SESSION/SÉANCE : #3
Predictive Modeling in Claims Management, Pricing and Reserving
SPEAKER(S)/CONFÉRENCIER(S) : Barry Senensky FCIA
President Claim Analytics
# COMPUTER PERFORMANCE

<table>
<thead>
<tr>
<th>Measure</th>
<th>IBM 7094 c. 1967</th>
<th>Laptop c. 2009</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor Speed (MIPS)</td>
<td>0.25</td>
<td>2,800</td>
<td>11,000-fold increase</td>
</tr>
<tr>
<td>Main Memory</td>
<td>144 KB</td>
<td>4,000,000 KB</td>
<td>28,000-fold increase</td>
</tr>
<tr>
<td>Approx. Cost ($2009)</td>
<td>$12,000,000</td>
<td>$1,000</td>
<td>12,000-fold decrease</td>
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</table>
Introduction to Predictive Modeling

Predictive Modeling Applications for Group
- Claim Scoring
- Calculation of Claimant Disabled Life Reserves
- Disability Insurance Pricing
- Other

Summary/Conclusion
Introduction to Predictive Modeling
What is Predictive Modeling

• **Analyze** historic data

• **Identify & quantify** relationships between predictive inputs and outcomes

• Apply learning to **predict outcomes** of new cases
TWO “ERA’S”

• Traditional
  – Around for 100+ years
  – Low usage of computer power
  – Relatively easy to understand

• Modern
  – Have been around 40+ years
  – Exploits power of computer processing
  – Can be “black boxes”
SOME MODERN PREDICTIVE MODEL APPLICATIONS

• Credit Scores
• Credit Card Fraud Detection
• Stock Selection
• Mail sorting
• Hot dogs and Hamburgers
SOME MODERN PREDICTIVE MODELING METHODS

- Classification and Regression Trees
- Generalized Linear Models
- Neural Networks
- Genetic Algorithms
- Stochastic Gradient Boosted Trees
- Support Vector Machines
Predictive Modeling and the Life Insurance Industry

“The Past”
THE PAST-P&C INDUSTRY

• Progressive Insurance started using predictive models in the mid-90’s
• Incorporated Credit Ratings into pricing automobile insurance
• Huge competitive advantage
• Catalyst-others needed to follow
• Majority of US P&C Industry now uses predictive modeling for pricing underwriting
THE PAST-LIFE INSURANCE INDUSTRY

• Not too much
• Some application for target marketing
• A few fraud applications
• Recently started seeing interest in mortality applications
• Claim Analytics applications for group claims management, reserving and pricing
WHY HAS THE LIFE INSURANCE INDUSTRY LAGGED?

- Conservative Industry
- Not tool of choice of Actuaries
- Lack of Foresight
- No “earth-shattering” catalyst
WHAT WILL THE FUTURE BRING?

• Predictive Models will become the tool of choice!
• Its only a matter of time!
• It just makes too much sense!
• Innumerable applications to help solve insurance problems
Applications for Group
Applications for Group Claim Scoring
Claim Scoring

- Currently used by over 20 Life Insurance Companies in Canada and US
- Tool for Disability Claims Management
  - LTD
  - STD
- Resource Allocation Tool
- Boosted Trees Model
What is claims scoring?

- Based on its specific attributes, a claim will be scored between 1 and 10

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>15%</td>
<td>25%</td>
<td>35%</td>
<td>45%</td>
<td>55%</td>
<td>65%</td>
<td>75%</td>
<td>85%</td>
<td>95%</td>
</tr>
</tbody>
</table>
Each claim receives the appropriate level and type of attention

CLAIM SCORES – RETURN TO WORK

Return to Work Probability

Claim Score

Low Touch
- Monitor claims
- RTW plan in place
- Communication
CLAIM SCORES – RETURN TO WORK

Risk stratification provides early identification of at risk claims

- Expense Mgmt
  - Major impairment
  - Manage expenses
  - Maximize offsets
  - Consider settlement

- Low Touch
  - Monitor claims
  - RTW plan in place
  - Communication
CLAIM SCORES – RETURN TO WORK

Scores facilitate claim triage – appropriate action for each claim

Return to Work Probability

- Expense Mgmt
  - Major injury
  - Manage expenses
  - Monitor treatment
  - Consider settlement

- Return to Health
  - Most complex claims
  - Actively manage claimant
  - Apply resources to improve outcome
  - Closely monitor

- Low Touch
  - Monitor claims
  - RTW plan in place
  - Communication

Claim Score
Opportunities in approach.

In profit. In potential.

Before

After
Applications for Group Disabled Life Reserves
Current Disabled Life Reserves

- Table-based
- Use small subset of known information:
  - Age
  - EP
  - Gender
  - Maybe occ or diag
- May not capture the true value of each claim
- Promotes cherry-picking
- May not be appropriate over time
Using Predictive Modeling

• Allows several additional factors to be accounted for:
  • Primary, secondary and tertiary diagnosis
  • Industry / SIC Code
  • Monthly benefit
  • Own occ period
  • And more…

• DLR’s are claimant specific and capture the true value of each claim
Claimant Specific DLR’s

• Promotes good claim management
• Better financial projections
• Remain appropriate if mix of claims changes
• Valuable input into renewal underwriting process
Modeling Approach

• Models are very consistent with those built for claim scoring
  ➢ Except need to account for mortality
  ➢ Need to interpolate between key points

• Beyond 36 or 48 months, blend into table
  ➢ Too few terminations to model
Applications for Group Disability Pricing
Current Industry Approach

- Traditional actuarial methods focus on one, maybe two risk factors at a time
- Solve for one factor, then move to the next
- Unable to account for correlations and interactions between rating variables
- Lots of uncertainty in rates
Uncertainty in Current Rates

Quotes for Claim Analytics employee LTD benefits

<table>
<thead>
<tr>
<th>Insurer</th>
<th>Rate per $100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company 1</td>
<td>0.539</td>
</tr>
<tr>
<td>Company 2</td>
<td>1.110</td>
</tr>
<tr>
<td>Company 3</td>
<td>1.986</td>
</tr>
</tbody>
</table>

- No consistency between insurers
- Does anyone have confidence in their rates?
Predictive Modeling Approach

• Tool of choice is GLM
• Ideally suited to multivariate analysis
  ➢ Facilitates analysis of interaction effects
  ➢ Uncover and quantify complex relationships between risk factors and claim experience
• Improved accuracy vs traditional methods
• Greater confidence in rates
Recent Project Highlights

- Identified a key rating variable that was not priced for in current rates
- Identified and quantified two-way interaction effects between rating variables
- Better quantification of all effects
- Significant improvements compared to existing rates
Applications for Group Other
Other Group Applications

• Fraud/Abuse
  ➢ Techniques available to profile providers and identify outliers

• Automating/Fast Tracking Disability Claim Approvals

• Rehab Analysis
Summary
Summary

• Lots of applications for Predictive Modeling
• Provides a competitive advantage
• Never too soon to get started
QUESTIONS?