

Machine Learning via Neural Networks

From zero to one.

What is ML?

ML gets you
from input to output
without even writing code!

Machine Learning is concerned with the development, the analysis, and the application of algorithms that allow computers to learn.

What is learning?

Goals:

Make predictions and better understand the system.

1. Improve performance at some task with experience.
 2. Extract a model of a system from the sole observation of said system in certain situations.
 3. Make relationships between the variables used to describe the system.
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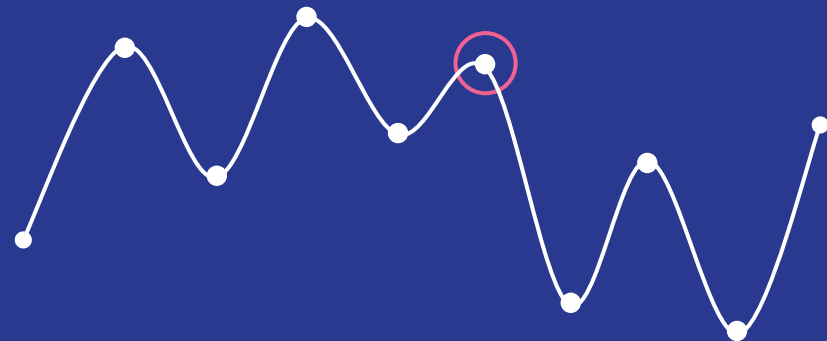
Where can I use ML?

Anywhere a large amount of data is available and quantifiable relationships between them can be built.

1. Human expertise does not exist (navigating on Mars).
 2. Humans are unable to explain their expertise (speech recognition).
 3. Solution changes in time (routing on a computer network).
 4. Solution needs to be adapted to particular cases (user biometrics).
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Netflix Recommendation System

Predict how much someone is going to love a new movie based on their previous movies preferences.



Data collected for over 100 million ratings that 480,000 users gave to nearly 18,000 movies.

Architecture

Data Generation and Preprocessing

Data Generation

Collect data types, determine sample size.

Preprocessing

Normalization, missing values smoothing, feature selection.

Machine Learning

Learning and Training

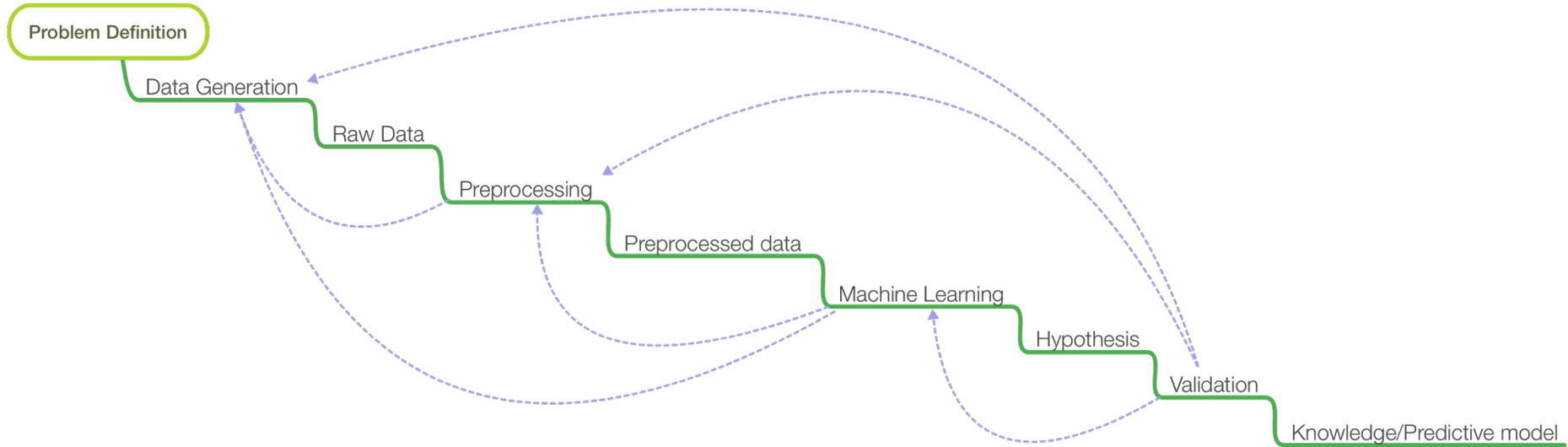
- Hypothesizing
- Choosing a learning algorithm
- Training
- Comparing and Tweaking

Validation

Corrections

- Cross Validation
- Real Data Comparison
- Model Deployment

Stages of A Machine Learning Solution



Machine Learning Components

Dataset

- Integral part
- Direct relationship to accuracy
- Are difficult and expensive to produce because of the large amount of time needed to label the data.

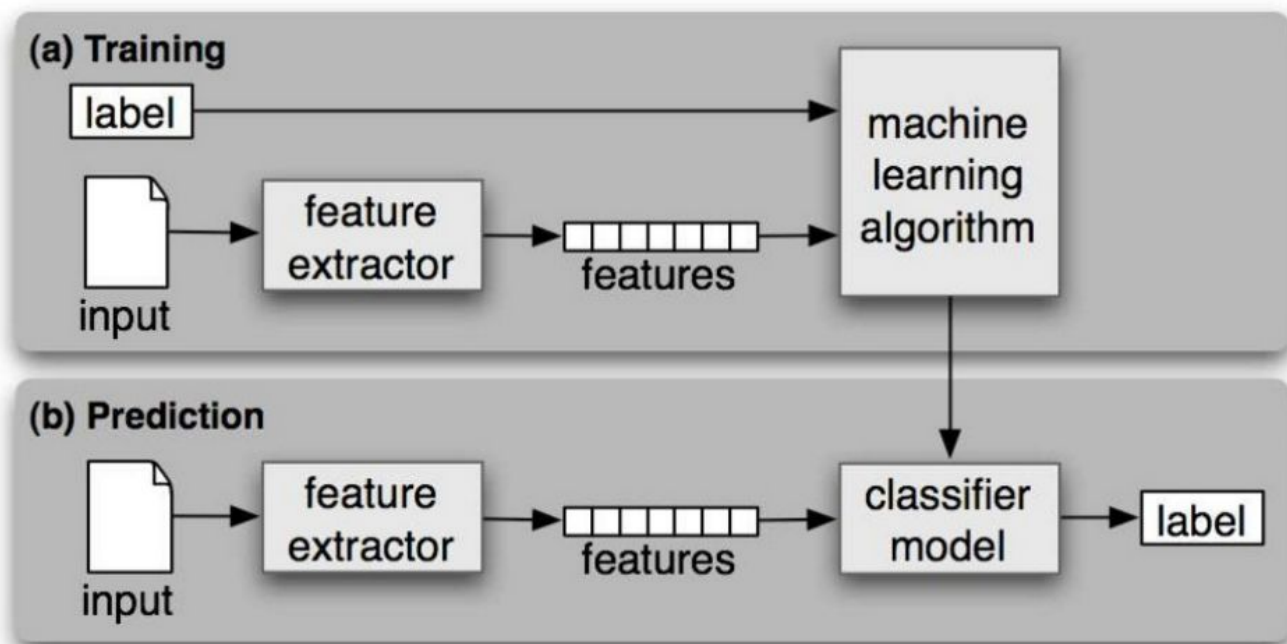
Neural Network

An artificial neural network (ANN) learning algorithm, usually called "neural network" (NN), is a learning algorithm that is inspired by the structure and functional aspects of biological neural networks.

Trainer

A trainer is an algorithm that helps you get from the input to the output via the Neural Network. The backbone of modern Machine Learning is the Back Propagation Algorithm.

Information Flow



Types Of Learning

Supervised

Supervised learning is the automatic inferring of a function from training data.

- Labeled Datasets
- Correct classes of datasets is predefined.

Unsupervised

Unsupervised learning is inferring a function to describe the structure of data.

- Unlabeled Datasets
- Correct classes can be predicted by clustering or other preprocessing.

Reinforcement

Reinforcement learning is inferring a behaviour based on feedback from the environment.

The behaviour can be learnt once for call or can be adapted as time goes by.

Techniques

Regression

- Predict a value from observation.
- Measure of relation between the mean value of a variable against the variable itself.
- Example: Predicting the rent prices within a city.

Classification

- Predict a class from observation.
- Example: Assigning a given email into a “spam” or “not spam” bucket.
- Naive Bayes classifier is the most popular.

Clustering

- Group observations into groups.
- K-Means and Hierarchical clustering are popular.
- Commonly a method of unsupervised learning.

Types of Neural Networks

Feed Forward

- Data moves only in one direction - forward.
- Relationships with previous data are not made.

Recurrent

- Has a bi-directional data flow.
- Propagate data from later processing stages to earlier stages.

Radial Basis Function

- Maps the distance to the center
- Is usually a Gaussian function.
- Used extensively to solve regression problems.

Types of Layers in a Neural Network

Input Layer

- Takes input from your dataset.
- Raw or unmodified values are passed through.
- Always a linear layer. Since no processing of data is required.

Hidden Layer

- Conversion of input to output takes place here.
- Each neuron in one hidden layer acts as output to another neuron in another layer.
- Can be as many as required.

Output Layer

- The final conversion of input to output takes place here.
- Usually a linear layer, but not always. Some level of processing can happen if required.

The End.