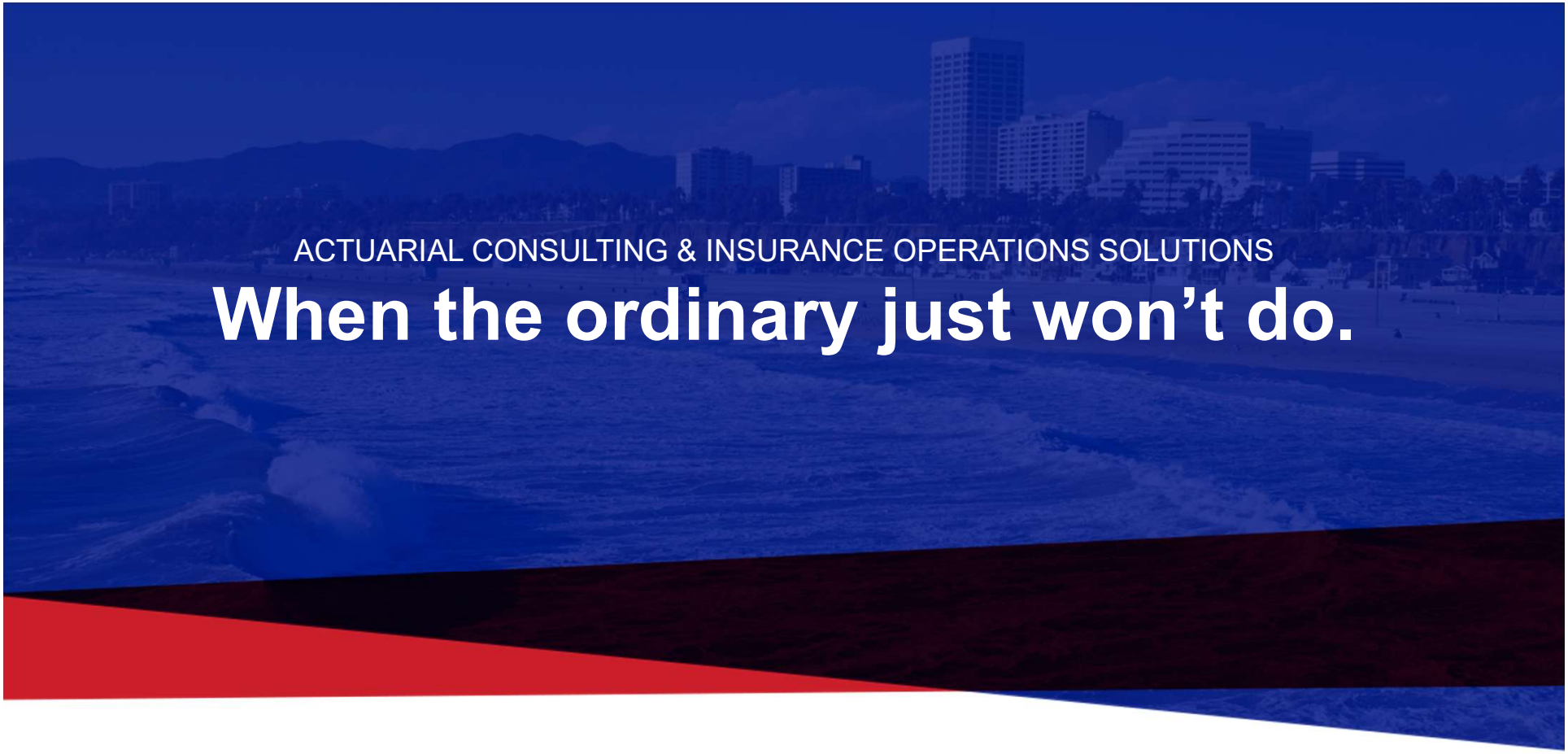


PERR&KNIGHT

Perr&Knight Predictive Analytics Overview

Services

Pricing and Product Development	• Creation of new rating plan using predictive analytics best practices
Rate Plan Monitoring	• Current algorithm monitored for rating variable revisions
Underwriting Analysis	• Program analysis to provide guidance on optimal UW action – drivers of best and worst loss ratios
External Data Sources	• Incorporate supplemental data to enhance analysis
Case Reserve Model	• Dynamic model to accurately set loss reserves based on claim and policy attributes
Software Support	• Provide guidance and support across multiple analytic software solutions
Creative Solutions	• Predictive analytics can provide data driven solutions to a wide variety of non-traditional problems

Pricing and Product Development

Product Development

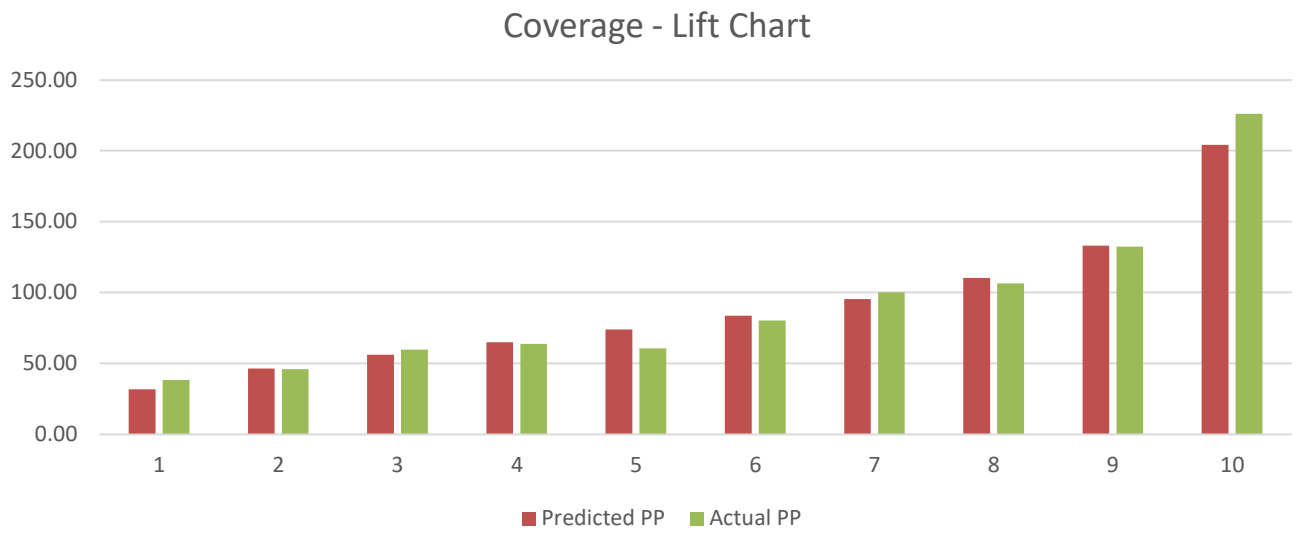
- General Linearized Models (GLMs) used to create rating plans based on data-driven analysis
- Custom solutions to meet DOI regulations
- Client data, competitor data, industry data, and relevant external data

Tier Rating

- Solutions that supplement current rating plans
- Option to enhance segmentation of program
- Does not require rebuild of current rating plan

New Program Pricing – 2021 Example

- Client provides historical policy and claim records
- Analysis completed using Python software
- GLM used to predict Frequency/Severity/Pure Premium
- Analysis identified key variables that drive differences in Loss Cost
- Final rating plan included multiple interaction variables



Rate Plan Monitoring

Review of Client Rate Plan

- Client provides historical policy and loss data

On-leveled by Variable

- Code automates refined premium on-leveling by rating variable

Data Driven Guidance

- Both univariate and multivariate
- Variables ranked by contribution to Loss Ratio differences
- Provide client with monthly monitoring of program

Estimate Rate Plan Changes

- Rate Plan updates produce new output
- View of multivariable impact
- Once solution is built, results available in minutes

Rank	Variables	Random Forest Variable Importance	Cumulative Importance
1	RenewalDiscount	0.133	0.133
2	Household Mix	0.095	0.228
3	Vehicle Attribute	0.089	0.317
4	Surcharge B	0.081	0.398
5	Driver Age Group	0.072	0.470
6	Multi Car	0.067	0.537
7	Vehicle Age	0.065	0.602
8	Discount A	0.065	0.667
9	Gender	0.063	0.730
10	Variable X	0.052	0.782
11	Variable Y	0.045	0.827
…	…		…
31	Total		1.000

Rate Plan Monitoring - Recap

Automated Program Monitoring

- R monitoring code run using latest valuation of program data
- Variables ranked by contribution to loss ratio differences
- Excel output provided to client:
  - traditional one-way results with color-coded visuals
  - random forest multivariate results display variable importance by coverage
- Provides monthly automated results to assist program managers

UW Assistance- Gradient Boosting Machines (GBM)

Review of Client Rating Plan

- Client provides policy and loss data
- R code tailored to program to provide results extracted to Excel

GBM Multivariate Analysis

- Variables ranked on $ impact for loss ratio differences
- Correlations across variables are accounted for

Actionable Insights

- Summarized results assist with pricing, marketing, and UW actions
- Fast-turnaround

External Data - Examples

Census Data	• Government data source • Demographic and geographic data
Federal Data	• Macroeconomic data • Potential correlations to insurance data
Financial Markets	• Historical stock/index prices and bond market yields • Financial statement data

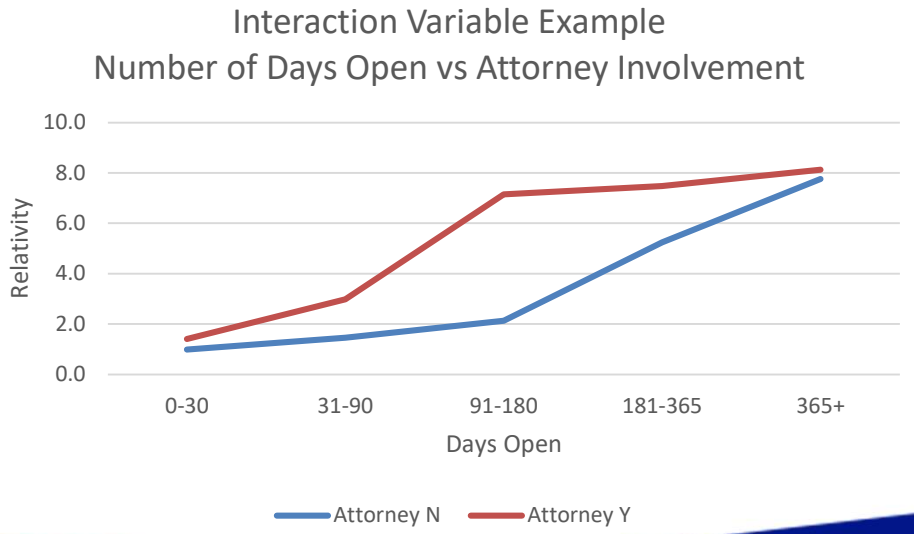
Case Reserving Model

Predictive Analytics

- Data driven case reserve estimate
- Predicts ultimate severity of individual claims
- Incorporates probability of payment vs nonzero payment

Application

- Provides guidance to claims reserve practices
- Especially valuable for changing books of business



PERR & KNIGHT

Perr&Knight Actuarial Consulting & Insurance Operations Solutions

Software Support

Python, R	• Used for data analysis and predictive models • Can produce custom visual aids, charts, etc.
SQL	•Good for large datasets •Can integrate with Excel
AWS (Amazon Web Services)	•Suite of software solutions with large processing power
Tableau / Power BI	• Used for dynamic data visualizations and analysis
Maps	• Geographical analysis – heat maps, visual results
EMBLEM / Classifier	• Assist clients that use proprietary software tools and need capacity

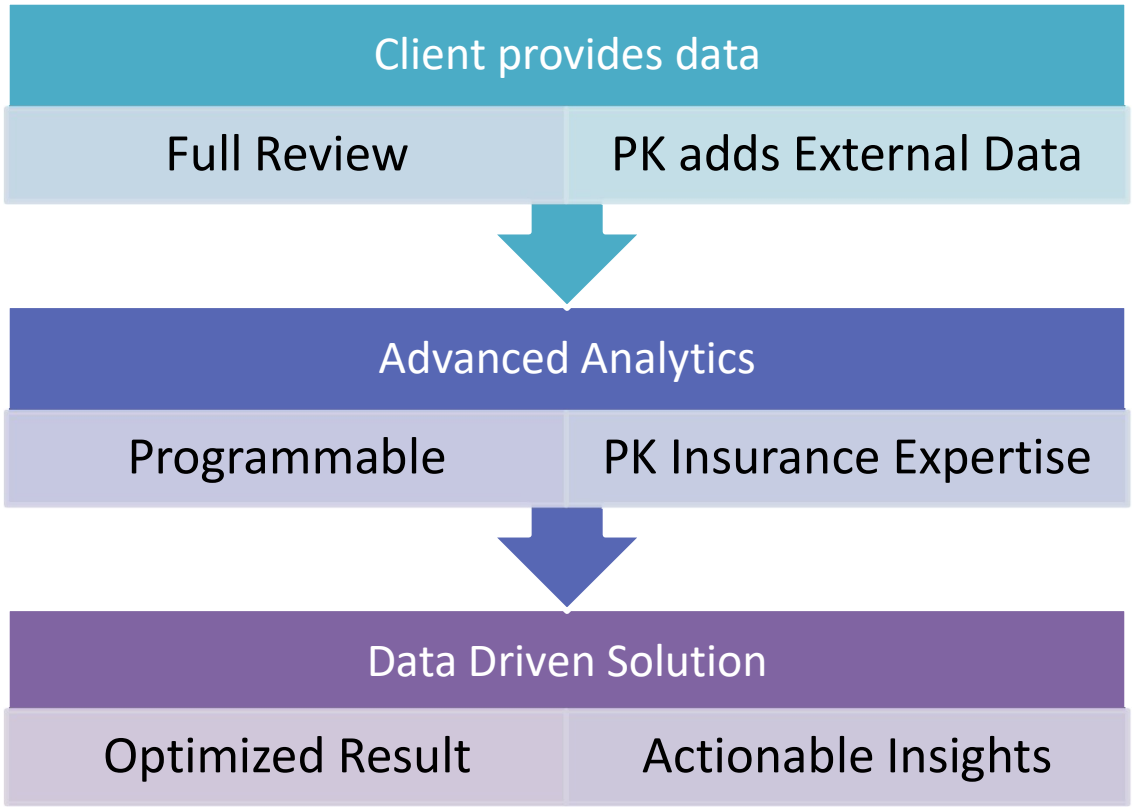
Creative Solutions

Simulations	• Reinsurance applications • Distribution fitting • Frequency and Severity analysis
Trend Projections	• Analyze company programs and pricing trends • Multivariable pricing analysis produces key drivers of trends • Produces trend projections with wide variety of applications
Marketing Analysis	• Identification of key drivers of marketing efforts • Provide guidance on suggested marketing actions
Fraud Analysis	• Identification of key drivers of fraud/flag open claims for review • Provide guidance to reduce fraud
Implementation of Code	• We can provide R or Python code to client • Provide guidance and support for implementation of code

More Predictive Analytics Solutions

Linear Models – Regression	• Continuous target variable • Commonly used for pricing, tier development • Can be used for program analysis, trend projection, case reserve analytics, monitoring
Linear Models - Classification	• Binary or categorical target variable • Commonly used for underwriting • Can be used for other analytics
Machine Learning	• Can be applied to any type of analysis • Unsupervised and Supervised learning methods • Commonly used for fast variable importance • Tree-based methods (GBM, Random Forest)

Recap - Predictive Analytics Process



Let's work together on your next project!

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