Personal Auto Predictive Modeling Update: What's Next?

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You've Heard…

Where predictive modeling for auto has been

…and…

What the road has been like getting there

…and now…

Where are we going next?

What's Next?

- New Data

- New/Expanded Applications

- New Techniques

New Data

- **External data**
  - Vehicle use data
  - Vehicle characteristics
  - Vehicle ownership history
- **Internal data**

Vehicle Use Headlines

- **March 21, 2005 -** Black Box Car Insurance Comes to Canada
- **July 17, 2007** - Auto Insurance First: Technology Lets Americans who Drive Less, Pay Less
  - GMAC Insurance rolls out nationwide discount program for low-mileage driving; leverages in-vehicle OnStar by GM technology to save up to 54% on premiums.
- **July 21, 2008** - High Point Auto Insurance Launches Statewide Safety Initiative
  - *OnStar by GM Signs On As Founding Partner*
- **June 27, 2008** - One-of-a-Kind Car Insurance Program Lets Drivers Save Big Bucks Based on How They Drive
  - Progressive prepares countrywide launch of MyRate^{SM}, an optional behavior-based insurance program

Vehicle Use

- **Data**
  - Mileage driven
  - Time of day
  - Speed
  - Braking
  - Sharpness of turns
  - Where you drive
- **Application**
  - Auto insurance rating
  - Encourage safety

Vehicle Characteristics

Data

- Daytime running lights
- ESC/DSC
- Weight
- Engine size
- Segmentation
- CID
- Body type

- Cylinders
- Driving wheels
- High performance code
- Transmission
- Wheel base
- Height
- Width

Applications

- Liability symbols
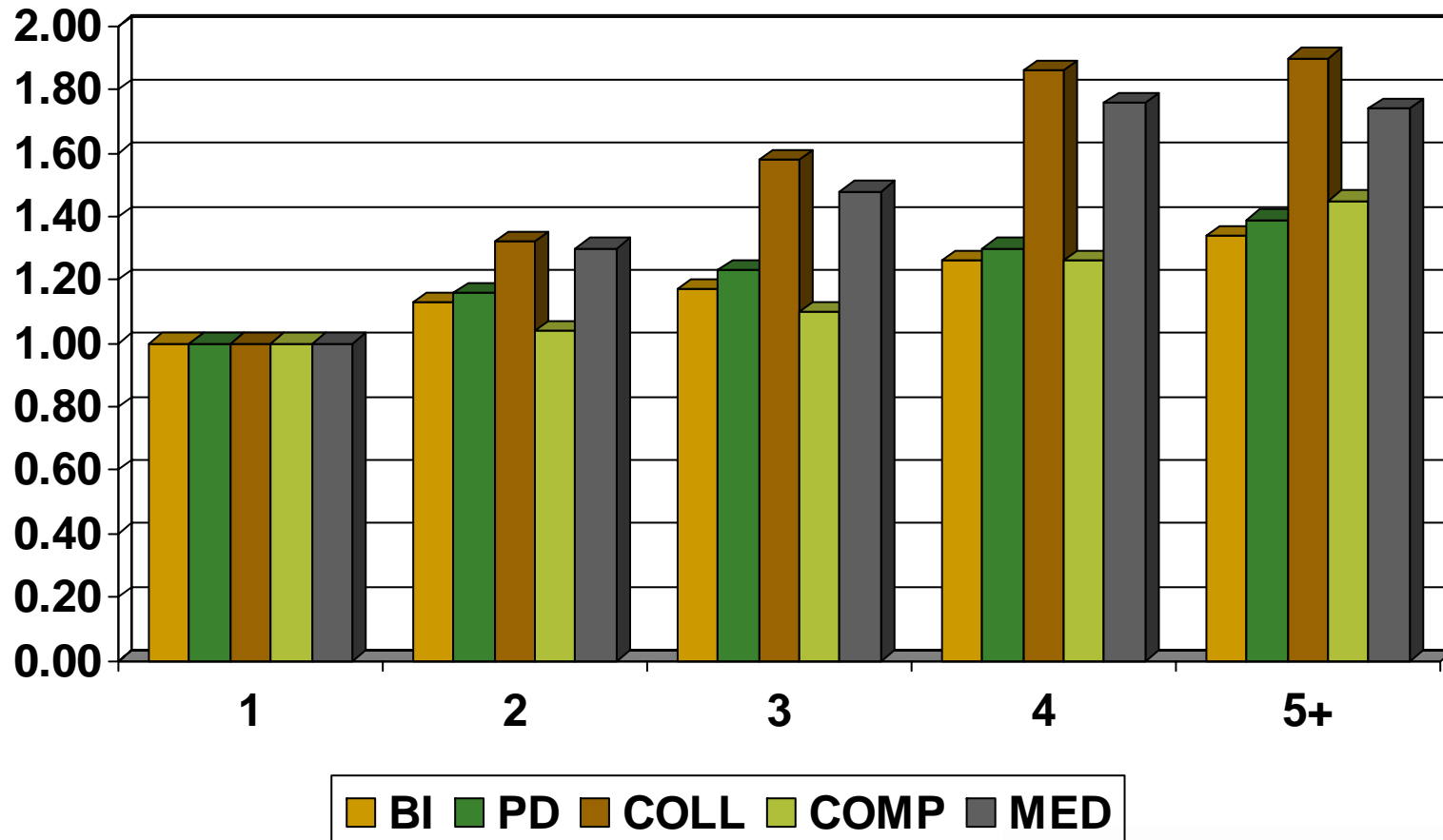- Enhanced physical damage classification
- New model classification
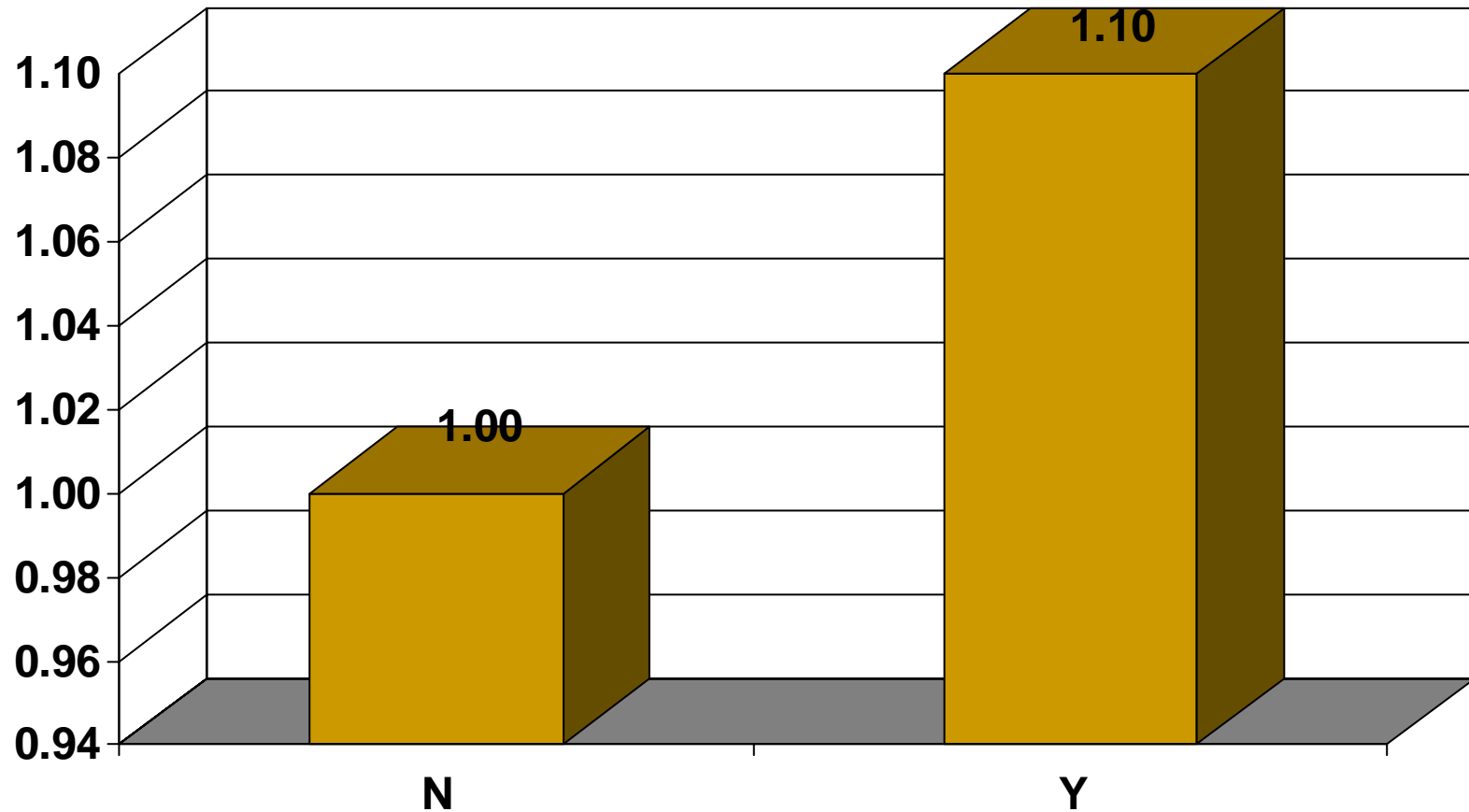
Vehicle Ownership History

- Vehicle damage history
- Emissions test results
- Odometer readings
- Lease history
- Use history (rental, commercial)
- Number of prior owners
- Ownership length

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Number of Owners

Potential Damage

Use of Vehicle Owner History

- **Rating/tiering**
  - Prior ownership count, branded title
- **Underwriting**
  - Potential damage, flood loss
- **Mileage verification**

Internal Data

- Cross-line information
    - Pricing characteristics
    - Claim information
- Endorsements
- Billing
- Insurance premium payment history
- More granular prior loss data
- Lapse/cancellation history

New/Expanded Applications

- Target marketing

- Customer Response Modeling

- Automated underwriting/re-underwriting

- Price optimization

- Agency evaluation

Target Marketing

- Purpose: analysis of marketing efforts to identify targets most likely to purchase insurance
- Measure characteristics of shoppers, quoters, purchasers, and retained business
- Characteristics
  - Internal company information
  - External demographic information
  - Credit profiles
  - Shopping incentives
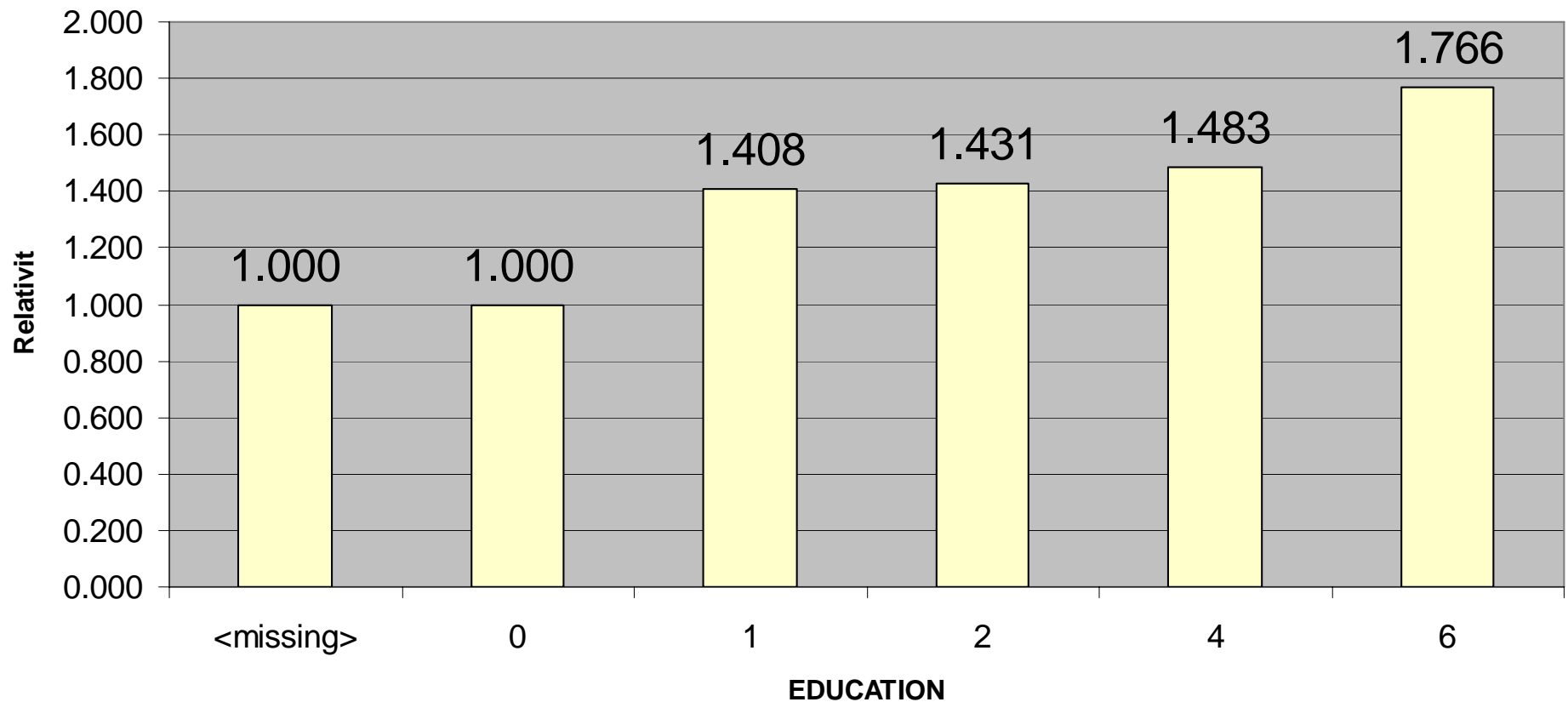- Identify insureds to target

Customer Response Modeling

- <u>Quoting analysis</u>: analysis of the likelihood of a prospective insured obtaining an insurance quote from you
- <u>Conversion analysis</u>: analysis of the likelihood of a insured that has received a quote purchasing insurance from you
- <u>Retention analysis</u>: analysis of the likelihood of a current insured renewing with you
- Use of these likelihoods as a proxy for competition?
  - Does not tell why you are losing/not writing risks
- Target marketing is typically combination of quoting plus conversion analysis
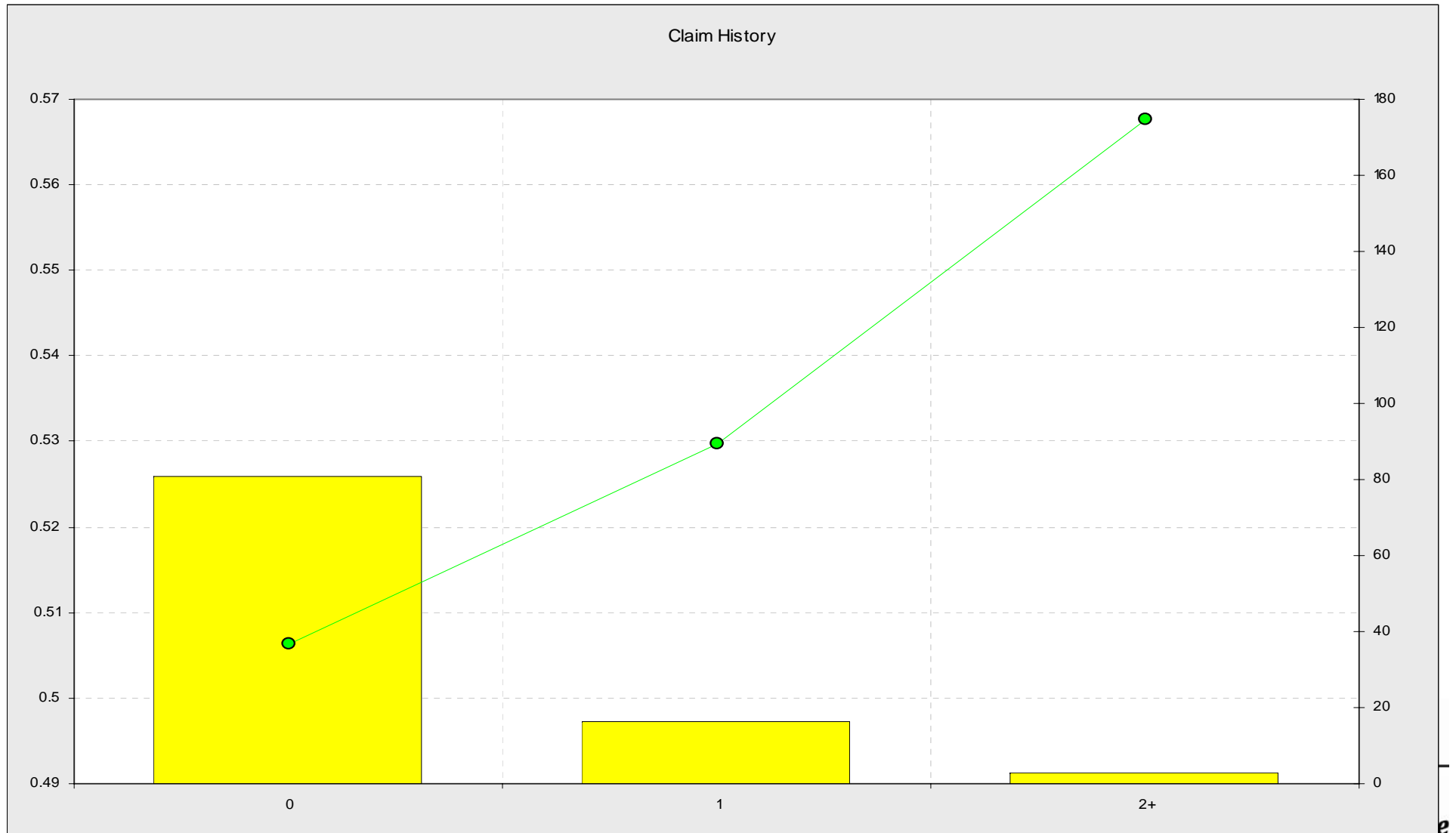
Conversion Analysis Example

Example

Relative Likelihood by EDUCATION:

EDUCATION	Relative Likelihood
<missing>	1.000
0	1.000
1	1.408
2	1.431
4	1.483
6	1.766

Retention Analysis

Claim History

Automated Underwriting / Re-Underwriting

- Straight through processing for new business based on characteristics

- Underwriters spend time on more difficult risks

- Automatic flagging of renewal business for action (e.g. underwriter review, automated ordering of external information)

- Targeted inspection (homeowners / auto)

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Definition

- **Optimize**
  1. to make as <u>effective</u>, <u>perfect</u>, or <u>useful as possible</u>
  2. to make the <u>best</u> of

- **Optimization**: a <u>mathematical technique</u> for finding a <u>maximum</u> or <u>minimum</u> value of a function of several variables subject to a set of constraints, as linear programming or systems analysis

- **Price optimization**: mathematical technique for finding the best (most effective, perfect, most useful, maximum, minimum) price subject to a set of constraints

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Constraints

- **Profitability**: premiums charged
- **Growth**
  - Success of marketing efforts
  - New business hit ratios
- **Loyalty**: retention ratios
- **Competitive**: competitor price AND operational considerations
- **Future**: understanding lifetime implications
- **Actuarial**: not excessive, not inadequate, not unfairly discriminatory
- **Regulatory:** must operate within parameters of the law

Expected Profit - Example

Expected Profit Accounting for Demand

Base level → | Price Change

Legend: Profit — Premium — Quantity
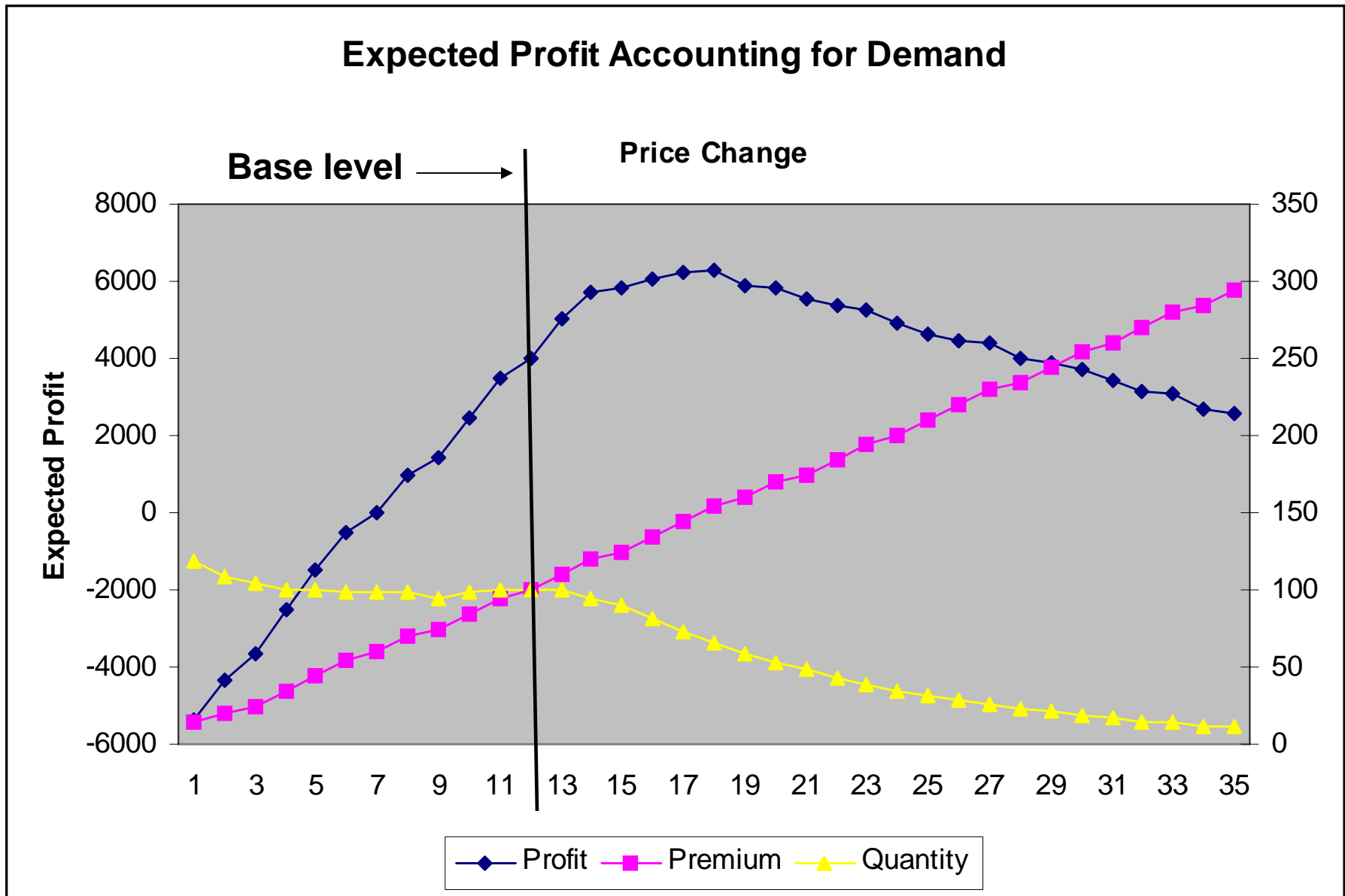
Agency Evaluation

1) Review agency experience to assist in evaluating:

- Commission scales
- Contingent commissions
- Agency retention/rehabilitation

2) Reflect differences in books of business (class, territory) that exist between agencies

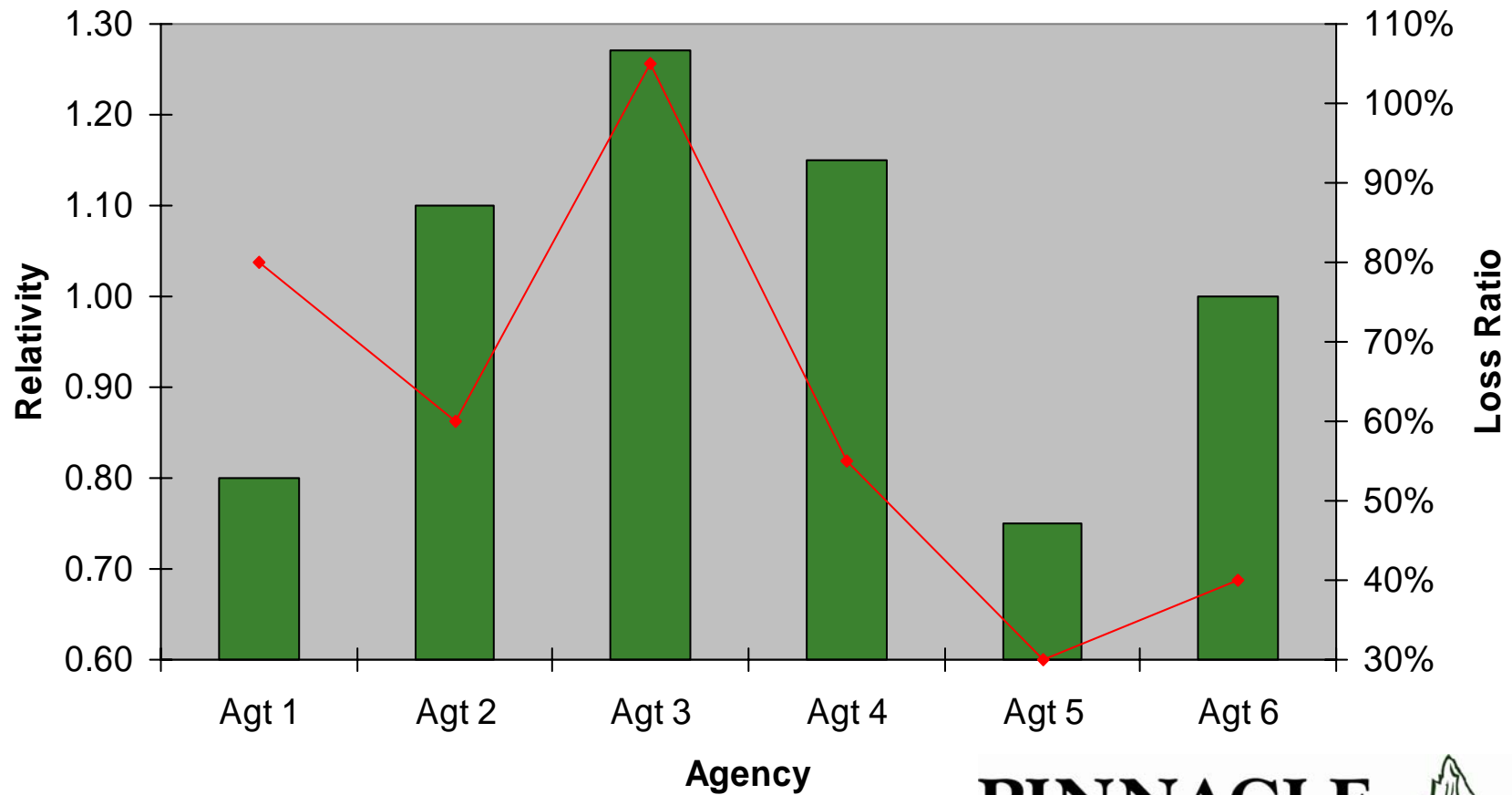3) What Agencies do you want to re-underwrite? What Lines of Business?

Agency Relativities

New Techniques

- Clustering/Segmentation

- Principal Components

- Decision Trees

- Neural Networks

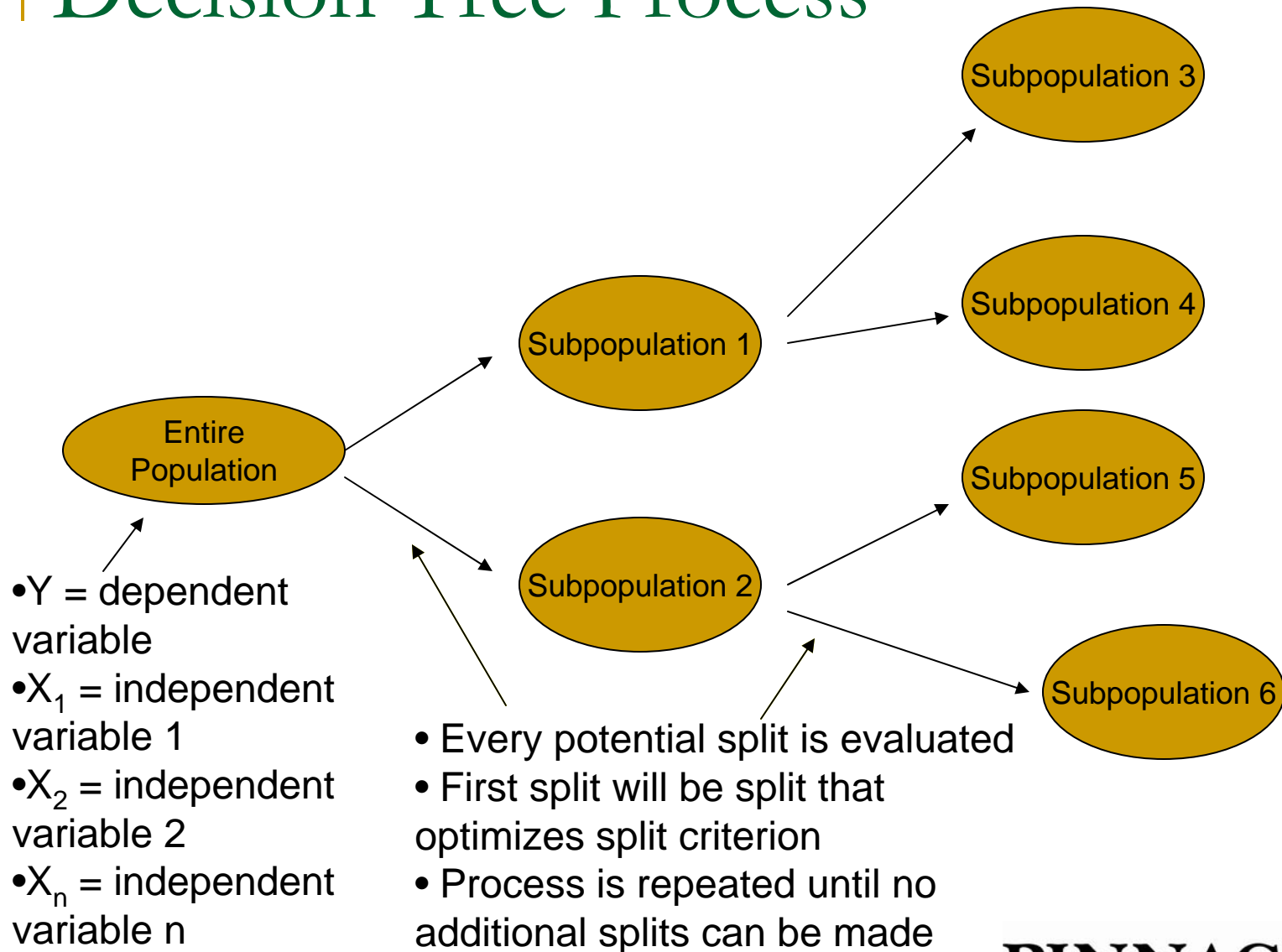- Ensemble

Clustering/Segmentation

- Unsupervised classification technique

- Focuses on **<u>input</u>** variables

- Groups data into set of discrete clusters or contiguous groups of cases

- Example: group customers into segments for purposes of marketing campaigns

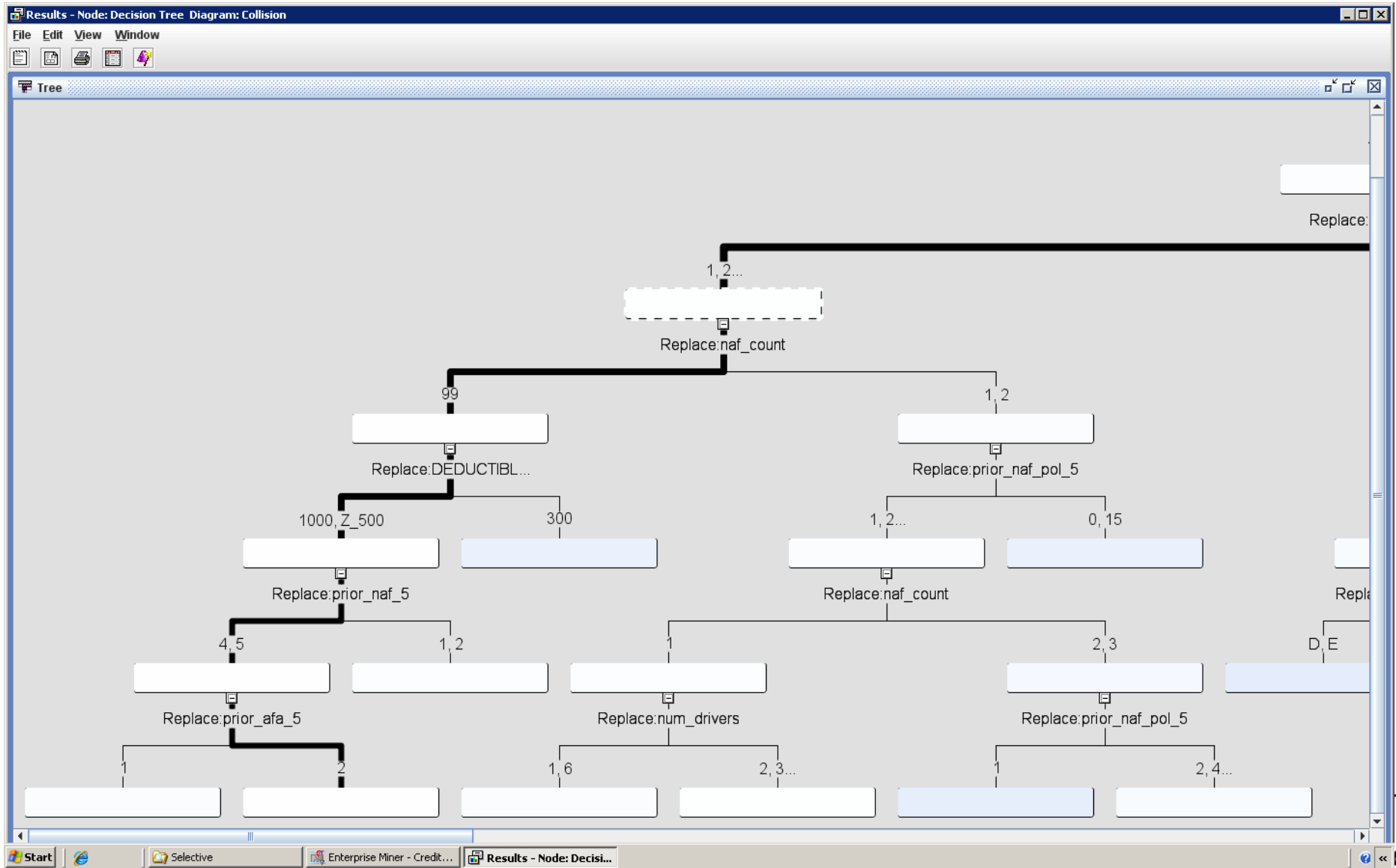- Can be used as a deimnsion reduction technique

Principal Components

- Mathematical transformation of input variables

- Calculated from the correlation matrix of the input variables

- Can be used as a dimension reduction technique, creates a summarized version of the inputs to use in successive models

Decision Tree Process

Subpopulation 3

Subpopulation 4

Subpopulation 1

Subpopulation 5

Entire Population

Subpopulation 2

Subpopulation 6

- Y = dependent variable
- X_1 = independent variable 1
- X_2 = independent variable 2
- X_n = independent variable n

- Every potential split is evaluated
- First split will be split that optimizes split criterion
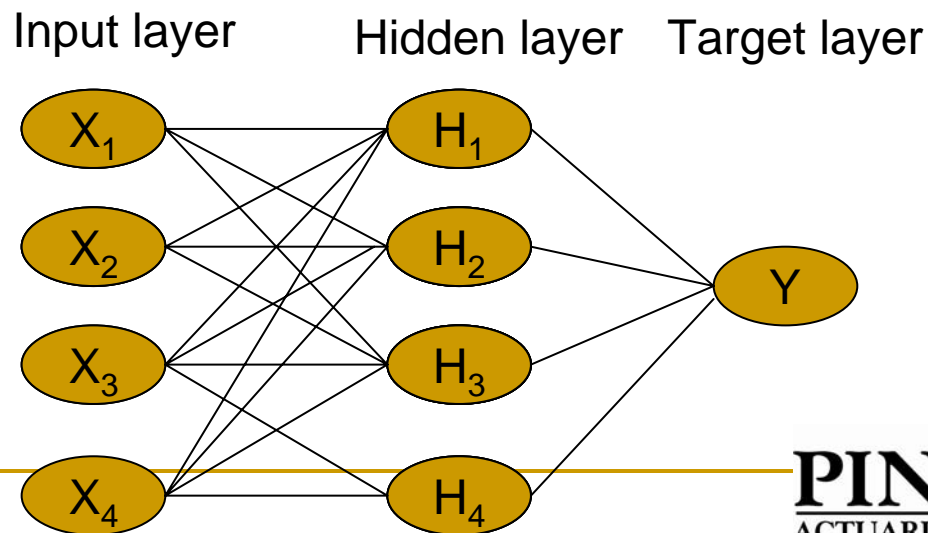- Process is repeated until no additional splits can be made

Claim Frequency

Neural Networks

- Target layer regression model on a series of derived input, called <u>hidden units</u>

- Hidden units (or layers) are regressions on the original inputs

- Target and hidden layers both have activation functions

Input layer   Hidden layer   Target layer

X_1 H_1

X_2 H_2

X_3 H_3 Y

X_4 H_4

Ensemble

- Creates new model by Combining probabilities from multiple models
- Produces more accurate results than individual models to the extent they disagree