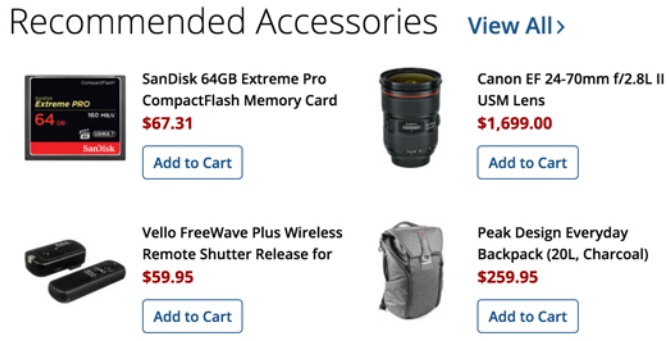
Introduction

Machine learning is pervasive!

- purchase/movie recommendations
- spoken language understanding
- autonomous vehicles

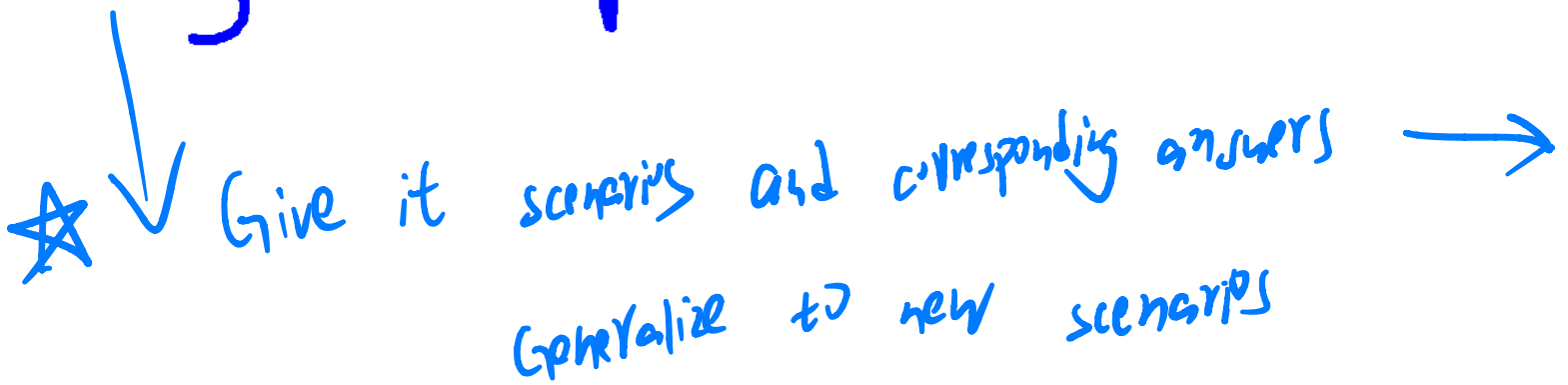


amazon alexa

Machine learning involves finding patterns in data

- Automatic identification of structure

- Learn by example



Example: Movie Ratings

	Jake	Jennifer	Julia	Justin
Star Trek	3	9	2	8
The Martian	1	7	1	7
Pride + Prejudice	9	3	5	2
Sense + Sensibility	9	2	6	3
The Empire Strikes Back	2	9	2	?

Predict based on patterns

A matrix is an ordered collection of numbers.

$$\underline{R} = \begin{bmatrix} 4 & 7 & 2 & 8 \\ 3 & 8 & 3 & 7 \\ 9 & 3 & 5 & 2 \\ 9 & 3 & 6 & 3 \\ 2 & 9 & 2 & 8 \end{bmatrix}$$

rows (Movies)

columns (Individuals)

A vector is a single row or column

$$\underline{r}_2 = \begin{bmatrix} 3 & 8 & 3 & 7 \end{bmatrix}$$

$$\underline{c}_3 = \begin{bmatrix} 2 \\ 3 \\ 5 \\ 6 \\ 2 \end{bmatrix}$$

Matrix methods are the foundation of machine learning.

- Ordered organization → pattern discovery
  - → clean/organized data structure → (facilitate) pattern discovery
- Linear algebra → powerful tools

Focus on principles for machine learning, not software or toolboxes