Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data

Ratner, B., 3rd ed., Taylor & Francis, 2017.



Table of Contents

Preface to Third Edition	xxiii
Preface of Second Edition	xxvii
Acknowledgments	xxxi
Author	xxxiii
1. Introduction	1
1.1 The Personal Computer and Statistics	1
1.2 Statistics and Data Analysis	3
1.3 EDA	4
1.4 The EDA Paradigm	5
1.5 EDA Weaknesses	6
1.6 Small and Big Data	7
1.6.1 Data Size Characteristics	7
1.6.2 Data Size: Personal Observation of One	8
1.7 Data Mining Paradigm	8
1.8 Statistics and Machine Learning	9
1.9 Statistical Data Mining	10
References	11
2. Science Dealing with Data: Statistics and Data Science	
2.1 Introduction	13
2.2 Background	
2.3 The Statistics and Data Science Comparison	
2.3.1 Statistics versus Data Science	
2.4 Discussion: Are Statistics and Data Science Different?	
2.4.1 Analysis: Are Statistics and Data Science Different?	
2.5 Summary	2 3
2.6 Epilogue	23
References	23
3. Two Basic Data Mining Methods for Variable Assessment	
3.1 Introduction	
3.2 Correlation Coefficient	2

3.3 Scatterplots	27
3.4 Data Mining	28
3.4.1 Example 3.1	28
3.4.2 Example 3.2	29
3.5 Smoothed Scatterplot	30
3.6 General Association Test	33
3.7 Summary	34
References	35
4. CHAID-Based Data Mining for Paired-Variable Assessment	37
4.1 Introduction	37
4.2 The Scatterplot	37
4.2.1 An Exemplar Scatterplot	38
4.3 The Smooth Scatterplot	38
4.4 Primer on CHAID	39
4.5 CHAID-Based Data Mining for a Smoother Scatterplot	40
4.5.1 The Smoother Scatterplot	42
4.6 Summary	45
Reference	45
5. The Importance of Straight Data Simplicity and Desirability for Good	
Model-Building Practice	47
5.1 Introduction	47
5.2 Straightness and Symmetry in Data	
5.3 Data Mining Is a High Concept	48
5.4 The Correlation Coefficient	48
5.5 Scatterplot of (xx3, yy3)	50
5.6 Data Mining the Relationship of (xx3, yy3)	50
5.6.1 Side-by-Side Scatterplot	53
5.7 What Is the GP-Based Data Mining Doing to the Data?	53
5.8 Straightening a Handful of Variables and a Baker's Dozen of Variables	53
5.9 Summary	54
References	54
6. Symmetrizing Ranked Data: A Statistical Data Mining Method for	
Improving the Predictive Power of Data	55
6.1 Introduction	
6.2 Scales of Measurement	
6.3 Stem-and-Leaf Display	
6.4 Box-and-Whiskers Plot	58
6.5 Illustration of the Symmetrizing Ranked Data Method	
6.5.1 Illustration 1	
6.5.1.1 Discussion of Illustration 1	59
6.5.2 Illustration 2	61
6.5.2.1 Titanic Dataset	62
6.5.2.2 Looking at the Recoded Titanic Ordinal Variables CLASS_,	
AGE_, GENDER_, CLASS_AGE_, and CLASS_GENDER	62
6.5.2.3 Looking at the Symmetrized-Ranked Titanic Ordinal	

	Variables rCLASS_, rAGE_, rGENDER_, rCLASS_AGE_,	
	and rCLASS_GENDER	64
	6.5.2.4 Building a Preliminary Titanic Model	65
6.6 Summary		68
References		68
7. Principal Componen	t Analysis: A Statistical Data Mining Method for	
	nent	69
7.1 Introductio	n	69
7.2 EDA Reexp	ression Paradigm	69
7.3 What Is the	e Big Deal?	70
7.4 PCA Basics.		70
7.5 Exemplary	Detailed Illustration	71
7.5.1 D	Discussion	71
7.6 Algebraic P	roperties of PCA	72
7.7 Uncommor	ı Illustration	73
7.7.1 P	CA of R_CD Elements (X1, X2, X3, X4, X5, X6)	74
7.7.2 🗅	Discussion of the PCA of R_CD Elements	74
7.8 PCA in the	Construction of Quasi-Interaction Variables	76
7.8.1 S	AS Program for the PCA of the Quasi-Interaction Variable	78
,		
8. Market Share Estima	ation: Data Mining for an Exceptional Case	81
	ın	
8.2 Background	d	81
•	g for an Exceptional Case	
	xceptional Case: Infant Formula YUM	
8.4 Building the	e RAL-YUM Market Share Model	83
	Decile Analysis of YUM_3mos MARKET-SHARE Model	
	conclusion of YUM_3mos MARKET-SHARE Model	
	_	
Appendix 8.A [Dummify PROMO Code	93
• •	PCA of PROMO_Code Dummy Variables	
	ogistic Regression YUM_3mos on PROMO_Code	
	les	
Appendix 8.D (Creating YUM_3mos_wo_PROMO_CodeEff	94
	Jormalizing a Variable to Lie Within [0, 1]	
9. The Correlation Coef	fficient: Its Values Range between Plus and Minus 1,	
		97
•	ın	
	ne Correlation Coefficient	
	of the Correlation Coefficient	
	g	
	of the Adjusted Correlation Coefficient	
	of Rematching	
•	0	
= =====================================		···· – • –

10. Logistic Regression: The Workhorse of Response Modeling	105
10.1 Introduction	
10.2 Logistic Regression Model	
10.2.1 Illustration	106
10.2.2 Scoring an LRM	107
10.3 Case Study	109
10.3.1 Candidate Predictor and Dependent Variables	110
10.4 Logits and Logit Plots	110
10.4.1 Logits for Case Study	111
10.5 The Importance of Straight Data	112
10.6 Reexpressing for Straight Data	112
10.6.1 Ladder of Powers	
10.6.2 Bulging Rule	114
10.6.3 Measuring Straight Data	114
10.7 Straight Data for Case Study	115
10.7.1 Reexpressing FD2_OPEN	116
10.7.2 Reexpressing INVESTMENT	116
10.8 Techniques when the Bulging Rule Does Not Apply	118
10.8.1 Fitted Logit Plot	118
10.8.2 Smooth Predicted-versus-Actual Plot	119
10.9 Reexpressing MOS_OPEN	119
10.9.1 Plot of Smooth Predicted versus Actual for MOS_OPEN	120
10.10 Assessing the Importance of Variables	123
10.10.1 Computing the G Statistic	123
10.10.2 Importance of a Single Variable	124
10.10.3 Importance of a Subset of Variables	124
10.10.4 Comparing the Importance of Different Subsets of Variables	124
10.11 Important Variables for Case Study	125
10.11.1 Importance of the Predictor Variables	126
10.12 Relative Importance of the Variables	127
10.12.1 Selecting the Best Subset	
10.13 Best Subset of Variables for Case Study	
10.14 Visual Indicators of Goodness of Model Predictions	
10.14.1 Plot of Smooth Residual by Score Groups	130
10.14.1.1 Plot of the Smooth Residual by Score Groups for	
Case Study	
10.14.2 Plot of Smooth Actual versus Predicted by Decile Groups	132
10.14.2.1 Plot of Smooth Actual versus Predicted by Decile	
Groups for Case Study	
10.14.3 Plot of Smooth Actual versus Predicted by Score Groups	134
10.14.3.1 Plot of Smooth Actual versus Predicted by Score	
Groups for Case Study	
10.15 Evaluating the Data Mining Work	136
10.15.1 Comparison of Plots of Smooth Residual by Score Groups:	
EDA versus Non-EDA Models	137
10.15.2 Comparison of the Plots of Smooth Actual versus Predicted by	
Decile Groups: EDA versus Non-EDA Models	139

10.15.3 Comparison of Plots of Smooth Actual versus Predicted by	
Score Groups: EDA versus Non-EDA Models	140
10.15.4 Summary of the Data Mining Work	141
10.16 Smoothing a Categorical Variable	141
10.16.1 Smoothing FD_TYPE with CHAID	142
10.16.2 Importance of CH_FTY_1 and CH_FTY_2	144
10.17 Additional Data Mining Work for Case Study	
10.17.1 Comparison of Plots of Smooth Residual by Score Group:	
4var-EDA versus 3var-EDA Models	146
10.17.2 Comparison of the Plots of Smooth Actual versus Predicted	
by Decile Groups: 4var-EDA versus 3var-EDA Models	147
10.17.3 Comparison of Plots of Smooth Actual versus Predicted	
by Score Groups: 4var-EDA versus 3var-EDA Models	147
10.17.4 Final Summary of the Additional Data Mining Work	149
10.18 Summary	150
11. Predicting Share of Wallet without Survey Data	151
11.1 Introduction	151
11.2 Background	151
11.2.1 SOW Definition	152
11.2.1.1 SOW_q Definition	152
11.2.1.2 SOW_q Likeliness Assumption	152
11.3 Illustration of Calculation of SOW_q	153
11.3.1 Query of Interest	153
11.3.2 DOLLARS and TOTAL DOLLARS	153
11.4 Building the AMPECS SOW_q Model	158
11.5 SOW_q Model Definition	
159	
11.5.1 SOW_q Model Results	160
11.6 Summary	161
Appendix 11.A Six Steps	162
Appendix 11.B Seven Steps	164
References	167
12. Ordinary Regression: The Workhorse of Profit Modeling	169
12.1 Introduction	169
12.2 Ordinary Regression Model	169
12.2.1 Illustration	170
12.2.2 Scoring an OLS Profit Model	171
12.3 Mini Case Study	172
12.3.1 Straight Data for Mini Case Study	172
12.3.1.1 Reexpressing INCOME	174
12.3.1.2 Reexpressing AGE	175
12.3.2 Plot of Smooth Predicted versus Actual	177
12.3.3 Assessing the Importance of Variables	178
12.3.3.1 Defining the F Statistic and R-Squared	
12.3.3.2 Importance of a Single Variable	
12.3.3.3 Importance of a Subset of Variables	179

12.3.3.4 Comparing the Importance of Different Subsets	
of Variables	180
12.4 Important Variables for Mini Case Study	180
12.4.1 Relative Importance of the Variables	181
12.4.2 Selecting the Best Subset	181
12.5 Best Subset of Variables for Case Study	182
12.5.1 PROFIT Model with gINCOME and AGE	
12.5.2 Best PROFIT Model	
12.6 Suppressor Variable AGE	185
12.7 Summary	
References	
13. Variable Selection Methods in Regression: Ignorable Problem,	
Notable Solution	189
13.1 Introduction	189
13.2 Background	
13.3 Frequently Used Variable Selection Methods	
13.4 Weakness in the Stepwise	
13.5 Enhanced Variable Selection Method	
13.6 Exploratory Data Analysis	
13.7 Summary	
References	
	200
14. CHAID for Interpreting a Logistic Regression Model	203
14.1 Introduction	
14.2 Logistic Regression Model	
14.3 Database Marketing Response Model Case Study	
14.3.1 Odds Ratio	
14.4 CHAID	
14.4.1 Proposed CHAID-Based Method	
14.5 Multivariable CHAID Trees	
14.6 CHAID Market Segmentation.	
14.7 CHAID Tree Graphs	
14.8 Summary	246
14.0 3dillillary	210
15. The Importance of the Regression Coefficient	219
15.1 Introduction	
15.2 The Ordinary Regression Model	
15.3 Four Questions	
15.4 Important Predictor Variables	
15.5 p-Values and Big Data	
15.6 Returning to Question 1	
15.7 Effect of Predictor Variable on Prediction	
15.8 The Caveat	
15.9 Returning to Question 2	
15.10 Ranking Predictor Variables by Effect on Prediction	
15.10 Ranking Predictor Variables by Effect on Prediction	
15.11 Returning to Question 3	220 227

15.13 Summary	227
References	228
AC The America Consolution A Statistical Bata Minima Manager (Co.	
16. The Average Correlation: A Statistical Data Mining Measure for	
Assessment of Competing Predictive Models and the Importance	220
of the Predictor Variables	
16.1 Introduction	
16.2 Background	
16.3 Illustration of the Difference between Reliability and Validity	
16.4 Illustration of the Relationship between Reliability and Validity	
16.5 The Average Correlation	
16.5.1 Illustration of the Average Correlation with an LTV5 Model	232
16.5.2 Continuing with the Illustration of the Average Correlation	
with an LTV5 Model	
16.5.3 Continuing with the Illustration with a Competing LTV5 Model	
16.5.3.1 The Importance of the Predictor Variables	
16.6 Summary	
Reference	237
17. CHAID for Specifying a Model with Interaction Variables	230
17.1 Introduction	
17.2 Interaction Variables	
17.3 Strategy for Modeling with Interaction Variables	
17.4 Strategy Based on the Notion of a Special Point	
17.5 Example of a Response Model with an Interaction Variable	
17.6 CHAID for Uncovering Relationships	
17.7 Illustration of CHAID for Specifying a Model	
17.8 An Exploratory Look	
17.9 Database Implication	
17.10 Summary	
References	249
18. Market Segmentation Classification Modeling with Logistic Regression	251
18.1 Introduction	
18.2 Binary Logistic Regression	
18.2.1 Necessary Notation	
18.3 Polychotomous Logistic Regression Model	
18.4 Model Building with PLR	
18.5 Market Segmentation Classification Model	
18.5.1 Survey of Cellular Phone Users	
18.5.2 CHAID Analysis	
18.5.3 CHAID Tree Graphs	
18.5.4 Market Segmentation Classification Model	
18.6 Summary	
10.0 Julilliary	203
19. Market Segmentation Based on Time-Series Data Using Latent Class Analysis	265
19.1 Introduction	265
19.2 Background	265

	19.2.1 K-Means Clustering	265
	19.2.2 PCA	266
	19.2.3 FA	266
	19.2.3.1 FA Model	
	19.2.3.2 FA Model Estimation	267
	19.2.3.3 FA versus OLS Graphical Depiction	268
	19.2.4 LCA versus FA Graphical	
	Depiction	268
	19.3 LCA	270
	19.3.1 LCA of Universal and Particular Study	
	19.3.1.1 Discussion of LCA Output	
	19.3.1.2 Discussion of Posterior Probability	
	19.4 LCA versus k-Means Clustering	
	19.5 LCA Market Segmentation Model Based on Time-Series Data	
	19.5.1 Objective	
	19.5.2 Best LCA Models	
	19.5.2.1 Cluster Sizes and Conditional Probabilities/Means	
	19.5.2.2 Indicator-Level Posterior Probabilities	
	19.6 Summary	
	Appendix 19.A Creating Trend3 for UNITS	
	Appendix 19.B POS-ZER-NEG Creating Trend4	
	References	285
		207
20. M	arket Segmentation: An Easy Way to Understand the Segments	
	20.1 Introduction	
	20.2 Background	
	20.3 Illustration	
	20.4 Understanding the Segments	
	20.5 SummaryAppendix 20.A Dataset SAMPLE	
	• •	
	Appendix 20.B Segmentor-Means	
	References	
	Netel effees	292
)1 Th	e Statistical Regression Model: An Easy Way to Understand the Model	293
-1	21.1 Introduction	
	21.2 Background	
	21.3 EZ-Method Applied to the LR Model	
	21.4 Discussion of the LR EZ-Method Illustration	
	21.5 Summary	
	Appendix 21.A M65-Spread Base Means X10–X14	
	Appendix 21.B Create Ten Datasets for Each Decile	
	Appendix 21.C Indexed Profiles of Deciles	
	11	
22. CH	HAID as a Method for Filling in Missing Values	307
	22.1 Introduction	
	22.2 Introduction to the Problem of Missing Data	
	22.3 Missing Data Assumption	

22.4 CHAID Imputation	310
22.5 Illustration	311
22.5.1 CHAID Mean-Value Imputation for a Continuous Variable	
22.5.2 Many Mean-Value CHAID Imputations for a Continuous Variab	ole 313
22.5.3 Regression Tree Imputation for LIFE_DOL	
22.6 CHAID Most Likely Category Imputation for a Categorical Variable	
22.6.1 CHAID Most Likely Category Imputation for GENDER	
22.6.2 Classification Tree Imputation for GENDER	
22.7 Summary	320
References	321
23. Model Building with Big Complete and Incomplete Data	323
23.1 Introduction	323
23.2 Background	323
23.3 The CCA-PCA Method: Illustration Details	324
23.3.1 Determining the Complete and Incomplete Datasets	324
23.4 Building the RESPONSE Model with Complete (CCA) Dataset	326
23.4.1 CCA RESPONSE Model Results	327
23.5 Building the RESPONSE Model with Incomplete (ICA) Dataset	328
23.5.1 PCA on BICA Data	329
23.6 Building the RESPONSE Model on PCA-BICA Data	329
23.6.1 PCA-BICA RESPONSE Model Results	330
23.6.2 Combined CCA and PCA-BICA RESPONSE Model Results	331
23.7 Summary	332
Appendix 23.A NMISS	333
Appendix 23.B Testing CCA Samsizes	333
Appendix 23.C CCA-CIA Datasets	333
Appendix 23.D Ones and Zeros	333
Reference	334
24. Art, Science, Numbers, and Poetry	
24.1 Introduction	
24.2 Zeros and Ones	
24.3 Power of Thought	336
24.4 The Statistical Golden Rule: Measuring the Art and Science	
of Statistical Practice	
24.4.1 Background	
24.4.1.1 The Statistical Golden Rule	
24.5 Summary	
Reference	340
25. Identifying Your Best Customers: Descriptive, Predictive,	
and Look-Alike Profiling	
25.1 Introduction	
25.2 Some Definitions	
25.3 Illustration of a Flawed Targeting Effort	
25.4 Well-Defined Targeting Effort	
25 5 Predictive Profiles	345

	25.6 Continuous Trees	348
	25.7 Look-Alike Profiling	350
	25.8 Look-Alike Tree Characteristics	353
	25.9 Summary	353
26 Ass	assemant of Marketing Models	255
20. ASS	essment of Marketing Models	
	26.2 Accuracy for Response Model	
	26.3 Accuracy for Profit Model	
	,	
	26.4 Decile Analysis and Cum Lift for Response Model	
	26.5 Decile Analysis and Cum Lift for Profit Model	
	26.6 Precision for Response Model	
	26.7 Precision for Profit Model	
	26.8 Separability for Response and Profit Models	
	26.9 Guidelines for Using Cum Lift, HL/SWMAD, and CV	
	26.10 Summary	364
27. Dec	ile Analysis: Perspective and Performance	367
	27.1 Introduction	367
	27.2 Background	367
	27.2.1 Illustration	369
	27.2.1.1 Discussion of Classification Table of RESPONSE Model	370
	27.3 Assessing Performance: RESPONSE Model versus Chance Model	371
	27.4 Assessing Performance: The Decile Analysis	372
	27.4.1 The RESPONSE Decile Analysis	372
	27.5 Summary	377
	Appendix 27.A Incremental Gain in Accuracy: Model versus Chance	378
	Appendix 27.B Incremental Gain in Precision: Model versus Chance	379
	Appendix 27.C RESPONSE Model Decile PROB_est Values	380
	Appendix 27.D 2 × 2 Tables by Decile	382
	References	385
28. Net	T-C Lift Model: Assessing the Net Effects of Test and	
Control	Campaigns	387
	28.1 Introduction	387
	28.2 Background	387
	28.3 Building TEST and CONTROL Response Models	389
	28.3.1 Building TEST Response Model	390
	28.3.2 Building CONTROL Response Model	392
	28.4 Net T-C Lift Model	394
	28.4.1 Building the Net T-C Lift Model	395
	28.4.1.1 Discussion of the Net T-C Lift Model	
	28.4.1.2 Discussion of Equal-Group Sizes Decile of the Net T-C	
	Lift Model	397
	28.5 Summary	
	Appendix 28.A TEST Logistic with Xs	
	Appendix 28.B CONTROL Logistic with Xs	
	Appendix 28.C Merge Score	

Appendix 28.D NET T-C Decile Analysis	406
References	410
29. Bootstrapping in Marketing: A New Approach for Validating Models	413
29.1 Introduction	
29.2 Traditional Model Validation	
29.3 Illustration	
29.4 Three Questions	
29.5 The Bootstrap Method	
29.5.1 Traditional Construction of Confidence Intervals	
29.6 How to Bootstrap	
29.6.1 Simple Illustration	
29.7 Bootstrap Decile Analysis Validation	
29.8 Another Question	
29.9 Bootstrap Assessment of Model Implementation Performance	
29.9.1 Illustration	
29.10 Bootstrap Assessment of Model Efficiency	
29.11 Summary	
References	
20 Malidatina tha Lasistia Rassassian Madal. Tru Rastatus sina	420
30. Validating the Logistic Regression Model: Try Bootstrapping	
30.1 Introduction	
30.2 Logistic Regression Model	
30.4 Summary	
Reference	
Neterence	430
31. Visualization of Marketing Models: Data Mining to Uncover Innards	
of a Model	
31.1 Introduction	
31.2 Brief History of the Graph	
31.3 Star Graph Basics	
31.3.1 Illustration	
31.4 Star Graphs for Single Variables	
31.5 Star Graphs for Many Variables Considered Jointly	
31.6 Profile Curves Method	
31.6.1 Profile Curves Basics	
31.6.2 Profile Analysis	
31.7 Illustration	
31.7.1 Profile Curves for RESPONSE Model	
31.7.2 Decile Group Profile Curves	
31.8 Summary	
Appendix 31.A Star Graphs for Each Demographic Variable about the Deciles	
Appendix 31.B Star Graphs for Each Decile about the Demographic Variables	
Appendix 31.C Profile Curves: All Deciles	
References	452

32. The Predictive Contribution Coefficient: A Measure of Predictive Importance	453
32.1 Introduction	453
32.2 Background	453
32.3 Illustration of Decision Rule	455
32.4 Predictive Contribution Coefficient	457
32.5 Calculation of Predictive Contribution Coefficient	458
32.6 Extra-Illustration of Predictive Contribution Coefficient	459
32.7 Summary	462
Reference	463
33. Regression Modeling Involves Art, Science, and Poetry, Too	465
33.1 Introduction	465
33.2 Shakespearean Modelogue	465
33.3 Interpretation of the Shakespearean Modelogue	466
33.4 Summary	469
References	469
34. Opening the Dataset: A Twelve-Step Program for Dataholics	
34.1 Introduction	
34.2 Background	
34.3 Stepping	
34.4 Brush Marking	
34.5 Summary	
Appendix 34.A Dataset IN	
Appendix 34.8 Samsize Plus	
Appendix 34.C Copy-Pasteable	
Appendix 34.D Missings	
References	476
35. Genetic and Statistic Regression Models: A Comparison	477
35.1 Introduction	477
35.2 Background	477
35.3 Objective	
35.4 The GenIQ Model, the Genetic Logistic Regression	478
35.4.1 Illustration of "Filling Up the Upper Deciles"	
35.5 A Pithy Summary of the Development of Genetic Programming	
35.6 The GenIQ Model: A Brief Review of Its Objective and Salient Features	482
35.6.1 The GenIQ Model Requires Selection of Variables and Function:	
An Extra Burden?	
35.7 The GenIQ Model: How It Works	
35.7.1 The GenIQ Model Maximizes the Decile Table	
35.8 Summary	
References	486
36. Data Reuse: A Powerful Data Mining Effect of the GenIQ Model	487
36.1 Introduction	487
36.2 Data Reuse	487
36.3 Illustration of Data Reuse	488

36.3.1 The GenIQ Profit Model	488
36.3.2 Data-Reused Variables	489
36.3.3 Data-Reused Variables GenlQvar_1 and GenlQvar_2	490
36.4 Modified Data Reuse: A GenIQ-Enhanced Regression Model	491
36.4.1 Illustration of a GenIQ-Enhanced LRM	491
36.5 Summary	
·	
37. A Data Mining Method for Moderating Outliers Instead of	
Discarding Them	495
37.1 Introduction	495
37.2 Background	495
37.3 Moderating Outliers Instead of Discarding Them	496
37.3.1 Illustration of Moderating Outliers Instead of Discarding Them	496
37.3.2 The GenIQ Model for Moderating the Outlier	498
37.4 Summary	499
Reference	499
38. Overfitting: Old Problem, New Solution	501
38.1 Introduction	501
38.2 Background	501
38.2.1 Idiomatic Definition of Overfitting to Help Remember the	
concept	502
38.3 The GenIQ Model Solution to Overfitting	503
38.3.1 RANDOM_SPLIT GenIQ Model	505
38.3.2 RANDOM_SPLIT GenIQ Model Decile Analysis	505
38.3.3 Quasi N-tile Analysis	507
38.4 Summary	508
39. The Importance of Straight Data: Revisited	509
39.1 Introduction	
39.2 Restatement of Why It Is Important to Straighten Data	
39.3 Restatement of Section 12.3.1.1 "Reexpressing INCOME"	
39.3.1 Complete Exposition of Reexpressing INCOME	
39.3.1.1 The GenIQ Model Detail of the gINCOME Structure	
39.4 Restatement of Section 5.6 "Data Mining the Relationship of (xx3, yy3)"	
39.4.1 The GenIQ Model Detail of the GenIQvar(yy3) Structure	
39.5 Summary	
40. The GenIQ Model: Its Definition and an Application	513
40.1 Introduction	513
40.2 What Is Optimization?	
40.3 What Is Genetic Modeling?	514
40.4 Genetic Modeling: An Illustration	515
40.4.1 Reproduction	517
40.4.2 Crossover	518
40.4.3 Mutation	
40.5 Parameters for Controlling a Genetic Model Run	519

40.6 Genetic Modeling: Strengths and Limitations	519
40.7 Goals of Marketing Modeling	520
40.8 The GenIQ Response Model	520
40.9 The GenIQ Profit Model	
40.10 Case Study: Response Model	522
40.11 Case Study: Profit Model	524
40.12 Summary	527
Reference	527
41. Finding the Best Variables for Marketing Models	529
41.1 Introduction	529
41.2 Background	
41.3 Weakness in the Variable Selection Methods	531
41.4 Goals of Modeling in Marketing	532
41.5 Variable Selection with GenIQ	533
41.5.1 GenIQ Modeling	535
41.5.2 GenIQ Structure Identification	537
41.5.3 GenIQ Variable Selection	539
41.6 Nonlinear Alternative to Logistic Regression Model	542
41.7 Summary	545
References	546
42. Interpretation of Coefficient-Free Models	547
42.1 Introduction	
42.2 The Linear Regression Coefficient	
42.2.1 Illustration for the Simple Ordinary Regression Model	
42.2.2 Illustration for the Simple Logistic Regression Model	
42.3 The Quasi-Regression Coefficient for Simple Regression Models	
42.3.1 Illustration of Quasi-RC for the Simple Ordinary Regression Model.	
42.3.2 Illustration of Quasi-RC for the Simple Logistic Regression Model	
42.3.3 Illustration of Quasi-RC for Nonlinear Predictions	
42.4 Partial Quasi-RC for the Everymodel	
42.4.1 Calculating the Partial Quasi-RC for the Everymodel	
42.4.2 Illustration for the Multiple Logistic Regression Model	
42.5 Quasi-RC for a Coefficient-Free Model	
42.5.1 Illustration of Quasi-RC for a Coefficient-Free Model	
42.6 Summary	567
43. Text Mining: Primer, Illustration, and TXTDM Software	
43.1 Introduction	
43.2 Background	
43.2.1 Text Mining Software: Free versus Commercial versus TXTDM	
43.3 Primer of Text Mining	
43.4 Statistics of the Words	
43.5 The Binary Dataset of Words in Documents	
43.6 Illustration of TXTDM Text Mining	
43.7 Analysis of the Text-Mined GenIQ_FAVORED Model	
43.7.1 Text-Based Profiling of Respondents Who Prefer GenIQ	584

43.7.2 Text-Based Profiling of Respondents Who Prefer OLS-Logistic	585
43.8 Weighted TXTDM	585
43.9 Clustering Documents	586
43.9.1 Clustering GenIQ Survey Documents	586
43.9.1.1 Conclusion of Clustering GenIQ Survey Documents	592
43.10 Summary	
Appendix	593
Appendix 43.A Loading Corpus TEXT Dataset	594
Appendix 43.B Intermediate Step Creating Binary Words	594
Appendix 43.C Creating the Final Binary Words	595
Appendix 43.D Calculate Statistics TF, DF, NUM_DOCS, and	
N (=Num of Words)	596
Appendix 43.E Append GenIQ_FAVORED to WORDS Dataset	
Appendix 43.F Logistic GenIQ_FAVORED Model	598
Appendix 43.G Average Correlation among Words	599
Appendix 43.H Creating TF–IDF	
Appendix 43.I WORD_TF-IDF Weights by Concat of WORDS and TF-IDF	
Appendix 43.J WORD_RESP WORD_TF-IDF RESP	
Appendix 43.K Stemming	
Appendix 43.L WORD Times TF–IDF	
Appendix 43.M Dataset Weighted with Words for Profile	605
Appendix 43.N VARCLUS for Two-Class Solution	606
Appendix 43.0 Scoring VARCLUS for Two-Cluster Solution	
Appendix 43.P Direction of Words with Its Cluster 1	607
Appendix 43.Q Performance of GenIQ Model versus Chance Model	
Appendix 43.R Performance of Liberal-Cluster Model versus Chance Model	609
References	610
44. Some of My Favorite Statistical Subroutines	611
44.1 List of Subroutines	
44.2 Smoothplots (Mean and Median) of Chapter 5—X1 versus X2	
44.3 Smoothplots of Chapter 10—Logit and Probability	
44.4 Average Correlation of Chapter 16—Among Var1 Var2 Var3	
44.5 Bootstrapped Decile Analysis of Chapter 29—Using Data from Table 23.4.	
44.6 H-Spread Common Region of Chapter 42	
44.7 Favorite—Proc Corr with Option Rank, Vertical Output	
44.8 Favorite—Decile Analysis—Response	
44.9 Favorite—Decile Analysis—Profit	
44.10 Favorite—Smoothing Time-Series Data (Running Medians of Three)	
44.11 Favorite—First Cut Is the Deepest—Among Variables with Large	
Skew Values	643
Index	645