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

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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 2001 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)

<table>
<thead>
<tr>
<th></th>
<th>Visits</th>
<th>Patients</th>
<th>Charges</th>
<th>Receipts</th>
<th>Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper Hospital</td>
<td>3,172</td>
<td>749</td>
<td>$42,144,097</td>
<td>$4,994,658</td>
<td>12%</td>
</tr>
<tr>
<td>Lourdes Hospital</td>
<td>811</td>
<td>337</td>
<td>$78,488,809</td>
<td>$1,028,661</td>
<td>13%</td>
</tr>
<tr>
<td>Virtua Hospital</td>
<td>805</td>
<td>331</td>
<td>$1,742,467</td>
<td>$345,092</td>
<td>20%</td>
</tr>
<tr>
<td>2005</td>
<td>838</td>
<td>370</td>
<td>$10,834,420</td>
<td>$1,269,373</td>
<td>12%</td>
</tr>
<tr>
<td>2006</td>
<td>738</td>
<td>355</td>
<td>$6,867,995</td>
<td>$891,549</td>
<td>13%</td>
</tr>
<tr>
<td>2007</td>
<td>790</td>
<td>369</td>
<td>$7,997,262</td>
<td>$901,181</td>
<td>11%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ED visits</th>
<th>Inpatient visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3,082</td>
<td>970</td>
</tr>
<tr>
<td></td>
<td>$6,150,592</td>
<td>$864,019</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total visits by block</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,001–11,920</td>
</tr>
<tr>
<td>296–1,000</td>
</tr>
<tr>
<td>176–295</td>
</tr>
<tr>
<td>141–175</td>
</tr>
<tr>
<td>132–170</td>
</tr>
<tr>
<td>101–131</td>
</tr>
<tr>
<td>67–100</td>
</tr>
<tr>
<td>61–66</td>
</tr>
<tr>
<td>15–60</td>
</tr>
<tr>
<td>2–13</td>
</tr>
<tr>
<td>0–1</td>
</tr>
<tr>
<td>No visits</td>
</tr>
</tbody>
</table>

Source: Cooper, Lourdes, and Virtua hospitals and ED billing data from January 2002 through June 2008.
Every business needs an explicit data strategy
## Key types of data for business strategy

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Examples</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business process data</td>
<td>• Inventory &amp; supply chain</td>
<td>Manage &amp; optimize business operations, reduce risk, provide external reporting</td>
</tr>
<tr>
<td></td>
<td>• Sales</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Billing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Human resources</td>
<td></td>
</tr>
<tr>
<td>Customer data</td>
<td>• Purchases</td>
<td>Provide a complete picture of the customer and allow for more relevant and valuable interactions</td>
</tr>
<tr>
<td></td>
<td>• Behaviors &amp; interactions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Comments &amp; reviews</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Demographics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Survey responses</td>
<td></td>
</tr>
<tr>
<td>Product or service data</td>
<td>• Maps data (for a Google)</td>
<td>Deliver the core value proposition of the business’s product or service</td>
</tr>
<tr>
<td></td>
<td>• Business data (for Bloomberg)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Weather data (for TWC)</td>
<td></td>
</tr>
</tbody>
</table>
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
Mobile data
“Internet of Things” data
New tools for unstructured data
Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.
Everything in the cloud
New analytic tools

Hadoop

Distributed processing

Text mining

In-memory computing

SAP HANA

In-Memory

predict

Analyze

Report

Real-time
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.
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...
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.
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.

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

Artificial Intelligence
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
- Audio patterns
- Semantic patterns

• Machine vision
• Voice recognition
• Natural language processing
3. How does A.I. impact business?
Artificial General Intelligence (Fiction)
Artificial Narrow Intelligence (Fact)
“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?
Business cases: emerging

- Marketing mix modeling
- Customer service (chatbots)
- Facial recognition
- Medical imaging diagnostics
- Loan default prediction
- Legal discovery
- Lawsuits
- Robotics
The Times Sharply Increases Articles Open for Comments, Using Google’s Technology

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

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
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?