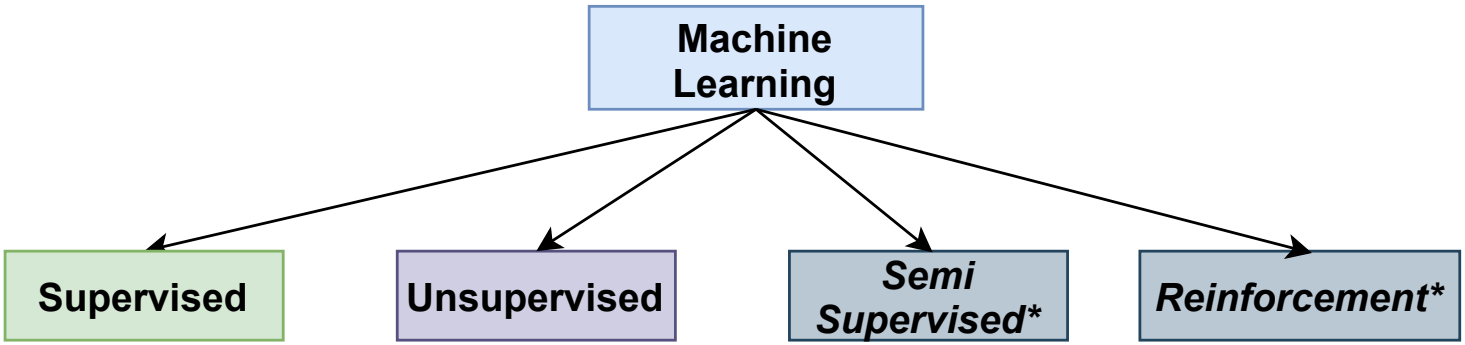
- Labels
- Models
- Learning styles

The ML techniques can be categorized based on the following criteria:

- Labels
- Models
- Learning styles

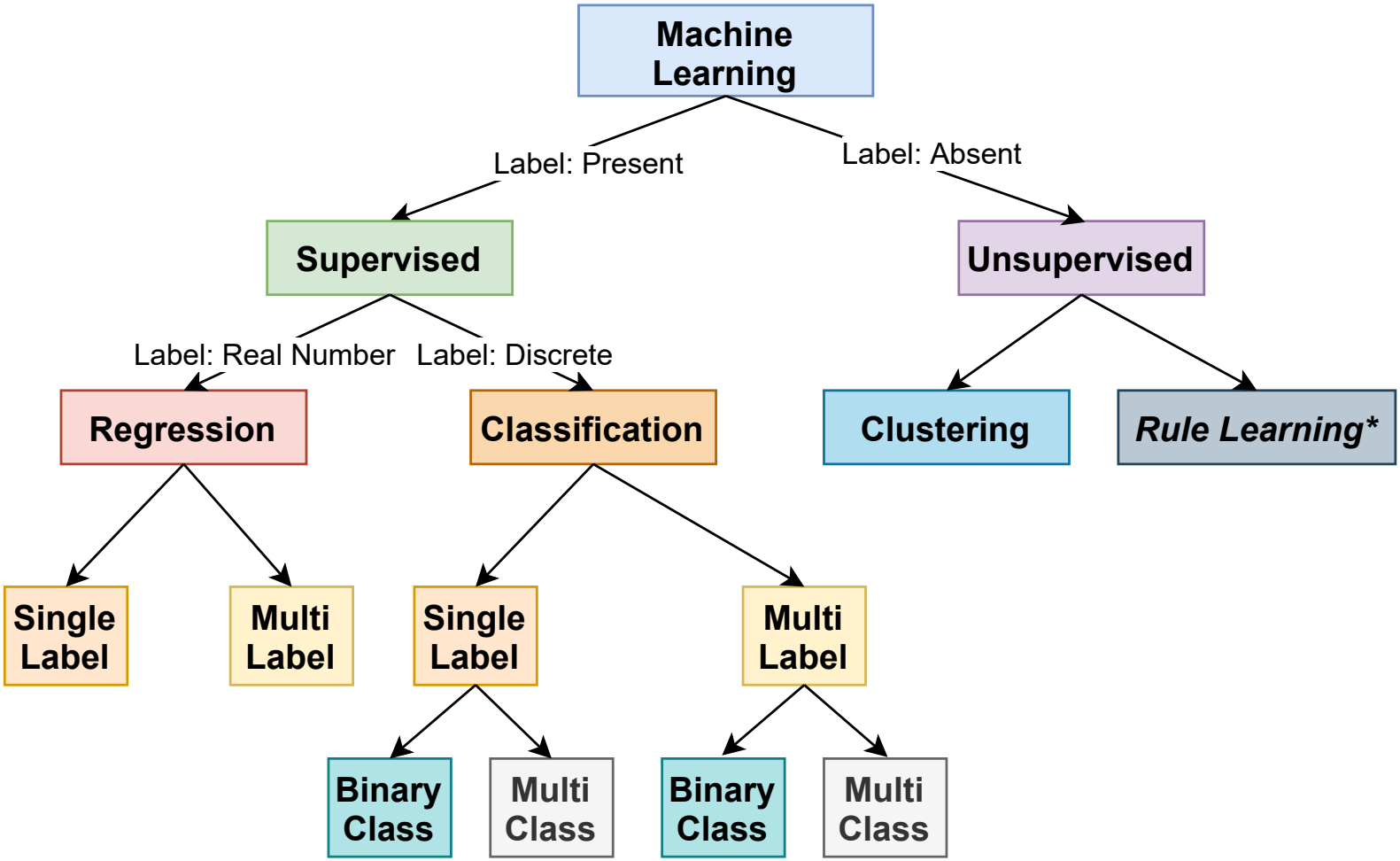
ML Techniques in a picture

Broad categories



* Not covered in this course

ML Techniques in a picture



* Not covered in this course

Is Label present?

Based on the presence or absence of label, ML techniques are divided into two types:

- **Supervised**: labels are present.
- **Unsupervised**: labels are not present.

Is Label present?

Based on the presence or absence of label, ML techniques are divided into two types:

- **Supervised**: labels are present.
- **Unsupervised**: labels are not present.

Is Label present?

Based on the presence or absence of label, ML techniques are divided into two types:

- **Supervised**: labels are present.
- **Unsupervised**: labels are not present.

Types of Supervised Learning

The supervised techniques are again divided into two types:

- **Regression**: the label is a real number.
- **Classification**: the label is a discrete quantity from some finite set.

Types of Supervised Learning

The supervised techniques are again divided into two types:

- **Regression**: the label is a real number.
- **Classification**: the label is a discrete quantity from some finite set.

Types of Supervised Learning

The supervised techniques are again divided into two types:

- **Regression**: the label is a real number.
- **Classification**: the label is a discrete quantity from some finite set.

Supervised Learning

Based on the number of labels, we get further division:

- Single label
- Multiple labels - multi-label classification/regression

Supervised Learning

Based on the number of labels, we get further division:

- **Single label**
- **Multiple labels** - multi-label classification/regression

Supervised Learning

Based on the number of labels, we get further division:

- **Single label**
- **Multiple labels** - multi-label classification/regression

Supervised Learning

Based on the number of labels in the label class:

- **Binary class**: the label is either positive or negative.
- **Multi-class**: there are more than two possibilities of labels.

Supervised Learning

Based on the number of labels in the label class:

- **Binary class**: the label is either positive or negative.
- **Multi-class**: there are more than two possibilities of labels.

Supervised Learning

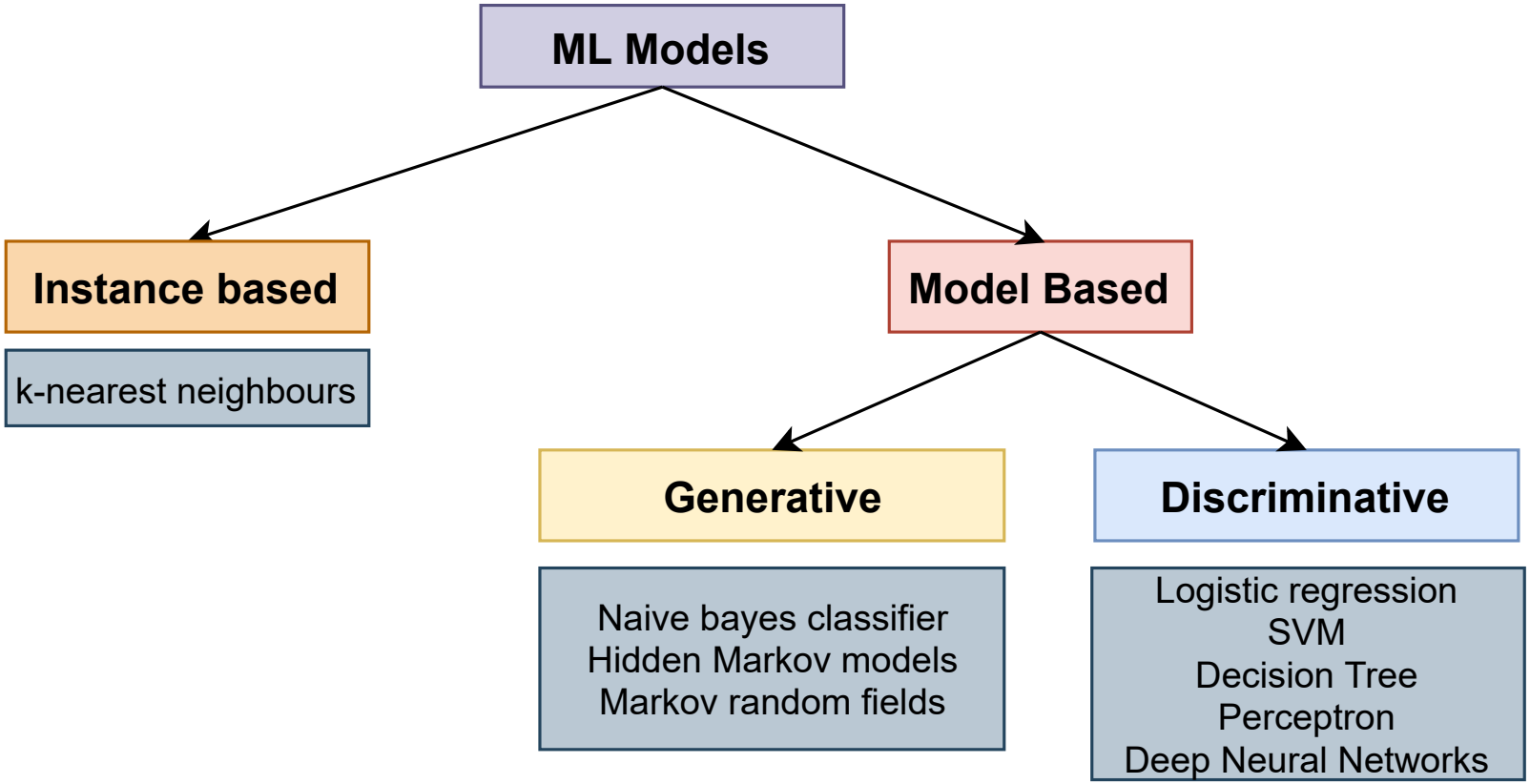
Based on the number of labels in the label class:

- **Binary class**: the label is either positive or negative.
- **Multi-class**: there are more than two possibilities of labels.

Examples

Type	Example	Label Characteristics
Single label regression	Prediction of price of a house	Single real number
Multi-label regression	Predict stock price for next 5 days	Multiple real numbers
Single label classification	Predict if the online transaction is fraudulent transaction	Single binary label- Fraudulent transaction: 1 Genuine transaction: 0
Multi-label classification	Label all fruits in the image	Multiple possible fruits, which are labels

Model Based Taxonomy



Model based techniques

Model based techniques: They learn a function mapping between input and output with a concrete mathematical function.

They are further divided as:

- Generative models.
- Discriminative models

Model based techniques

Model based techniques: They learn a function mapping between input and output with a concrete mathematical function.

They are further divided as:

- Generative models.
- Discriminative models

Generative models

Generative models: They use probability distributions for modeling the underlying data generation process and learn the parameters of distribution based on training examples.

Examples:

- Naive Bayes classifier
- Hidden Markov Model
- Markov random fields

Generative models

Generative models: They use probability distributions for modeling the underlying data generation process and learn the parameters of distribution based on training examples.

Examples:

- Naive Bayes classifier
- Hidden Markov Model
- Markov random fields

Discriminative models

Discriminative models: they learn separators between classes, instead of learning the underlying data distributions, based on the training examples.

Examples:

- Logistic regression.
- SVM, Decision Tree.
- Neural network.

Discriminative models

Discriminative models: they learn separators between classes, instead of learning the underlying data distributions, based on the training examples.

Examples:

- Logistic regression.
- SVM, Decision Tree.
- Neural network.

Instance-based techniques

Instance-based techniques: They store all the examples and rely on the notion of similarity between test and training examples for label assignment.

Examples:

- k-nearest neighbor classification/regression

Instance-based techniques

Instance-based techniques: They store all the examples and rely on the notion of similarity between test and training examples for label assignment.

Examples:

- k-nearest neighbor classification/regression

Learning Style based taxonomy

ML Techniques can be categorized into following based on learning style:

- Batch learning
- Online learning

This will be covered in detail in this course later.

Learning Style based taxonomy

ML Techniques can be categorized into following based on learning style:

- Batch learning
- Online learning

This will be covered in detail in this course later.

Learning Style based taxonomy

ML Techniques can be categorized into following based on learning style:

- Batch learning
- Online learning

This will be covered in detail in this course later.

Unsupervised Learning

Following are two types of unsupervised learning:

- Clustering
- Rule Learning

Unsupervised Learning

Following are two types of unsupervised learning:

- Clustering
- Rule Learning

Unsupervised Learning

Following are two types of unsupervised learning:

- Clustering
- Rule Learning