

Introduction

Machine learning is pervasive!

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



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Machine learning involves finding patterns²
in data

- Automatic identification of structure

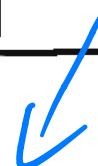
- Learn by example

★ ↓ Give it scenarios and corresponding answers →
Generalize to new scenarios

Example: Movie Ratings

3

	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. 4

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

rows (movies)

columns (Individuals)

A vector is a single row or column

$$\underline{r}_2 = [3 \ 8 \ 3 \ 7]$$

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

Matrix methods are the foundation of
machine learning. 5

- Ordered organization → **pattern discovery**
 - clean/organized data structure
- Linear algebra → **powerful tools**

Focus on principles for machine learning,
not software or toolboxes

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Barry Van Veen