Artificial Intelligence
&
Machine Learning

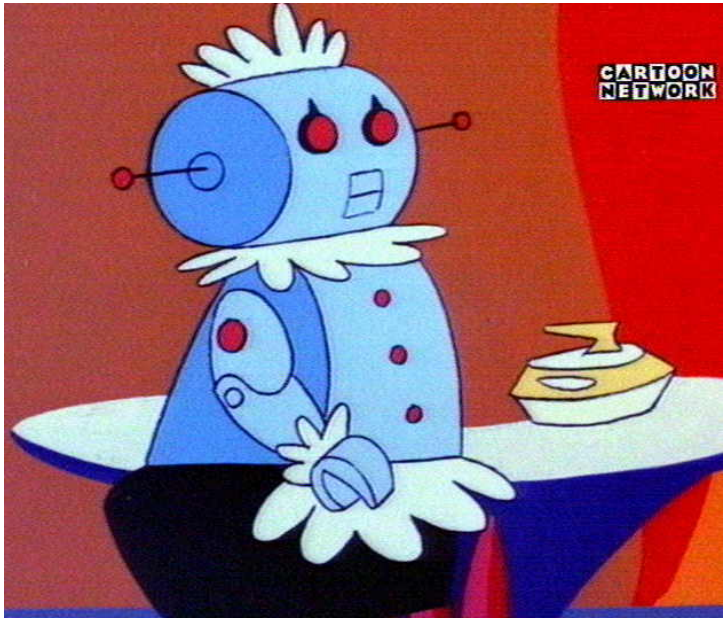
ICS 90 Guest Lecture

Prof. Alex Ihler

BREN:ICS
INFORMATION AND COMPUTER SCIENCES

UNIVERSITY of CALIFORNIA IRVINE

What is AI?



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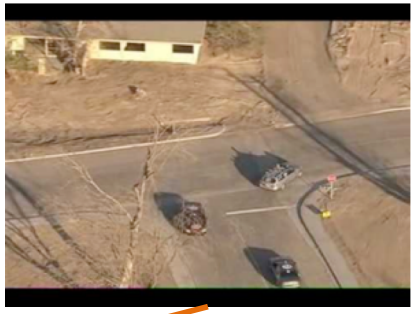
Rapid Progress in AI

- Autonomous Vehicles



2004 2005 2007 2011 2014 2016

(DARPA Grand Challenge)

Stanford "Stanley"

Nevada license

Rapid Progress in AI

- Games

Go “AlphaGo”

1992 1994 1997 2011 2017

Checkers “Chinook”

Jeopardy “Watson”

UCI alum Yutian Chen with DeepMind’s team playing Ke Jie

Rapid Progress in AI

- …and more games…

DOTA2 PvP (OpenAI)

Super Smash Bros (MIT)

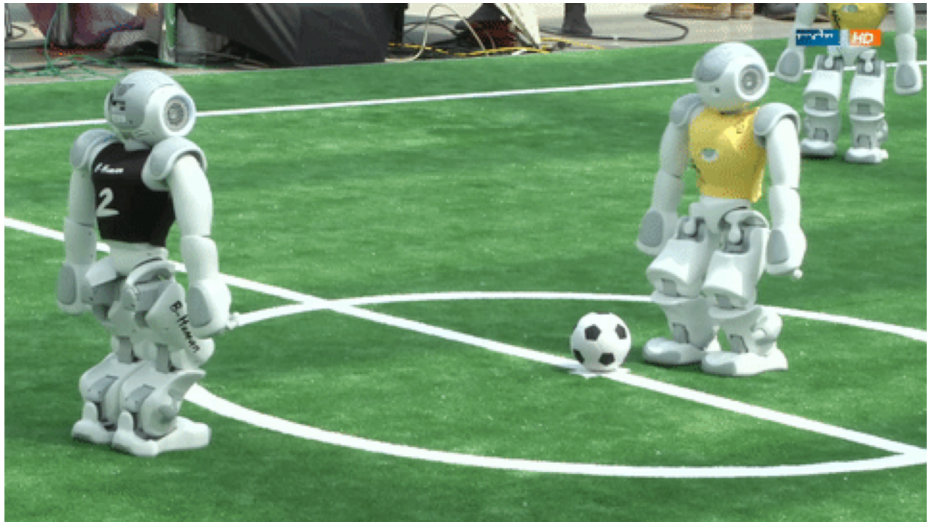
AI Competitions:

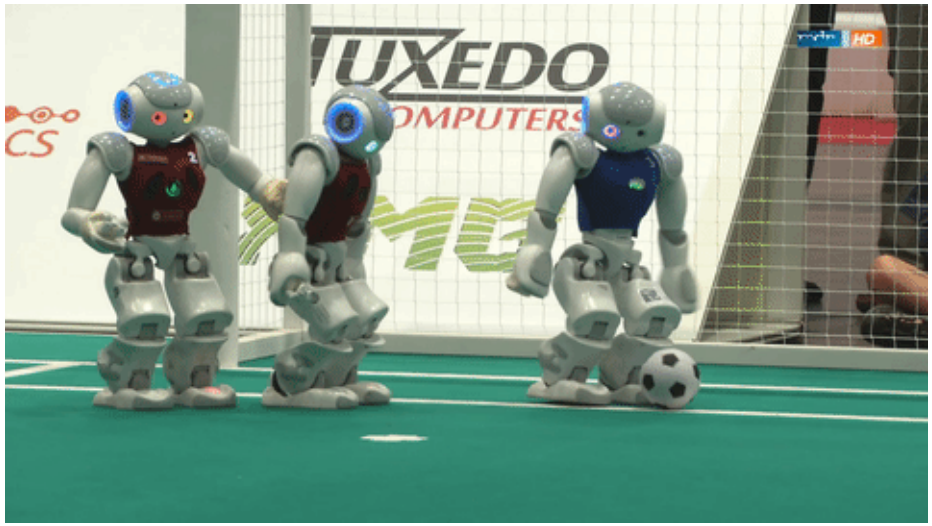
2010 – present
https://cilab.sejong.ac.kr/sc_competition/

2012 – present
http://www.aibirds.org/

2016 – present
http://www.pacmanvghosts.co.uk/

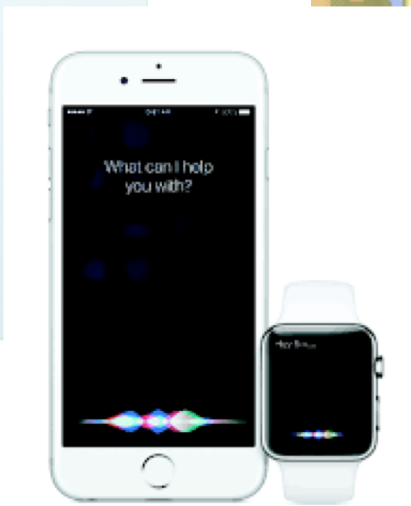
Still a Long Way to Go

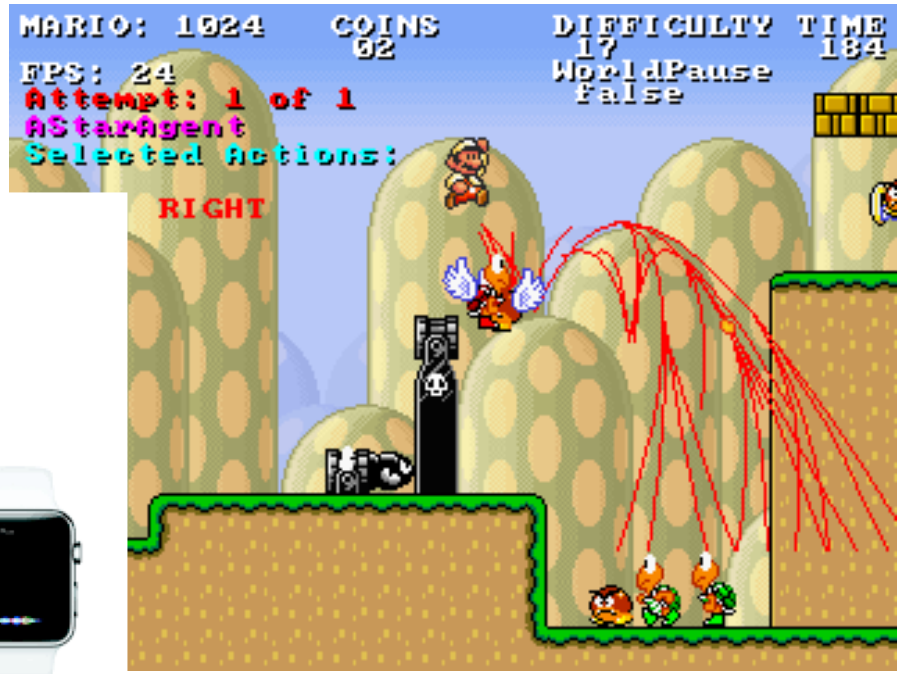




AIs

- AI as an assistant
  - Simplify interface, “do what you want”





AIs

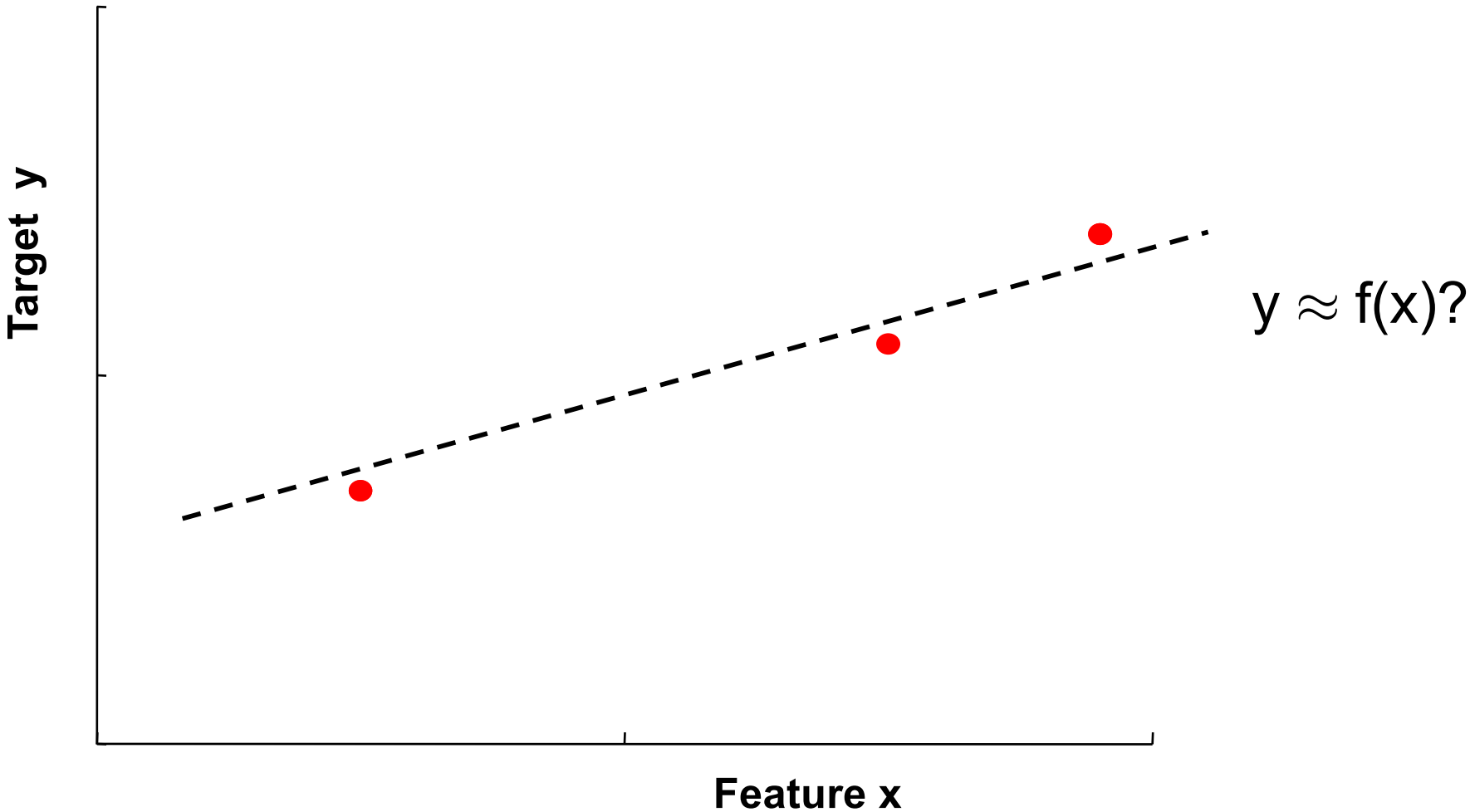
- AI as an assistant
  - Simplify interface, “do what you want”
- AI as an opponent
  - Responsive & “realistic” behavior
  - Train; evaluate play quality; …

What is ML?

- How can a computer “learn” from experience (observed data)?
- Less than the whole of AI?
  - Just one part of intelligence…
- More than just AI?
  - Applicable to many “practical” problems
  - Making sense of data automatically
  - Found in
    - Data mining & information retrieval
    - Computational biology
    - Signal processing
    - Image processing & computer vision
    - Data compression and coding

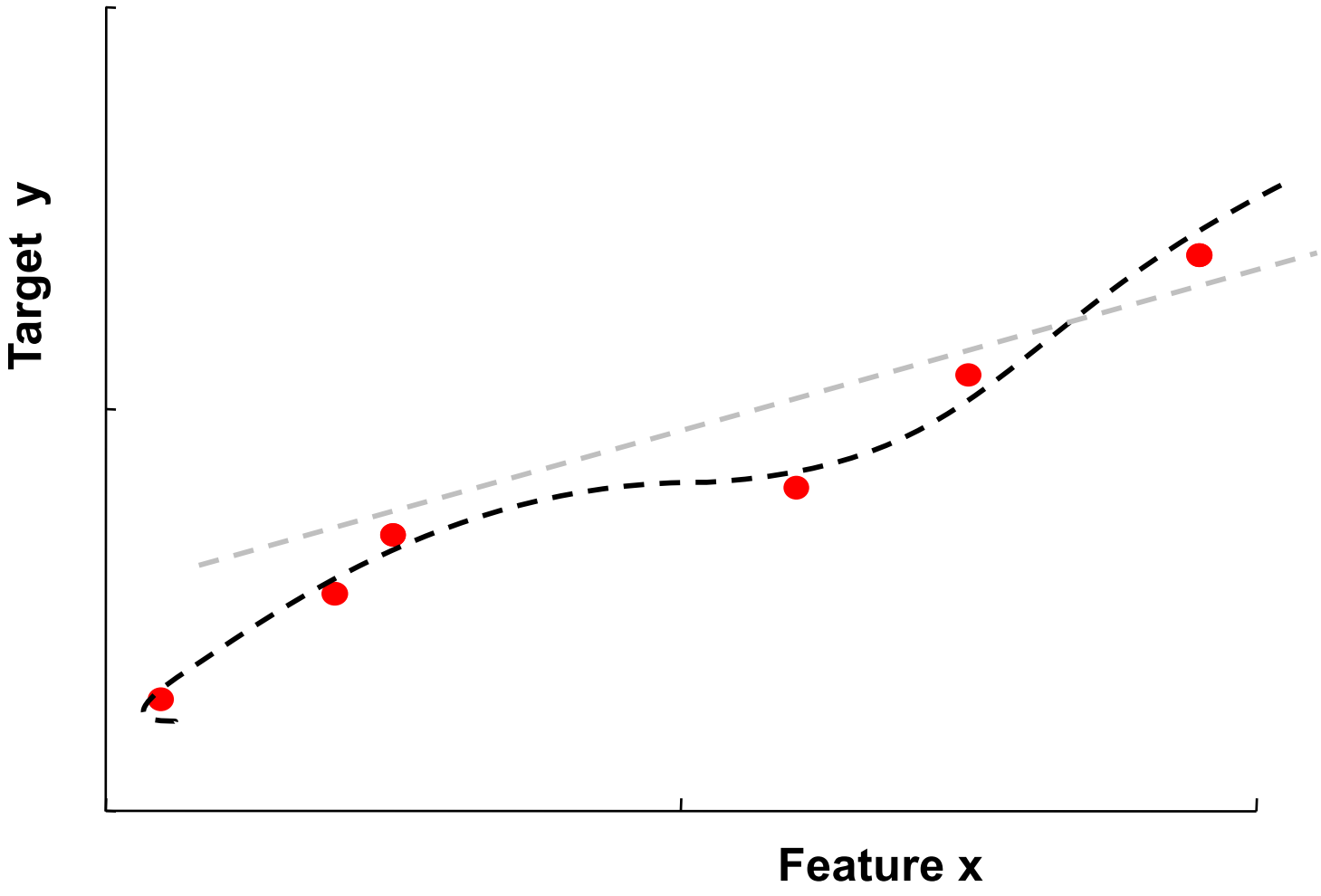
Supervised learning

- Observe examples; try to predict for new data



Supervised learning

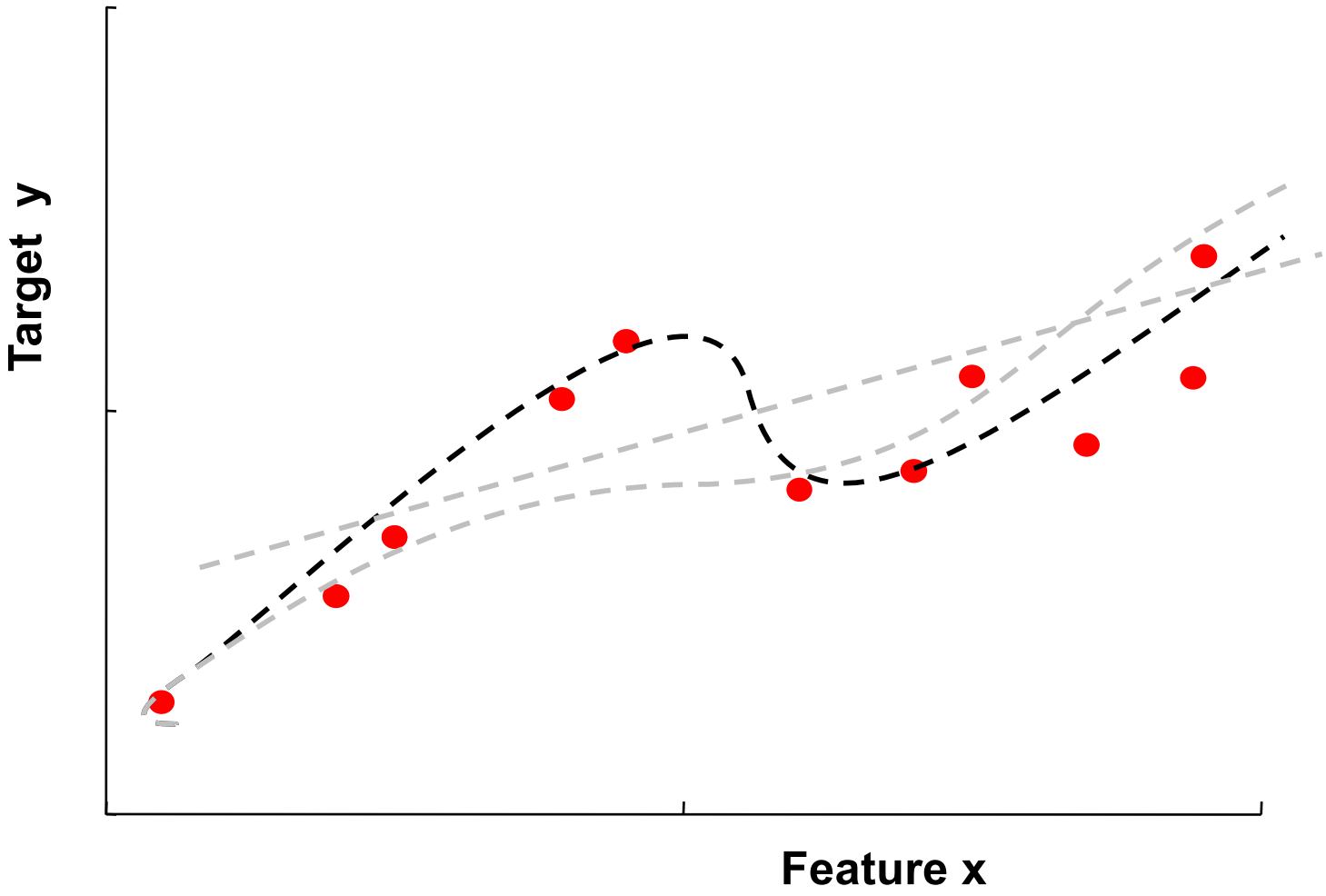
- Observe examples; try to predict for new data



$y \approx f(x)$?

Supervised learning

- Observe examples; try to predict for new data



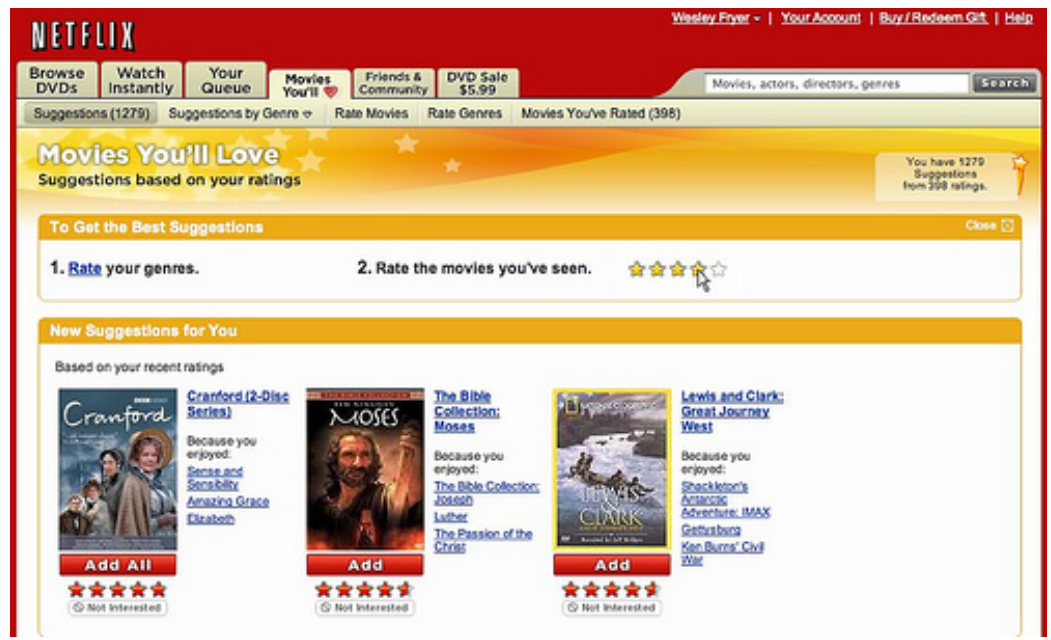
$y \approx f(x)$?

Prediction

- Based on past history, predict future outcomes

Wall Street

Netflix



Classification

- Discriminating between two (or more) types of data

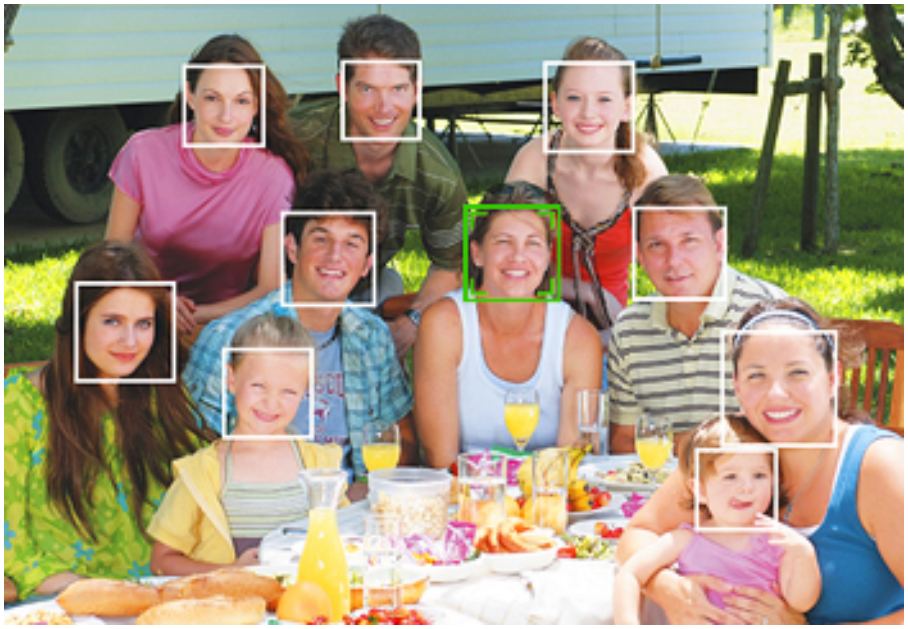
- Example: Spam filtering

Cures fast and effective! - Canadian *** Pharmacy #1 Internet Inline Drugstore Viagra Our price $1.15 Cialis Our price $1.99 …

Interested in your research on graphical models - Dear Prof. Ihler, I have read some of your papers on probabilistic graphical models. Because I …

Classification

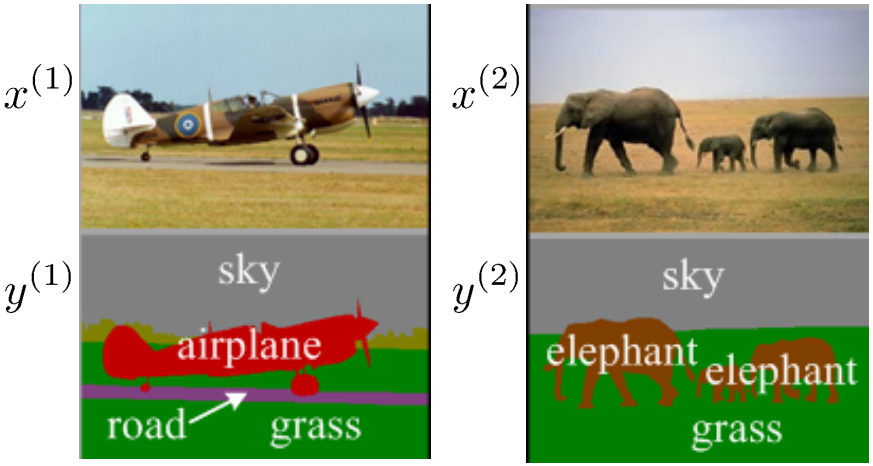
- Example: face detection



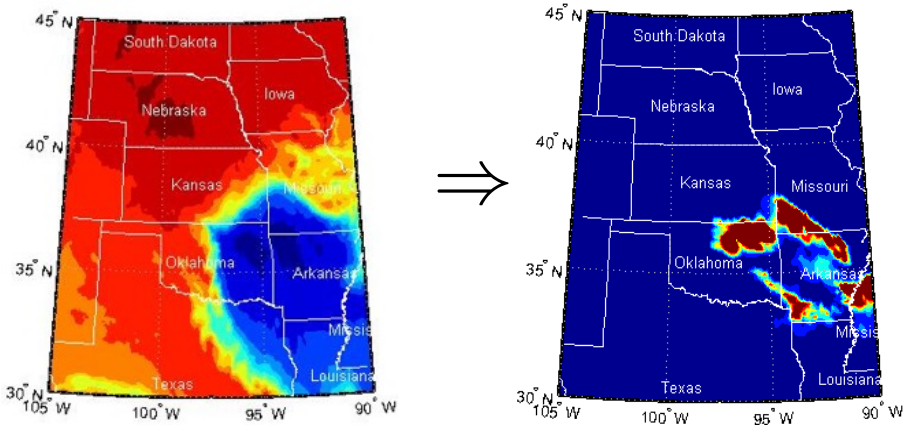
Structured prediction problems

- Given an observation x, predict structured set of targets y

Object categorization:



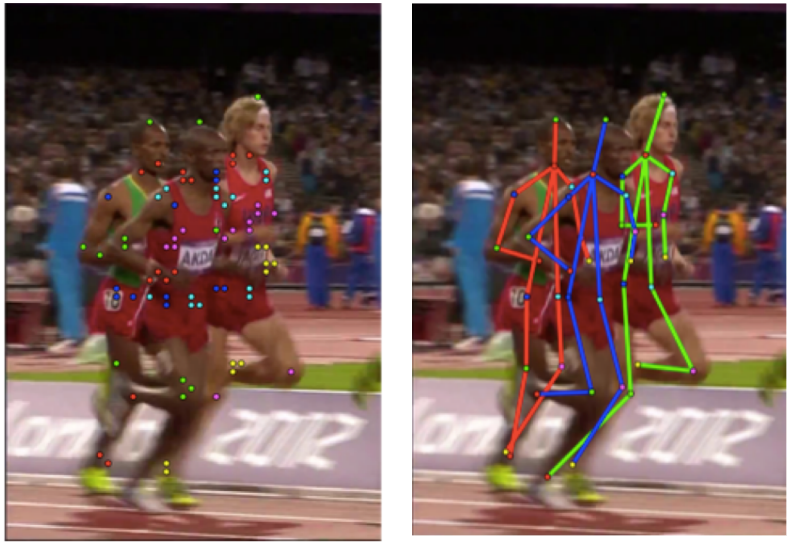
Remote sensing:



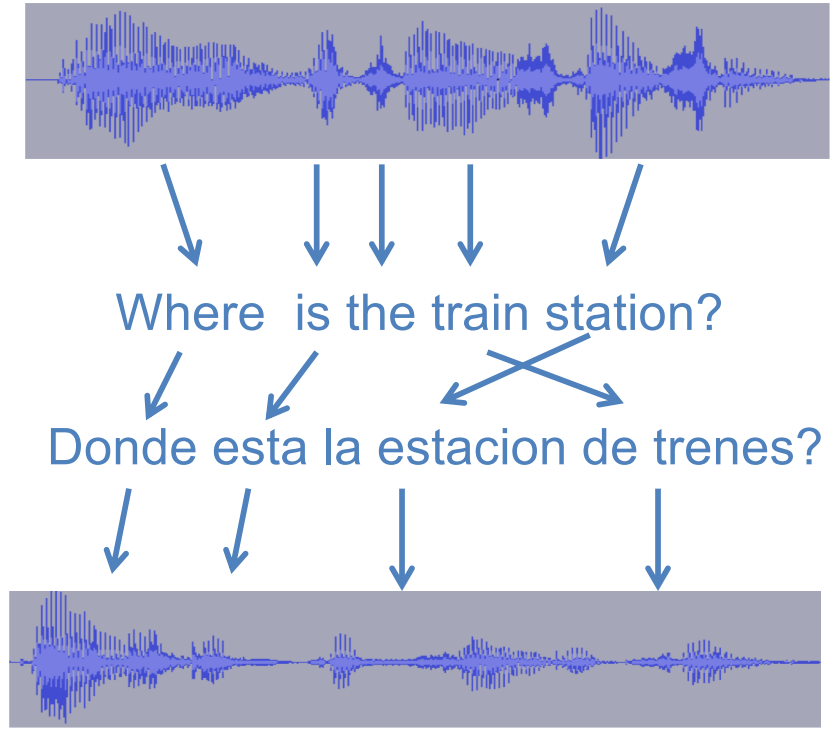
Structured prediction problems

- Given an observation x, predict structured set of targets y
- May layer multiple models capturing different aspects

Pose estimation:



Speech to text; translation:



Tools for Machine Learning

- Probability and Statistics
  - Allows computing with / about uncertainty
  - Combine multiple sources of (uncertain) information
  - Search for “simple” explanations
- Also: optimization, information theory, …

- Classes
  - CS171, Intro to AI
  - CS178, Machine Learning
  - CS177, Probability in Computer Science
  - CS175, Projects in AI
  - CS179, Graphical models
  - CS172, Neural networks & deep learning

Collaborative Filtering (Netflix)

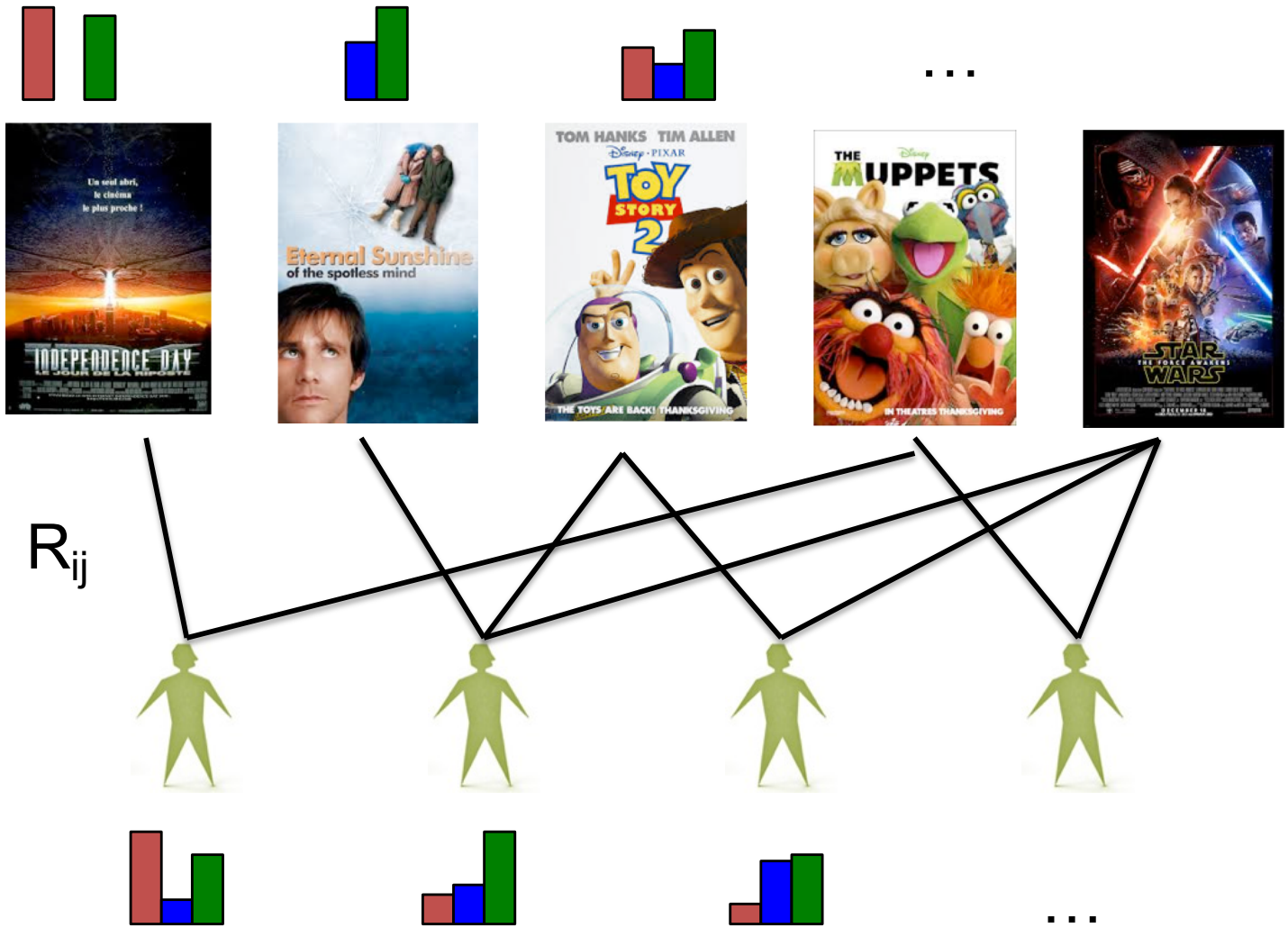
(slide from BellKor)

users

movies

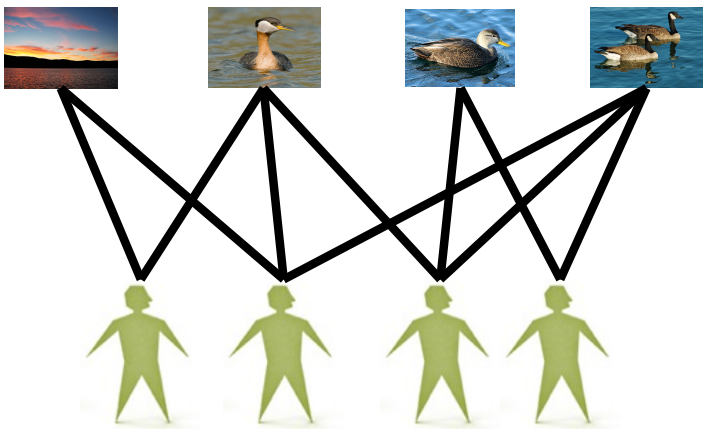
	1	2	3	4	5	6	7	8	9	10	11	12
1	1		3		?	5			5		4	
2			5	4			4			2	1	3
3	2	4		1	2		3		4	3	5	
4		2	4		5			4			2	
5			4	3	4	2					2	5
6	1		3		3			2			4	

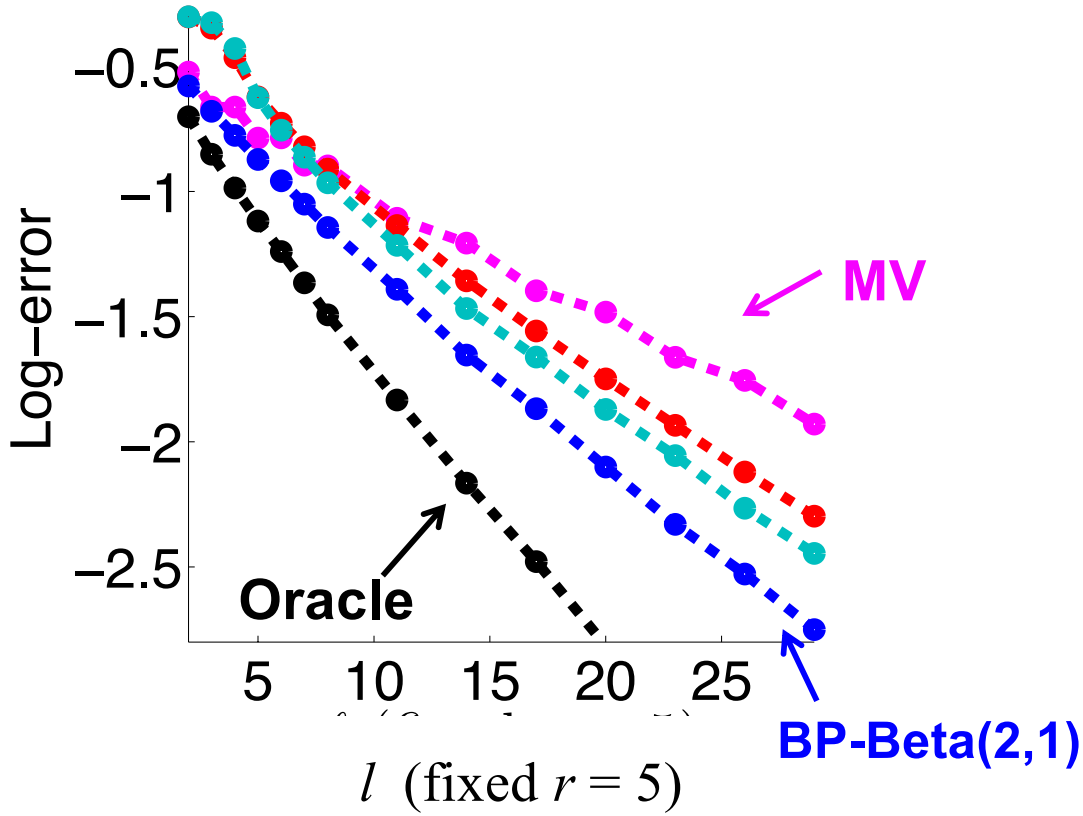
Latent variable models



Crowdsourcing

- Use "workers" to evaluate data or make predictions
  - Workers are unreliable: ask multiple workers
  - Combine results using a probabilistic model





Conclusions

- Artificial Intelligence
  - Search, planning, making decisions
- Machine learning
  - Organizing and understanding observed data
  - Finding simple representations
  - Making predictions in complex systems
  - Approximate computations for difficult problems
- Related disciplines
  - Computer vision
  - Computational biology

- Lots of great classes: 171, 177, 178, 179, 175, …
- Lots of great faculty here at UCI