What big data means for the insurance industry

better decisions, customer-centric innovation

Jim Guszcza
Chris Stehno
IAAA
February 26, 2019
Two overdue sciences

**Big data**

The term itself is vague, but it is getting at something that is real... Big Data is a tagline for a process that has the potential to transform everything.

— Jon Kleinberg, Cornell University
Two overdue sciences

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Choice architecture

Many programmes and services are designed not for the brains of humans but of Vulcans. Thanks in large part to Kahneman and his many collaborators pupils and acolytes, this can and will change.

— Rory Sutherland, Ogilvy Mather
A little word on big data
Three definitions of big data

1. Data sets with sizes beyond the capability of standard IT tools to capture, process, and analyze in reasonable time frames.
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2. Data with high Volume, Velocity, Variety
   - Huge datasets
   - ... emanating continuously from smart phones, sensors, cameras, GPS devices, computers, TVs, ...
   - ... involving all manner of numeric, text, photographic data
Three definitions of big data

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3. “Anything that doesn’t fit in Excel”
The city of New York does actuarial prediction big data

Big Data in the Big Apple

How New York’s first “director of analytics” revolutionized the city’s building inspections.

By Viktor Schönberger and Kenneth Cukier

A new way to figure out which old buildings are most at risk.
The rebirth of AI
‘AI IS THE NEW ELECTRICITY’

“Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don’t think AI will transform in the next several years.”

Andrew Ng
Former chief scientist at Baidu, Co-founder at Coursera
The second machine age
Neural networks in the 1990s

Convolutional Neural Networks are designed to recognize visual patterns directly from pixel images with minimal preprocessing. They can recognize patterns with extreme variability (such as handwritten characters), and with robustness to distortions and simple geometric transformations.
Neural networks today

Figure 2. Outline of the DeepFace architecture. A front-end of a single-convolution-pooling-convolution filtering on the rectified input, followed by three locally-connected layers and two fully-connected layers. Colors illustrate feature maps produced at each layer. The net includes more than 129 million parameters, where more than 95% come from the local and fully connected layers.
Reframing big data
Data science – the classic example

(CREDIT SCORE FACTORS)

(This we know)
A more striking correlation

CREDIT SCORE FACTORS

- On-time payments
- Capacity used
- Length of credit history
- Types of credit used
- Past credit applications

(!)

NOTICE OF LOAN DEFAULT

(!)
More food for thought
Hard to swallow
Digital breadcrumbs and personalization

Our lives are digitally mediated. We continually leave behind digital breadcrumbs about:

- Who we email, call
- Our communication style
- How we drive
- What we buy
- What we eat
- What we read, watch
- How we sleep
- How we exercise
- What we think

The Personalized and the Personal
Socially Responsible Innovation through Big Data

By James Guszcza, David Schweidel and Shantanu Dutta
Psychologist Michal Kosinski developed a method to analyze people in minute detail based on their Facebook activity. Did a similar tool help propel Donald Trump to victory? Two reporters from Zurich-based Das Magazin went data-gathering.
Customer-centric uses of big data

The role of applied behavioral economics
Customer-centricity

We’ve become a truly customer-centric company...

We need to understand how our customers think, what their needs are, and make sure we understand it from their perspective.

— CEO of household-name life insurer
Economists assume that the people they study, so called homo economicus, or what I call Econs, are really smart. They know as much economics as the best economist. They make perfect forecasts, have no self-control problems and are complete jerks. They’ll steal your money if they can and get away with it.

— Richard Thaler
Most of the people I meet don’t have any of those qualities. They have trouble balancing their checkbook without a spreadsheet. They eat too much and save too little… They’ll leave a tip at a restaurant even if they don’t plan to go back.

— Richard Thaler
The three bounds

**Bounded rationality:** we are terrible natural statisticians. We need help from data science.

Bounded selfishness: we are driven by fairness, and social norms – not just economic benefits.

Bounded self-control: we make short-term decisions at odds with our long-term goals.
The three bounds

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Reinventing insurance

**Data:** Use telematics data to calculate risk factors

**Digital:** Periodic driver feedback reports

**Design:** Employ Opower-style peer comparisons

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**Ingenie**

You'll get driving feedback

To help you earn your discounts, we'll send feedback on your driving every 10 days (as long as you've driven at least 40 miles).

Your score out of 100 is based on the trends in your driving, and we'll tell you how much you're on track to save too.

To help you earn your discounts, we'll send you colour-coded messages with tips on speed, acceleration, braking and cornering.

---

Data from the black box builds a picture of driving style, including speed, acceleration, braking and cornering. The driver gets regular feedback and a driving score out of 100. Their insurance is reviewed 3 times a year - and the better their score, the less they pay.

More than 90% of young drivers engage with feedback on their driving behaviour and on average check feedback 14 times a month.

Young drivers sharing feedback with a parent or guardian are 28% less likely to crash than those who don’t.

Drivers with high scores are less likely to have serious crashes than those with lower scores.

Ingenie has seen a 21% reduction in highly dangerous driving incidents in 2014, compared with 2013.

40% of new driver crashes, involving 17 to 25-year-old drivers, could be avoided through wider adoption of black box insurance.

WITH INGENIE, ONLY ONE IN EIGHT young drivers crashes within their first 6 months on the road.
Prosocial applications of big data

Introducing the John Hancock Vitality HealthyFood Program

The John Hancock Vitality HealthyFood benefit encourages the purchase of healthy, nutrient-rich foods over less healthy, calorie-dense, nutrient-poor foods.
Nudging honesty

**Data:** Statistical fraud detection using web click data

**Digital:** Interactions mediated by web site

**Design:** Optimize behavioral nudge pop-up messages (use A/B testing)

**Result:** improper unemployment insurance payments cut in half.

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*Dan Ariely* The Honest Truth About Dishonesty

*Kindling Honesty among Unemployment Claimants* by Joy Forehand and Michael Greene
A Differentiator

Non-medical Big Data in Morbidity and Mortality Risk Prediction
Using medical data only, we get a health picture of the individual but we know nothing about how the individual got to that point, nor what treatment would provide the best results.

<table>
<thead>
<tr>
<th>Medical</th>
<th>John</th>
<th>Bill</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age – 42 years</td>
<td>Age – 41 years</td>
<td>Age – 42 years</td>
<td></td>
</tr>
<tr>
<td>Diagnosis/Condition – Back injury (ICD)</td>
<td>Diagnosis/Condition – Back injury (ICD)</td>
<td>Diagnosis/Condition – Back injury (ICD)</td>
<td></td>
</tr>
<tr>
<td>Treatment – Surgery, Rehab 3 months (CPT)</td>
<td>Treatment – Rehab 6 months (CPT)</td>
<td>Treatment – Rehab 4 months (CPT)</td>
<td></td>
</tr>
<tr>
<td>Rx – Similar dosage, duration, refills (NDC)</td>
<td>Rx – Similar dosage, duration, refills (NDC)</td>
<td>Rx – Similar dosage, duration, refills (NDC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Based the above medical data 12% chance of becoming an opioid abuser</td>
<td>Based the above medical data 15% chance of becoming an opioid abuser</td>
<td>Based the above medical data 10% chance of becoming an opioid abuser</td>
</tr>
</tbody>
</table>
Greater Insight to Medical Risks and Customizing Treatment Programs

Expanding the data elements, to include both internal and external sources, increases the predictive power of future opioid abuse and helps to define optimal treatment programs.

<table>
<thead>
<tr>
<th>Data Source</th>
<th>John</th>
<th>Bill</th>
<th>Sarah</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medical</strong></td>
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<td>chance of becoming an opioid abuser</td>
<td></td>
</tr>
<tr>
<td><strong>Personal</strong></td>
<td>Has lived in three addresses in last year</td>
<td>Has lived in three addresses in last year</td>
<td>Based the above medical and lifestyle data 2% chance of becoming an opioid abuser.</td>
</tr>
<tr>
<td></td>
<td>Commuting distance – 45 miles</td>
<td>Commuting distance – 45 miles</td>
<td>Based the above medical and lifestyle data 2% chance of becoming an opioid abuser.</td>
</tr>
<tr>
<td></td>
<td>Recently divorced with no children</td>
<td>Recently divorced with no children</td>
<td>Best treatment pattern is to include spouse in medical education</td>
</tr>
<tr>
<td></td>
<td>Avid book reader – Science Fiction</td>
<td>Avid book reader – Science Fiction</td>
<td>Best treatment pattern is to introduce group support</td>
</tr>
<tr>
<td></td>
<td>Purchases self help books online</td>
<td>Purchases self help books online</td>
<td>Best treatment pattern is to introduce group support</td>
</tr>
<tr>
<td></td>
<td>High television consumption indicators</td>
<td>High television consumption indicators</td>
<td>Best treatment pattern is to introduce group support</td>
</tr>
<tr>
<td></td>
<td>Fast food purchaser, smoker</td>
<td>Fast food purchaser, smoker</td>
<td>Best treatment pattern is to introduce group support</td>
</tr>
<tr>
<td></td>
<td>Visits an on line poker site frequently</td>
<td>Visits an on line poker site frequently</td>
<td>Best treatment pattern is to introduce group support</td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td>High investment risk tolerance</td>
<td>Foreclosure/bankruptcy indicators</td>
<td>Rents home</td>
</tr>
<tr>
<td></td>
<td>Good financial indicators</td>
<td>Gaps in known residence</td>
<td>Excellent financial indicators</td>
</tr>
<tr>
<td></td>
<td>Owns home</td>
<td></td>
<td>Revolve moderate monthly balances</td>
</tr>
<tr>
<td><strong>Regional</strong></td>
<td>Moderate Regional Economic Growth</td>
<td>Low Regional Economic Growth</td>
<td>High Regional Economic Growth</td>
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<td>Best treatment pattern is to introduce group support</td>
<td>Best treatment pattern is to limit Rx duration</td>
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</table>
Market Update
Many of the top life and group insurers are using some form of augmented and digital intelligence.

USAA Among First to Use Electronic Health Records to Accelerate Life Insurance Process

SoFi and Protective make term life insurance dramatically easier for Millennials

“Lincoln TermAccel® is a fully underwritten offering that requires a streamlined paperless online eTicket and electronic policy delivery process. Coupled with automated underwriting, this process eliminates attending physician statements and substantially improves submission processing times. Opportunity to waive labs for qualified clients.”

Product Highlights:
- Quick streamlined underwriting decision in 2 days
- No medical screenings, test of telephone interviews
- Highly competitive premiums for 10, 15 or 20-year durations
- Face Amounts ranging from $100,000-$1,000,000
- John Hancock Vitality Program

AXA Equitable Makes It Easier To Stop Ignoring Life Insurance

NEW YORK - To make the purchase of life insurance easier and more convenient, AXA Equitable introduced today in approved states a simplified issue underwriting process for its Return of Premium Term (ROP TermSM) life insurance on policy face amounts from $100,000 to $249,999.
### Augmented and Digital Intelligence Opportunity Set in Insurance

#### Sampling of Applications of Data Science in Core Operations for Insurers

<table>
<thead>
<tr>
<th>Producer Optimization</th>
<th>Product Design &amp; Pricing</th>
<th>Sales and Marketing</th>
<th>New Business &amp; Underwriting</th>
<th>Inforce Management</th>
<th>Claims and Fraud</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Producer Recruitment</strong>&lt;br&gt;Identification of individuals most likely to become a successful producer for a given manufacturer</td>
<td><strong>Target Marketing / Lead Generation</strong>&lt;br&gt;Improving quality of leads by identifying those most likely to qualify &amp; most likely to buy</td>
<td><strong>Application Triage</strong>&lt;br&gt;Identifying certain healthy individuals for which certain medical exams can be waived</td>
<td><strong>Customer Lifetime Value</strong>&lt;br&gt;Enable calculation of customized individual CLV; deploy customized proactive tactics for retention, second offers, etc.</td>
<td><strong>Claims Management (Active Lives)</strong>&lt;br&gt;For each active life, estimate the likelihood of developing certain cognitive or physical impairments, then proactively encourage healthy policyholder behavior to enable prevention</td>
<td></td>
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<td><strong>Producer Retention</strong>&lt;br&gt;Segmenting existing producers and deploying customized tactics to support success and retention</td>
<td><strong>Underwriting</strong>&lt;br&gt;Predicting mortality experience on a seriatim basis, using new data sources to supplement or replace certain traditional medical exams</td>
<td><strong>Post-Level Term Offers</strong>&lt;br&gt;Segment population based on current health risk, current life insurance needs, likelihood to buy. Deploy customized, targeted offers</td>
<td><strong>Claims Management (Disabled Lives)</strong>&lt;br&gt;For each disabled life, estimate the likelihood of transitions between type of impairment (physical vs. cognitive) and associated level of care required (home health care, assisted care facility, nursing home), then proactively encourage healthy policy holder behavior</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Producer-Client Matching</strong>&lt;br&gt;Identify behavioral patterns and personality attributes associated with successful, lasting producer-client relationships; deploy tactics to optimize matches</td>
<td><strong>Up-Sell Programs</strong>&lt;br&gt;Identify existing customers whose need for life insurance has increased, and who remain healthy. Offer increased face amount with limited underwriting</td>
<td><strong>EHRs</strong>&lt;br&gt;Utilize Electronic Health records to speed up the underwriting process, reduce costs and improve customer experience</td>
<td><strong>Retention Strategy</strong>&lt;br&gt;Use customized, individual estimate of lapse likelihood to enable customized proactive and reactive tactics to improve retention effectiveness</td>
<td><strong>Fraud Detection</strong>&lt;br&gt;Identify potential over-payments of claims</td>
<td></td>
</tr>
<tr>
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Sampling of Risk Orientated Big Data
Why is Lifestyle/Behavioral data powerful?

PredictRisk is a dataset that can be accessed real time to better understand life and health insurance specific attributes about a customer.

- **260M+** U.S. Adults Scored
- Data updated every **1 Month**
- Contains over **1,500+** variables on a person’s lifestyle and other metrics
- **50+** Advanced predictive algorithms
- **400+** Variables used in the predictive algorithms
- Provides **360° view** of a person
- Algorithms rebuilt every **2 years**
- **40+** Clients served
The innovative data contained in risk analysis big datasets

**Data attributes for Life and Health Insurance**

- **Composite life insurance purchase indicators**
  - Likely to buy by product (life and health)
  - Likely to qualify health risk scores
  - Financial means to buy insurance
  - Face amount calculator

- **Composite Disease Propensity indicators**
  - Disease propensity scores
  - Disease expected severity scores
  - Age gender neutral population health scores

- **Synthetic Variables**
  - Comorbidity indicators
  - High output fitness indicators
  - Financial health composite scores

**Traditional attributes available for Marketing**

- **Demographic information**
  - Age
  - Gender
  - Household/Marital
  - Dwelling Type

- **Basic financial information**
  - Net Worth
  - Estimated income
  - Homeowner status
  - Asset investment type

- **Lifestyle information**
  - Purchase & spending behaviors
  - Sports & other hobbies
  - Retail and Online purchase types
  - Subscriptions
Intelligence to life – Insights driven prospecting
Use health risk data upstream into Sales & Marketing process

**Upload & Score Prospects**
Marketing team upload the prospects and does a batch pull to bring in the health and risk scores from PredictRisk

**Prioritize/Distribute Prospects**
In-built scoring & distribution engine leverage PredictRisk scores to prioritize, score and evenly distribute prospects to Agents

**Starting the Day**
Diana, an agent logs in and settles into her Customer Engagement Command Center, a CRM where she manages her prospects and current book

**Gather Insights & Outreach**
Scans through the heat map to decide whom to pursue and further look into the PredictRisk dataset to be prep and be informed for her sales conversation

**Prospect Conversion**
Captures additional information on prospect profile before conversion
Intelligence to life – Proactive Retention
Increase your share of wallet with insights led engagement

Upcoming Annual Review
Financial Advisor starts his day and finds an appointment to conduct annual review for one his clients

Client Profile Review
Open the 360 degree view of assets, Life events, products and households

Prep & Presentation
Financial Advisors leverages all the insights and preps him for the annual review and identifies the next best action and product that could interest his client

Insights driven assessment
Uses the real-time API of PredictRisk to refresh the Health risk scores on the client profile
Using Predictive Analytics to Enhance the Traditional Underwriting Process

Life insurance underwriters are utilizing predictive analytics to triage applications, identifying certain healthy applications for whom selected medical underwriting requirements can be waived.

Application Triage Process Flow

1. **Application Received**
   - Initial application for insurance is received.

2. **Third-Party Databases Queried**
   - Queries to traditional external data sources, and potentially to non-traditional data sources
     - MIB
     - Motor Vehicle Records
     - Prescription Drug

3. **Telephone Interview Conducted**
   - Trained medical professional conducts telephone interview.

4. **Application Triage Model Applied**
   - Data collected to date is processed by predictive model. Each application receives a health score and reason code.

   - **Score Reason Codes**

5. **Policy Issued Without Medical Exams**
   - Application approved for issue
   - <24 hr turnaround
   - 35% of applications

6. **Traditional Underwriting Process**
   - Average time to issue is 30+ days

   - Applicant determined to be **not** eligible for medical underwriting requirements to be waived.
   - Must order labs and proceed through traditional underwriting process

   - 65% of applications
Digital Customer Marketing and Engagement

Combining highly qualified big data, Facebook ads and behavioral economics allows us to reach and drive leads for people who are likely to need and qualify and buy Insurance products
Nudge Selected Individuals Down the Funnel

**Consumer Data**

PredictRisk data is a risk based consumer database that comprises 263M individuals 18+ in the US.

What sets this data apart is that it goes beyond demo and household information, and **includes health risk data points which allows us to bucket consumer by likelihood they will qualify for a policy**, plus it includes age, gender, and more.

**Facebook Lead Gen**

Facebook offers a lead generation ad unit, which allows us to **create a policy interest form right on Facebook so users can bypass clicking to site**.

Once a user completes a form, their information is shared with us in an Excel file and can be passed directly to sales agents to contact warm leads.

**Nudging**

Nudging is a behavioral economics capability.

It works by gently nudging users down the customer sign up process by **providing consumers with subtle reminders such as the need to complete a next step in the policy sign up phase or sharing honest information**.

Example: [New Mexico Unemployment claims](#)
Use Consumer data to determine potential consumers and import data into Facebook using onboarding partners.

Advertise to matched users using Lead Ads on Facebook. Gather consumer info for the home office.

Agents reach out to reach out to consumers to talk about policies.

Digital to apply nudging techniques to help consumers bypass final hurdles to signing up.

Asses successes, improvement areas, how to maintain customers, etc.

Each step provides new information that can be used to update previous steps.
Electronic Health Records Tool
## EHR Solutions can be leveraged in Life Insurance Underwriting

An EHR solution has the potential to significantly reduce Life Insurance underwriting operations costs and streamline the process.

### Life Insurance Underwriting

The traditional life insurance underwriting process typically includes invasive, expensive, and slow medical underwriting requirements such as para-medical exams, lab work, prescription checks, and Attending Physician Statements (APS).

EHR solutions offer the potential to replace these requirements with a single efficient and cost-effective solution. The EHR solution also creates a better customer experience and can drive a long-term customer relationship for the insurance carrier.

### Differentiation

| Increase in placed applications from improved placement rates due to shorter underwriting time |
| A low cost production environment allows for initial sourcing of EHRs while refining their use in your underwriting process |
| Decrease in underwriting requirements costs (APS, labs, para-med exam, Rx check) |
| Improved customer experience through faster and less invasive process, & opportunity to build long-term relationship with applicants |

### Anticipated Results

The EHR solution is currently in a stage where several insurance carrier clients are actively using the solution. Results to date have suggested:

- **High quality of data** – the data found in the EHR solution has been rich and valuable to underwriters.
- **Consumer adoption is key** – some carriers have struggled to find the right way to engage and incent consumers and/or agents. Our tele-interview process removes this issue.
- **Consumer preference** – most carriers have seen a majority of initial participants express preference for the EHR process.
- **Provider & health system specific benefits** – initially, EHRs are especially valuable for slow or difficult providers and health systems.
Expected “hit rate” and time to retrieve records

90%
We believe we can retrieve records from over 90% of Providers and Health Plans
• Most of the larger / well-known organizations are already in our directory
• New requested ones can be added within 24 hours of the request

60%
Can be retrieved instantaneously

30%
Can be retrieved in 24 hours
EHR Implementation Approach: Developing a scalable solution

EHR can be operationalized quickly into the existing underwriting process with an immediate benefit of replacing time consuming APSs. In the longer term, EHR can be incorporated into an underwriting rules based engine and AI driven models, significantly changing traditional underwriting processes and requirements, creating a simplified straight through process for most of the applicants.

### Short Term Solution (2-3 months)

<table>
<thead>
<tr>
<th>Access EHR</th>
<th>Implement in existing processes</th>
<th>Define new processes</th>
<th>Scale the solution</th>
<th>Enhance Advanced AI Driven Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receive.</strong> Set-up the Technology / Tool / Processes to access and receive EHR for an applicant</td>
<td><strong>Replace.</strong> Use EHR to replace traditional source of augmented medical data (APS) within existing processes to quickly realize benefits.</td>
<td><strong>Prepare.</strong> Redefine process maps that will use EHR as a replacement to standard medical requirements and drive to a future state of suppressed fluid requirements.</td>
<td><strong>Operationalize.</strong> Scale the solution by developing rules to automate underwriting decisions through a rules-based engine.</td>
<td><strong>Model.</strong> Develop sophisticated application triage and AI driven EHR models that will improve the overall mortality experience while creating real-time application processing for most applicants.</td>
</tr>
</tbody>
</table>

### Long Term Solution (6 - 12 months)

**Standardize.** Automate organization of EHR from vendors / providers into a standardized, usable format for quick processing.

**Change.** Develop change management strategy to mitigate risk associated with process disruption and drive adoption.
EHR results suggest that the life insurance underwriting process can be radically transformed…

...while delivering incredible value for our customers

**Initial results**

**DATA AVAILABILITY:**
More than 85% of pilot participants were able to successfully retrieve data through the patient portal technology

**DATA QUALITY:**
95% of EHR pilot participants who were able to access EHR produced underwriting data that was at least as rich as traditional underwriting data

**CUSTOMER EXPERIENCE:**
More than 80% of retrospective pilot participants reported a preference for the EHR process over the traditional underwriting process

**Lessons learned**

**PROGRAM DESIGN IS CRITICAL:**
Our comprehensive pilot planning led to an integrated program design with critical stakeholder buy-in from across the organization

**NO UNIVERSAL SOLUTION:**
Because each life insurance carrier has a unique distribution, risk assessment, and communications strategy, the EHR solution needs to be customized for each carrier

**VALUE IS REAL:**
The solution can potentially create hundreds of dollars of value on each life insurance application for carriers while also creating an improved customer and producer experience
Copies available in the lobby

For more discussion see:

“The Last Mile Problem: how data science and behavioral science can work together”
*Deloitte Review*, January 2015
http://dupress.com/articles/behavioral-economics-predictive-analytics/

“The Importance of Misbehaving: a conversation with Richard Thaler”
*Deloitte Review*, January 2016

“Cognitive collaboration: why humans and computers think better together” *Deloitte Review*, January 2017