2020 and Beyond: The Future of Insurance

Stephen J. Mildenhall
May 30, 2018

ST. JOHN'S UNIVERSITY

Tobin College of Business
School of Risk Management

The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a...

The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a...

Fundamental business *problem*?

- KYC
- Adverse selection
- Morale hazard

Unique to insurance

The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a. . .

Fundamental business *problem*?

- KYC
- Adverse selection
- Morale hazard

Unique to insurance

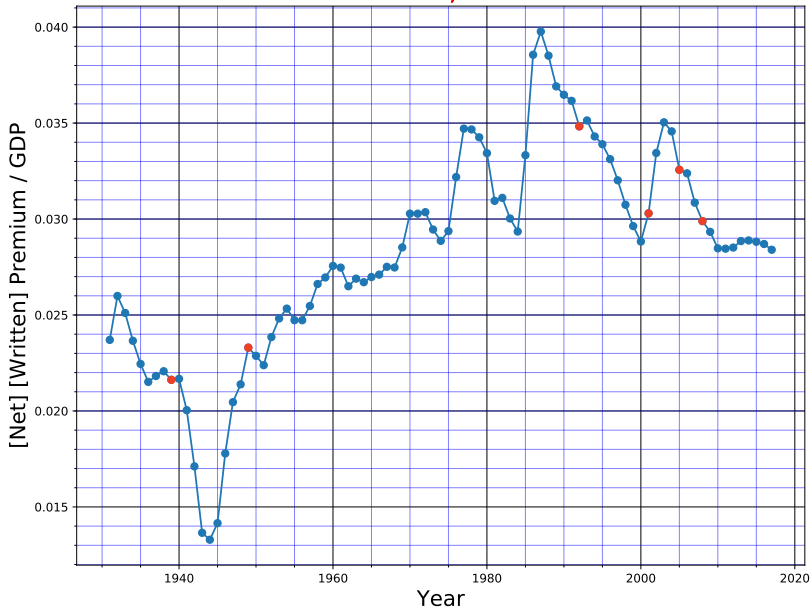**Fundamental business *objective*?**

- Growth
- Profitability
- Risk

Common to all businesses
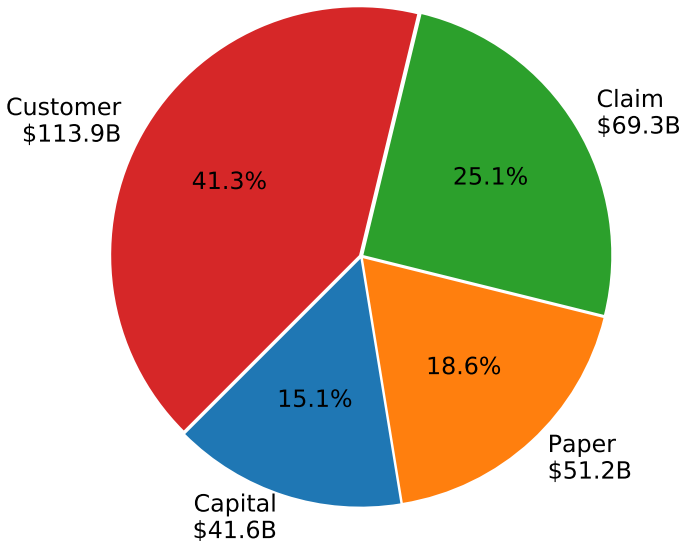
Insurance Today: Looking Forwards by Looking Backwards

Insurance in the Broader Economy

Premium to GDP Ratio, 1930 to Present
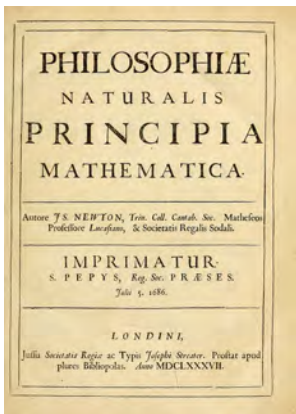
4

Insurer Expenses By Value Chain Component

*The insurance industry is prime for disruption
in its current state*

The insurance industry is prime for disruption in its current state

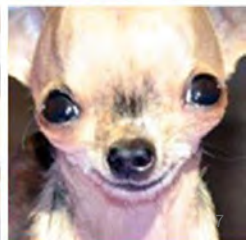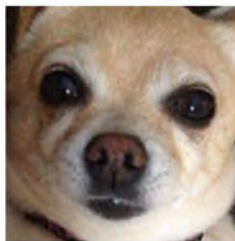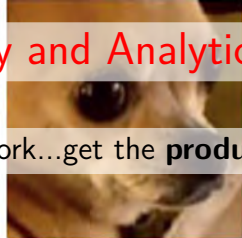| Old does not imply wrong	Old does not imply right
Principia, Written 1686	Lloyd's, Founded 1686

Technology and Analytics

Get **tech** to work...get the **product** right...**liftoff**

AI Will Be More Important Than Fire & Electricity

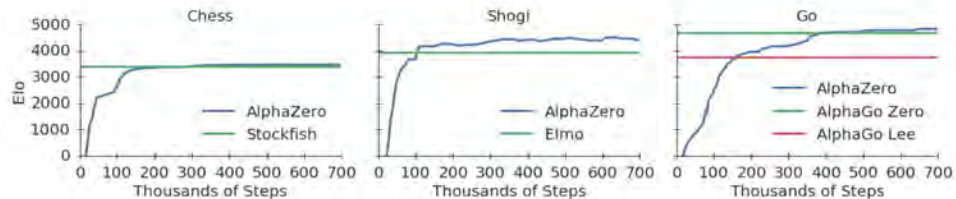# AI Will Be More Important Than Fire & Electricity

Figure 1: Training AlphaZero for 700,000 steps

Symbiotic Quadrangle of InsureTech Capabilities
...in Search of Problems

Hardware
- Mobile
- **Cloud**
- ASIC, GPUs
- Internet of Things (IoT)
- Home sensors
- Auto telematics
- Drones, micro satellites
- Quantum computing

Software
- Text analysis, semantics
- Voice recognition
- Chat bots, Siri, Alexa
- Image recognition
- Virtual reality
- **Tensor Flow**, Go
- Hadoop, MongoDo, Redis
- Python, R, Julia

Algorithms
- **Artificial intelligence (AI)**
- Neural networks
- Deep learning
- **Machine learning (ML)**
- Hash functions
- Cryptography
- Compressed sensing

Data
- **Big data (BD)**
- Text, speech, image, video
- Behavioral data
- Social media
- Spending
- Credit
- Trading, financial data

Get **tech** to work...get **product** right...**liftoff**

Insurance Opportunities: Real but Defensive

More granular pricing

- You can't afford to be the company with the **coarsest rating plan**—adverse selection is a real and is an arms race
  - Race to the bottom, CBA or ROI rationale least-bad choice
  - First mover advantage largely gone
- Overly-granular rating plans **undermine the purpose** of insurance
  - Important social questions about appropriate rating variables
  - Important regulatory about price optimization
- Opportunities exist in lines which use proxy data: personal and small commercial
  - Big data less applicable for individually loss rated accounts

Actuarial optimism

- If you don't keep up you will die. . . **how soon do you want to die?**

Insurance Opportunities: Real and Positive

New products and services

- Better KYC and more **effective** underwriting & marketing

- Become the trusted risk partner: 24x7 risk monitoring

  - Home telematics, monitoring and improved design
  - Auto driving feedback: make near-misses real
  - Health insurance nudges
  - Build service income to offset lower loss cost/premium

- Improved claims adjusting process

  - Better fraud detection
  - Improved customer satisfaction

- Learn from near misses—more underwriting information

Actuarial optimism

- **How long do you want to live?**

Potential of Technology Varies with Problem Domain

Stunning Results

- Static, rules based environment
- Clean, direct observations
- Essentially limitless data
- Definitive right answer
- Classification problems
- Simple dynamic control

Building Capability

- Autonomy

Potential of Technology Varies with Problem Domain

Stunning Results

- Static, rules based environment
- Clean, direct observations
- Essentially limitless data
- Definitive right answer
- Classification problems
- Simple dynamic control

Building Capability

- Autonomy

Characteristics of Insurance

- Behavioral feedbacks
- Dynamic: reacts as we learn
- Proxy data, not direct
- Granularity drives small classes
- Uncertain information: claim development, trend
- Latency: asbestos and environmental
- Need to protect social function

Dangers of AI/ML: We Don't Understand Why It Works

x
"panda"
57.7% confidence

$+ .007 \times$

$\text{sign}(\nabla_x J(\boldsymbol{\theta}, \boldsymbol{x}, y))$
"nematode"
8.2% confidence

$=$

$x + \epsilon\text{sign}(\nabla_x J(\boldsymbol{\theta}, \boldsymbol{x}, y))$
"gibbon"
99.3 % confidence
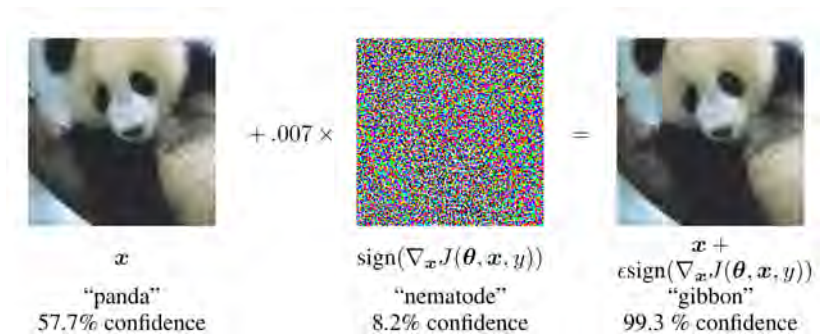
- Machine learning is like training your dog: it generally does what you want but you don't know why

- Insurance issues: regulatory compliance, unwitting discrimination

Insurance: Strong, but Stealth, Record of Innovation

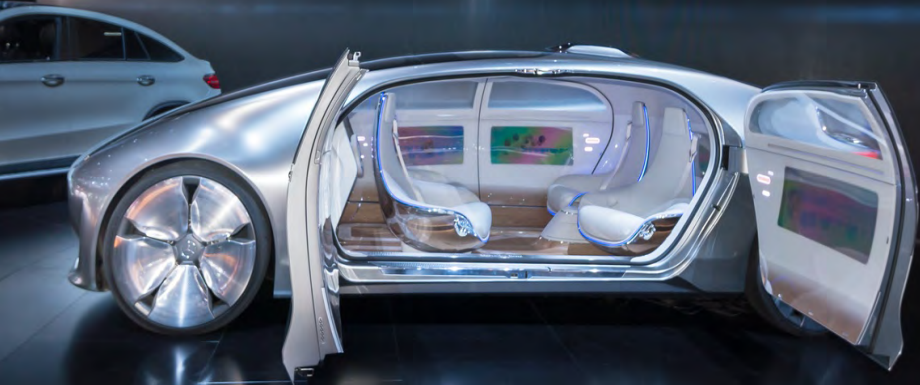| Function	Innovation	Result
Customer	**Direct Response**	GEICO market share march since 1990s, #2 auto insurer today with strong growth trajectory.
Paper	**Credit Scoring**	Using big data since before there was big data; decline in auto residual markets, except NC
Capital	**Alternative Capital**	ILS, sidecars, collateralized solutions grown from almost nil in 2000 to nearly USD90 billion today; capital availability and speed-to-market has dampened underwriting cycle and lowered cost of cat reinsurance
Claims	**Digital Settlement**	Allstate QuickFoto app introduced 2013 for smaller claims; today 50 percent of all drivable vehicles inspected through two digital operating centers using QuickFoto. Video chat to review damage with body shops collapsed 5-7 day process to get "eyes on a vehicle" to hours. USD52 million restructuring charge, Q2 2017 call.

Driverless Cars

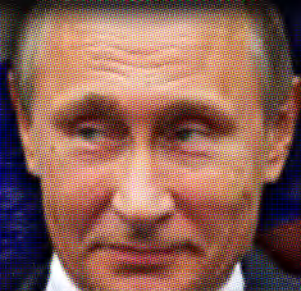Human-driven cars kill $\approx$ 37000 people per year in the US

Auto drives **45 percent** of global property casualty premium

Auto lowers industry volatility by **30 percent**…

…and creates over **USD100 billion** capital capacity for other lines

Tech-Driven Social Interactions Becoming More Complex

The future... my bot negotiating with your bot

- Russian hacking scandal shows challenges of using digital-breadcrumb big data analytics

- **Talk is cheap**: **actions** speak louder than **words**

- Practical, socially acceptable data elements must be verifiable, hard (expensive) to fake, with a system to correct errors

- **Credit history**

- Gödel's theorem: the challenger/hacker always beats the system

Actuarial optimism

- **Uncertainty** is **opportunity** for insurers
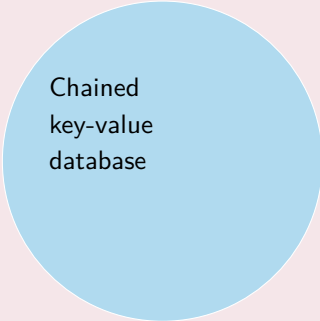- Solving difficult problems creates value

What if We Could Engineer a Trust-Machine...

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers
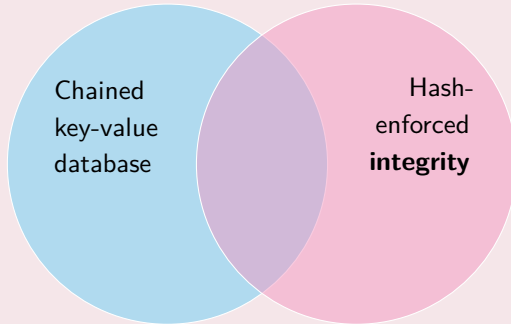
Chained
key-value
database

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers

Chained key-value database

Hash-enforced **integrity**

What if We Could Engineer a Trust-Machine. . .

The Blockchain: enabling trust between strangers

- Chained key-value database
- Hash-enforced **integrity**
- Peer-to-peer distributed **validation**

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers

Chained key-value database

Hash-enforced **integrity**

Peer-to-peer distributed **validation**

Double-spend mechanism

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers

- Chained key-value database
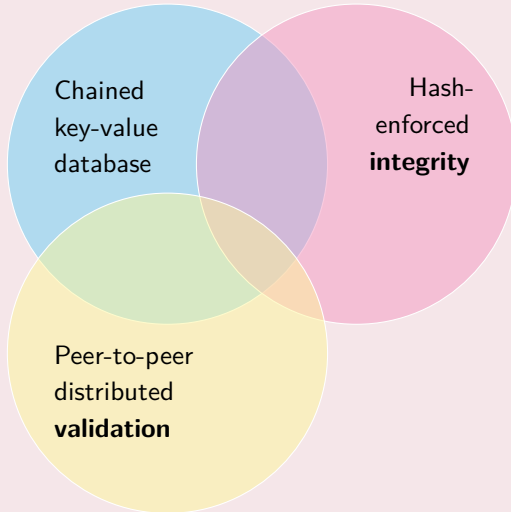- Hash-enforced **integrity**
- Bitcoin!
- Peer-to-peer distributed **validation**
- **Double-spend mechanism**

Blockchain Fills the Trust Vacuum

Reclaim personal ownership of personal information

- It is possible to **verify** information without **revealing** it: a **zero knowledge proof**
  - Where's Waldo? with a mat; Alibaba's Cave
- Distributed database of all private credit, health, behavioral data
  - One-time **read/verify-only** access
  - Read, **act** and **forget**, rather than read, act and **store**
  - User **cannot pass along** what they've learned
  - Transferable, international credit history, Bloom Credit
  - No possibility of Equifax hack: data encrypted, you hold keys
  - Smart contracts, DAO = decentralized autonomous organization
- Central database of underwriting information: easier bindable quotes
  - Theoretic potential is huge but commercial model less clear

New Economic Reality Generates New Opportunities

Major opportunities

- **Cyber risk**: front-runners see on-going risk advisory service bundled with meaningful indemnity back-up
- **Gig economy** coverage gaps, e.g. Uber driver coverage, AirBnB

Minor opportunities

- Peer to Peer
- Pay-as-you-Go/Use/Need
- Toy and trinket coverages
- Purchasing groups, Bought by Many

Prognosis

GOOD NEWS

BAD NEWS

Prognosis: Challenges, but Net Opportunity

Trend	Problems			Objectives			Net
	KYC	AS	MH	Grow	Pft	Risk	
Environmental	neutral	negative	negative	positive	positive	negative	Opportunity
Demographic	negative	neutral	neutral	positive	neutral	neutral	Opportunity
Tech, Analytics	positive	positive	positive	positive	positive	negative	Opportunity
Driverless Cars	positive	neutral	neutral	negative	negative	negative	Threat
Social	negative	negative	negative	positive	neutral	positive	Opportunity
Economic	negative	negative	negative	positive	neutral	neutral	Opportunity

KYC: know your customer   ● positive
AS: adverse selection   ● neutral
MH: morale hazard   ● negative
Pft: Profitability

Predictions:
The Insurer of the Future Will…

- Update systems to unleash full power of data an analytics
- Scale risk bearing capacity for mega-cats
- Be a 24/7 risk advisor
- Profit from the trust vacuum

References

- Swiss Re buildling, London UK, author, https://flic.kr/p/qYjpC8
- Rear view mirror https://flic.kr/p/eNFZz7
- Premium to GDP, premium from A.M. Bests Aggregates and Averages at St. John's Kathryn and Shelby Cullom Davis Library, FRED GDP time series, author's analysis
- Insurer expenses by value chain: data from NAIC statutory filings, SNL; author's analysis
- Prime for disruption quote from https://hackernoon.com/tradable-insurance-on-the-blockchain-why-we-should-think-about-it-part-1-of-2-b4e3109cd148; Newton Principia cover: https://en.wikipedia.org/wiki/Philosophi%C3%A6_Naturalis_Principia_Mathematica; Lloyds policy from 1901, Kathryn and Shelby Cullom Davis Library
- Muffins and dogs. https://goo.gl/eAp9ia
- Heading quote Sundar Pichai, CEO Google at the World Economic Forum 2018; AlphaZero paper *Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm*, Silver, David; Hubert, Thomas; Schrittwieser, Julian; et al. 2017; "AI is bursting" quote from Benedict Evans, https://www.ben-evans.com/benedictevans/2016/3/14/to58mvtuxcs47ndvw0gmdqnh7d1tab

- Get tech to work: Benedict Evans, op. cit.
- Explaining and Harnessing Adversarial Examples Ian J. Goodfellow, Jonathon Shlens, Christian Szegedy. https://arxiv.org/abs/1412.6572
- Driverless car image: Google images
- Tokyo at night image http://sf.co.ua/id104123; impact of Auto on global P&C insurance from Aon Benfield Insurance Risk Study, 9th Edition, page 17 (2014)
- Russian Hacking Image, author
- Japanese temple to economics image, author, https://flic.kr/p/7SD1BC
- Prognosis image http://www.humresconstruction.co.uk/outlook-uk-construction-industry-next-year/
- Light bulb image, author, https://flic.kr/p/DbxWsf
- Stacked rocks image, author, https://flic.kr/p/YR7rTW

Stephen J. Mildenhall

Tobin College of Business
School of Risk Management, Insurance
and Actuarial Science
St. John's University
New York, NY
mildenhs@stjohns.edu | +1.312.961.8781

About the Speaker: Stephen Mildenhall is an Assistant Professor in the School of Risk Management, Insurance and Actuarial Science at St. John's University in New York. He was previously Global CEO of Analytics for Aon plc, based in Singapore, and head of Aon Benfield Analytics. Prior to joining Aon, he worked at Kemper Insurance and CNA Insurance. Stephen has an undergraduate degree in Mathematics from the University of Warwick, England, and a Masters and Doctorate in Mathematics from the University of Chicago. He is a Fellow of the Casualty Actuarial Society, an Associate of the Society of Actuaries, a Chartered Enterprise Risk Analyst (CERA) and a Certified Specialist in Predictive Analytics (CSPA). His research interests include risk theory, capital determination, allocation and optimization, and applications of statistics to reserving and ratemaking. He is a two-time winner of the CAS Woodward-Fondiller prize for the best research paper by a new fellow of the CAS.