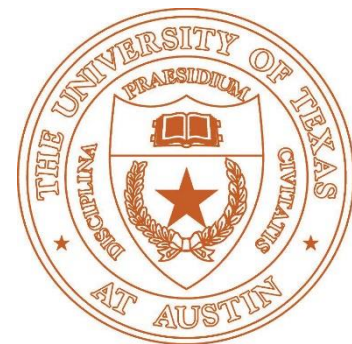


CS354 Computer Graphics

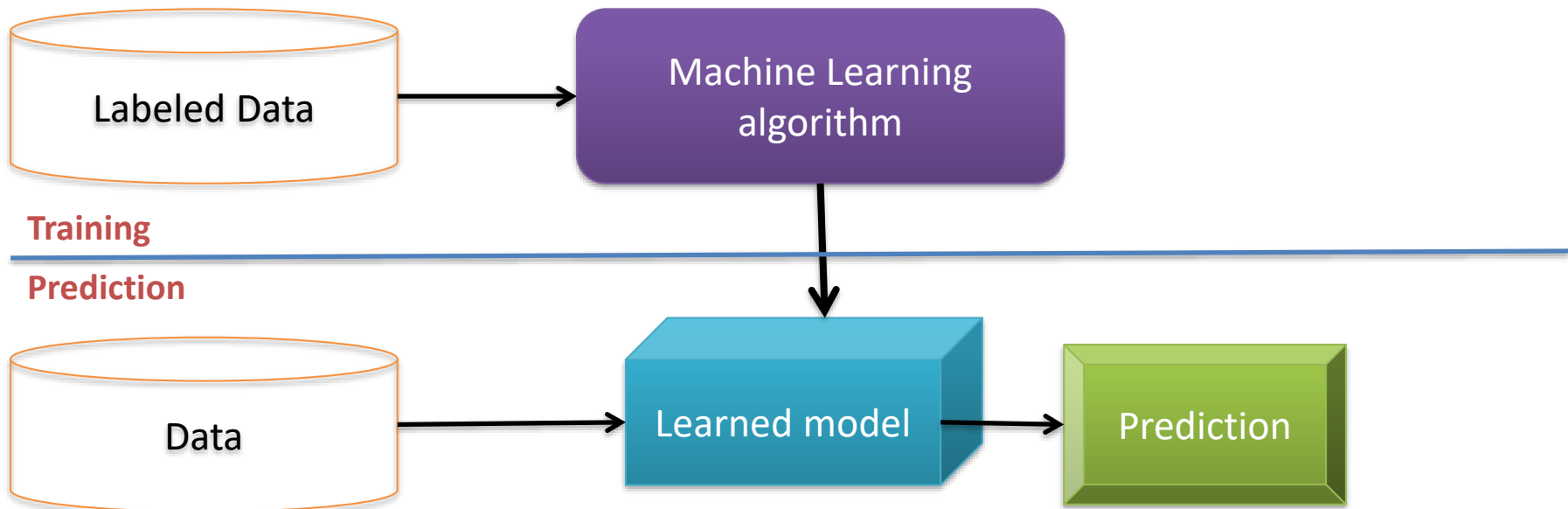
Deep Learning I

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Machine Learning Basics

Machine learning gives computers the ability to **learn without being explicitly programmed**



Types of Learning

Supervised: Learning with a **labeled training** set

Example: email *classification* with already labeled emails

Unsupervised: Discover **patterns** in **unlabeled** data

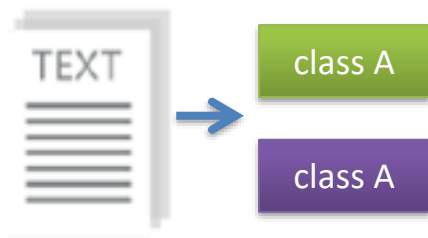
Example: *cluster* similar documents based on text

Semi-Supervised

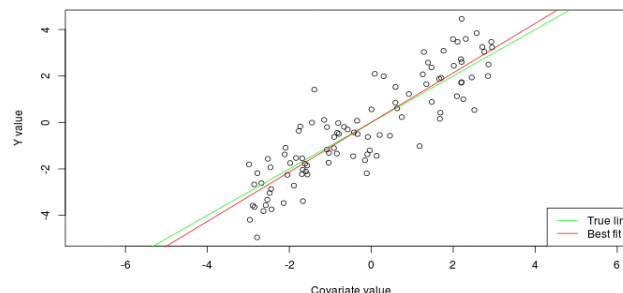
Weakly-Supervised

Reinforcement learning: learn to **act** based on **feedback/reward**

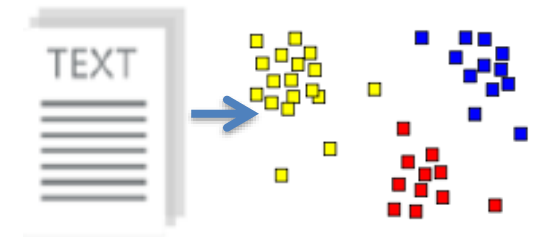
Example: learn to play Go, reward: *win or lose*



Classification



Regression

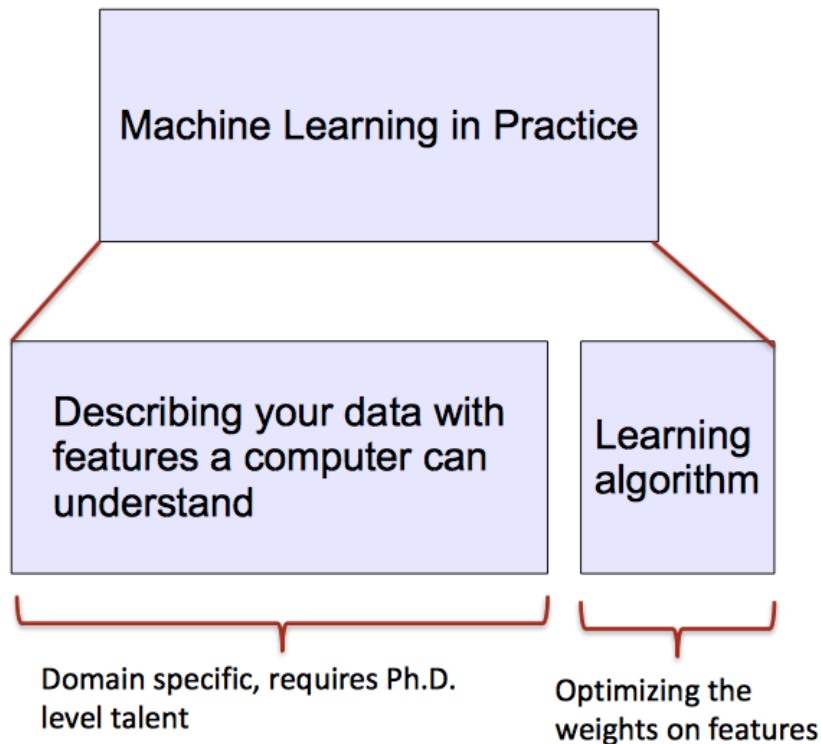


Clustering

ML vs. Deep Learning

Most machine learning methods work well because of **human-designed representations** and **input features**

ML becomes just **optimizing weights** to best make a final prediction

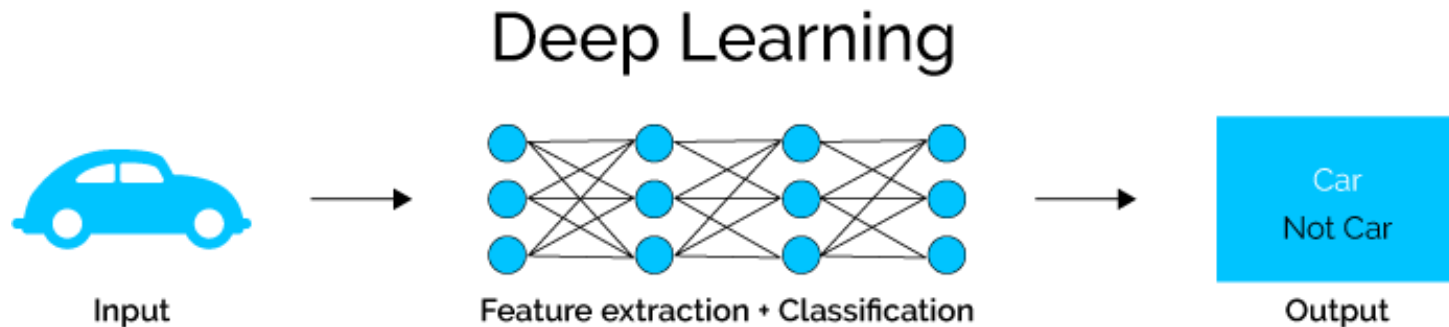
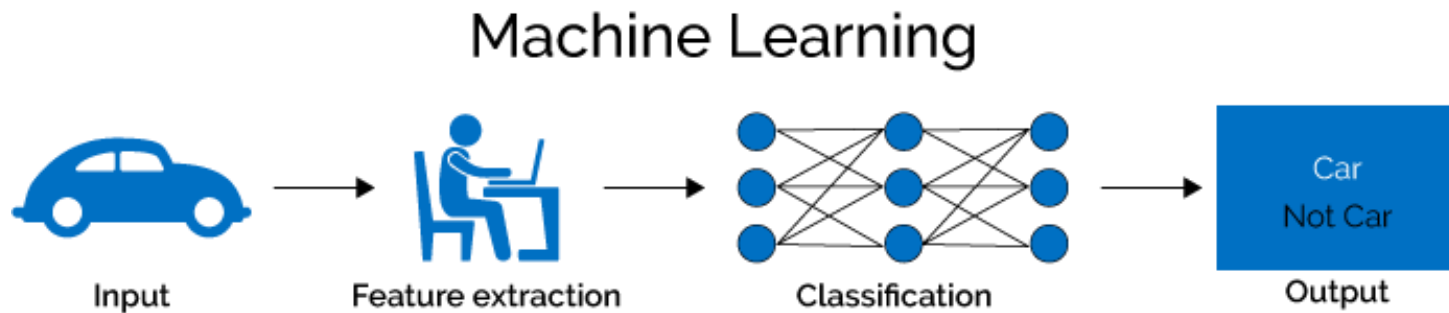


Feature	NER
Current Word	✓
Previous Word	✓
Next Word	✓
Current Word Character n-gram	all
Current POS Tag	✓
Surrounding POS Tag Sequence	✓
Current Word Shape	✓
Surrounding Word Shape Sequence	✓
Presence of Word in Left Window	size 4
Presence of Word in Right Window	size 4

What is Deep Learning (DL) ?

A ML subfield of learning **representations** of data.

Deep learning algorithms attempt to learn (multiple levels of) representation by using a **hierarchy of multiple layers**



Why is DL useful?

- Manually designed features are often **over-specified, incomplete** and take a long time to design and validate
- Learned Features are **easy to adapt, fast** to learn
- Deep learning provides a very **flexible**, (almost?) **universal**, learnable framework for representing world, visual and linguistic information.
- Can learn both unsupervised and supervised
- Leverage warm-start (e.g., pretraining and then fine-tuning)

In ~2010 DL started outperforming other ML techniques
first in speech and vision, then NLP

