# Machine learning for developers

## Advancing AI for everyone

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# Outline


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# Bringing the benefits of AI to everyone

At Google AI, we're conducting research that advances the state-of-the-art in the field, applying AI to products and to new domains, and developing tools to ensure that everyone can access AI.

> *We want to use AI to augment the abilities of people, to enable us to accomplish more and to allow us to spend more time on our creative endeavors.*
>
> —*Jeff Dean, Google Senior Fellow*

# Machine Learning a new Paradigm

## Traditional programming

Involves us writing rules, expressed in a programming language, that act on data and give us answers. [1], this paradigm is limited to those problems that can be solved by an implementation.

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[a] L. Moroney, *AI and machine learning for coders a programmers guide to artificial intelligence*. 2021.

## Machine Learning

Otherwise, In ML systems, humans present the data as well as the answers expected from it, and produces the rules. These rules can be applied to new data to output new answers.

Therefore, a machine-learning system is **trained** rather than explicitly programmed. So, by presenting it with many examples relevant to the task, it will eventually find statistical structure in these examples that allow it to develop rules that permit it to automate the task **(Predictions)**.

# Key ingredients

## Data

Information collected from the past, generally while trying to understand a given phenomenon, that could be organized in rows and columns, like a database table or an Excel spreadsheet (structure-data), or presented in the form of images, videos, and text, so-called unstructured data.

## Machine Learning Algorithm

In the context of machine learning, an "algorithm" is a program that "learns" to perform a given task by being exposed to data relevant to it. It produces a model that can perform the same way or sometimes better on new observations provided with a minimum error. Machine learning algorithms perform "pattern recognition." [2]

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[*b*] J. Brownlee, *Difference between algorithm and model in machine learning*, Aug. 2020. [Online]. Available: https://machinelearningmastery.com/difference-between-algorithm-and-model-in-machine-learning/.

# Key ingredients

## Model

Artifact created by a machine learning algorithm after it has been trained. In the end, we really want to have is the "model," and the "algorithm" will do its best to find the path to get the more accurate. In summary, the machine learning model is a program automatically written or created or learned by the machine learning algorithm to solve our problem. [2]

## Prediction

Apply the model to:forecast what is going to happen in the future, or automatically make a decision for unknown data, etc.

# Sklearn example

```
1   from sklearn.datasets import load_iris ❶
2   from sklearn.linear_model import LogisticRegression
3   from sklearn.model_selection import train_test_split
4   from sklearn.metrics import (
5       classification_report,
6       confusion_matrix
7   )
8   print("[DEBUG]: Load dataset")
9   X,y = load_iris(return_X_y=True)❷
10  X_train, X_test, y_train, y_test = \
11  train_test_split(X,y, test_size=0.30)
12
13  print("[DEBUG]: Define and fit model")
14  model = LogisticRegression(solver= 'liblinear')❸
15  model.fit(X_train, y_train)
16
17  print("[DEBUG]: Evaluate Accuracy")
18  predicted = model.predict(X_test)
19  report = classification_report(y_test, predicted)
20  confusion_matrix = confusion_matrix(y_test, predicted)❹
21  print(report)
22  print(confusion_matrix)
```

❶ Import script dependencies.
❷ Load Iris dataset.
❸ Define Model.
❹ Evaluate Model.

# The three components of Learning

previously slide introduced the concept of learning, so let's review which are the three components:

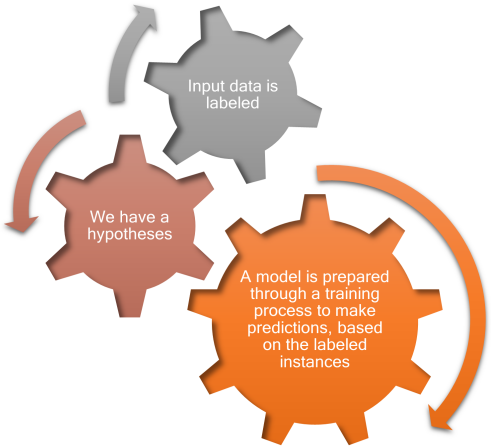
| **Representation** | **Evaluation** | **Optimization** |
|---|---|---|
| Instances<br>Hyperplanes<br>Decision Trees<br>Set of rules<br>Neural networks<br>(Bioinspired)<br>Graphical models | Accuracy/Error rate<br>Precision and recall<br>Squared error<br>Likelihood<br>Posterior probability<br>Information gain<br>K-L divergence<br>Cost/Utility<br>Margin | Combinatorial<br>and Continuos<br>optimization:<br>Unconstrained<br>- Gradient descent<br>- Conjugate gradient<br>- Quasi-Newton methods<br>Constrained<br>- Linear programming |
| A learner must be represented in some formal language | An evaluation function assesses the performance of a learner | Find the highest-scoring learner |

# Types of Learning

## Supervised Learning

### Task driven

Learning Machines are presented with input data and a desired outputs, and the goal is to learn mapping of inputs to outputs given the set of labelled pairs




## Unsupervised Learning

### Data driven

The machine is presented with data, and the task of the algorithm will be to find some hidden/interesting structure in data ("knowledge discovery"). With the objective of grouping the observations, perform dimensionally reduction or Matrix completion.


## Reinforcement Learning

### Learn from mistakes

The learner(artificial agent) interacts with the world via actions, with the objective of finds the optimal policy of behavior based on "rewards" it receives. Try and error learning.


*Thank you!*

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