



CS 329P : Practical Machine Learning (2021 Fall)

## 3.1 ML Model Overview

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<https://c.d2l.ai/stanford-cs329p>


# Types of ML Algorithms



Supervised 

Semi-supervised 

Unsupervised 

Reinforcement learning 

- Train on labeled data to predict labels
- Train on both labeled and unlabeled data, use models to infer labels for unlabeled data
  - E.g. self-training
- Train on unlabeled data
  - E.g. clustering, density estimation
- Use observations from the interaction with the environment to take actions to maximize reward

# Types of ML Algorithms



Supervised 

Semi-  
supervised 

Unsupervised 

Reinforcement  
learning 

- We can design supervised training tasks for unlabeled data
  - Self-supervised learning: generate labels from data. E.g. word2vec, BERT
  - GAN: generating fake data with trivial label from unlabeled data,
- Training tasks can be different from how the model is evaluated / used.

# Components in Supervised Training



Model 

- A parameterized function to map inputs to label
  - Model parameters VS hyper parameters
  - E.g. listing house  $\rightarrow$  sale price

Loss 

- The measure of how good the model does in terms of predicting the outcome
  - E.g. classification / regression / contrastive / triplet / ranking
  - E.g.  $(\text{predict\_price} - \text{sale\_price})^2$

Objective 

- The goal to optimize model params for
  - E.g. minimize the sum of losses over examples
- The algorithm for solving the objective

Optimization 

# Types of Supervised Models



Decision trees



- Use trees to make decisions

Linear methods



- Decision is made from a linear combination of input features

Kernel machines



- Use kernel functions to compute feature similarities

Neural Networks



- Use neural networks to learn feature representations

# Summary

