A VISION FOR ACTUARIAL SCIENCE IN THE 21ST CENTURY: ACTUARIES AS DATA SCIENTISTS

California Actuarial Student Summit
Claudine Modlin, FCAS MAAA
May 24, 2019
25 DAYS, 2 HOURS AND A HANDBFUL OF MINUTES ….
Chapter 1: Becoming

Chapter 2: The Joys of Getting Started

Chapter 3: Venturing Out

Chapter 4: Evangelist & Expert

Chapter 5: Leading Change

…Chapter 6??
CASUALTY ACTUARIAL SOCIETY (CAS)

- World’s *only* actuarial organization focused exclusively on property and casualty risks
- 100+ year track record in training property/casualty actuaries
- More than 8,000 members worldwide, and growing
- Vibrant, growing community with deep and extensive resources to help CAS members, candidates, and students advance their careers; strong employer support
## WHY P&C ACTUARIAL WORK?

### #P&CInsuranceIsSexy
- Huge, established industry
- Varied products
- Dynamic risk
- Complex / constrained
- Data rich
- Evolving
- Work lifestyle

### #WhyActuariesThrive
- Credibility
- Quantitative & operational knowledge
- Community of continuous learning
- Opportunities
WHERE ARE ACTUARIES

Core
- Reserving
- Pricing
- Capital adequacy
- Reinsurance / Catastrophe modeling

Growing
- Claims
- Underwriting
- Product Management
- Marketing
- Distribution/Sales
- Operations
- Strategy / Business transformation / New ventures
CAS MEMBERS MOVING OUTSIDE INSURANCE

- Uber
- Google
- Expedia
- Lowes
- General Motors
- United Technologies
- Hertz
- Citi Research
ACTUARIES AND DATA SCIENTISTS (CLAUDINE’S VIEW!)

What do we have in common? Use analytics (e.g., math and stats) to transform data into useful insights that solves problems

Where’s the difference?

Actuaries
- Professionally trained to evaluate financial implications of risk and uncertainty
- Strong domain knowledge, trusted by business partners
- Most comfortable working with structured data

Data scientists
- Not domain specific (often partner with domain experts)
- Proficient programmers and data engineers (mine complex data - structured and unstructured data)
- Well-versed in computational / machine learning approaches
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- Not domain specific (often partner with domain experts)
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- Well-versed in computational / machine learning approaches as well as visualizations

Can we be both?
What does that mean?
USE CASE #1: EVOLUTION OF P&C RATEMAKING

\[ E \text{ (Premium)} = E \text{ (Loss)} + E \text{ (Expenses)} + \text{Target Profit} \]

- Examine historical data to understand each of these components, making adjustments to project each one into the future.

- If the equality does not hold, rates need to go up or down.

- Also need to understand which risk attributes are driving the cost of claims (and their relative importance) so we can develop rates appropriate for individual risks.

The science of doing this is always evolving!
## P&C RATEMAKING – PERSONAL AUTOMOBILE INSURANCE

<table>
<thead>
<tr>
<th>Era</th>
<th>Risk characteristics</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1990s</td>
<td>Limited (e.g., driver age/sex/marital, type of car, geography)</td>
<td>Rudimentary, univariate</td>
</tr>
<tr>
<td>1990s</td>
<td>Introduce psychographic variables (e.g., credit)</td>
<td>Statistical, multivariate</td>
</tr>
<tr>
<td>&gt;2000</td>
<td>More granular data (e.g., accidents/violations, car safety features) and new types of data – e.g., driving behavior</td>
<td>Statistical, augmented with machine learning</td>
</tr>
</tbody>
</table>

But data science is just getting started…
Meet Katie and Heidi
They have similar profiles in terms of drivers and cars

<table>
<thead>
<tr>
<th></th>
<th>Katie</th>
<th>Heidi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zip code/address</td>
<td>604XX</td>
<td>604XX</td>
</tr>
<tr>
<td>Homeowners</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Age</td>
<td>Adult</td>
<td>Adult</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Female</td>
</tr>
<tr>
<td>Household driving record</td>
<td>No convictions; No accidents</td>
<td>No convictions; 1 fender bender not submitted</td>
</tr>
<tr>
<td>Household status</td>
<td>Married, kids are good students</td>
<td>Married, kids are good students</td>
</tr>
<tr>
<td>Location</td>
<td>Garage at residence</td>
<td>Garage at residence</td>
</tr>
<tr>
<td>Number of eligible vehicles</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Years licensed range</td>
<td>1—10+</td>
<td>2—10+</td>
</tr>
<tr>
<td>Age of oldest driver</td>
<td>40—55</td>
<td>40—55</td>
</tr>
<tr>
<td>Excluded driver</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Financial responsibility</td>
<td>Yes, Pay in Full, EFT</td>
<td>Yes, Pay in Full, EFT</td>
</tr>
<tr>
<td>Persistency</td>
<td>7 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Other pols</td>
<td>Home, small toys</td>
<td>Home, small toys</td>
</tr>
<tr>
<td>Vehicle type &amp; mileage</td>
<td>2014 CT 200H; 30k</td>
<td>2015 Prius V; 20k</td>
</tr>
<tr>
<td>Vehicle ACV</td>
<td>$17,000</td>
<td>$18,000</td>
</tr>
<tr>
<td>Vehicle stability control</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Basic safety systems</td>
<td>Airbags, anti-lock brakes, no motorized seat belts</td>
<td>Airbags, anti-lock brakes, no motorized seat belts</td>
</tr>
<tr>
<td>Coverage amounts</td>
<td>100/300, $1000 Ded, Rental/towing</td>
<td>100/300, $1000 Ded, Rental/towing</td>
</tr>
<tr>
<td>Annual mileage</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Vehicle use</td>
<td>Pleasure</td>
<td>Pleasure</td>
</tr>
</tbody>
</table>
Two drivers look alike on paper, so we price them similarly
Telematics data gives us unprecedented insight into individual driving behavior...

<table>
<thead>
<tr>
<th>Katie</th>
<th>Heidi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of driving</td>
<td>Minimal, Highways</td>
</tr>
<tr>
<td>Average number of trips/week</td>
<td>6</td>
</tr>
<tr>
<td>Average length of trip</td>
<td>32</td>
</tr>
<tr>
<td>Time of day</td>
<td>Off peak</td>
</tr>
<tr>
<td>Road type</td>
<td>Uncongested freeway</td>
</tr>
<tr>
<td>Driving condition</td>
<td>Cruise control + podcast</td>
</tr>
<tr>
<td>Distracted driving</td>
<td>2 per trip</td>
</tr>
</tbody>
</table>

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... and vehicle features in use
Things aren’t always as they appear
Biometrics can revolutionize how we understand drivers.

<table>
<thead>
<tr>
<th></th>
<th>Katie</th>
<th>Heidi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainwaves</td>
<td>Less attentive</td>
<td>Very alert</td>
</tr>
<tr>
<td>Eye movement &amp; gaze</td>
<td>Nav to street</td>
<td>All around the vehicle</td>
</tr>
<tr>
<td>Blinking</td>
<td>Excessive</td>
<td>Normal</td>
</tr>
<tr>
<td>Heart rate</td>
<td>High</td>
<td>Normal</td>
</tr>
<tr>
<td>Voice modulation</td>
<td>Quiet</td>
<td>Noisy</td>
</tr>
<tr>
<td>Blood alcohol content</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Medical devices</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sensor data (Rideshare)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
As mobility behaviors change, so does individualized risk
Predicting future losses requires an understanding of how drivers act—both at time of quote and renewal.
What next?
ACTUARIAL SCIENCE AND/OR DATA SCIENCE?

- Well-defined problem relating to estimation of financial consequences of risk and uncertainty

- Data starts off as “big data” (millions of customers and hundreds of predictors) and eventually becomes “Big Data” (disparate sources of data, including streaming data) that requires unique skills/tools to manage

- Implementation of findings requires knowledge of insurance ratemaking – regulation, public policy, customer/agent expectations, systems implications

- Opportunities for actuaries in behavioral science (how to “nudge” the driving behavior you want) and algorithmic auditing (avoiding “weapons of math destruction”)
USE CASE #2: WILDFIRE PREDICTION

- **Context:** two catastrophic wildfire years (2017-2018) - $24B industry losses

- **Problem to solve:** reduce exposure to wildfire loss through surgical identification of which properties are most at risk

- **Approach:** imagery / AI / machine learning / probabilistic score = improved underwriting & pricing

- **Considerations**
  - Data robustness
  - Statistical (predictive power)
  - Acceptance (regulators, agents, customers)
  - Deployment
  - Cost benefit
WHAT ELSE CAN ACTUARIES AS DATA SCIENTISTS ADDRESS?

- **Mine text** to better understand which claims are most likely to increase in complexity (resulting in better claims experience and more stable reserves)

- **Analyze IoT data** (smart homes, wearables) to understand the impact on risk and customer engagement

- **Leverage web clickstream and call center data** to identify customer pain points that lead to lower retention

- **Analyze which agent behaviors** have the biggest drain on premium and profitability

- **Study which customers are influencers** of other customers to help develop programs to have those influencers help you out

……... and many others
CONCLUDING THOUGHTS ...

- Actuaries have a great history of solving problems using quantitative discipline and business acumen in the field of risk.

- The set of problems where our skills apply is growing – both in and outside insurance - and the solutions are often fueled by advances in data and technology.

- Tackling these problems require additional skills that we can either obtain or learn how to harness (in others).

- Most important is to position yourself as a critical thinker!

And a few other bits of info....
INTERNSHIPS

What you get
- Exposure to business problems & current approaches
- Opportunities to learn and interact with professionals
- Participate in research, analysis, execution, ideation/design

What employer gets
- Labor
- Fresh perspective
- Assess future talent - see how you learn, think, perform, communicate, interact
- Example summer intern projects
  - Research connected home and IoT offerings
  - Driverless technology loss experience & feature identification
  - Loss experience by customer’s distance to agency
  - Web scraping public data sources relevant to insurance underwriting
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WHAT IS THE CAS INSTITUTE (ICAS)?

- Subsidiary of the Casualty Actuarial Society
- Provides specialist credentials and resources for quantitative professionals in selected areas, such as:
  - Predictive Analytics / Data Science
  - Quantitative Reinsurance Analysis
  - Capital Modeling / ORSA analysis
  - Catastrophe Risk Management
  - Other analytics and quantitative specialties
DATA SCIENCE CREDENTIAL

Certified Specialist in Predictive Analytics (CSPA)

Curriculum covers:

- Property and Casualty Insurance Fundamentals
- Data Concepts and Visualization
- Predictive Modeling Methods and Techniques
- Ethics and Professionalism
- Hands-on case study project
QUESTIONS

For interest in career opportunities at Farmers, register here to access open roles and stay connected:
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