



CARIBBEAN ACTUARIAL ASSOCIATION



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2013 Conference “Risk, Recovery & Real Growth”

23rd Annual CAA Conference

Secrets Wild Orchid Montego Bay,
Jamaica.

4th to 6th December 2013

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Developments in Motor Insurance Pricing

Predictive Modeling with Machine Learning

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Eckler Ltd.

6 December 2013

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Agenda

- Current Environment
- Uses and Benefits of Predictive Modeling
- Machine Learning
- Predictive Modeling Steps
- Expertise Needed
- Implementation



Current Environment

- Leading companies today are creating long-term analytical plans that continuously build greater breadth and competencies
- In widespread practice, current state-of-the-art insurance modeling uses Generalized Linear Models (GLMs)
- Areas where tools are used
 - Pricing/Underwriting
 - Profitability monitoring
 - Marketing
 - Competitive positioning
 - Claims frequency and severity



Potential Uses of Predictive Modeling

- Minimize adverse selection
- Produce accurate pricing of risks
- Gain better knowledge of book of business
- Identify problem areas
- Determine opportunities for growth
- Improve rating plans



Benefits of Predictive Modeling

- Reveals new information
- Finds innovative ways to replace intuition-based decision making
- Helps determine market inefficiencies
- Helps understand consumer behaviour and market-based pricing
- Algorithms outperform human experts at combining multiple pieces of information

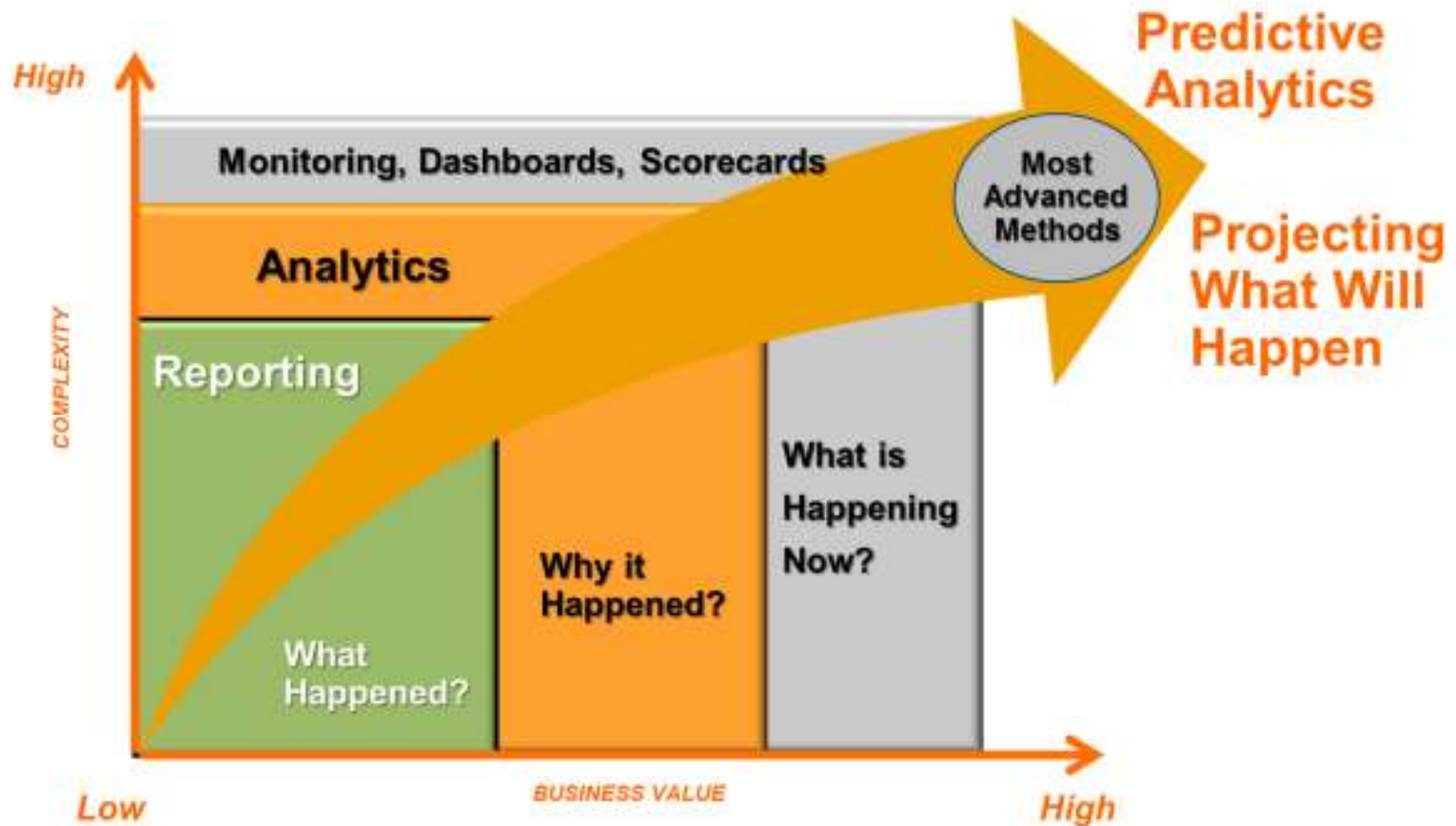


Machine Learning

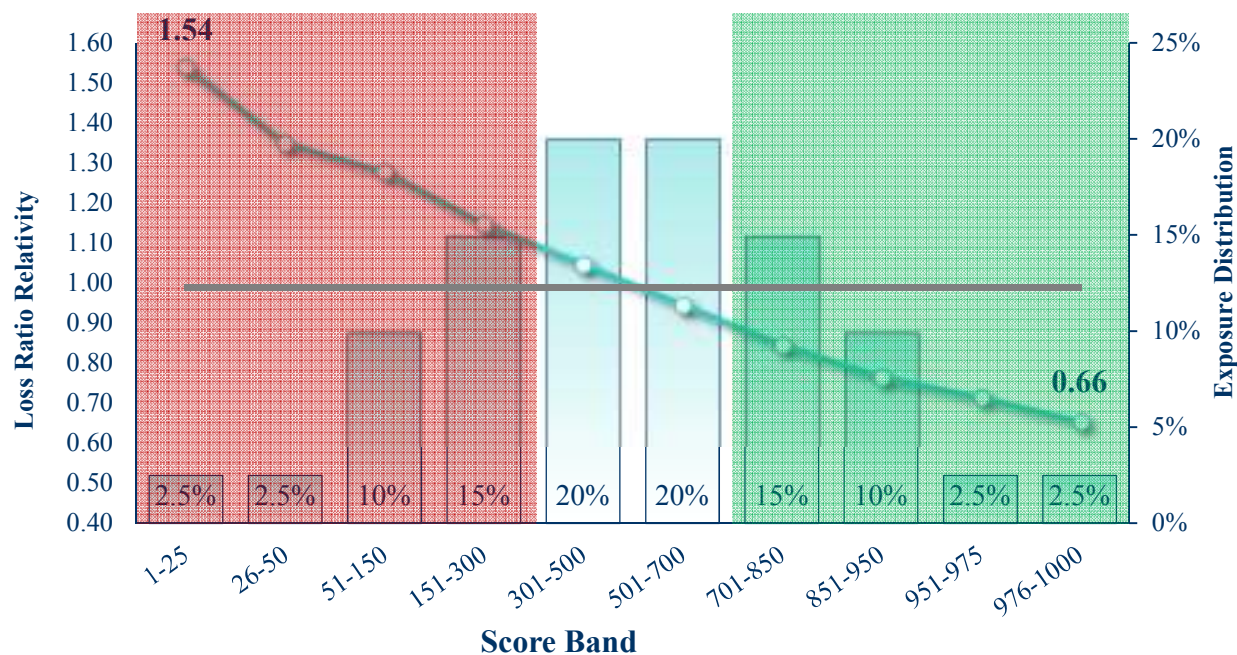
- Machine Learning uses advanced mathematical methods and technology to automatically search your data set
- Finds unique combinations of variables that are predictive of future events
- These combinations are difficult, if not impossible, to find using traditional methods



Greater Insight Through Machine Learning



Pricing & UW: What is Being Missed Every Day



— Perceived State-of-the-Art Result (1.00) Exposure Distribution —○— Actual Relativity

60% of the exposures in their technical premiums had pricing errors greater than 10%.

- Underpricing errors of up to 54%
- Overpricing errors of up to 34%



Predictive Modeling Steps

- Select/Build software
- Determine available hardware
- Prepare data (incl. holdback)
- Create models
- Analyze results of models
- Communicate to stakeholders
- Implement model



Preparation of Data

- Need to understand the data
- Determine data available
- Merge sources of data
- Need to clean the data
- Determine subsets of data

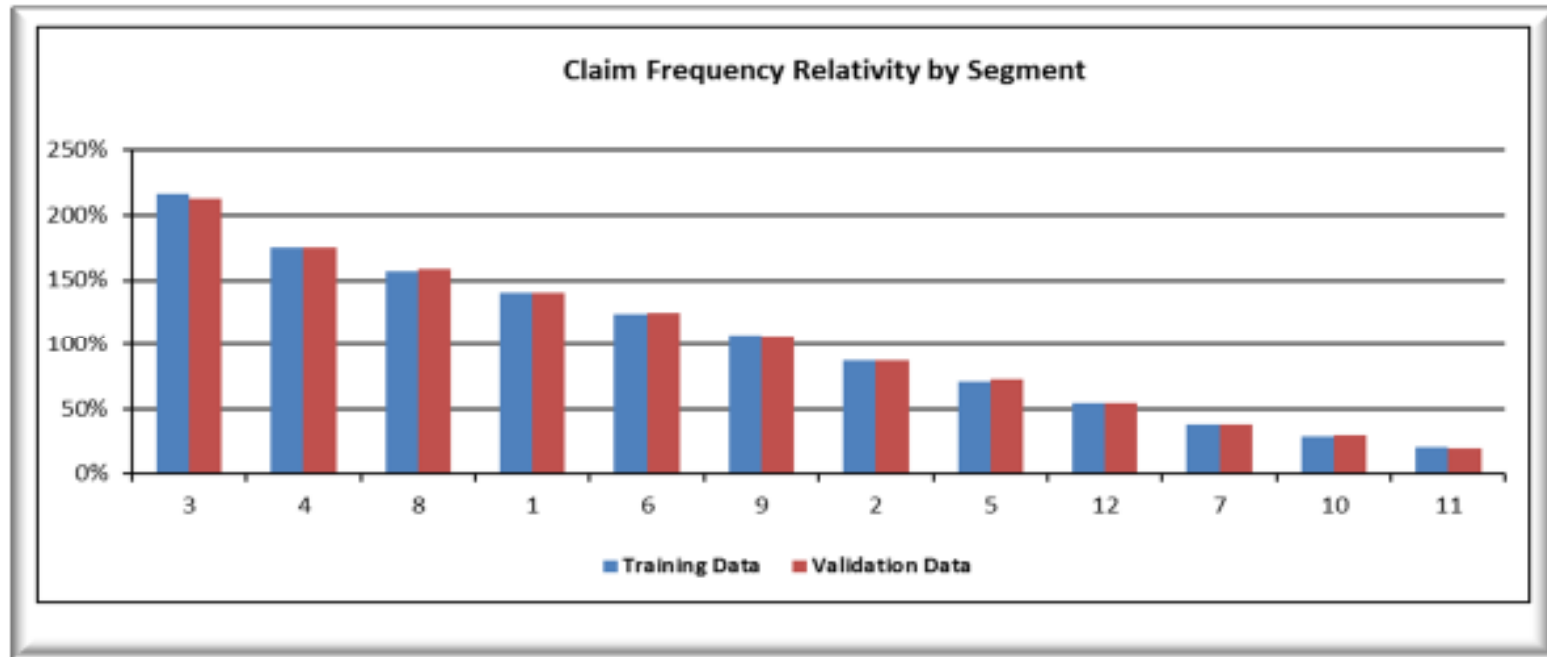


Data - Holdback Concept

- Keep a random portion of the dataset for purposes of testing and validating the model
- Size of the holdback will vary
- Holdback will help prevent overfitting the model



Data - Validation/Credibility

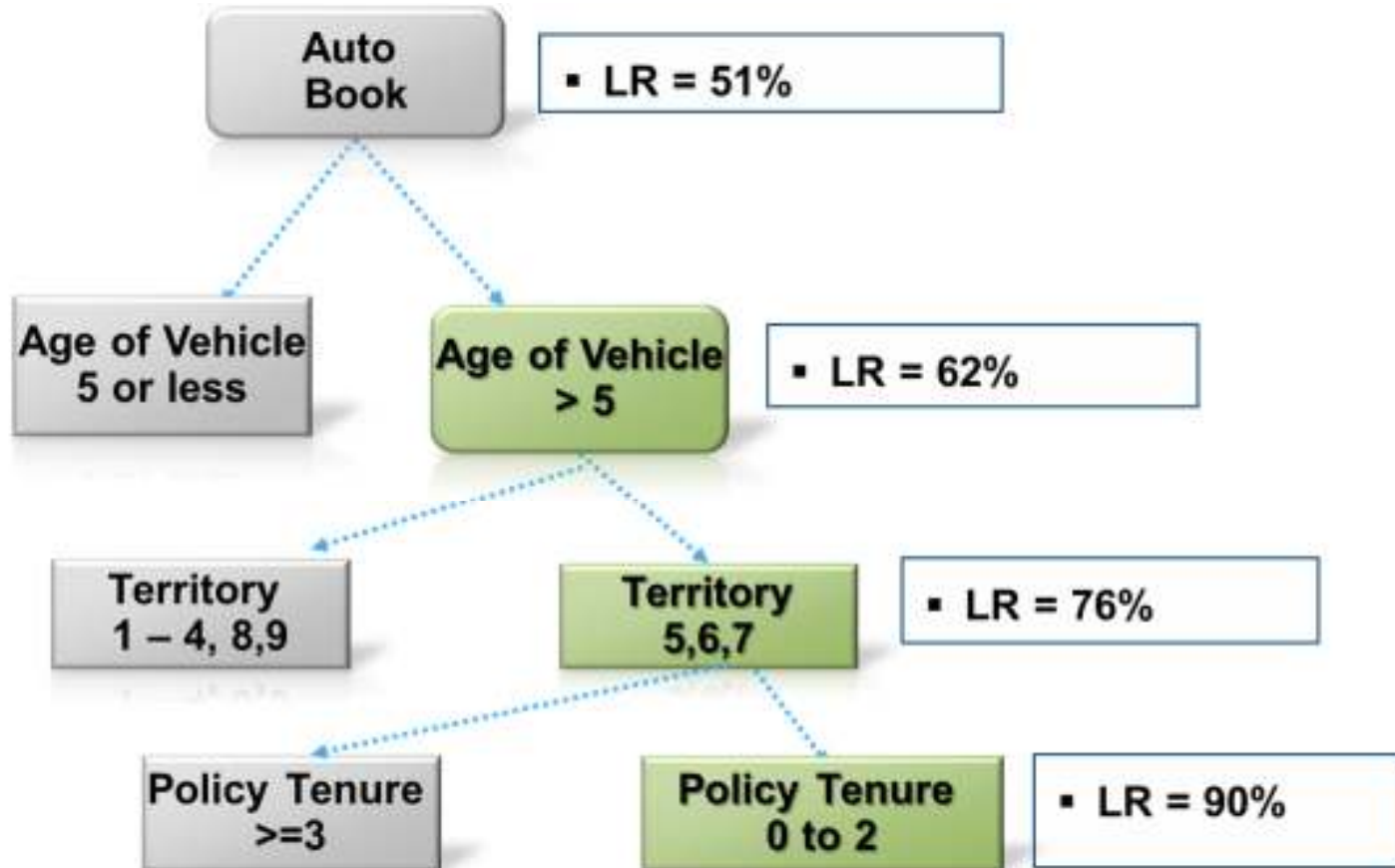


Validation

- Training using randomly selected 70% of the data
- Validate on remaining 30%
- Correlation between Training & Validation = 98.4%
- If data set is large enough recommend 3rd split for final test



Models - How is a Segment Built?



Models - Loss Ratio Analysis

Business Selection: PA

Analysis Type: Complete Segmentation Loss Ratio Lift: 35.1-150.1% = 4.3x

Status: Public [Glossary](#)

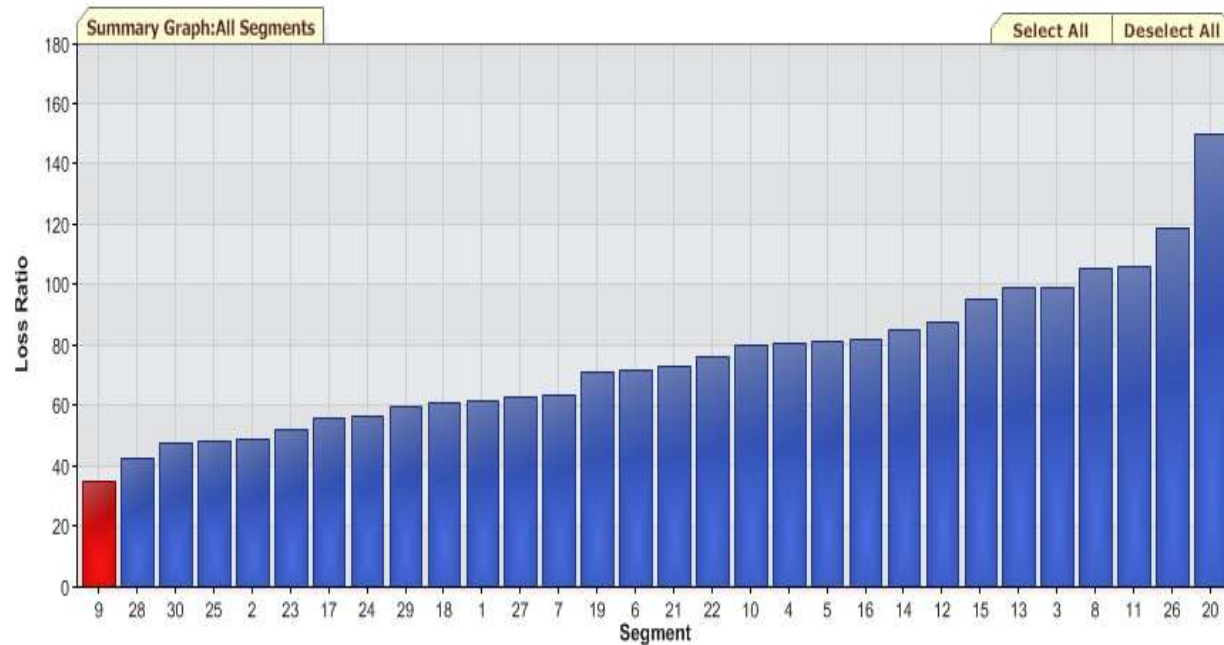
Analysis Name: Segmentation 2000

Date Range: 2005-2007

Correlation: 95.8 %

Selected Segment(s): 9

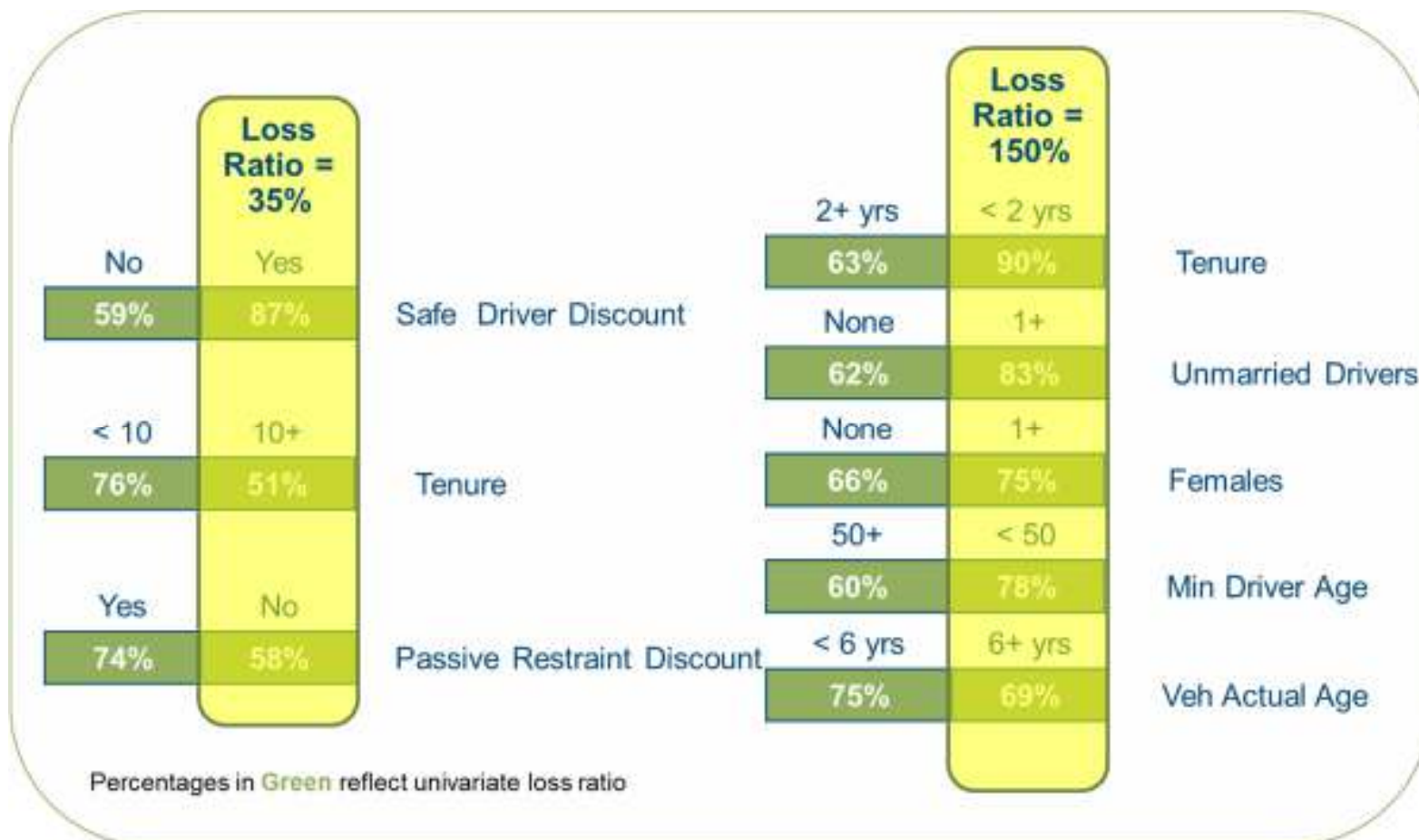
Summary Graph (Hide Details...)



- Segment 9 definition
 - Vehicle - Class Code - Safe Driver Disc
Yes
 - Policy - Tenure
10 or more
 - Vehicle - Passive Restraint Discount
N
- Segment 28 definition
- Segment 30 definition
- Segment 25 definition
- Segment 2 definition
- Segment 23 definition
- Segment 17 definition
- Segment 24 definition
- Segment 29 definition
- Segment 18 definition
- Segment 1 definition
- Segment 27 definition
- Segment 7 definition
- Segment 19 definition



Models - Best & Worst Customer Segments



Models – Use of Cross Models

Increase retention of profitable with poor retention business

Exposures		RetScrTier	Retention							Total
LR	LRScrTier	001-099	100-199	200-349	350-499	500-649	650-799	800-899	900-1000	
75.4%	001-099	0.0%	0.0%	0.1%	0.7%	1.2%	2.7%	1.5%	2.0%	8%
61.4%	100-199	0.0%	0.1%	0.5%	1.4%	2.0%	2.9%	2.0%	1.0%	10%
58.2%	200-349	0.0%	0.4%	1.5%	2.7%	3.6%	4.2%	2.0%	0.8%	15%
55.5%	350-499	0.3%	1.0%	2.6%	3.4%	3.7%	2.7%	1.5%	0.7%	16%
49.5%	500-649	0.7%	2.0%	3.6%	3.4%	2.6%	1.9%	1.2%	0.6%	16%
45.8%	650-799	2.0%	3.0%	3.5%	2.4%	1.6%	1.1%	1.2%	0.5%	15%
42.7%	800-899	3.6%	2.2%	1.8%	0.8%	0.7%	0.3%	0.7%	0.6%	11%
35.0%	900-1000	3.0%	1.6%	1.8%	0.9%	0.4%	0.1%	0.4%	0.5%	9%
Total		10%	10%	15%	16%	16%	16%	11%	7%	100%

*9% of Portfolio

Customers that would be the target for this action can be identified by attaching Loss Ratio and Retention Scores in batch mode and producing policy listing to take immediate actions.



Expertise Needed

- Actuarial
- IT
- Underwriting
- Marketing
- Claims
- Statistical
- Legal



Considerations before Implementation

- Policyholder dislocation
- Systems constraints
- Legal environment
- Public and regulatory acceptance



Typical Project

■ Phase 1

- Identify a key area of focus, usually a line of business or region
- Document organizational objectives and goals vis-a-vis project goals
 - *Make sure project goals are in sync with corporate and management objectives*

■ Phase 2

- Gather data
- Review data for quality, consistency and completeness
- Univariate analysis – assess current state strengths and weaknesses



Typical Project (cont'd)

■ Phase 3

- Machine learning, multivariate segmentation analysis
- Iterative discussions among various stakeholders

■ Phase 4

- Identify and prioritize actions against original goals
- Communicate findings and recommendations across the organization
- Determine and implement methods to track results



Thank you ...

- *If you wish a copy of this presentation,
please send me an email at ...*

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