data-ppf.github.io Tue Apr 9, 2019

lecture 11 of 14: 'AI reborn'

chris wiggins + matt jones, Columbia

themes for today (1995-2016)

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- 'trading zone'
  - (.vc, .com, .edu, .mil. . .)
  - ML, AI, VLDB, statistics, control theory, cognitive scientists, psychologists (e.g., MIJ), engineers
- triumph of prediction over interpretability,

historical & social context

contemporary context/modern day relevance

student observations

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- truth, esp algos

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  - opacity

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  - opacity
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- power, esp corporate

what are the new capabilities this week?

- big compute

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- big data, information platform in scale

readings: Jones, Jordan+Mitchell, Lewis-Kraus, Rudin

Jones: on companies

- {Fayyat,Gray}@MSFT

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- GOOG

Jones: on the trading zone

- database community

  The prevailing mode of decision making was that somebody would make a hypothesis, test if the hypothesis was correct, and re- peat the process. Once they had data mining tools, the decision-making process changed. Now they could use a data mining algorithm to generate all rules, and then debate which of them were valuable.

– "Rakesh Agrawal Speaks Out."

Jones: on the trading zone

- database community
- "knowledge discovery"

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Jones: on the trading zone

- database community
- "knowledge discovery"
- what is true?

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Jones: on ‘tech’

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- constraint of ‘in memory’ algorithms
- ‘performance emphasis’ (Quest)
- ‘a user is willing to wait’ (BIRCH 96)

(via Jones): why AI2.0 is not AI1.0

> *For those who were hoping that a small number of general rules could explain language, it is worth noting that language is inherently complex, with hundreds of thousands of vocabulary words and a vast variety of grammatical constructions- tions. Every day, new words are coined and old usages are modified. This suggests that we can't reduce what we want to say to the free combination of a few abstract primitives.*

– A. Halevy, P. Norvig, and F. Pereira, "The Unreasonable Effectiveness of Data," (apologies to Wigner)

Other thoughts on Jones?

Mitchell/Jordan

prior to this collaboration

> *"[Machine learning is just statistics]" –Jordan 1997: Machine Learning is the study of computer algorithms that improve automatically through experience. – Mitchell 2006: "How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes? – Mitchell*

Mitchell/Jordan

Machine learning is a discipline focused on two interrelated questions: 1. How can one construct computer systems that automatically improve through experience? and 2. What are the fundamental statistical-computational-information-theoretic laws that govern all learning systems, including computers, humans, and organizations?

Mitchell/Jordan AI1.0 v AI2.0

> *Within artificial intelligence machine learning has emerged as the method of choice. . . it can be far easier to train a system. . . than to program it*

(A sentence that would not parse for most.. See Simon 83)

M/J: echoes of history

- Learning is "improving some measure of performance" (as in engineering + optimization)

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- "Conceptually. . . searching through. . . candidate programs"

M/J: echoes of history

- Learning is "improving some measure of performance" (as in engineering + optimization)
- "Conceptually. . . searching through. . . candidate programs"
- "causal modeling" (as in Yule 1898)

M/J: rise of .com

- "algorithms. . . customize their services"

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- "algorithms. . . customize their services"
- tech as differentiator

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- "algorithms. . . customize their services"
- tech as differentiator
  - "computing architecture"

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  - "10s of 1000's of processors"

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- tech as differentiator
  - "computing architecture"
  - "10s of 1000's of processors"
  - balance "time. . . space. . . accuracy"

M/J: echoes of ethics

- "Granular, personalized. . . data"

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- "Granular, personalized. . . data"
- "minimize privacy effects"

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- “Granular, personalized. . . data”
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- “differential privacy”

M/J: echoes of ethics

- "Granular, personalized. . . data"
- "minimize privacy effects"
- "differential privacy"
- "social, legal, political framework surrounding the deployment of a a system. . . cooperative or adversarial""

M/J on ethics

As with any powerful technology, machine learning raises questions about which of its potential uses society should encourage and discourage. The push in recent years to collect new kinds of personal data, motivated by its economic value, leads to obvious privacy issues, as mentioned above. The increasing value of data also raises a second ethical issue: Who will have access to, and ownership of, online data, and who will reap its benefits? Currently, much data are collected by corporations for specific uses leading to improved profits, with little or no motive for data sharing. However, the potential benefits that society could realize, even from existing online data, would be considerable if those data were to be made available for public good.

M/J: 3 paradigms

- Supervised (main topic)

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- Supervised (main topic)
- Unsupervised

M/J: 3 paradigms

- Supervised (main topic)
- Unsupervised
- Reinforcement

other thoughts on M/J?

Lewis-Kraus on Deep Neural Networks (DNN)

Why great awakening?

LK on DNN

Google's decision to reorganize itself around A.I. was the first major manifestation of what has become an industry wide machine-learning delirium. Over the past four years, six companies in particular — Google, Facebook, Apple, Amazon, Microsoft and the Chinese firm Baidu — have touched off an arms race for A.I. talent, particularly within universities. Corporate promises of resources and freedom have thinned out top academic departments. It has become widely known in Silicon Valley that Mark Zuckerberg, chief executive of Facebook, personally oversees, with phone calls and video-chat blandishments, his company's overtures to the most desirable graduate students. Starting salaries of seven figures are not unheard-of. Attendance at the field's most important academic conference has nearly quadrupled.

LK on history

- Turing 1950

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- “brittle” “rules”

LK on history

- Turing 1950
- “brittle” “rules”
- GIGO + discrimination

Other thoughts on Jones, MIJ/TM, LK?

Rudin

“High-Stakes” Explainable vs Interpretable

- “healthcare”, “justice”, “parole”,

“High-Stakes” Explainable vs Interpretable

- “healthcare”, “justice”, “parole”,
- what is difference between explainable and interpretable?

Interpretable

- no universal, but examples

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- no universal, but examples
  - sparse

Interpretable

- no universal, but examples
  - sparse
  - monotonic

Interpretable

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  - sparse
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  - additivity

Interpretable

- no universal, but examples
  - sparse
  - monotonic
  - additivity
- “can never be a single definition”

why black box?

- money

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  1. prediction-interpretability tradeoff

why black box?

- money
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  2. explainable is “faithful”

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  3. explanations are complete and make sense

why black box?

- money
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  1. prediction-interpretability tradeoff
  2. explainable is “faithful”
  3. explanations are complete and make sense
  4. models contain information outside database

What does this look like as math?

- optimization

$$L = \frac{1}{n} \sum_i [i \text{ is misclassified}] + \lambda \text{size}(f)$$

What does this look like as math?

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- what sets λ?

contemporary article(s) on the themes

power and principles

how did this capability rearrange power? who can now do what, from what, to whom?

role of rights, harms, justice?

foreshadowing data for Thursday

reminder of themes/big main takeaways

themes

up next