



**Expertise. Insight.  
Solutions.**



**FOCUSED ON YOUR FUTURE**

**[CASstudentcentral.org](http://CASstudentcentral.org)**

**2017 CA Actuarial Student Summit**  
**January 14, 2017**

# Data Science, Predictive Analytics, and the Casualty Actuarial Society



**Stephen Lowe, FCAS, MAAA, CERA**

- Chairman, Casualty Actuarial Society
- Consultant, Willis Towers Watson



# Agenda

- How is the world changing?
- How is the role of the actuary changing?
- How is the CAS responding?



# Agenda

- How is the world changing?
- How is the role of the actuary changing?
- How is the CAS responding?



# Three dimensions to technological change ("Moore, Moore, Moore")

## Technology (Moore's Law)

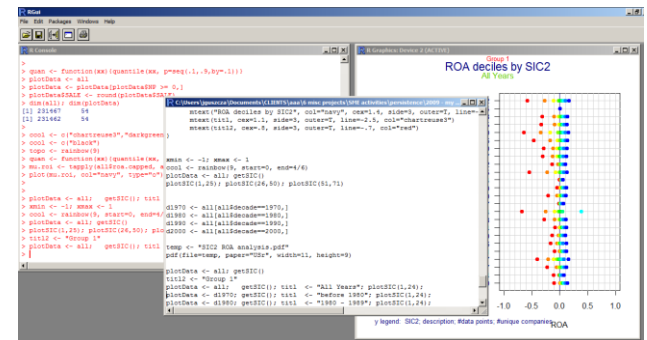
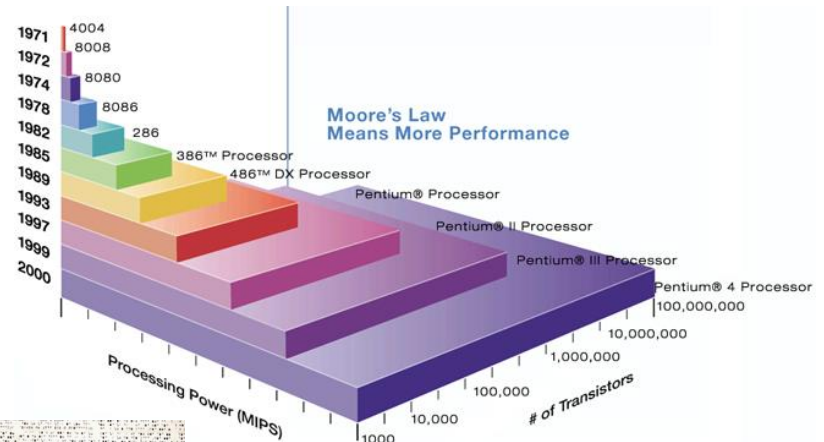
- Cost of storage and computing power has decreased exponentially

## Data

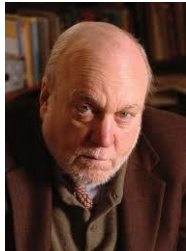
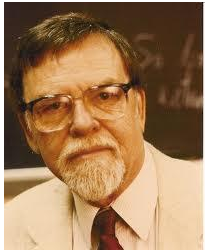
- It's everywhere
- Mobile devices, the internet of things, cloud computing, ...

## Software and algorithms

- Great analytic ideas keep coming from statistics, economics, machine learning, marketing, ...
- Vastly better query capabilities
- Facilitated visual display
- Free tools like R, Python



# “Clinical versus actuarial judgment: the motion picture”



*Science* 31 March 1989:  
Vol. 243 no. 4899 pp. 1668-1674  
DOI: 10.1126/science.2648573

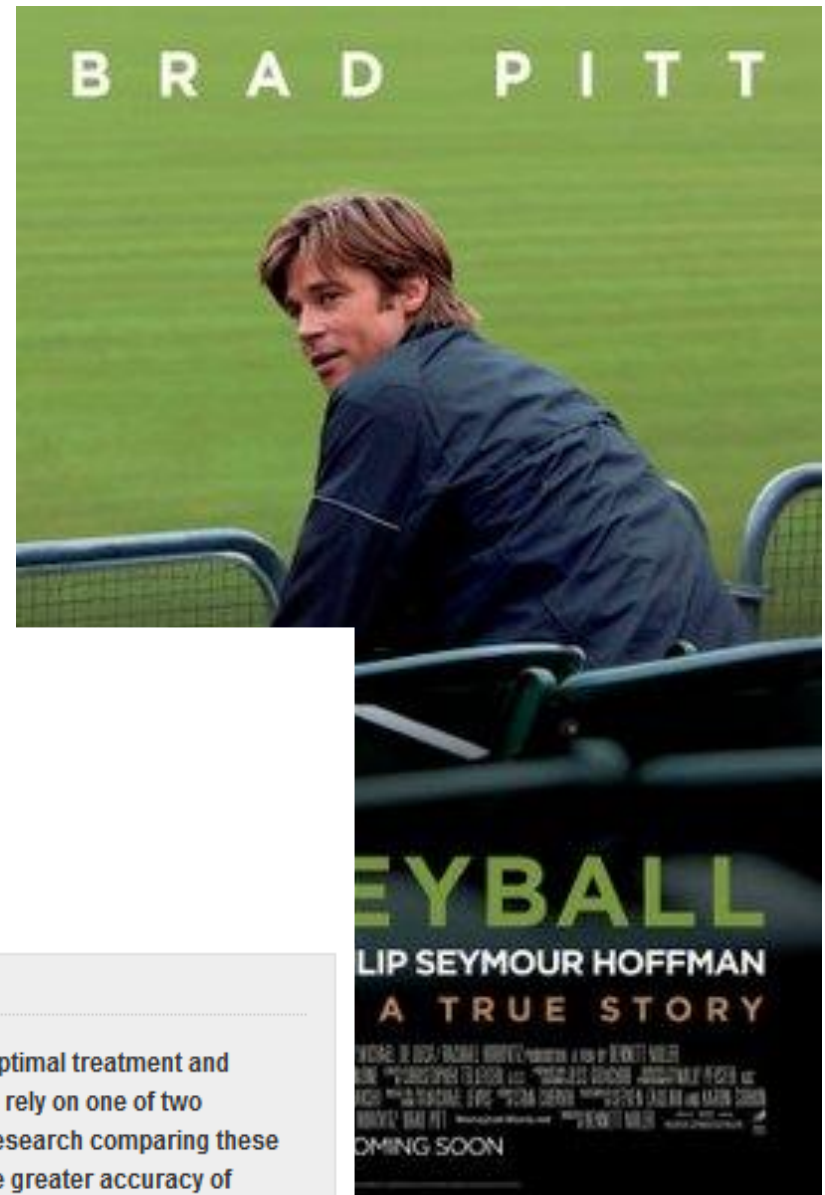
## Clinical versus actuarial judgment

RM Dawes, D Faust and PE Meehl

[±](#) Author Affiliations

### ABSTRACT

Professionals are frequently consulted to diagnose and predict human behavior; optimal treatment and planning often hinge on the consultant's judgmental accuracy. The consultant may rely on one of two contrasting approaches to decision-making--the clinical and actuarial methods. Research comparing these two approaches shows the actuarial method to be superior. Factors underlying the greater accuracy of actuarial methods, sources of resistance to the scientific findings, and the benefits of increased reliance on actuarial approaches are discussed.



# In choosing between expert clinical judgment and outcome-based statistics, its best to bet on the latter

Clinical Experts	Statisticians
Baseball scouts	Bill James' Sabermetrics, used by Billy Beane and Theo Epstein
Wine connoisseurs	Orly Ashenfelter's regression equation, relating wine quality to local rainfall and temperature in Bordeaux
83 legal experts – professors and legal scholars	Martin & Quinn – two political scientists' six factor decision tree
Insurance underwriters	Predictive models, linking customer attributes to claim propensity

- Statistical analysis can *validate* some clinical judgments
- It may *invalidate* others



# New York City builds a predictive model to make building inspections more efficient

## 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

# In Hollywood, “Nobody Knows Anything”... (except Netflix)

Third Law Of Film  
Thermodynamics



*-William Goldman*

[www.franciscoordonez.com](http://www.franciscoordonez.com)



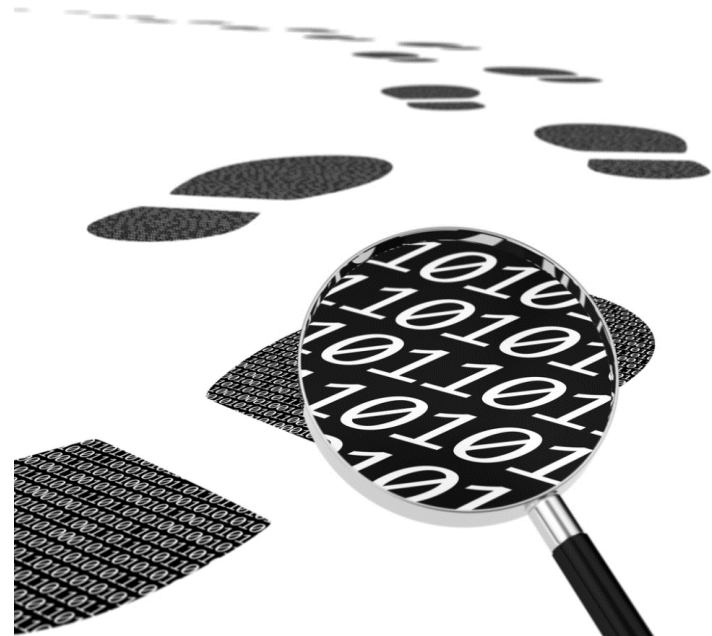
*Better viewing through “datafication”*

# The internet of things includes people

*Our lives are digitally mediated.*

*We continually leave behind digital breadcrumbs about:*

- How we drive
- Who we know
- What we buy
- What we eat
- How we exercise
- How we sleep
- What we watch
- What we read
- What we opine
- Where we travel
- How we socialize
- How we surf the web
- ...



# NYC Citi Bike Most Popular Roads

Sep–Nov 2015

**Data on every  
Citi bike ride  
is publicly  
available;  
download it  
for free**



# Agenda

- How is the world changing?
- How is the role of the actuary changing?
- How is the CAS responding?



# Actuaries have been doing predictive modeling since the beginning ...

[Known Attributes, Past Events]

... are predictive of ...

[Emergent Attributes, Future Events]

- 1880: Attained age → remaining life expectancy
- 1915: Occupation → worker injury costs
- 1962: Age, sex, marital status, vehicle use → auto accident costs

*But, attribute identification was clinical*



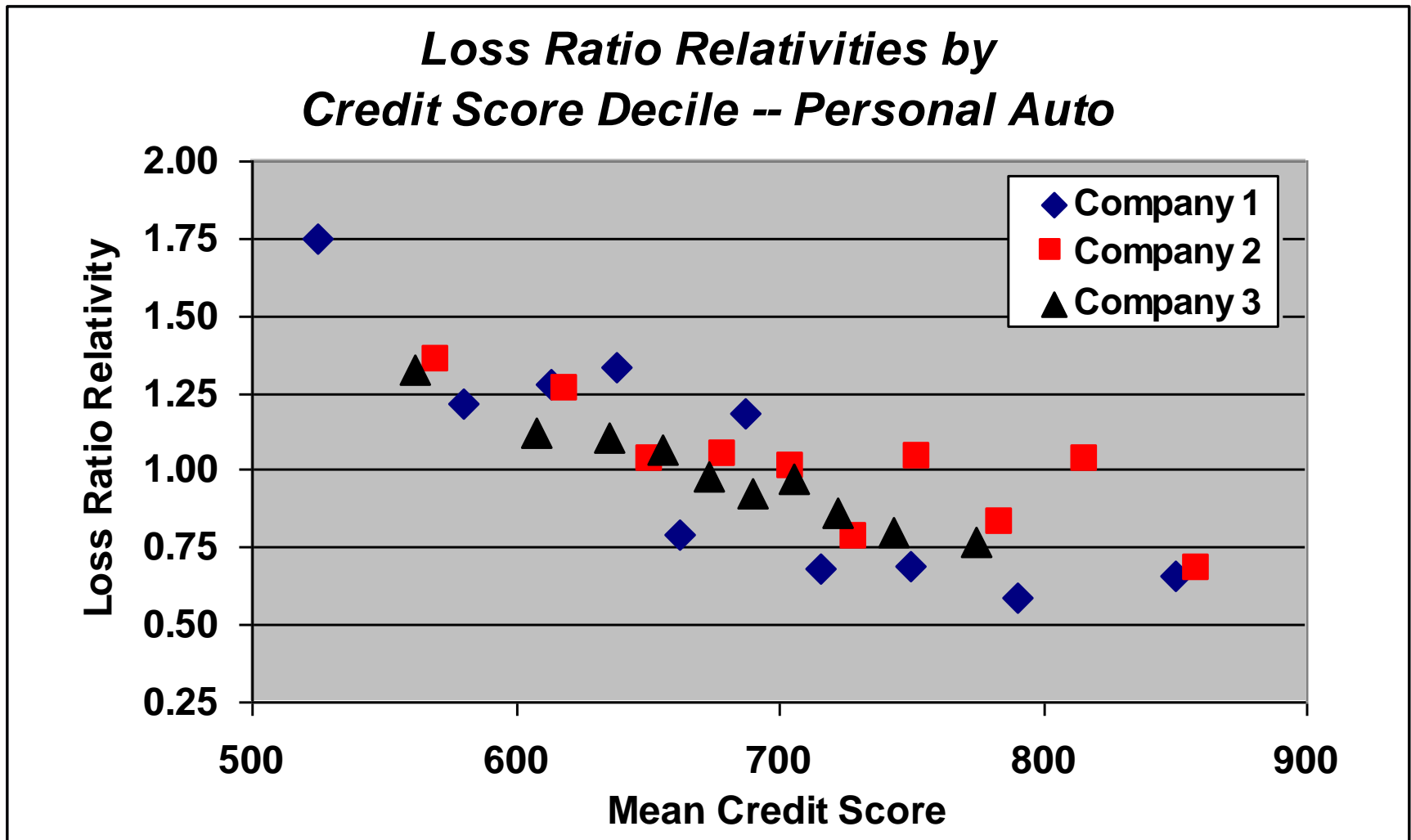
# Regulatory Solvenc

## *First big-data application for actuaries?*

- NAIC IRIS tests as “early warning system” for potential insolvencies
  - Financial ratios, threshold values, pass-fail test
  - No weighting, clinically-based judgment
- 1975: AIA sponsored development of alternative
  - Industry database – all financial ratios of all companies, including those that failed
  - Linear discriminant analysis used to find weighted combination of financial indicators that were most predictive of failures

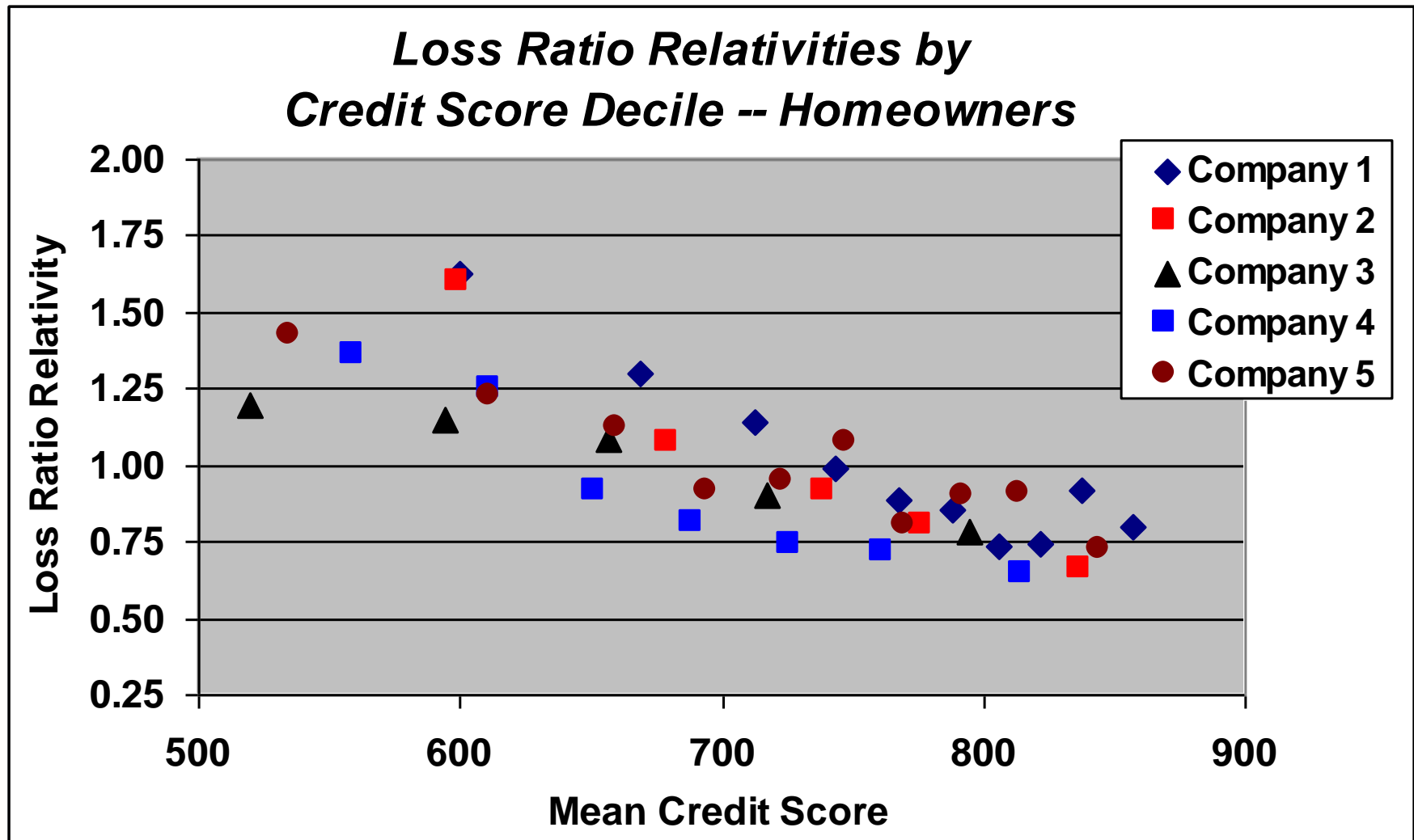


# Insurers have caught on to the predictive power of credit history





# Insurers have caught on to the predictive power of credit history



# Actuaries have (quietly) found many other predictive attributes of insurance customers

*Drivers of Value -- Automobile Insurance Customer*

	<i>Response</i>	<i>Retention</i>	<i>Cross-Sell</i>	<i>Experience</i>
<b>Credit history</b>		★		★
<b>Expiry month</b>	★			
<b>Garage door opener</b>	★			★
<b>Homeowners claim</b>				★
<b>Multiple policies</b>		★	★	★
<b>Bullfighter or hairdresser</b>				★

# Going forward, actuaries will need the capabilities to contribute to the new insurer value chain

## *Information Acquisition Strategy*

Vendor Supplied Information

- Credit/Financial
- Vehicle/Driving
- Purchasing/Lifestyle

Company Supplied Information

- Claim History
- Longevity

Customer Supplied Information

- Attributes

## *Knowledge Management*

Predictive Modeling to Determine Revenue and Cost Drivers

## *Customer Value Management*

Strategies

- Product
- Underwriting
- Pricing
- Segmentation
- Channel
- Claim



# ***Building an Effective Predictive Analytics Capability: Converging Around Three Key Skill Sets***

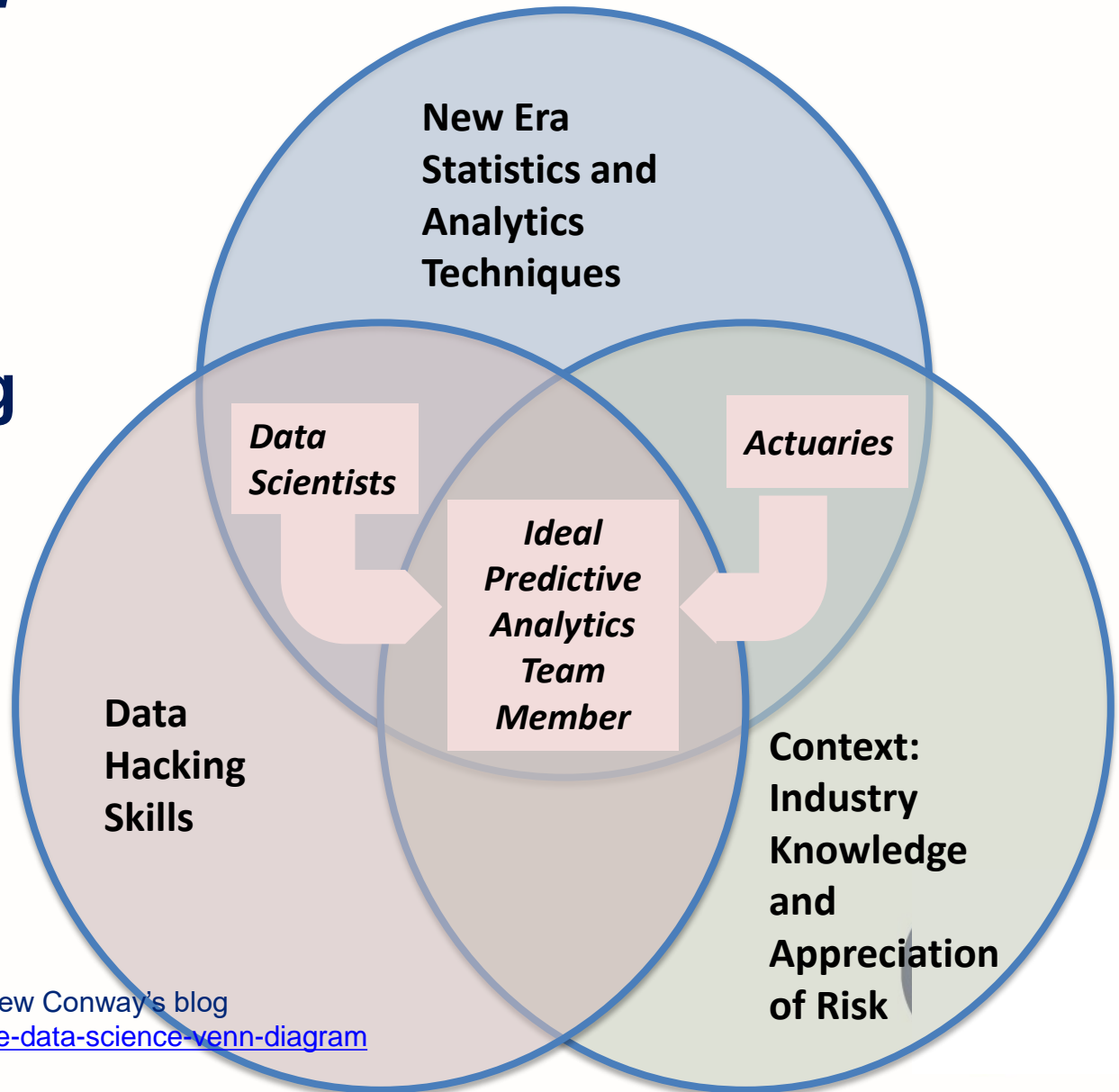


Image borrowed from Drew Conway's blog

<http://www.dataists.com/2010/09/the-data-science-venn-diagram>

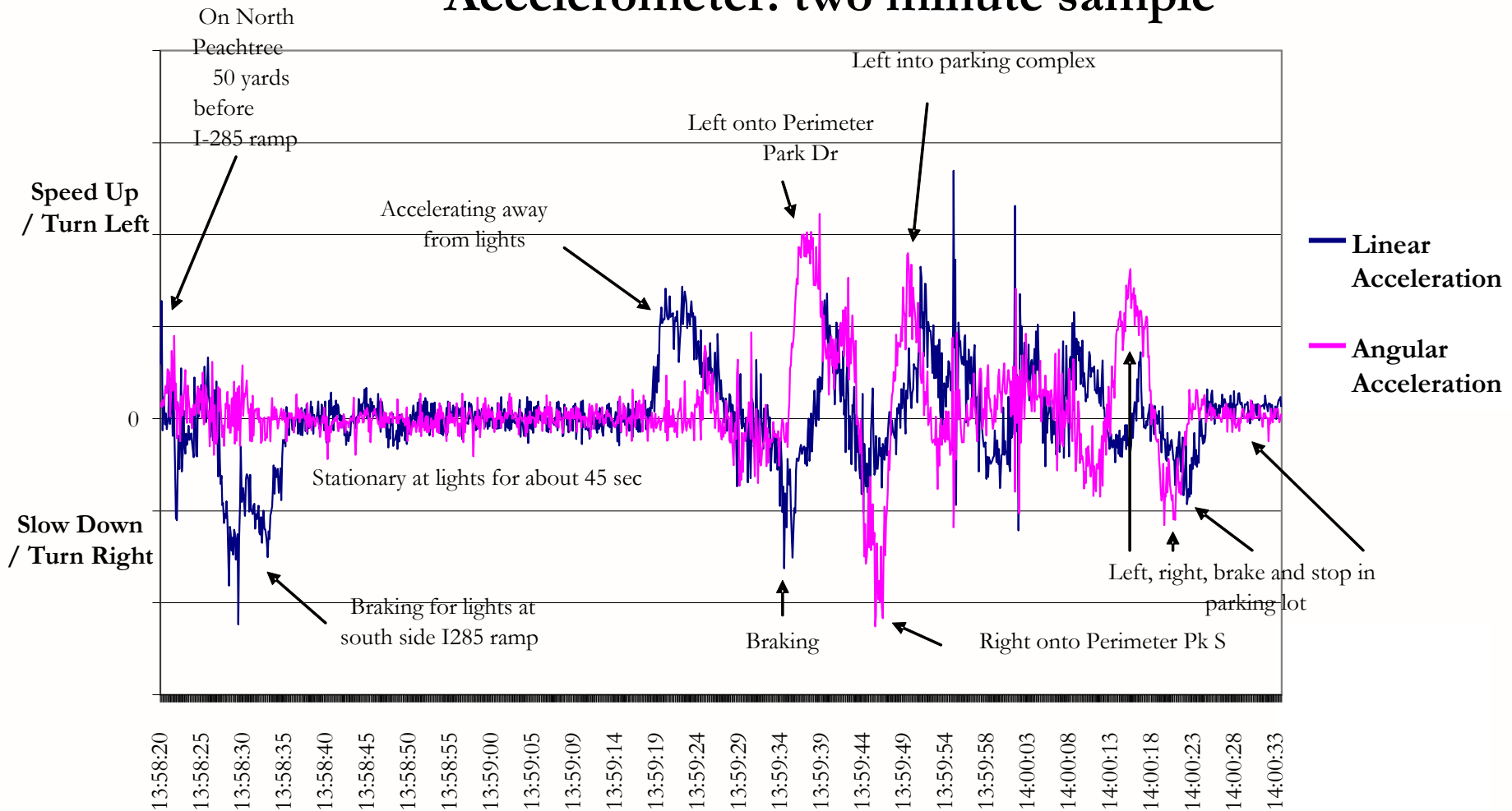
# Telematics – a more direct measure of risk characteristics

- Telematics is the monitoring of vehicle usage
  - Time of day, location, speed, acceleration
  - Linkages to other geographic data: speed limits, road conditions, construction, traffic, etc.
  - Vehicle performance information: oil pressure, engine temperature, seat belt usage, malfunction warnings, etc.
- Usage-based insurance programs use this data to more accurately assess driving risk
  - Actual usage and driver behavior, rather than proxies like credit score, determine premium



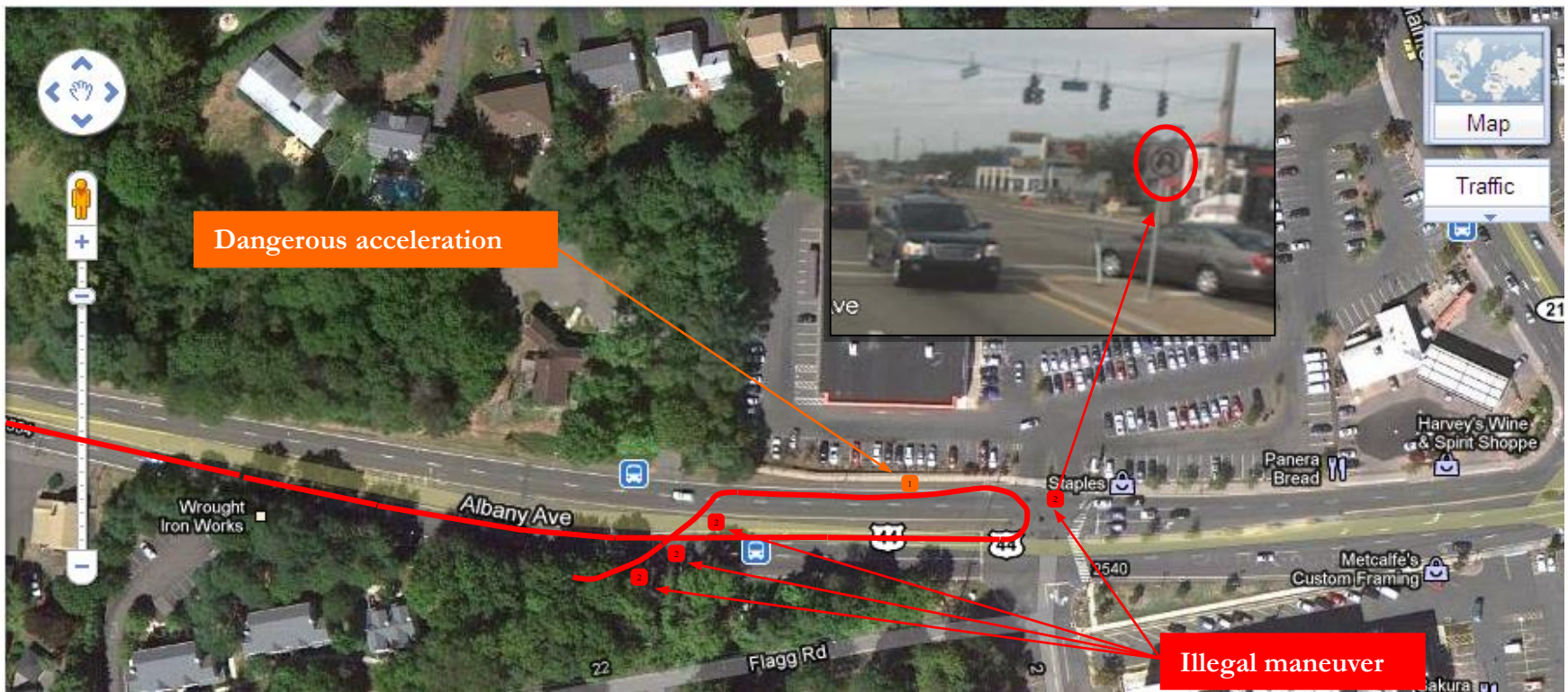
# Data is complex and voluminous; physics is required to interpret it

## Accelerometer: two minute sample



# Vehicle data can also assist in settling claims (like an airplane black-box)

“While traveling east, vehicle made an illegal U-turn, accelerated, went out-of-control, crossed over the double-yellow across oncoming traffic, and hit a tree”



# Agenda

- How is the world changing?
- How is the role of the actuary changing?
- How is the CAS responding?





# Casualty Actuarial Society

- World's *only* actuarial organization focused exclusively on general risks
- Celebrated 100<sup>th</sup> anniversary last year
- Vibrant community and unmatched resources help CAS members, candidates, students advance their careers
- 7,500+ members worldwide, and growing



# *Why CAS?*

## What makes us different?

- **Tangibles**
  - Depth and focus of training
  - Salaries
  - Employment opportunities
- **Intangibles**
  - Industry Leader
  - Values, culture and community
    - Spirit of volunteerism



# Actuarial skill set: A balance makes us valued

- Technical competence
- Communication skills
- Business acumen
- Professionalism



**We are a global society, with growth in membership over 6%**

## 2016 Geographic Distribution

United States	6,139	Switzerland	32
Canada	732	Hong Kong	36
Bermuda	106	Singapore	29
China	72	Germany	11
United Kingdom	52	Other	156



# Top employers of CAS members

Company or Organization	Number Employed	% of CAS membership
Liberty Mutual Group	334	4.5
The Travelers Companies	254	3.5
Zurich (including Farmers)	232	3.2
AIG	169	2.3
Towers Watson	158	2.2
Chubb	152	2.1
Marsh (including Guy Carpenter & Oliver Wyman)	132	1.8
The Hartford	123	1.7
Intact Insurance Company	114	1.6
Milliman, Inc.	114	1.6
CNA Insurance Companies	102	1.4

# CAS members are working outside of the insurance industry

- Uber
- United Technologies
- Google
- General Motors
- Hertz
- Citi Research
- Expedia
- Lowe's



# CAS basic education program is subject to continuous review

Current focus --

- What does the actuary of the future need to know?
  - How much data science, predictive analytics, statistics?
- What education and validation technology is best?



# CAS Announces Two New Exams

- Effective in 2018
- Replacements for existing requirements
- Addresses the emerging needs of future actuaries and their employers
- Increases the relevance of the CAS exam syllabus with respect to emerging statistical and analytics skills





# Modern Actuarial Statistics I (MAS-I)

- Largely a modification of current CAS Exam S, but with more emphasis on applied modeling and a deeper coverage of generalized linear models
- Covers Probability Models, Statistics, Extended Linear Models and Time Series with Constant Variance
- Transition rule: candidates with credit for Exam S achieved through an examination administered prior to January 1, 2018 will receive credit for MAS-I



# Modern Actuarial Statistics II (MAS-II)

- Replaces current CAS Exam 4 requirement that is typically fulfilled by most candidates through completion of SOA Exam C, which is being discontinued
- Covers several topics from Exam C, along with new statistics and predictive analytics material
  - Introduction to Credibility
  - Linear Mixed Models
  - Bayesian Analysis and Markov Chain Monte Carlo
  - Statistical Learning
- Transition rule: candidates with credit for SOA Exam C achieved through an examination administered prior to July 1, 2018 will receive credit for MAS-II



## MAS-I and MAS-II

- Four-hour exams, resulting in no net increase in exam hours required for CAS credentials
- Offered every six months as multiple-choice paper-and-pencil exams
- Offered in the same general windows in the spring and fall in which other CAS exams are offered
- Complete syllabi to be available in early 2017



# Broader CAS strategy to support an active role in data science and predictive analytics

- iCAS DS&PA credential
- Continued emphasis on DS&PA at RPM and other continuing education offerings
- Study group working on educational requirements for the actuary of the future
- New technology / alternative methods for education and competency validation
- Outreach to other aligned organizations
- External communications



[About CAS Student Central](#)[Study Tools](#)[Career Resources](#)[Online Community](#)

Tweets by  
@CASstudent

 CAS Studen...  
@CASstudent

Let us know your #actuarial club's Twitter handle so we can help promote your club's events!



22h

 CAS Studen...  
@CASstudent

# APPLY FOR THE CAS TRUST SCHOLARSHIP

The CAS Trust Scholarship will award up to three scholarships to college students pursuing a career in casualty actuarial science, for the 2017-2018 academic year.

1st Place Scholarship: **\$10,000**

2nd and 3rd Place Scholarships: **\$5,000**

Apply by **March 1, 2017**

[CAS Student Central News](#)[CAS Student Central Webinar - Registration Now Open](#)[Meet this](#)

## Join Us

CAS Student Central is a membership program for university students interested in pursuing an actuarial career. Join the community of 3,000 students from nearly 400 universities who have already joined this free

## The Actuary's Perspective: Top Ten Reasons to Be an Actuary



## Internship Opportunities

Search the CAS Career Center's database of actuarial internship opportunities in the property and casualty field!

The CAS Career Center offers a user

# Questions and Answers

