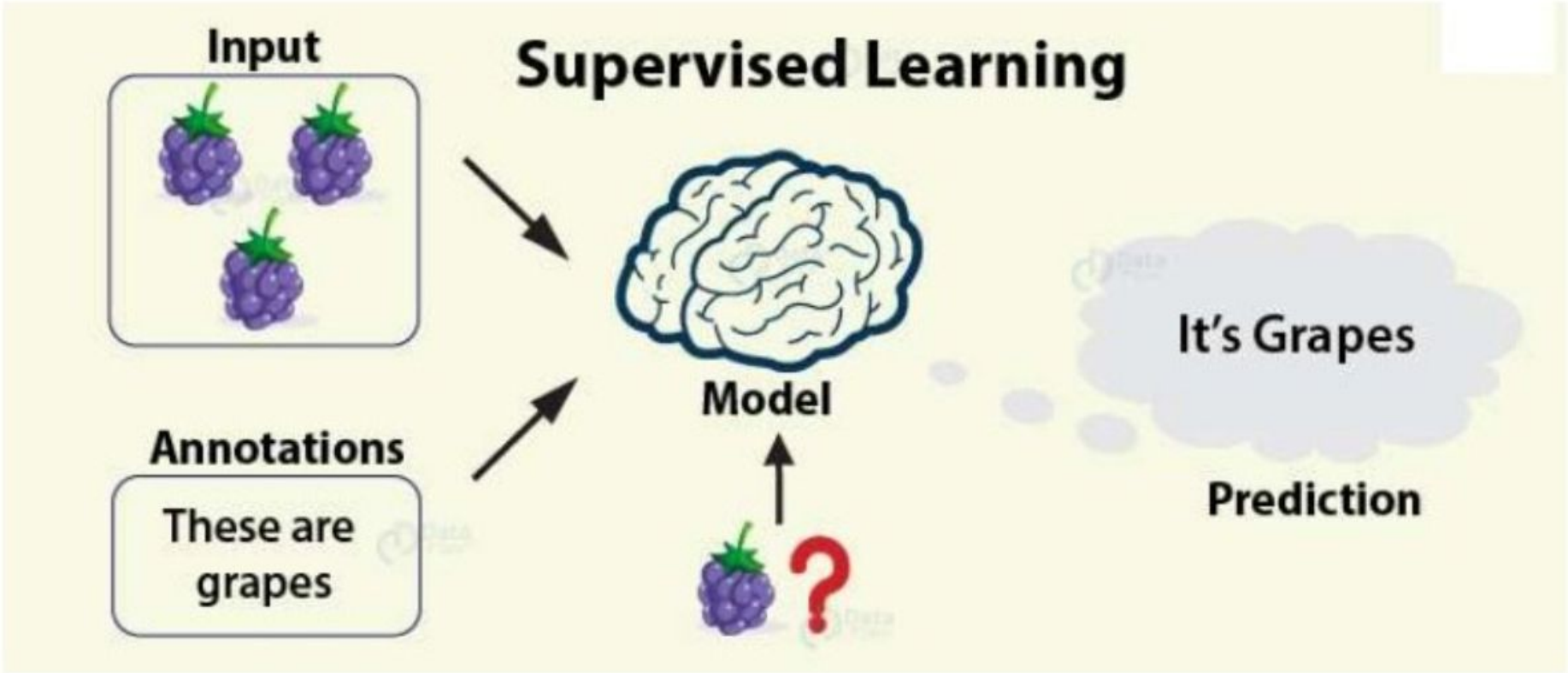
TYPES OF MACHINE LEARNING

- Machine Learning algorithm are divided into four types, based on the following criteria.
- Whether or not they are trained with human supervision
    1. Supervised Learning
    2. Unsupervised Learning
    3. Semi supervised Learning
    4. Reinforcement Learning



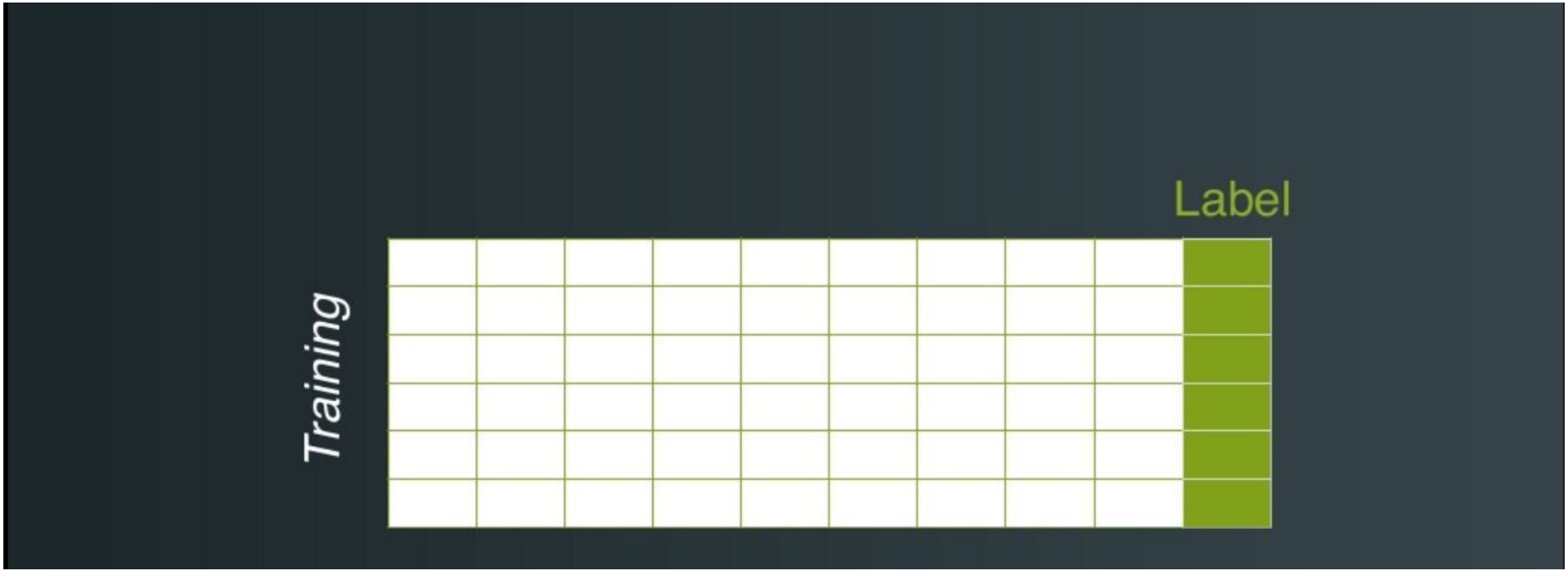
SUPERVISED LEARNING

- In supervised learning, the training set that provides data for an algorithm contains a convenient solution called labels.
- A typical supervised learning task is classification.
- Spam filter is a good example. It has been trained on with sample emails along with a label defined (spam or ham). After learning from existing emails it must classify new emails.
- Another common task is prediction for example car price prediction. For prediction it offers a number of features like mileage, age, make, etc. called predictors. With the help of predictors new car prize will be predicted. That kind of work called regression.

1. Training data provides “examples” and “outcomes”
2. The machine learns to predict the outcome of new data based on the past examples

SQFT	BEDS	BATHS
3.125	5	3
2.100	4	2
1.200	3	1,5
3.950	6	4

PRICE
530.000 $
460.000 $
250.000 $
???

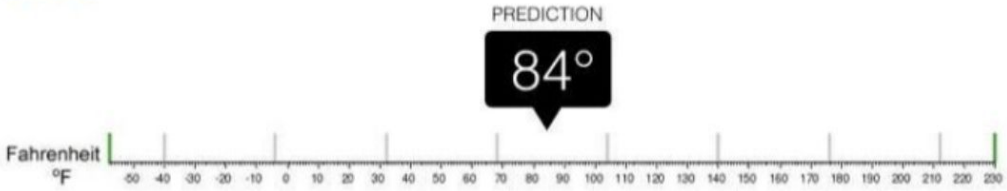


- Training data has one feature that is the “outcome”
  - Sometimes referred to as the “label” or “objective”
  - Goal is to build a model which can predict the outcome
  - If categorical: model is a“classification”
  - if numeric: model is a “regression”
- Because the data has a known value, model can be evaluated
  - Split the data into a training and test set
  - Model the training set / Predict the test test
  - Compares the predictions to the known values
- Algorithms
  - Model / Ensemble
  - Logistic Regression
  - Time Series

Example Question	Training Data
How much is this home worth?	Previous home sales
Will this customer default on a loan?	Previous loans that were paid or defaulted
How many customers will apply for a loan next month?	Previous months of loans applications
Is this cancer malignant?	Previous stats of benign / malignant cancers

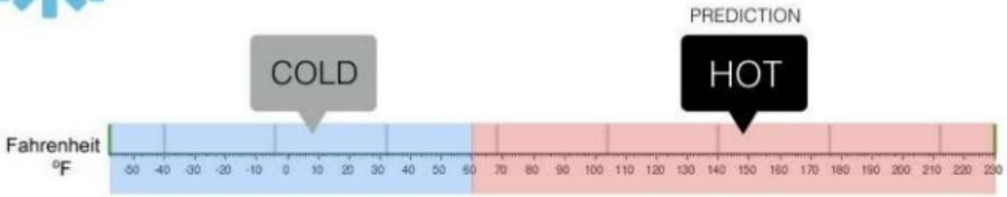
Regression

What is the temperature going to be tomorrow?



Classification

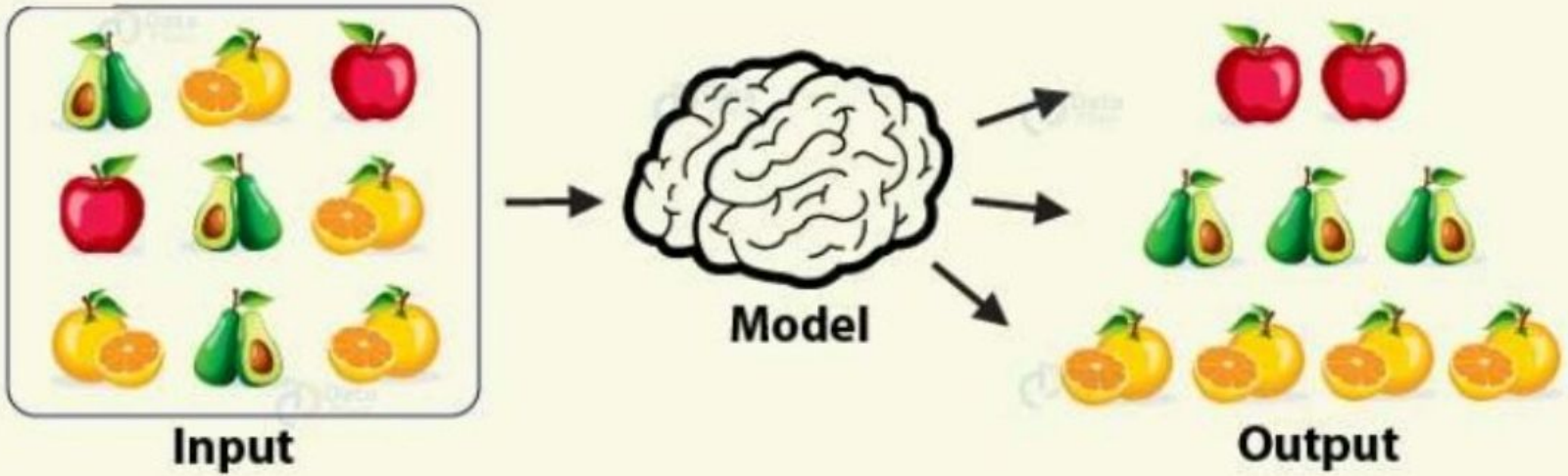
Will it be Cold or Hot tomorrow?



SUPERVISED LEARNING ALGORITHMS

- k-Nearest Neighbors
- Linear Regression
- Logistic Regression
- Support Vector Machines (SVMs)
- Decision Trees and Random Forests
- Neural networks

Unsupervised Learning



UNSUPERVISED LEARNING

In Unsupervised Learning training data is unlabeled. In this type of machine learning, system learn without a teacher. Some important Unsupervised Learning algorithm are given below:

1. Clustering(K-Means)
2. Anomaly detection and novelty detection (One-class SVM, Isolation Forest)
3. Visualization and dimensionality reduction (PCA)
4. Association rule learning

1. Training data provides “examples” - no specific “outcome”
2. The machine tries to find “interesting” patterns in the data

date	customer	account	auth	class	zip	amount
Mon	Bob	3421	pin	clothes	46140	135
Tue	Bob	3421	sign	food	46140	401
Tue	Alice	2456	pin	food	12222	234
Wed	Sally	6788	pin	gas	26339	94
Wed	Bob	3421	pin	tech	21350	2459
Wed	Bob	3421	pin	gas	46140	83
Thr	Sally	6788	sign	food	26339	51

- Training data has only examples and no specific “outcome”
  - This is common - labels are typically expensive
  - Goal is to perform discovery, find patterns, etc
  - Tends to be more difficult
- Algorithms
  - Clusters
  - Anomaly Detection
  - Association Discovery
  - Topic Models
- Because the data has no “outcome”, can not be evaluated
  - Each discovery method has it’s own quality measures

Example Question	Training Data
• Are these customers similar?	Customer profiles
• Is this transaction unusual?	Previous transactions
• Are the products purchased together?	Examples of previous purchases

Clustering

date	customer	account	auth	class	zip	amount
Mon	Bob	3421	pin	clothes	46140	135
Tue	Bob	3421	sign	food	46140	401
Tue	Alice	2456	pin	food	12222	234
Wed	Sally	6788	pin	gas	26339	94
Wed	Bob	3421	pin	tech	21350	2459
Wed	Bob	3421	pin	gas	46140	83
The	Sally	6788	sign	food	26339	51

similar

Anomaly Detection

date	customer	account	auth	class	zip	amount
Mon	Bob	3421	pin	clothes	46140	135
Tue	Bob	3421	sign	food	46140	401
Tue	Alice	2456	pin	food	12222	234
Wed	Sally	6788	pin	gas	26339	94
Wed	Bob	3421	pin	tech	21350	2459
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← unusual

Association Discovery

date	customer	account	auth	class	zip	amount
Mon	Bob	3421	pin	clothes	46140	135
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Thr	Sally	6788	sign	food	26339	51

{customer = Bob, account = 3421} → zip = 46140

{class = gas} → amount < 100

Association Discovery

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Mon	Bob	3421	pin	clothes	46140	135
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{customer = Bob, account = 3421} → zip = 46140

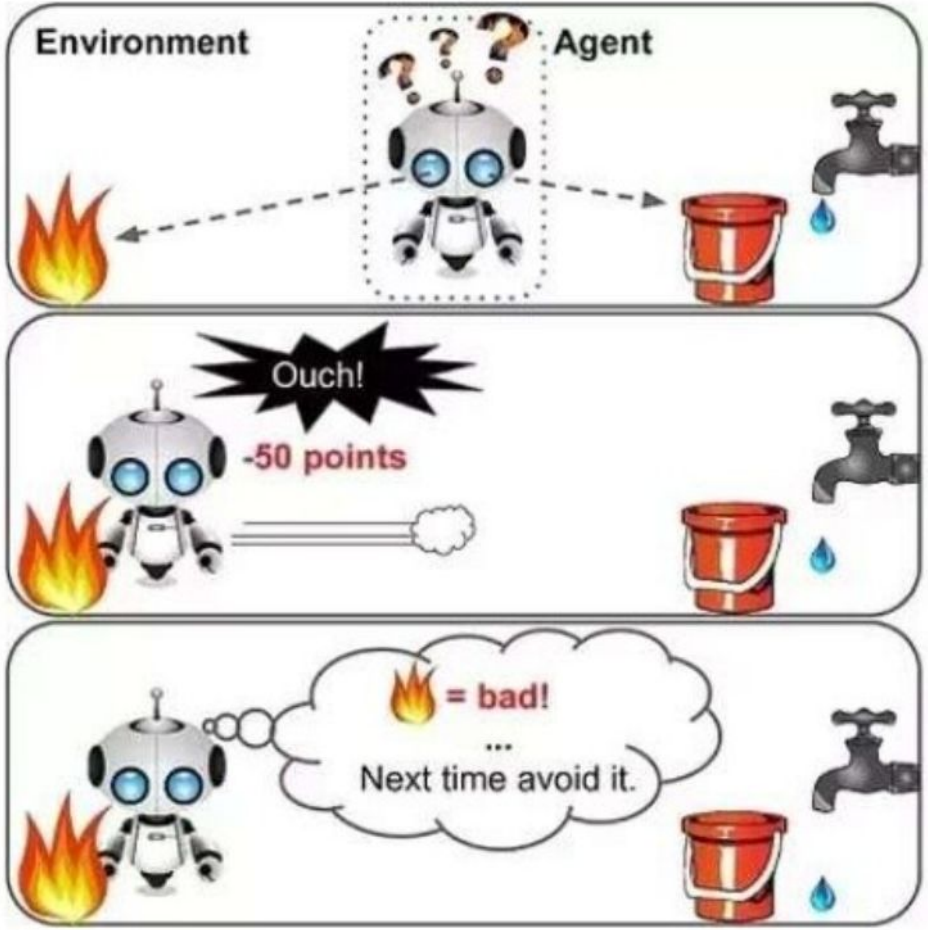
{class = gas} → amount < 100

SEMI- SUPERVISED LEARNING

- Labelling data is very costly and time-consuming process.
- Some algorithms can deal with data that's partially labeled means few labeled instances and few unlabeled instances. This is called semi-supervised learning.
- Some photo-hosting services, such as Google Photos, are good examples of this. Semi-supervised learning algorithms are combinations of unsupervised and supervised algorithms e.g. deep belief networks (DBNs).

REINFORCEMENT LEARNING

- Reinforcement learning is a whole other animal.
- This learning system is known as Agent.
- In reinforcement learning an action is taken by observing the environment and in return get reward.
- It learns by itself which is best policy to get the most reward over time.
- For example, many robots implement Reinforcement Learning algorithms to learn how to walk. DeepMind's AlphaGo program is also a good example of Reinforcement Learning



1. Observe
2. Select action using policy
3. Action!
4. Get reward or penalty
5. Update policy (learning step)
6. Iterate until an optimal policy is found

Supervised vs. Unsupervised Learning: What's the Difference?

Let me answer your Questions now.

Finally, it’s your time to speak.

Danke Schoen

Questions ? Any Feedbacks ? Did you like the talk?
Tell me about it.

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