Technology Fundamentals for Analytics Lab

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Agenda

1. Exam Details
2. Guest Speaker NICK ELPRIN Founder http://www.dominodatalab.com
3. Kaggle Details [Presentation]
4. Evaluating Models
5. Deploying Models [Cases Chequed.com and iNovum.]

Nick Elprin

http://www.dominodatalab.com

Domino Data Lab, Inc. is a new company that started out with a focus on enabling much easier cloud computation, and doing "version control for data science."

Exam Details

- You should be able to go from statement to R code. You can use a 1 page both sides cheat sheet.
- You should be able to go from R code to a statement describing what it does.
- You should have conceptual knowledge of Hadoop and Mapreduce [not specific syntax].
- You should be able to understand deployment of models for cost benefit analysis.

Kaggle

Cross Industry Standard Process for Data Mining (CRISP-DM; Shearer, 2000),

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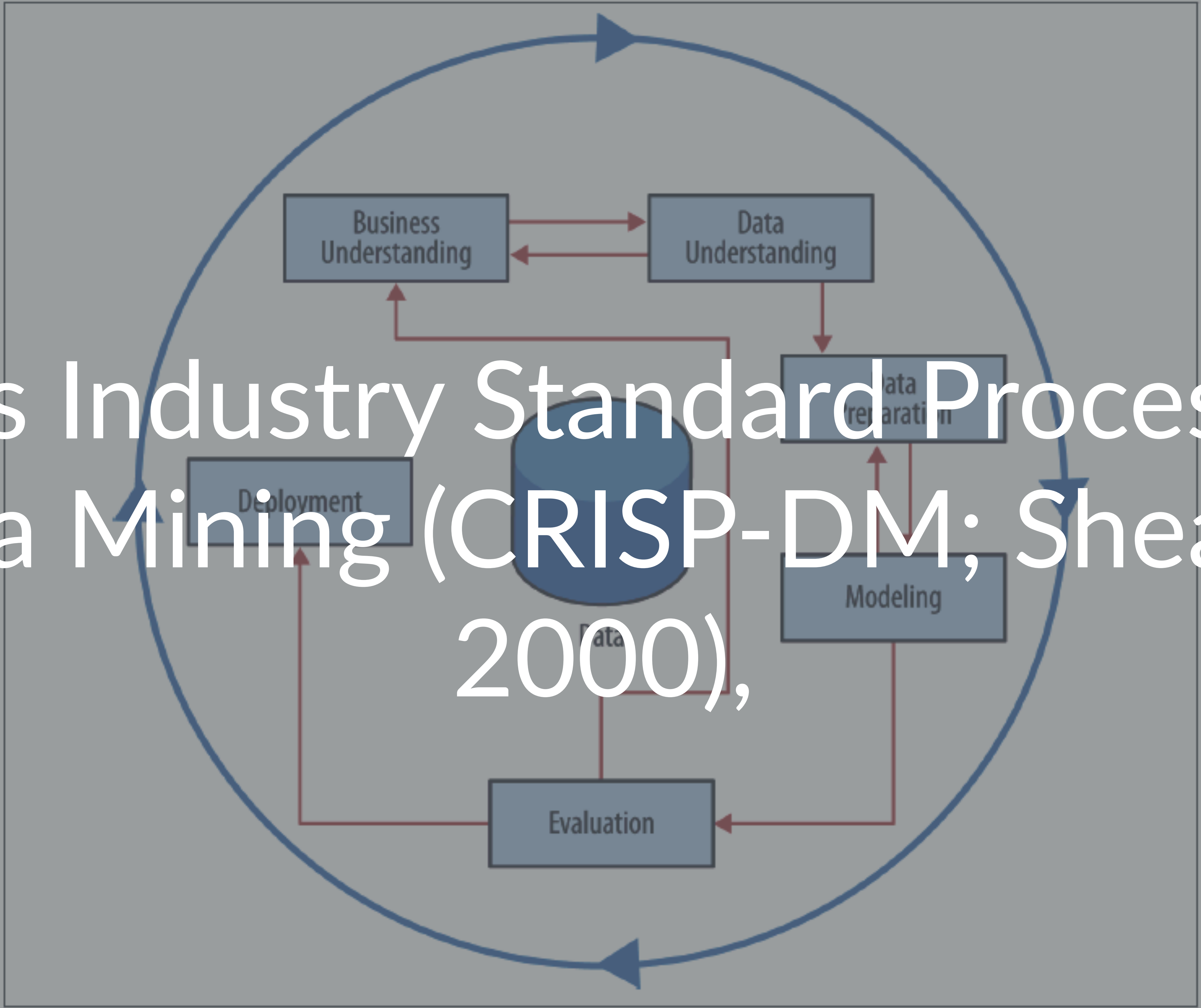


Figure 2-2. The CRISP data mining process.

Stages of Model Development

Pay attention we will use this as a framework

1. Data understanding
2. Data preparation
3. Modeling
4. Evaluation `<- Focus today`
5. Deployment (DDD) `<- Focus today`
5. Business Understanding

What is a good model?

What is a good model?

1. Predicts on data that the model has not been trained on. (This indicates that overfitting is not likely an issue).

2. Minimizes errors (classification or prediction)

3. (maybe) Understandible/parsimonious

Evaluation

What is a good model?

Classification

- Accuracy = Number of correct decisions/Total number of decisions

Prediction (Continuous DV)

- Root-mean-square error (RMSE)
- Root Mean Squared Logarithmic Error (RMSLE)

Classification Accuracy

Confusion Matrix

		Predicted class		
		Cat	Dog	Rabbit
Actual class	Cat	5	3	0
	Dog	2	3	1
	Rabbit	0	2	11

Prediction (Continuous DV)

Root-mean-square error (RMSE)

$$\mathrm{RMSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(y_i - x_i\right)^2}$$

Prediction (Continuous DV)

Root Mean Squared Logarithmic Error (RMSLE)

Submissions are evaluated one the Root Mean Squared Logarithmic Error (RMSLE). The RMSLE is calculated as

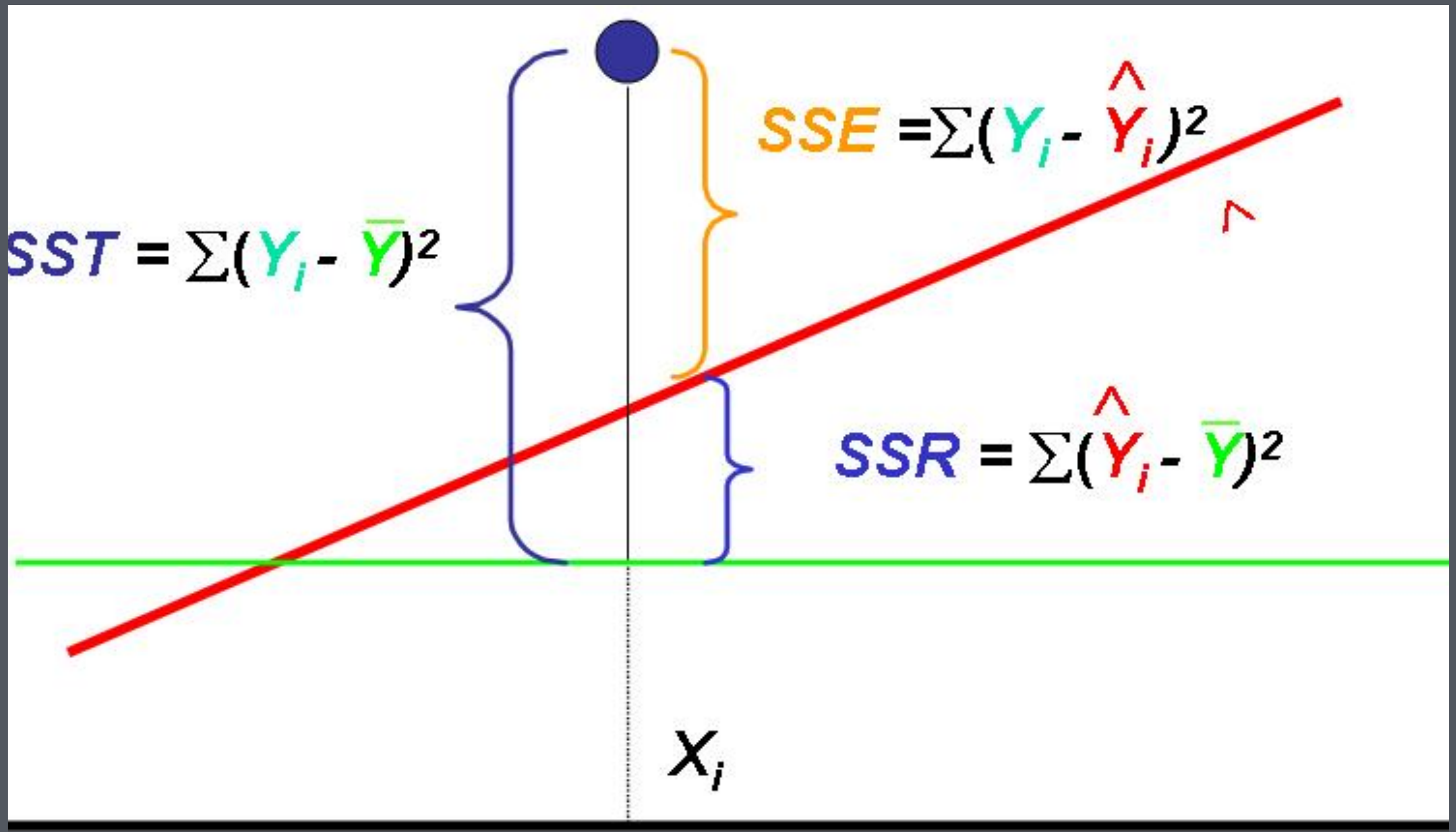
$$\sqrt{\frac{1}{n}\sum_{i=1}^{n}(\log(p_i + 1) - \log(a_i + 1))^2}$$

Where:

- n is the number of hours in the test set
- p_i is your predicted count
- a_i is the actual count
- $\log(x)$ is the natural logarithm

Prediction (Continuous DV)

Coefficient of Determination (R2)



Coefficient of Determination → $R^2 = \dfrac{SSR}{SST} = 1 - \dfrac{SSE}{SST}$

Sum of Squares Total → $SST = \sum (y - \bar{y})^2$

Sum of Squares Regression → $SSR = \sum (y' - \bar{y'})^2$

Sum of Squares Error → $SSE = \sum (y - y')^2$

What if one class is prevalent?

- Example, Fraud occurs in less than 1/100.

What if there is Unequal Costs and Benefits

- Difference between a false positive and a false negative.

Example Model Valuation
Chequed.com

HR Analytics Background - Survey Based methods

1. Multiple measures per construct
2. Data reduction
3. Regression
4. Deploy to predict job success

1. Multiple measures per construct.

Example

Neuroticism is a fundamental personality trait in the study of psychology characterized by anxiety, fear, moodiness, worry, envy, frustration, jealousy, and loneliness.

1. Multiple measures per construct.

Construct = Neuroticism Part of Big 5

I am not a worrier.
I am seldom sad or depressed.
I often feel helpless and want someone else to solve my problems.
At times I have been so ashamed I just wanted to hide.
I often feel inferior to others.
When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
I rarely feel lonely and blue.
I often feel tense and jittery.

1. Multiple measures per construct.

Survey on Likert Scale.

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

2. Average multiple measures from construct, reverse coding where necessary

- I rarely feel fearful or anxious. [6-Value]
- Too often, when things go wrong, I get discouraged and want to give up. [Value]

3. Regression

- Regression using multiple constructs and a dependent variable likely to be context specific.

4. Deploy to predict job success

- Variables are weighted in relationship to significance

HR Analytics DV - Ranking of salespeople

- We take our existing sales
- How might we evaluate the model?

HR Analytics DV - Ranking of salespeople

1. R2 [Easy because is outcome of regression and fits with IO psychology
2. RMSE based on rank
3. Classify top 20%. Either individual is in top 20% or not.
4. Classify in 5 different sections (0-20, 21-40, etc.)

Deploying Model

Deploying Model

How do you use the HR analytics?

Chequed fit score from 1-5

https://www.chequed.com/pre-employment-assessment-test/

Take 5 minutes and find an example of a model deployed in the wild.

Examples

Deploy - Classification

Consider

- For this case study, let's consider a real example of targeted marketing: targeting the best prospects for a charity mailing.

[It costs $1 to print and send a brochure. How might I improve the likelihood of a positive outcome?]

Expected Value

- Expected Benefit = Pr(x) * Vr + [1 - Pr(x)] * Vnotr

What business problem are we solving.

$$p(x)\$99 - [1-p(x)]\$1 > 0.$$

What other factors should be considered?

What factors should be considered?

- Some people might give \$1 others \$1000.
- There could be a negative cost of predicting wrong that differs depending

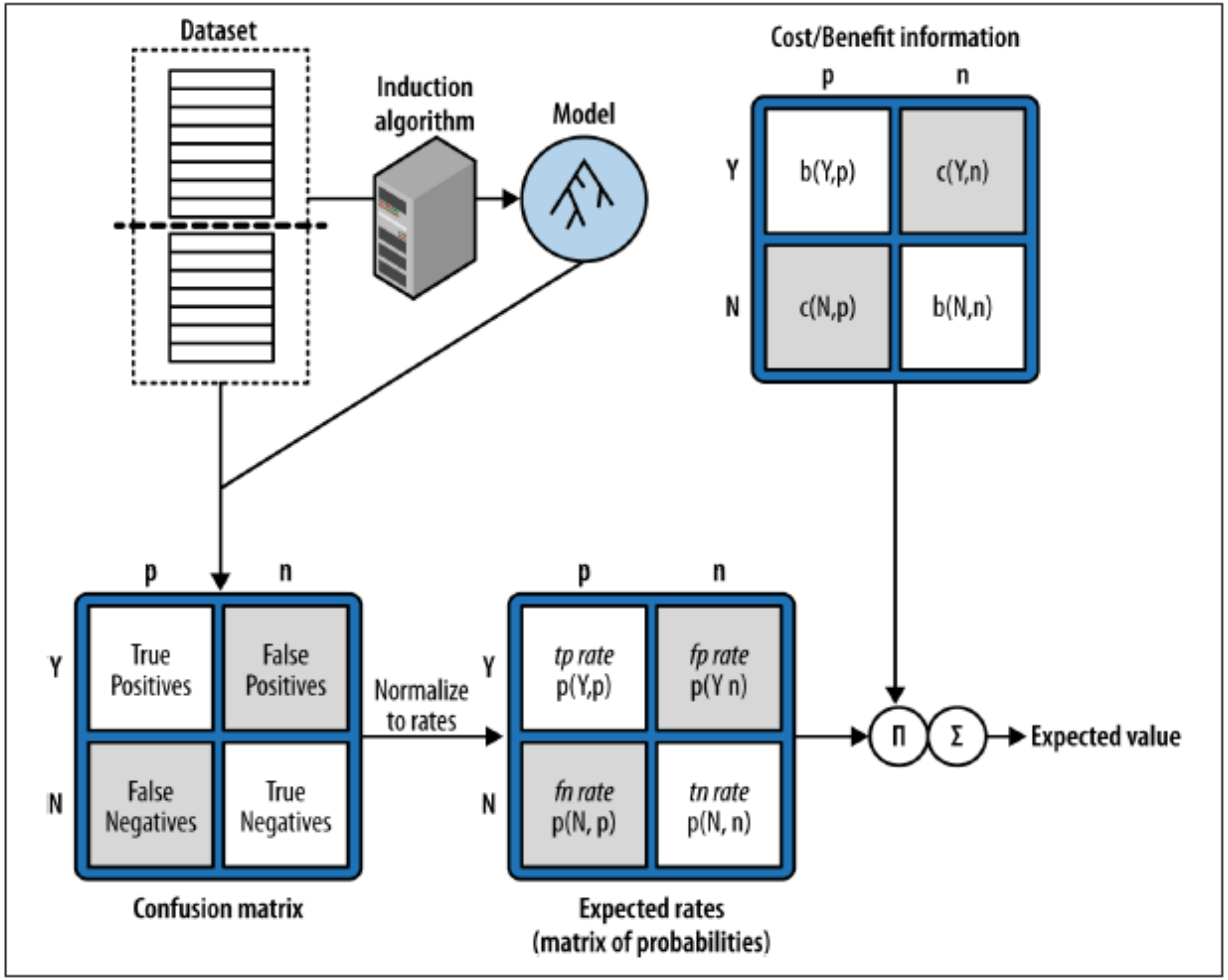


Figure 7-2. A diagram of the expected value calculation. The Π and Σ refer to the multiplication and summation in the expected value calculation.

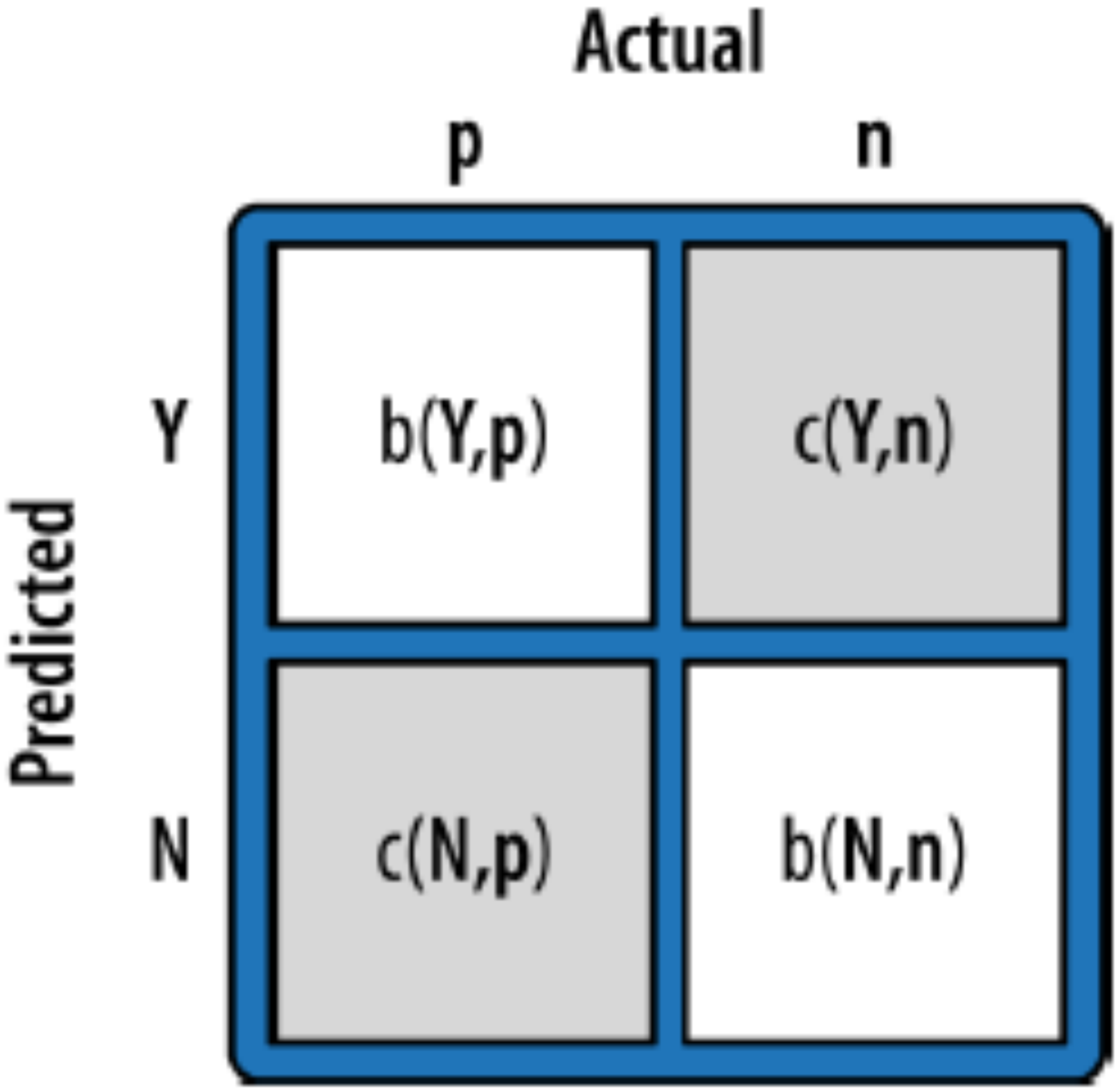


Figure 7-3. A cost-benefit matrix.

While probability can be estimated from the data, cost benefit is a separate process.

b(Y,p) and b(N, n) are the benefits of correct prediction.

c(N,p) and c(Y, n) are the costs of an incorrect prediction.

$$
\begin{array}{ccc}
 & & \text{Actual} \\
 & & \begin{array}{cc} \mathbf{p} & \mathbf{n} \end{array} \\
\text{Predicted} & \begin{array}{c} \mathbf{Y} \\ \mathbf{N} \end{array} & \begin{pmatrix} 99 & -1 \\ 0 & 0 \end{pmatrix}
\end{array}
$$

Figure 7-4. A cost-benefit matrix for the targeted marketing example.

Given a matrix of costs and benefits, these are multiplied cell-wise against the matrix of probabilities, then summed into a final value representing the total expected profit. The result is:

$$
\begin{aligned}
\textit{Expected profit} = {} & p(\mathbf{Y}, \mathbf{p}) \cdot b(\mathbf{Y}, \mathbf{p}) + p(\mathbf{N}, \mathbf{p}) \cdot b(\mathbf{N}, \mathbf{p}) + \\
& p(\mathbf{N}, \mathbf{n}) \cdot b(\mathbf{N}, \mathbf{n}) + p(\mathbf{Y}, \mathbf{n}) \cdot b(\mathbf{Y}, \mathbf{n})
\end{aligned}
$$

Share Examples on Progress with Kaggle 2

Interesting Book Resources to Check Out

Machine Learning for Hackers

https://github.com/johnmyleswhite/ML*for*Hackers