Who to Call, When to Call, What's the Objective?

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Collections Environment Overview

- Large credit banks have 50-100 million accounts
- 1% to 3% late on payment means large volume of decisions
- Action options: do nothing (self-cure), send letter, call, do letter and call, send account to a collections agency

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Action Selection Approach

- Segment population by delinquency level
- Develop action-specific models to predict Prob[Cure|Action] for each action
- Predict net revenue result if account cure results from a given action
- Use heuristics or optimization to assign actions to accounts

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Action Specific Modeling

- Performance definition: make payment within 30 days = cure
- Models must provide cure probability estimates per account, action
- Independent samples, each treated entirely with a single action
- Methodology: Stepwise Binary Logistic Regression, Continuous Variables

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Action Specific Modeling

- Modeling variables: credit bureau, call and delinquency history, demographics
- Model usage requirements: unbiased probability estimates
- Rebuild models every few months - harder estimation job than rank-ordering
- Typically 1-10 models

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Rules-Based Action Selection

- Exclusions: pre-assign accounts with certain business conditions or probability values
- Select action on per account basis, based on comparing expected net revenue:
  - Prob[Cure|Action]*(Revenue from Cure due to that Action)

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Optimal Action Selection

- Apply exclusions: business conditions, probabilities
- Present accounts set to optimizer, with expected net revenue per account per action
- Constraints: minimum and maximum number of accounts assigned to each action

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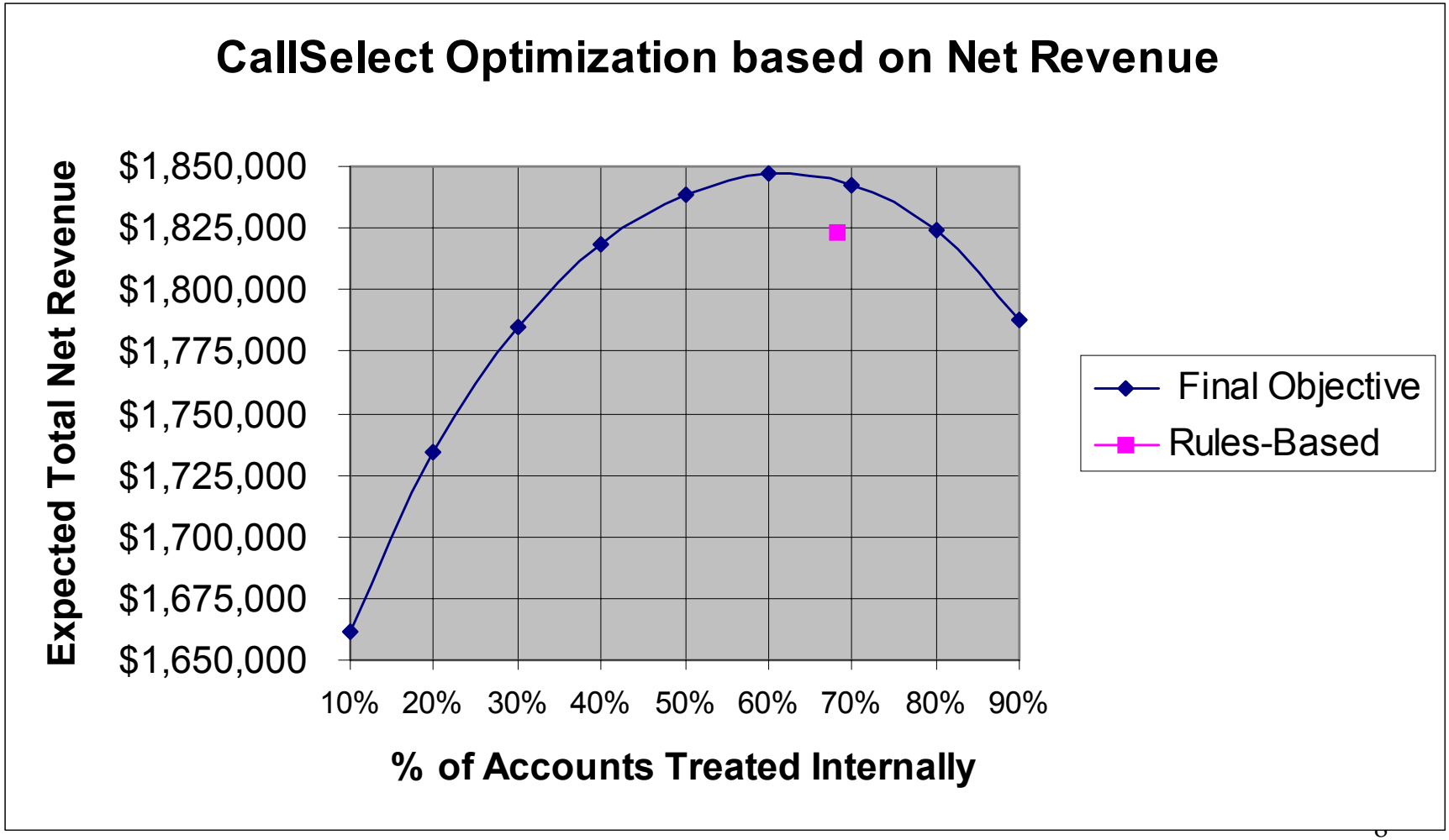
Action Selection Example



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Action Selection Method Trade

- Optimization is more effective, allows simulation, does not have to be customized for each installation, and can be used to evaluate efficiency of rules-based method
- Rules-based approach is more familiar and comprehensible to many customers
- Austin Logistics CallSelect (TM)

Calling Action Selection

How to Treat Accounts Selected for "Calling" - CallTech (TM)

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Call Center Environment

- Automated dialing machines: continuous dialing and call queuing to operators
- Large number of operators - Insufficient
- Call results vary with time of day, day of week, nature of customer, state of account
- Legal restrictions on calling hours

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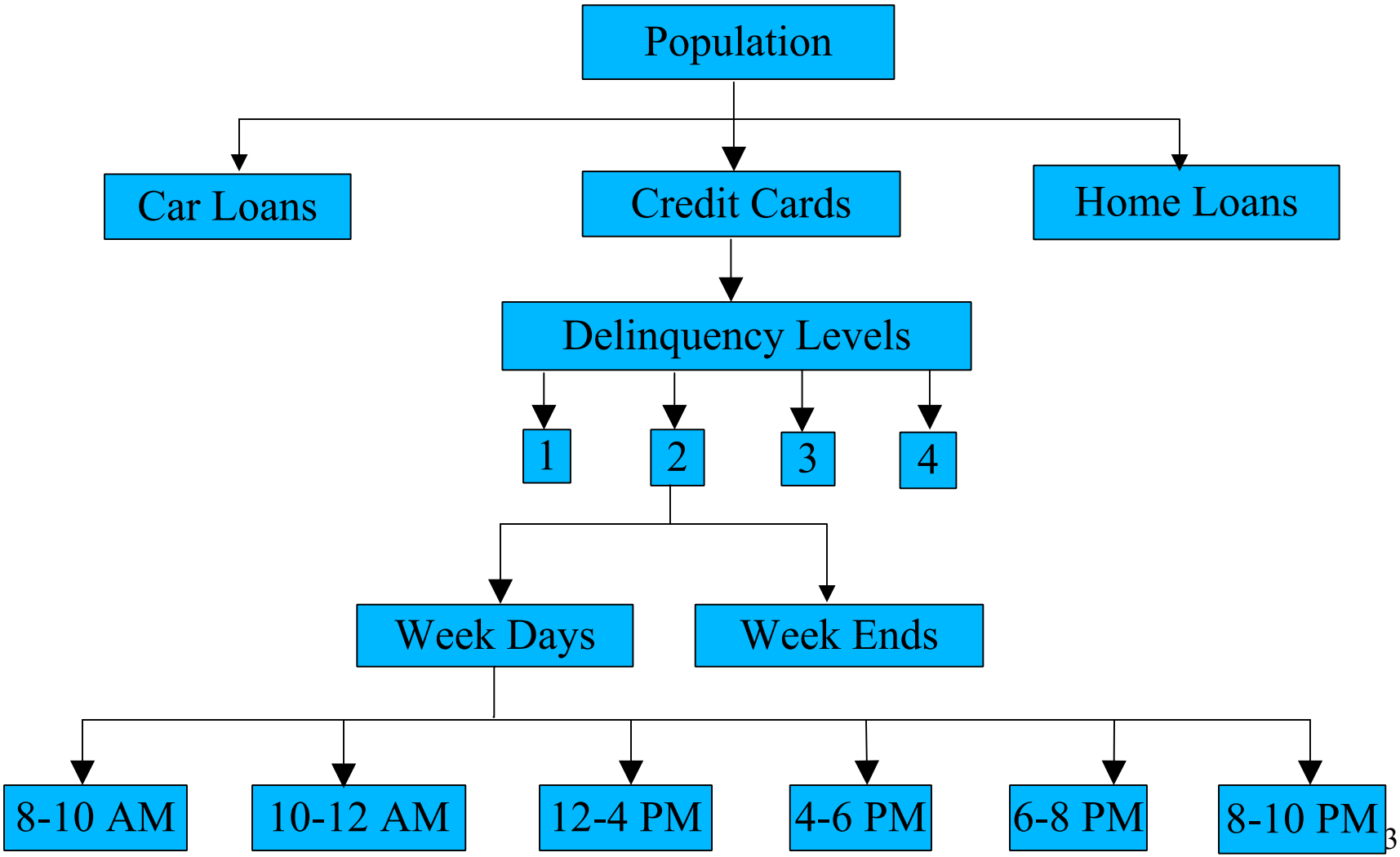
Calling Action Options

- Do not call (insufficient calling resources)
- Time of week, time of day
- Strategy selection (segmentation) - typically by delinquency level, loan type
- Strategy resource allocation - divide calling resources up between strategies

Calling Action Options



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Call Classification Modeling

- Performance classes: right party contact, wrong party contact, non-contact
- Models must provide probability estimates for each of the three outcomes
- Independent samples at lowest segmentation level
- Methodology: forward ternary logistic regression, continuous variables

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Call Classification Modeling

- Modeling variables: call, payment, and delinquency history; phone and account data, demographics
- Rebuilt models every1-2 months - dynamic environment, probability estimation
- Often > 100 models
- Automated Model Development

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Promise-To-Pay Modeling

- Performance definition: given a right party contact, was a promise-to-pay made?
- Model usage: estimate probability of promise-to-pay for right party contacts
- Develop at higher level (sample size limits)
- Methodology: forward binary logistic regression, continuous variables

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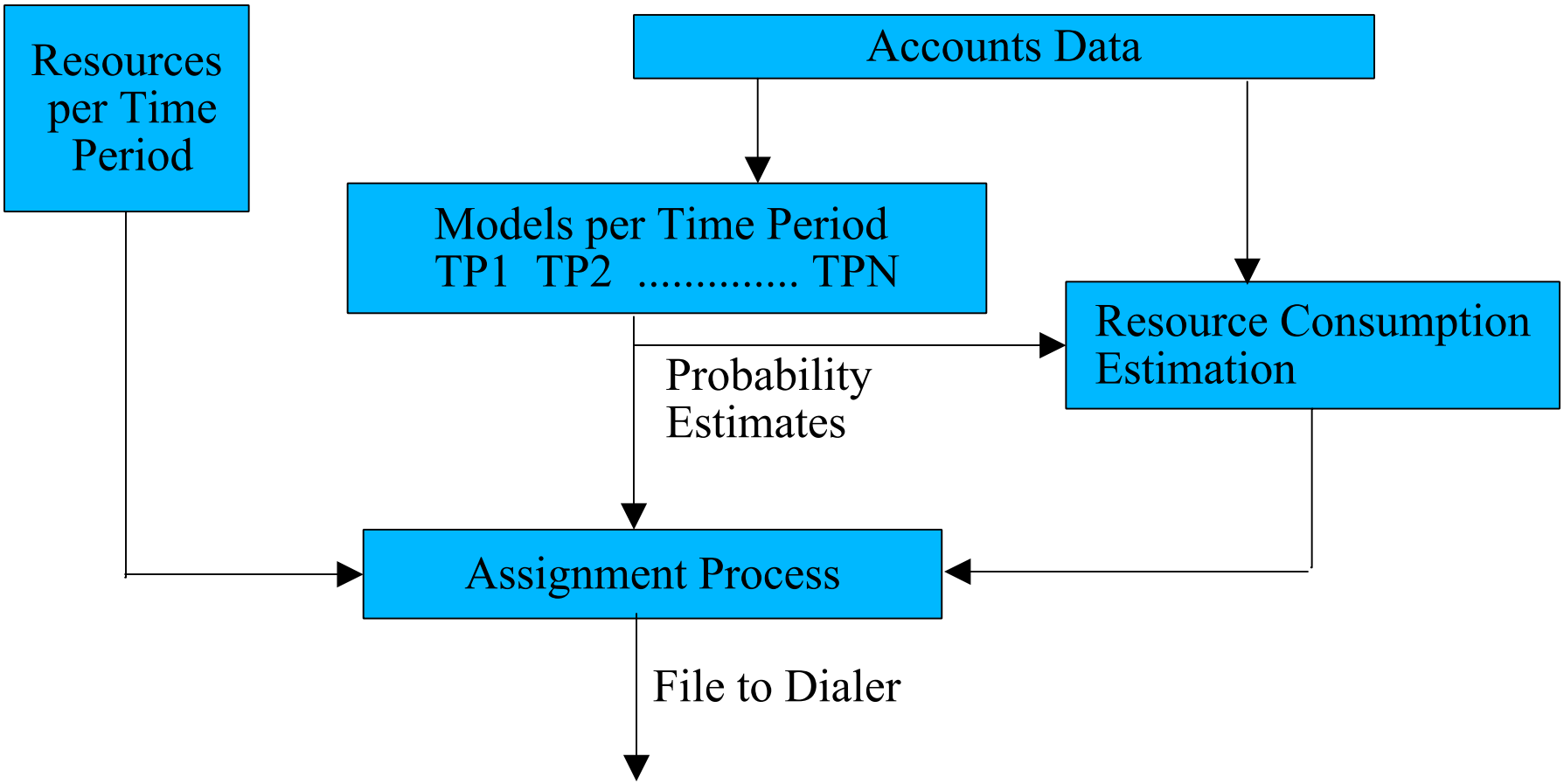
Daily Calling Action Selection

- Allocate calling resources to strategies
- Do optimal assignment over a set of time periods, per strategy
- Objective function based on Prob[right party contact]
- Compute expected consumption per time period and account using call outcome probabilities and average resource use

Daily Call Action Selection



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Daily Calling Action Selection

- Baseline objective: maximize expected right party contacts, sum of Prob[RPC] terms
- Possible weights on objective function terms: net revenue, delinquency level, default risk level
- Generalized linear network problem, integer programming problem solved with modified simplex method

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Daily Selection Behavior

- Runs during night to set up dialer files
- Sensitive to accuracy of resource estimates
- Optimizer likes high Prob[RPC] accounts; outliers can severely bias the process
- Symptoms: overestimated right party contact rates

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Daily Selection Behavior

- Result: Overestimate of resource consumption rate, disruption of calling schedule, loss of efficiency
- Other sources of same symptom: data quality deterioration, erroneous mixing of subpopulations, or significant shift in subpopulation behavior

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Custom Modeling Limitations

- Usual custom modeling approach geared to rank-ordering of accounts, not probability estimation
- Causes for outliers: using zeros for missing values, overbuilding of models, spurious variables in models, data behavior shifts
- Outliers can increase dramatically when only one variable changes behavior

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Modeling Methodology

- Compute means for use in application
- Automatically adjust significance thresholds based on sample size (smallest group)
- Truncate modeling candidate variables at 1% and 99% values
- Use information values to downsize variable set (eliminate spurious variables)

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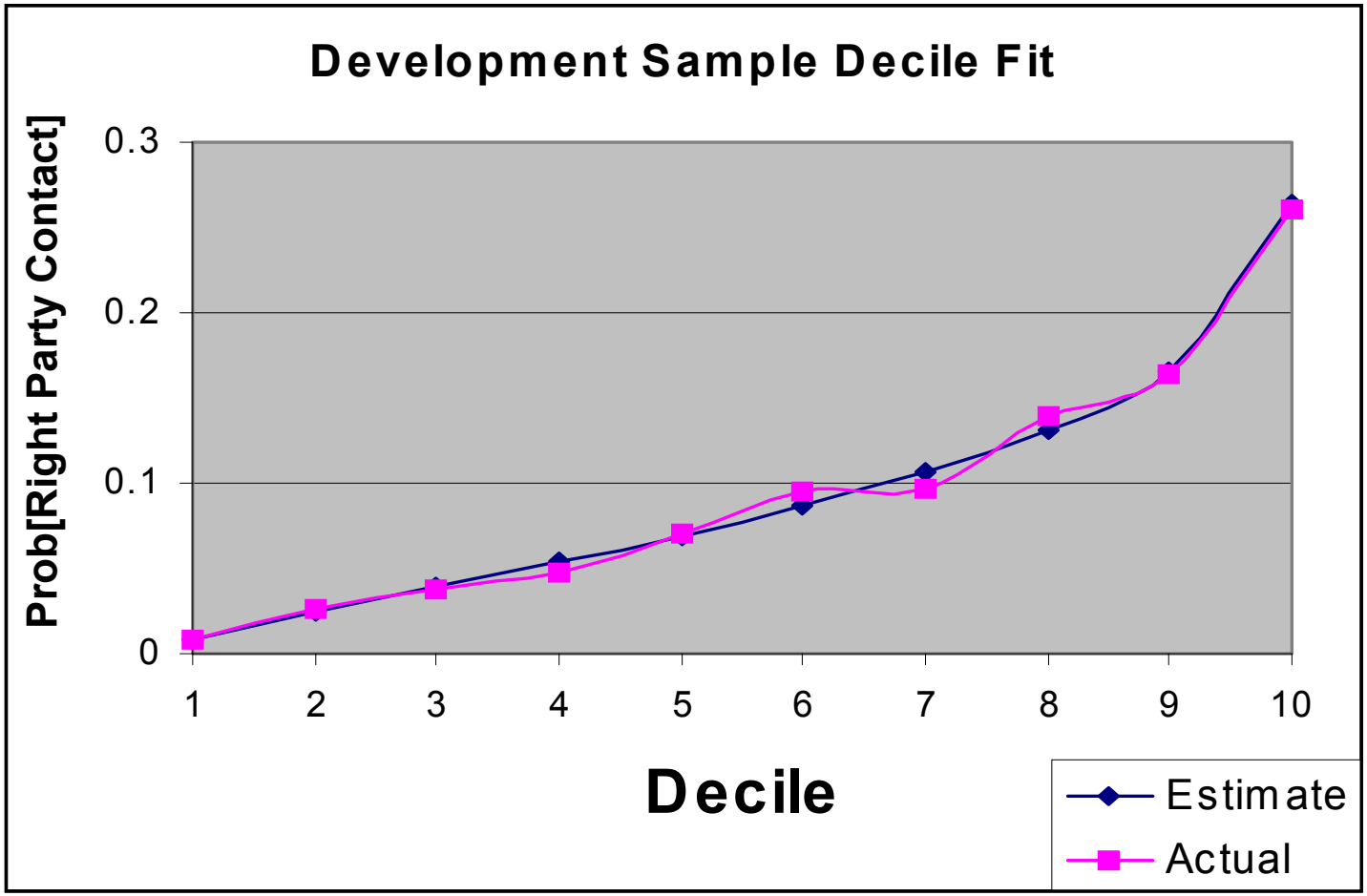
Modeling Methodology

- Compute development sample probability distributions
  - 95%, 99% and worst case values
  - Probability deciles and local fit
  - Identify outlier problems before models are deployed

Modeling Methodology



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Model Application

- Use mean values when modeling variables are missing
- Truncate modeling variables at 1% and 99% values
- Truncate probability estimates at 99% value
- Problem diagnostics: collect data at model sample level, compute fit to development deciles

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Model Application

- Use summary measures of performance
- Diagnostics when deciles match poorly:
  - Review subpopulation behavior
  - Compare frequency distribution of modeling variables to development sample
  - Most problems due to data deterioration, improper mixing of subpopulations, or population shifts

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Conclusion

- Complex modeling problems can be automated, but unique application requirements must be identified and addressed
- Higher degrees of automation are needed to scale application products to a large customer base
- The process can never be fully “hands-off”