

What is Machine Learning?

And what “Machine Learning A”  
is about?

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# Examples of Learning Systems

- Biological
  - Animals
  - Humans
  - Plants
- Machine learning

# Success stories of Machine Learning

- Speech recognition
- Computer vision: face/number plate/handwriting/etc. recognition
- Autonomous driving
- Bioinformatics: human genome and proteome analysis
- Machine translation (e.g., Google translate)
- Chat bots (e.g., Chat-GPT)
- ...

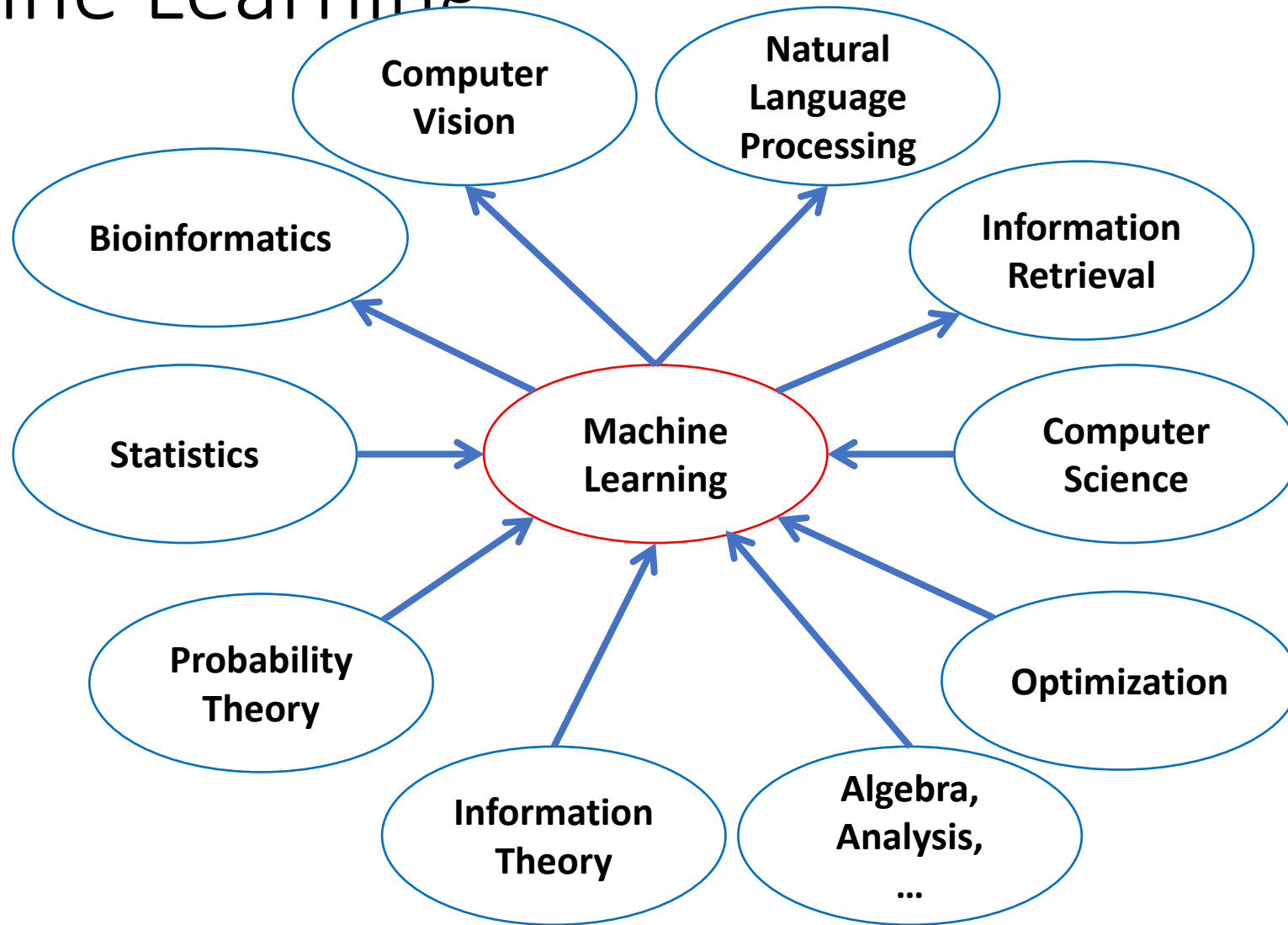
# What is Learning?

- Ability to use past experience to take better actions in new situations

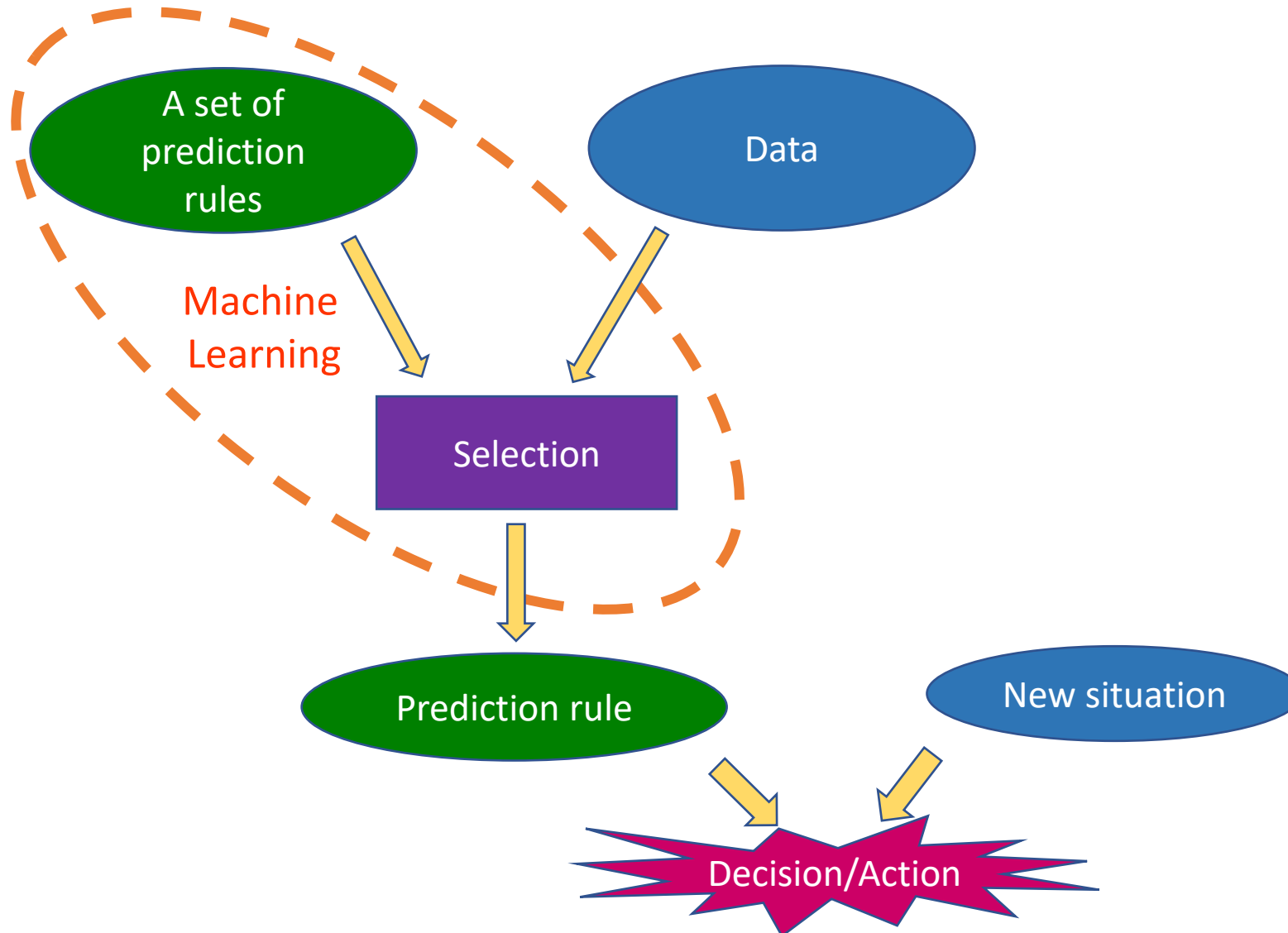
# What is Machine Learning?

- The science (and art) of selection under uncertainty

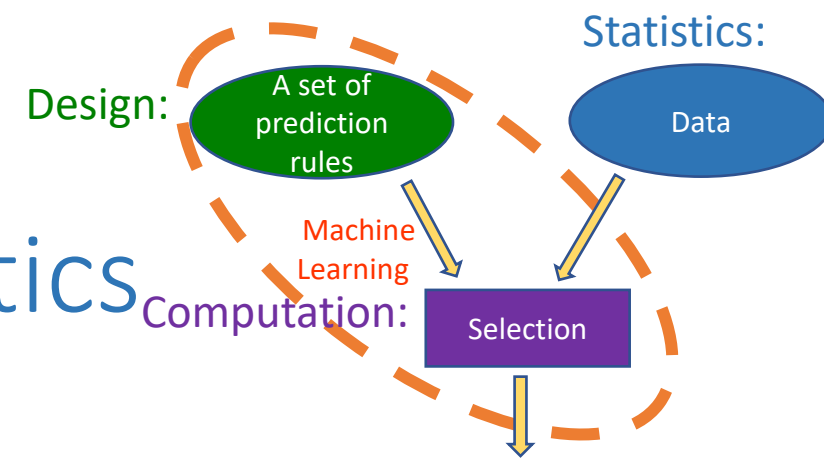
# Machine Learning



# The “Classical” Learning Process



# Machine Learning: Design, Computation, and Statistics



- Design

- Design a set of candidate prediction rules that is likely to include a “good” prediction rule
- Experience and domain knowledge

- Computation

- Find a “good” prediction rule in the set of candidate rules in a computationally efficient way
- Algorithms (Computer Science)

- Statistics

- How to estimate the quality of prediction rules?
- Selection under uncertainty
- Statistical analysis

The three elements should fit together!

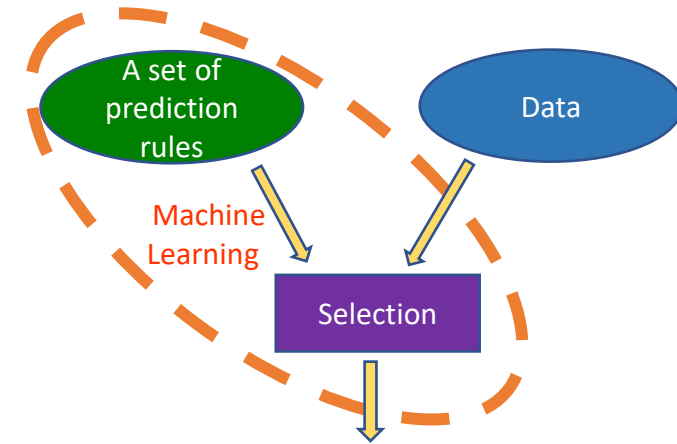
# Dealing with uncertainty

- What product to choose:
  - Rating 8.1/10, #Reviews: 4538
  - Rating 8.6/10, #Reviews: 182
- Imagine reviews detailed by age/family status/etc. categories



# Selection has a statistical cost

- The more selection is not necessarily the better



- Example #1:

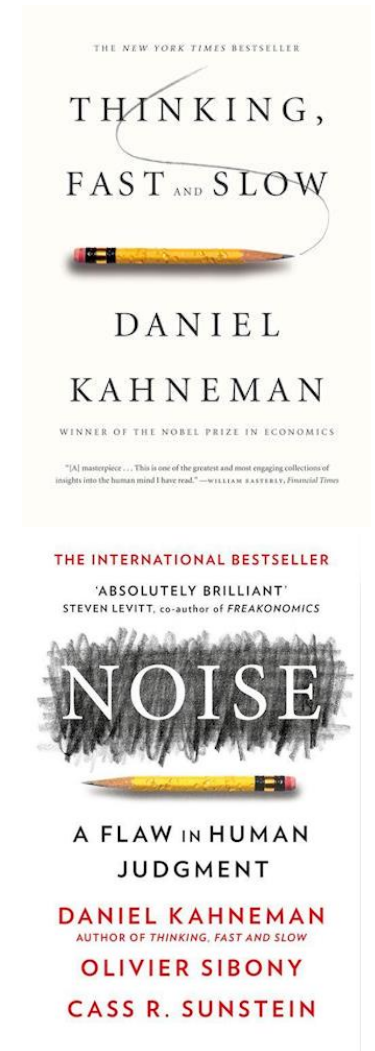
- An expert answers correctly 20 binary questions
- How much would you bet that he/she would answer correctly the 21<sup>st</sup> question?

- Example #2:

- You have a pool of 10,000,000 experts
- They all answer the same 20 binary questions
- The best in the pool makes 20/20
- How much would you bet that he/she would answer correctly the 21<sup>st</sup> question?

# The human side of it

- Humans are generally very bad at dealing with uncertainty
- And very noisy in their decision making
- Machine learning has the potential of being better



# Course goals

- Teach how to work with uncertainty
- Teach some machine learning algorithms
- Teach the assumptions behind learning algorithms
- Teach tools for analyzing the algorithms