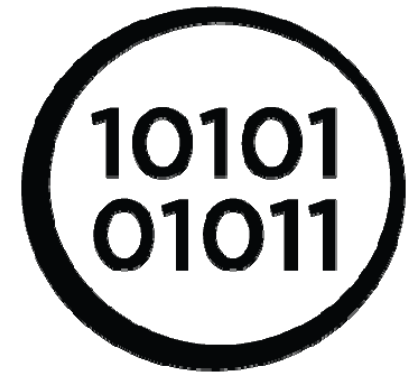


# Big Data, Analytics, and the True Power of A.I.



DATA

@David\_Rogers

Faculty Director, Digital Business Strategy

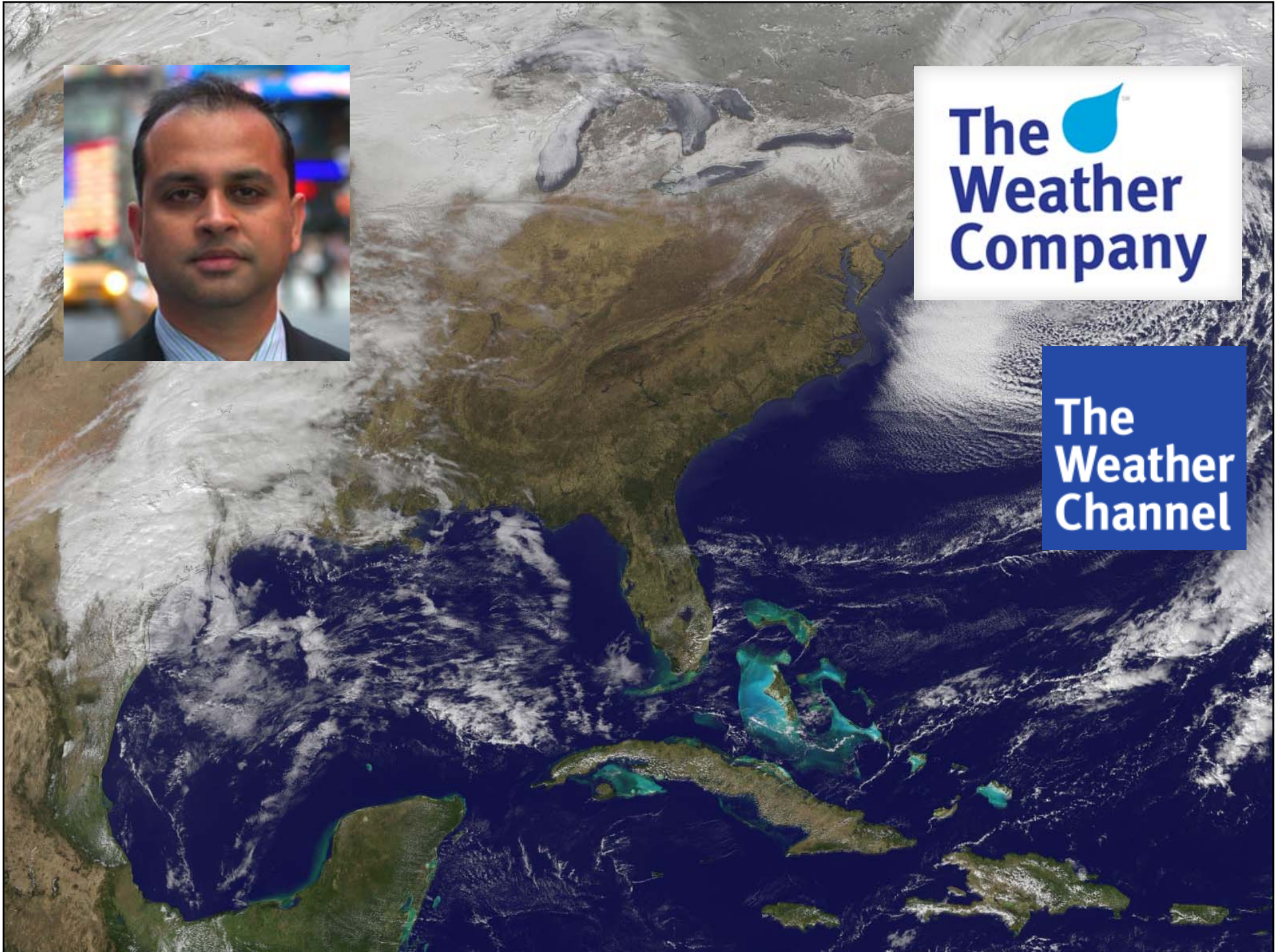
Columbia Business School Exec Ed

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The   
Weather  
Company

The  
Weather  
Channel







CAESARS  
ENTERTAINMENT®



  
**custora**







Camden  
Coalition  
of Healthcare Providers

*Dr. Jeffrey Brenner*

**Healthcarehotspotting.com**

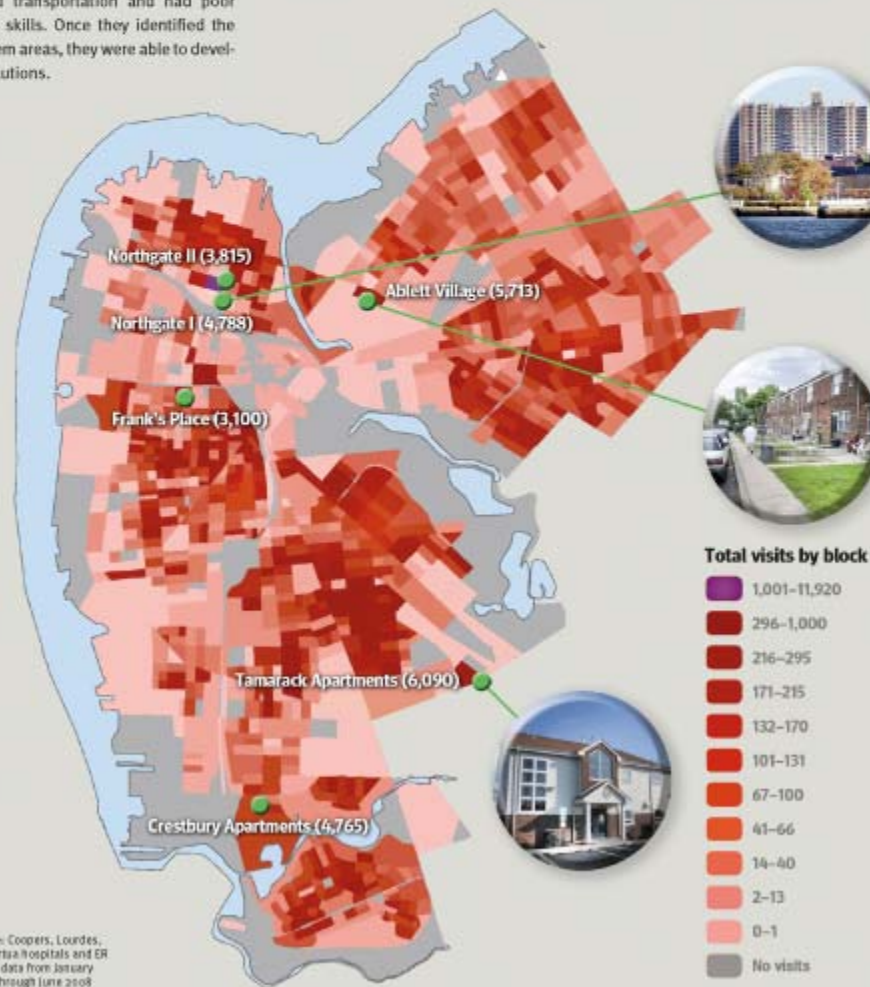


## Camden group studied inpatient and ED visits block by block

After poring through six years of claims data, The Camden Coalition for Healthcare Providers discovered some amazing trends. Data revealed that a single public housing development was responsible for \$12 million in health care costs from 2002 to 2008. They also learned that many of the high utilizers were homeless, lacked transportation and had poor social skills. Once they identified the problem areas, they were able to develop solutions.

Inpatient and ED visits in three Camden, N.J., hospitals (2005–2007)

	Visits	Patients	Charges	Receipts	Collected
<b>Cooper Hospital</b>	3,172	749	\$42,144,097	\$4,994,658	12%
<b>Lourdes Hospital</b>	811	337	\$7,848,809	\$1,028,661	13%
<b>Virtua Hospital</b>	805	331	\$1,742,467	\$345,092	20%
<b>2005</b>	838	370	\$10,834,420	\$1,269,373	12%
<b>2006</b>	738	355	\$6,867,995	\$881,549	13%
<b>2007</b>	790	369	\$7,997,262	\$901,181	11%
<b>ED visits</b>	3,882	978	\$6,150,592	\$864,019	14%
<b>Inpatient visits</b>	906	408	\$45,584,781	\$5,504,342	12%
<b>Total</b>	<b>4,788</b>	<b>1,070</b>	<b>\$51,734,374</b>	<b>\$6,368,361</b>	<b>26%</b>



Source: Cooper, Lourdes, and Virtua hospitals and ER billing data from January 2002 through June 2008

Every business needs an  
explicit data strategy

# Key types of data for business strategy

<b>Data Type</b>	<b>Examples</b>	<b>Utility</b>
Business process data	<ul style="list-style-type: none"><li>• Inventory &amp; supply chain</li><li>• Sales</li><li>• Billing</li><li>• Human resources</li></ul>	Manage & optimize business operations, reduce risk, provide external reporting
Customer data	<ul style="list-style-type: none"><li>• Purchases</li><li>• Behaviors &amp; interactions</li><li>• Comments &amp; reviews</li><li>• Demographics</li><li>• Survey responses</li></ul>	Provide a complete picture of the customer and allow for more relevant and valuable interactions
Product or service data	<ul style="list-style-type: none"><li>• Maps data (for a Google)</li><li>• Business data (for Bloomberg)</li><li>• Weather data (for TWC)</li></ul>	Deliver the core value proposition of the business's product or service



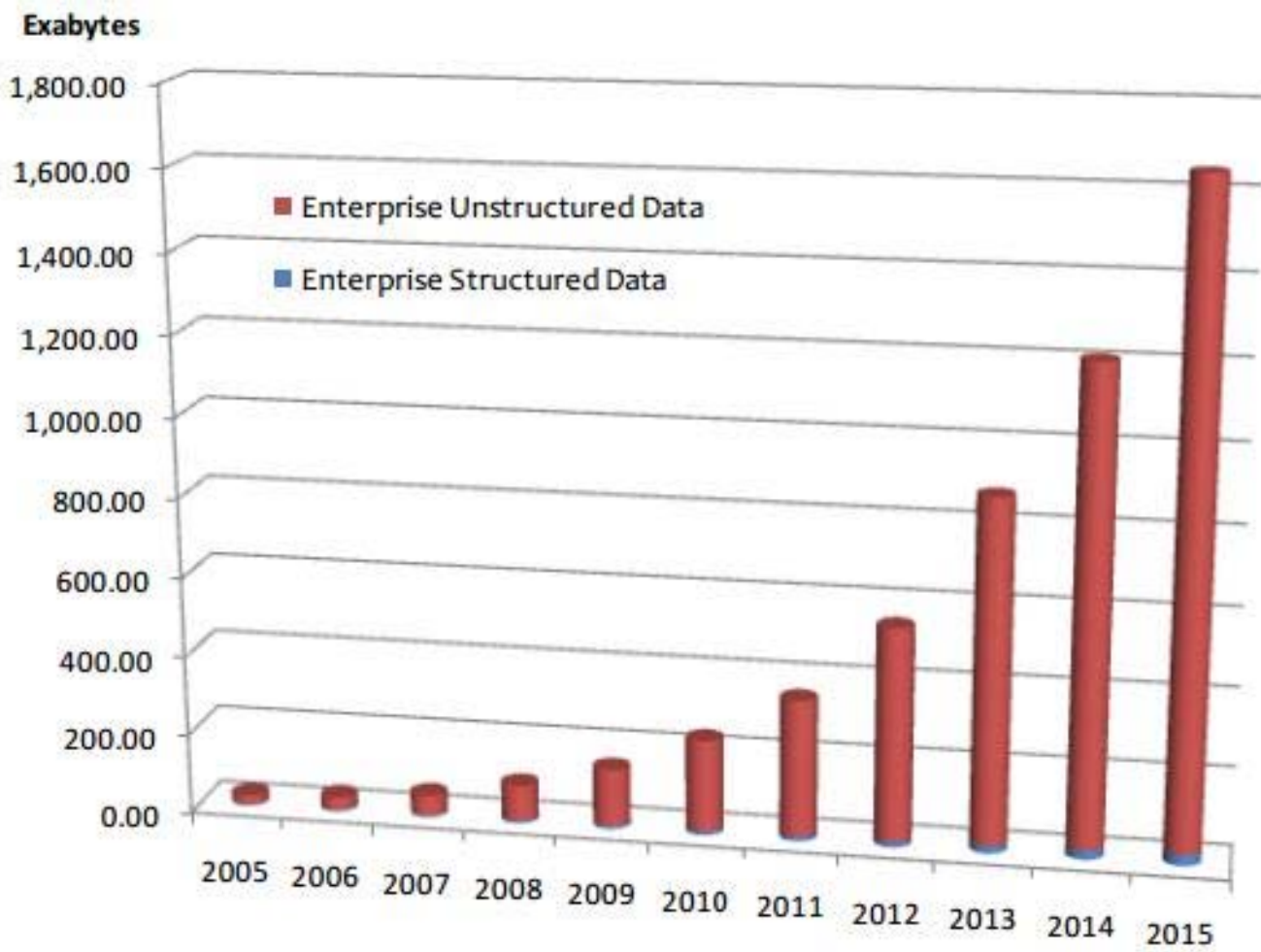
## Guiding principles

- Combine data across silos
- Gather diverse new data types
- Watch what customers do, not what they say
- Develop a 360-degree picture of your business
- Use data as a predictive layer in decision-making
- Apply data to new product innovation

what about

**BIG**

data?





New sources of  
“unstructured” data

# Social data



# Mobile data





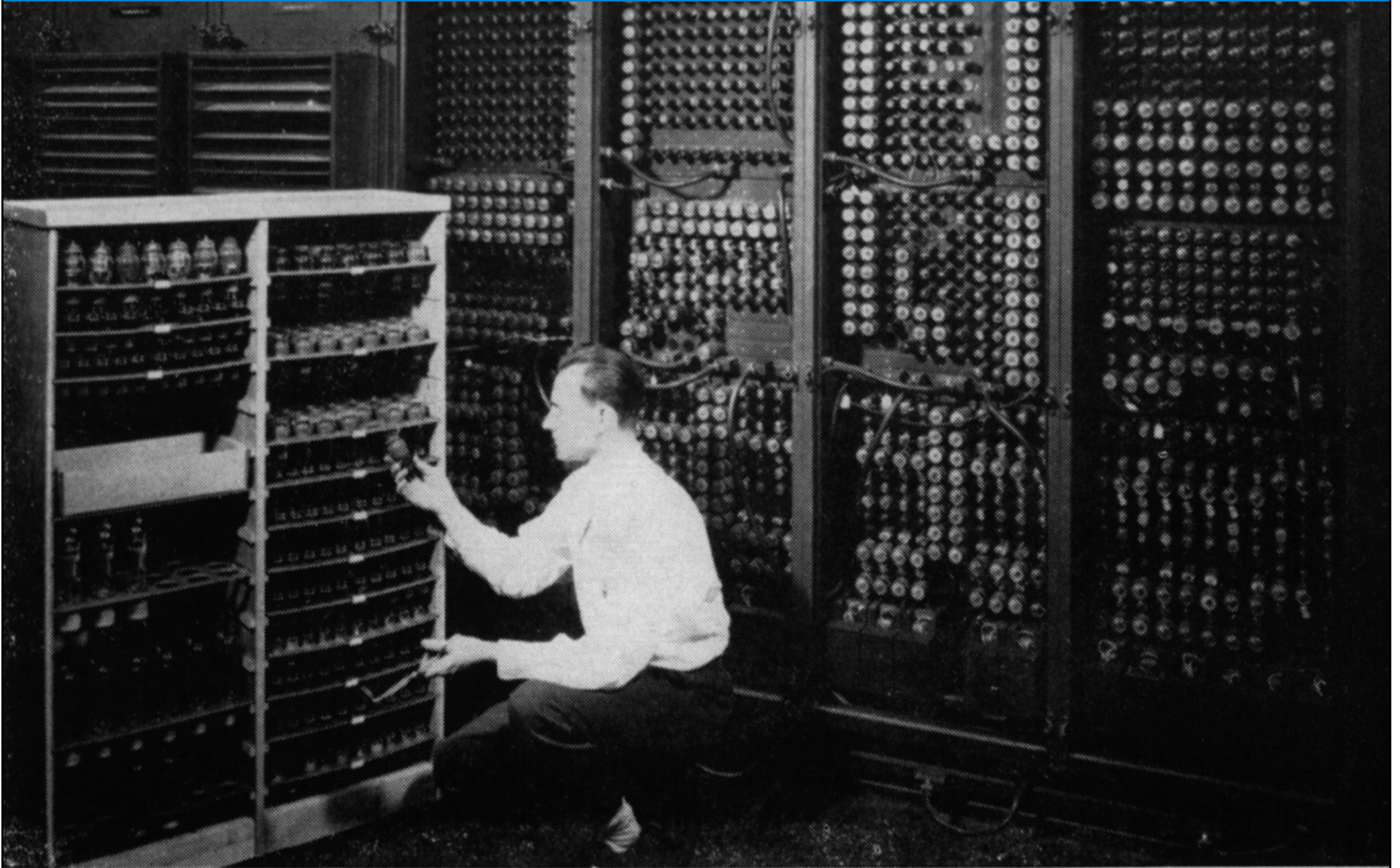
# “Internet of Things” data



# New tools for unstructured data



# Storage & processing power



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.



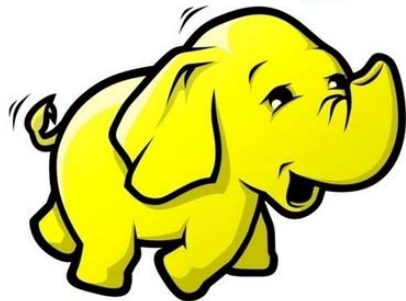
# Everything in the cloud

What can I help you with?



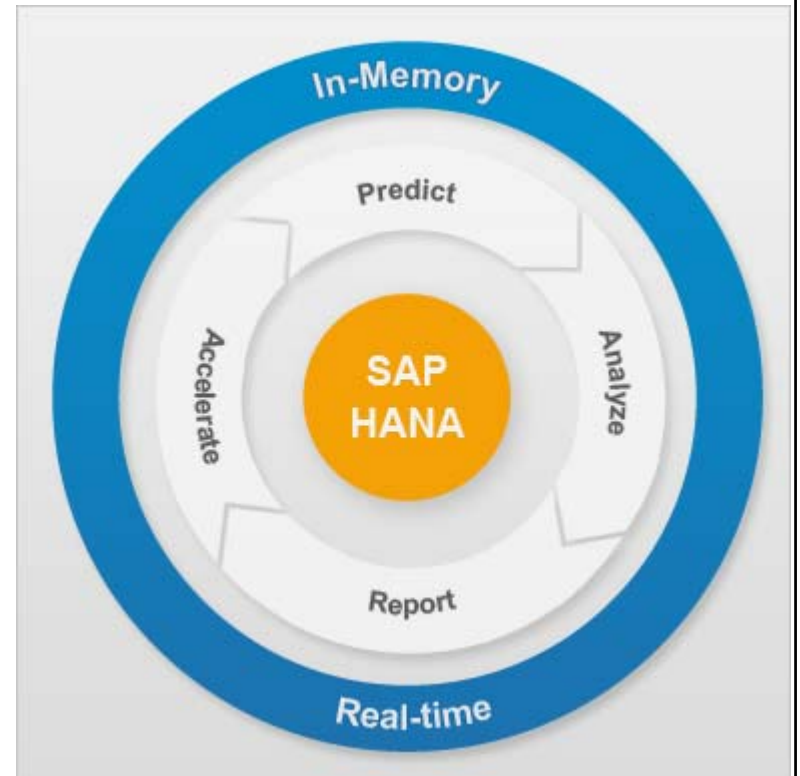
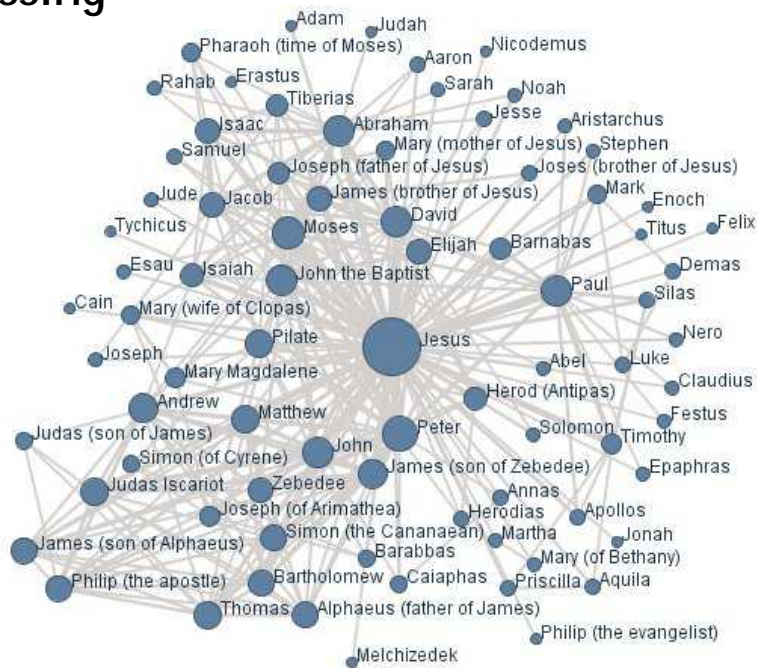
# New analytic tools

## *hadoop*



Distributed processing

Text mining



In-memory computing

What do you see?





“A.I.” - what do you think of?



“Alexa turn on Movie Night”

“Alexa, turn on Kids’ Bedtime .”

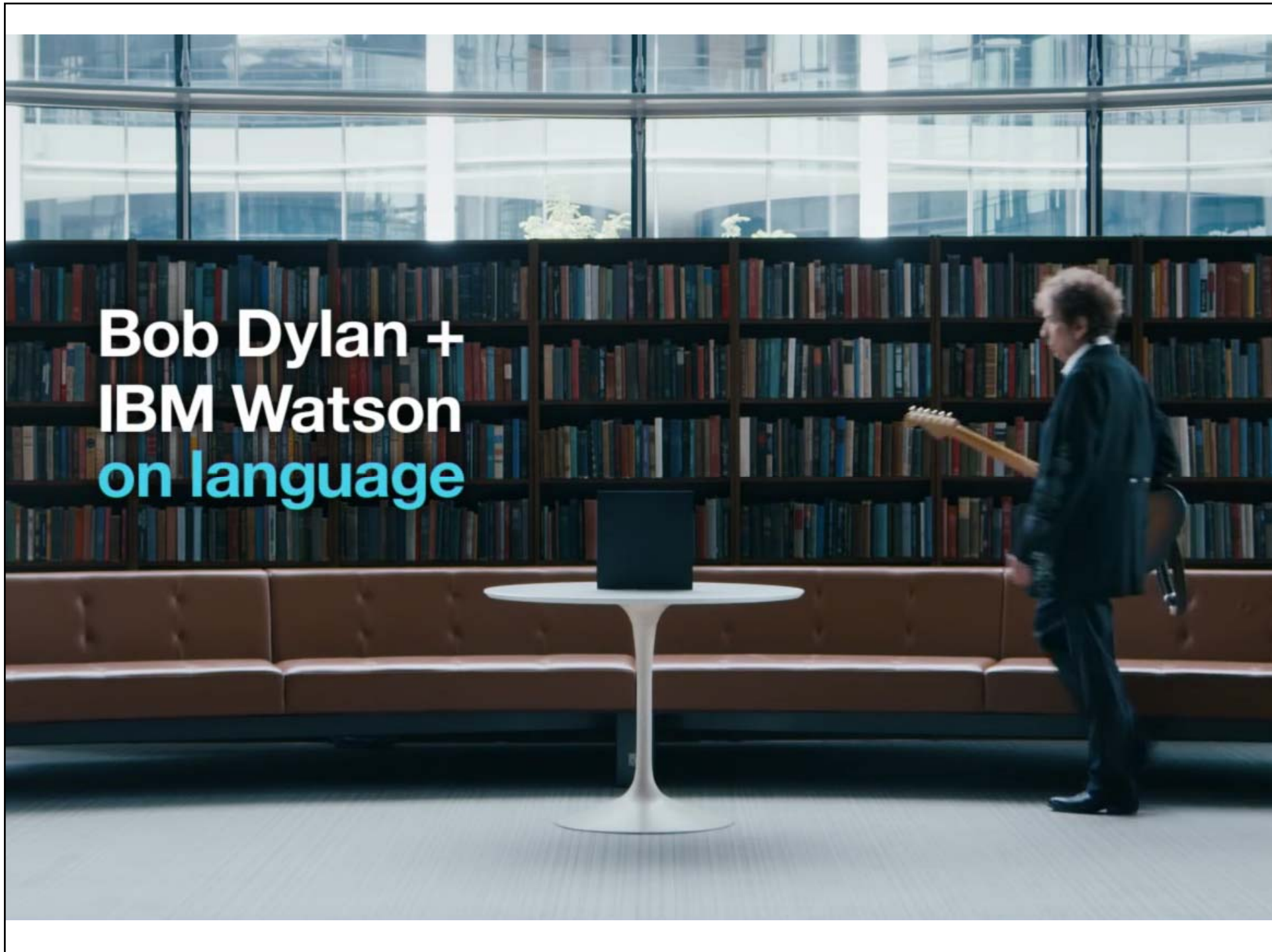


“Alexa, turn on My Morning Motivation Routine.”

“I’m outta here. Alexa, turn on the Leave Home Routine.”



**Bob Dylan +  
IBM Watson  
on language**





“We should be very careful about artificial intelligence... [it may be] our biggest existential threat.”

“With artificial intelligence, we are summoning the demon.”

**- Elon Musk**





1. What is A.I.?

2. What is changing in A.I.? (ML, DL, NLP...)

3. How does A.I. impact business?

4. What are the challenges & ethical questions A.I. is raising?

5. Who will thrive in an A.I. world?

1. What is A.I.?

*Artificial intelligence:*

A system or computer program that processes information and produces outcomes similar to human learning, decision-making, and problem solving.



```
UP A TREE SCORE: 0/10
LIT FOREST. THE PATH HEADS NORTH-SOUTH
HERE. ONE PARTICULARLY LARGE TREE WITH
SOME LOW BRANCHES STANDS AT THE EDGE OF
THE PATH.
>
UP A TREE
YOU ARE ABOUT 10 FEET ABOVE THE GROUND
NESTLED AMONG SOME LARGE BRANCHES. THE
NEAREST BRANCH ABOVE YOU IS ABOVE YOUR
REACH.
BESIDE YOU ON THE BRANCH IS A SMALL
BIRD'S NEST
IN THE NEST
A BIRD'S
EYES ARE
APPARENTLY WITH
CHILDREN'S
WITH FINE GOLD
LAPIS LAZULI
DELICATE, THIS
CLOSED, THE EGG
FRAGILE.
```



# The "A.I. Effect"

"Any sufficiently advanced technology is indistinguishable from magic."

*-Arthur C. Clarke*

"Any sufficiently advanced software will be perceived as A.I."

*-David L. Rogers*

# Where would you put "A.I."?

Abstract



1. Computing

A.I. (scientists)

2. P2P computing

"A.I." (business usage)

3. Blockchain

4. Cryptocurrency

5. Bitcoin

Concrete

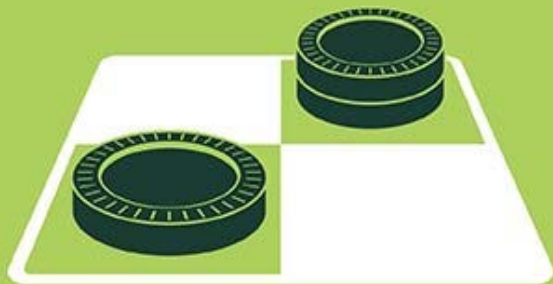


2. What is changing in A.I.? (ML, DL, NLP...)

# AI origins... "AI winter" ... AI boom

## ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



## MACHINE LEARNING

Machine learning begins to flourish.



## DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

1990's

2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

## Machine Learning:

*Coined by Arthur Samuel, c. 1959*

A field of computer science that gives computer systems the ability to "learn" (i.e., progressively improve performance on a specific task) with data, without being explicitly programmed.

## Artificial Intelligence

## Machine Learning

## Deep Learning

The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data.

A subset of AI that includes abstruse statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning

Any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning)



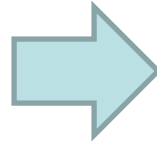
## What kind of patterns / what kind of data?

Visual patterns,  
object recognition



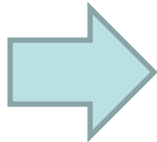
- Machine vision

Audio patterns



- Voice recognition

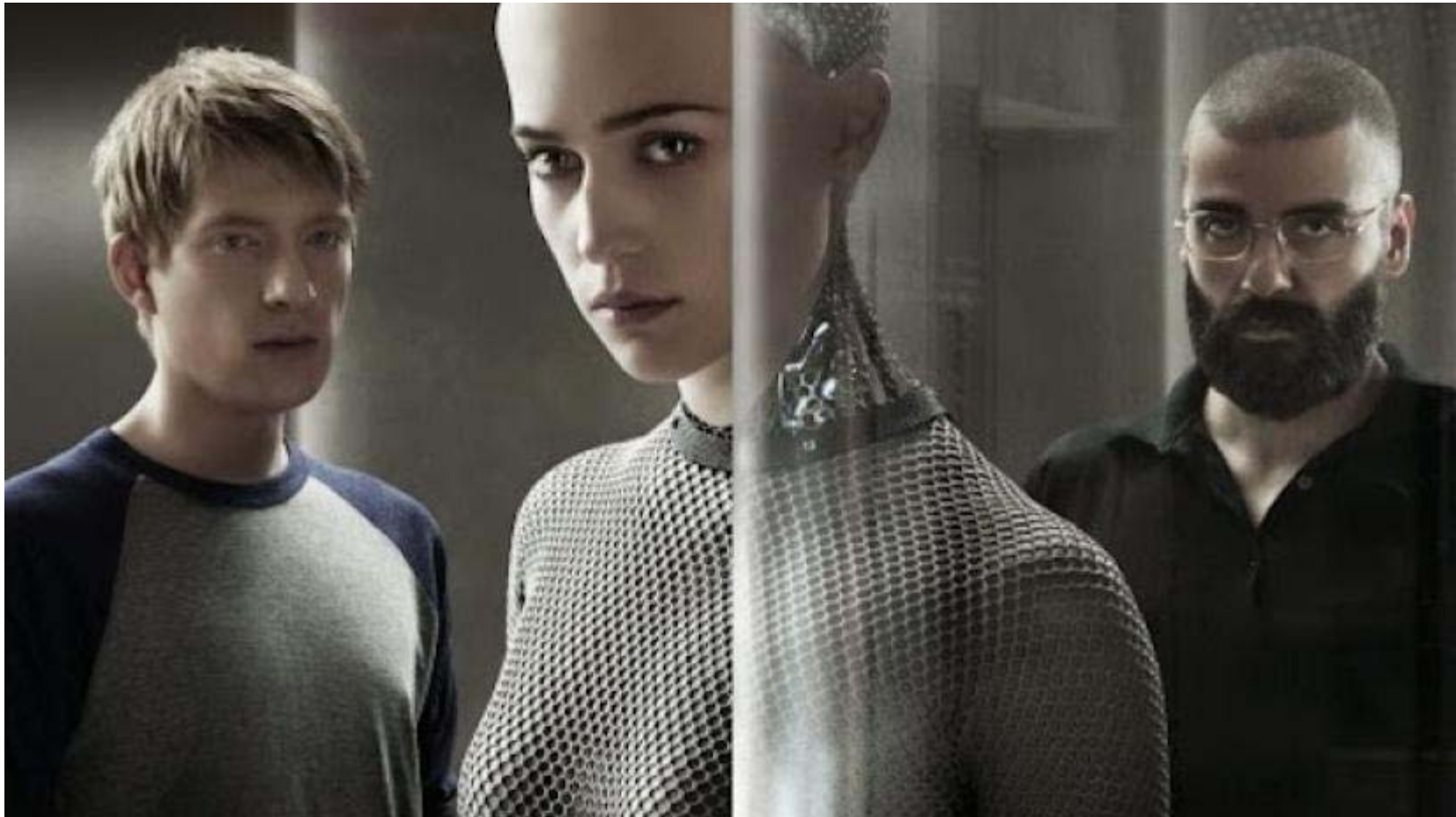
Semantic patterns



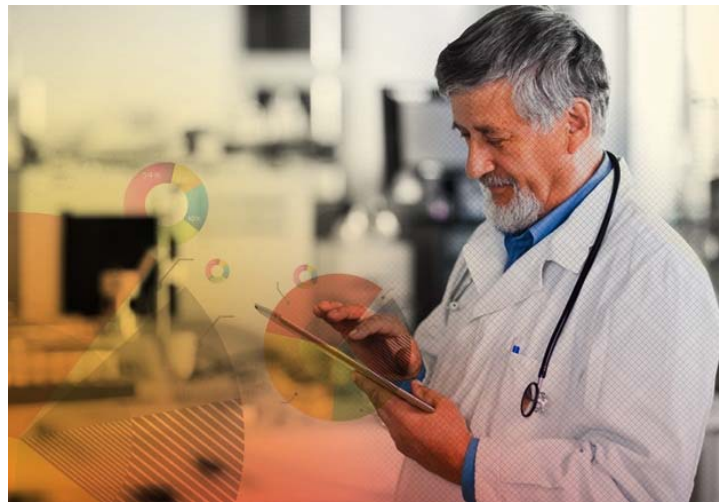
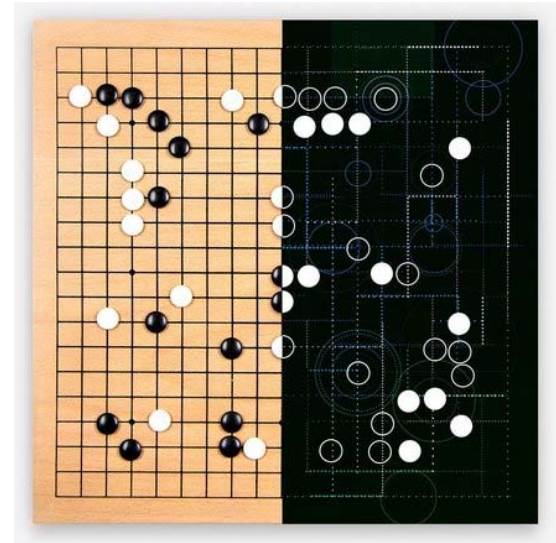
- Natural language processing

3. How does A.I. impact business?

# Artificial General Intelligence (Fiction)



# Artificial Narrow Intelligence (Fact)





## What's the use case?

“Machine learning drives our algorithms for demand forecasting, product search ranking, product and deals recommendations, merchandising placements, fraud detection, translations, and much more.

Though less visible, much of the impact of machine learning will be of this type -- **quietly but meaningfully improving core operations.**”

- Jeff Bezos, 2017 annual letter to shareholders

## Consumer cases: familiar

- **Search results / autocomplete**  
(Google, Bing, Baidu)
- **Voice recognition**  
(dictation apps, voice entry)
- **Language translation**  
(Google Translate)
- **Predictive content**  
(Spotify playlist, FB NewsFeed, Google cards)

## Business cases: familiar

- **Advertising**  
(Google & Facebook ad bidding, targeting, lookalikes)
- **Fraud detection**  
(credit cards)
- **Sales & inventory forecasting**
- **Managing investing portfolios**  
(robo-advisor, robo-index funds)

## Consumer cases: emerging

- Image sorting
- Visual search
- Text recognition
- Self-optimizing IoT
- Voice assistants
- Driverless cars?



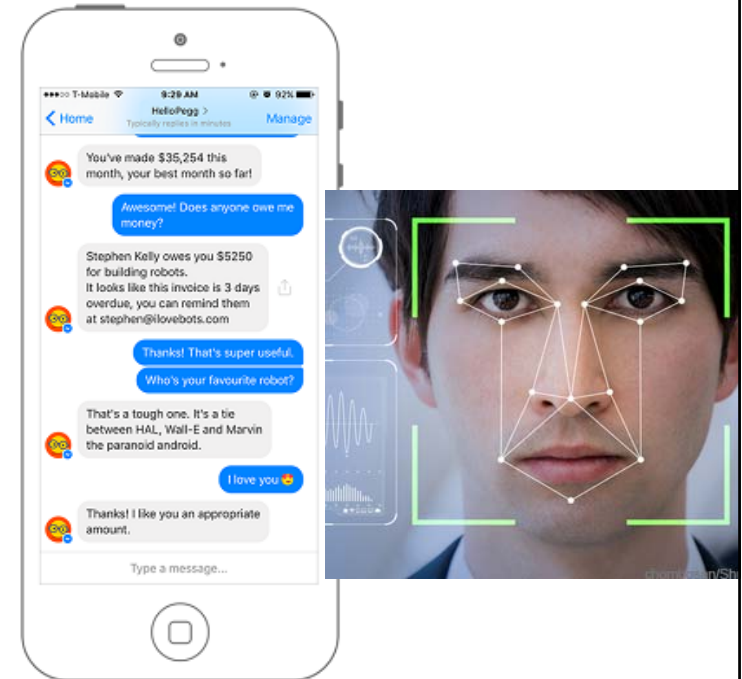
Hey Cortana





# Business cases: emerging

- Marketing mix modeling
- Customer service (chatbots)
- Facial recognition
- Medical imaging diagnostics
- Loan default prediction
- Legal discovery
- Lawsuits
- Robotics



## Spot the pattern?



The Times Sharply Increases Articles Open for Comments, Using Google's Technology



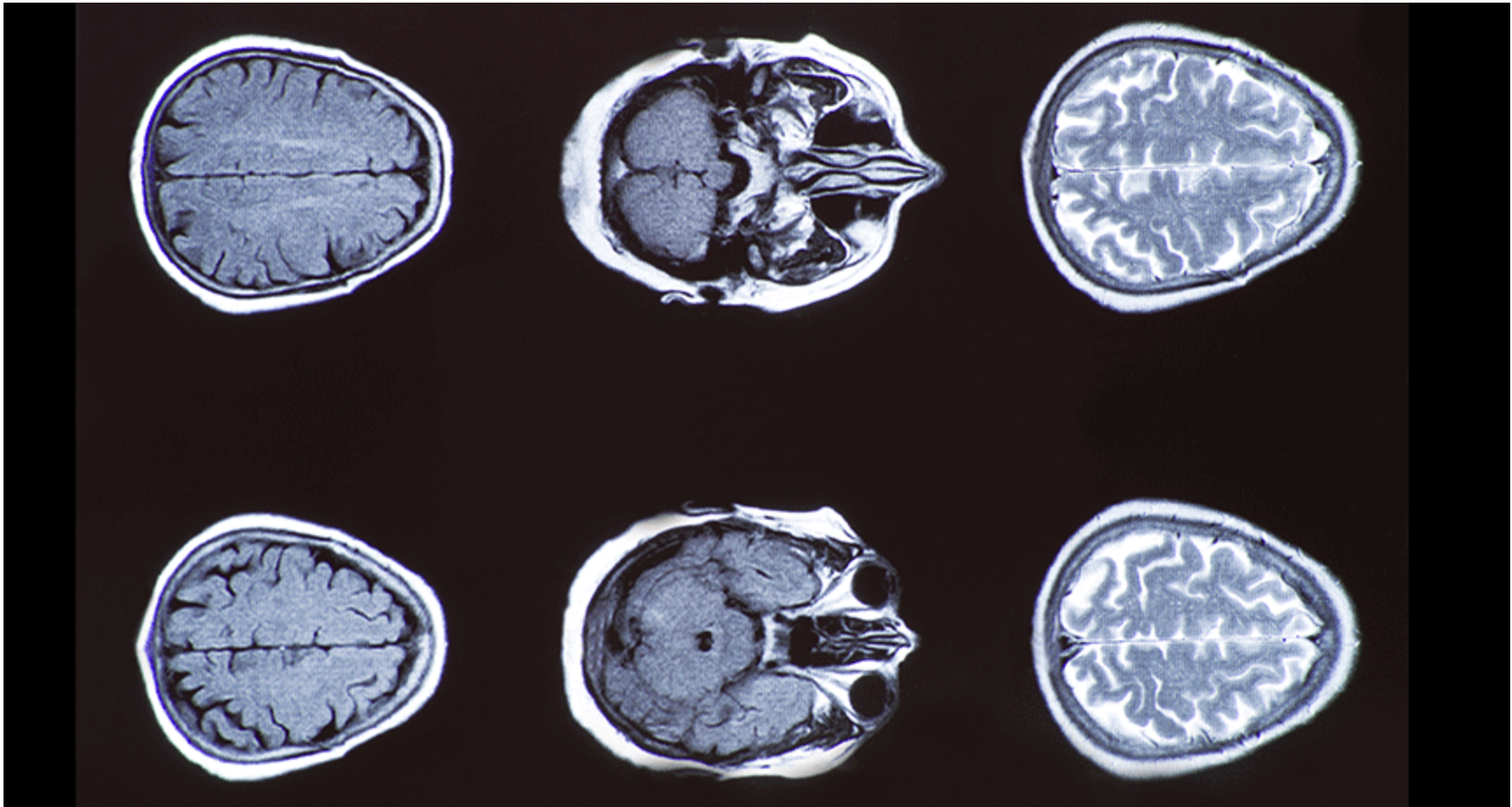
Unilever

**In Unilever's Radical Hiring Experiment, Resumes Are Out, Algorithms Are In**

To diversify its candidate pool, the company relies on software to sort applicants and targets potential hires on their smartphones

4. What are the challenges & ethical questions A.I. is raising?

# Quality & quantity of data to train on





Can you verify your results?



# Fairness & bias in data and algorithms

MIT  
Technology  
Review

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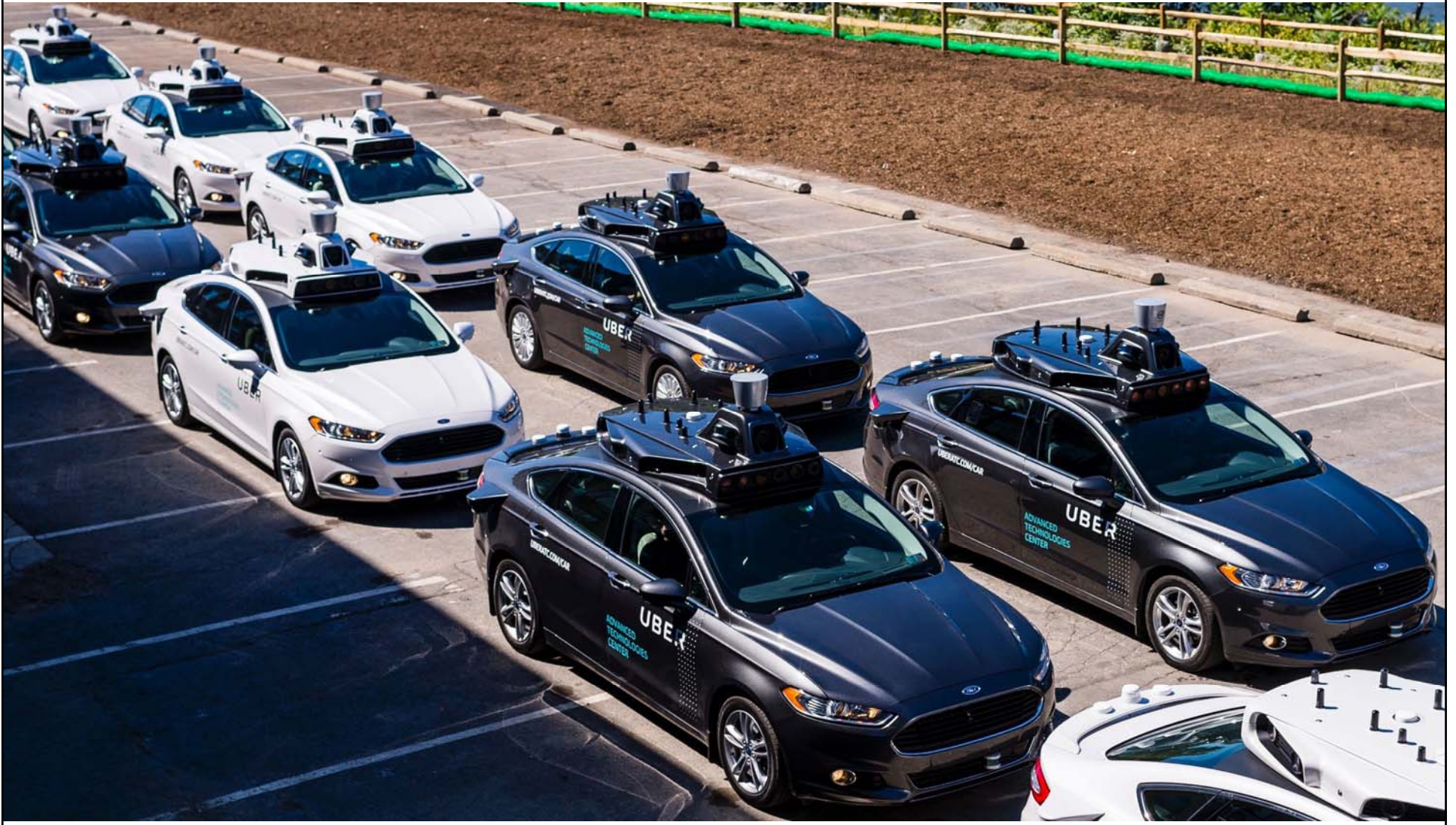
## Chicago's Experiment in Predictive Policing Isn't Working



Facebook reinstates Vietnam photo after outcry over censorship

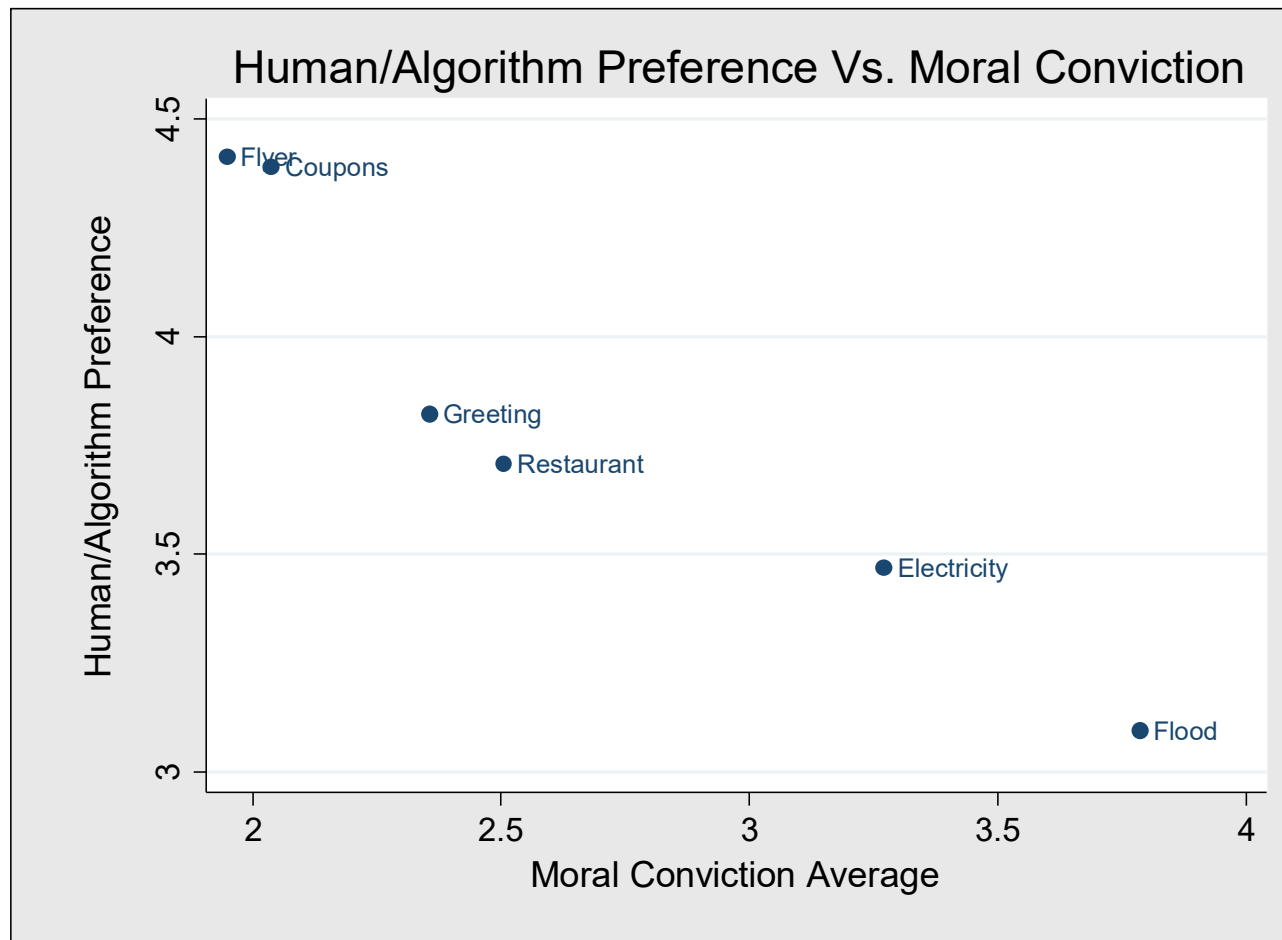


What choices are we *willing* to let non-human systems make?



# Algorithm aversion in moral domains

-- Berkeley Dietvorst and Dan Bartels (U. Chicago)



Correlation =  $-.951$  ( $p=.0035$ )





LOW moral implications =  
HIGH willingness to use algorithms

HIGH moral implications =  
LOW willingness to use algorithms





# Machine learning & the “black box” problem

## Career of the Future: Robot Psychologist

Engineers are using cognitive psychology to figure out how AIs think and make them more accountable

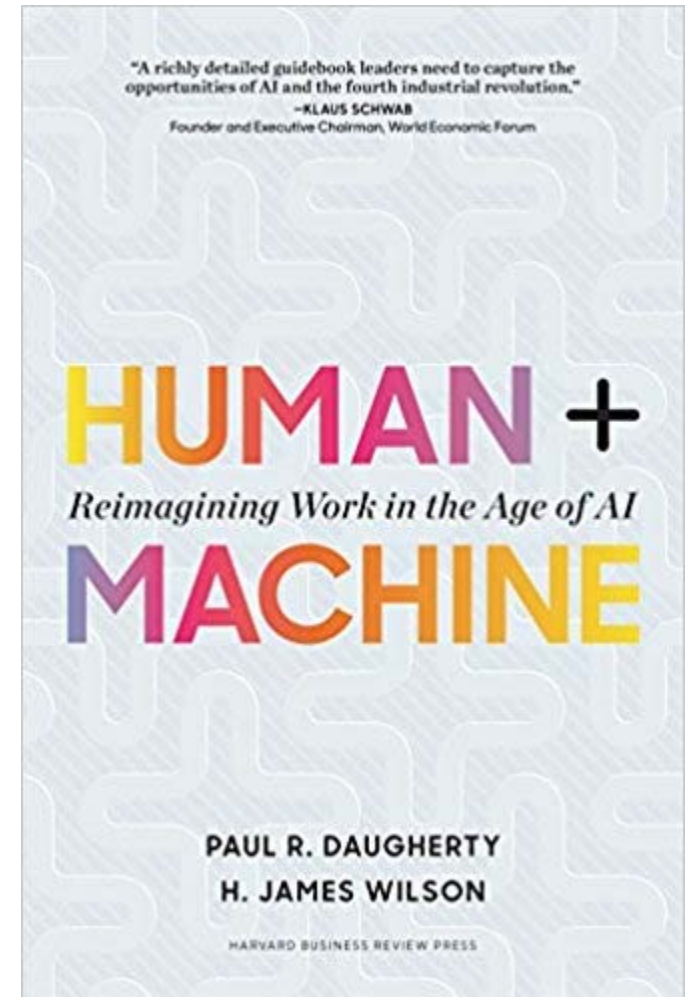
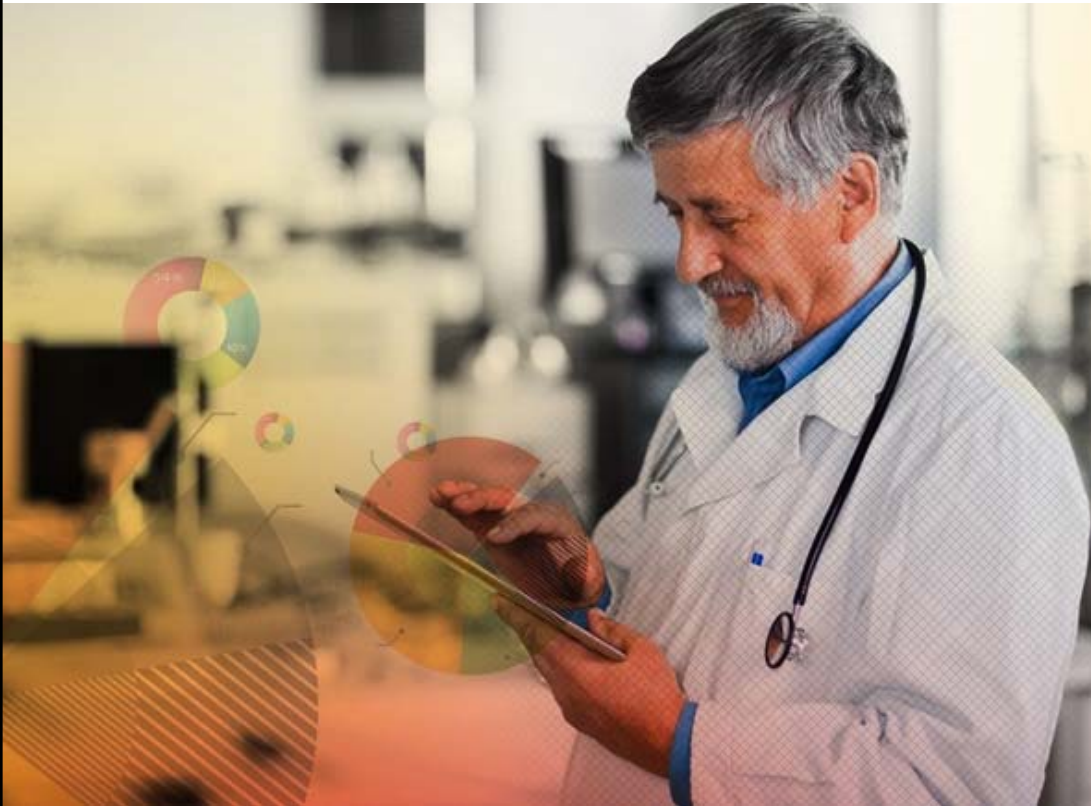


5. Who will thrive in an A.I. world?

## 3 Things You Need for A.I.

- Data
- Algorithms (open source)
- Computing power (open via cloud)

# The future of work: AI + Human



“Machines are for answers.  
Humans are for questions.”

- Kevin Kelly



Questions?