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- Build clustering, classification and statistical models
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Anasse Bari, PhD
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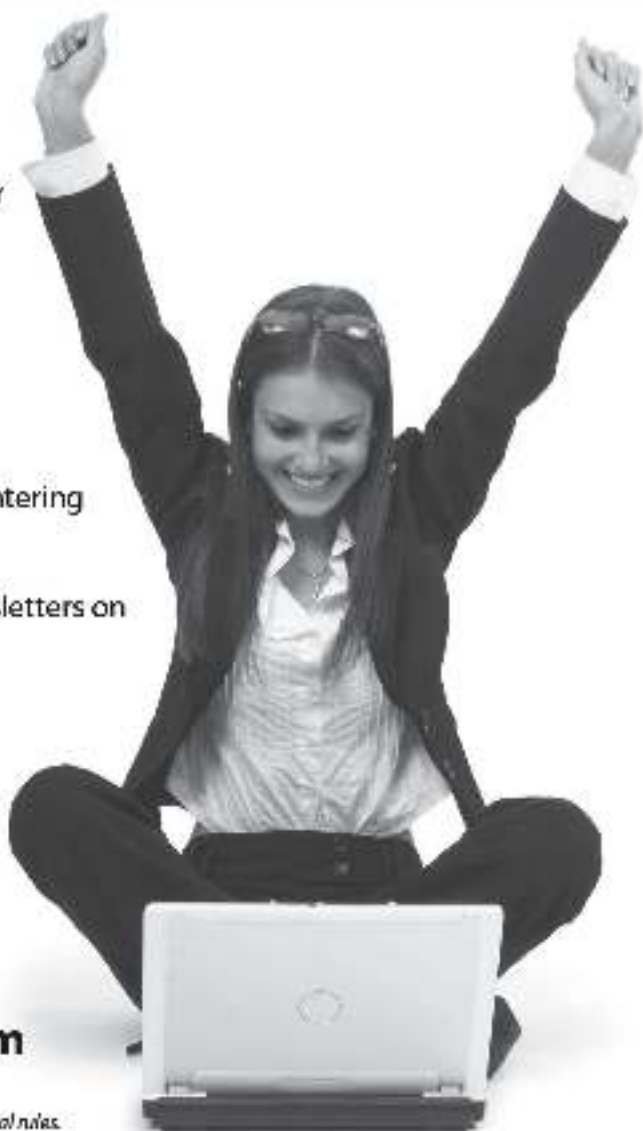
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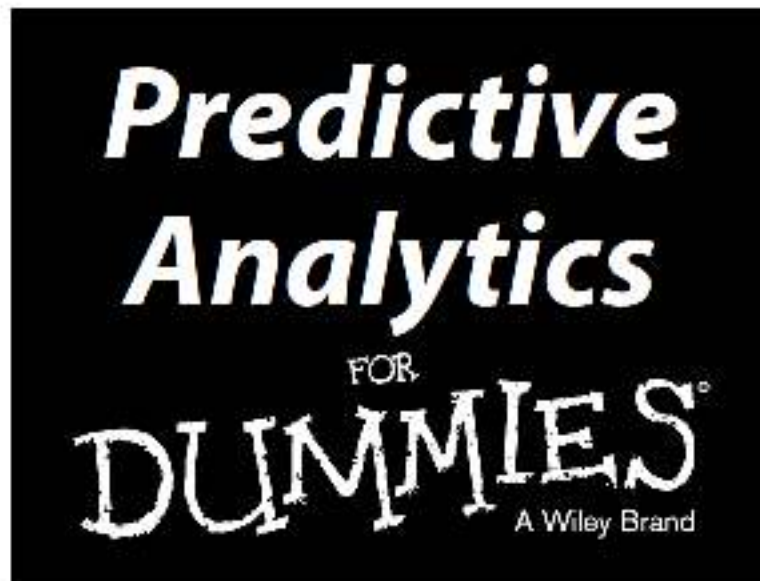
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**by Anasse Bari, PhD,
Mohamed Chaouchi,
and
Tommy Jung**

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Predictive Analytics For Dummies®

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Introduction

Predictive Analytics is the art and science of using data to make better informed decisions. Predictive analytics helps you uncover hidden patterns and relationships in your data that can help you predict with greater confidence what may happen in the future, and provide you with valuable, actionable insights for your organization.

About This Book

Our goal was to make this complex subject as practical as possible, in a way that appeals to everyone from technological experts to non-technical level business strategists.

The subject is complex because it is not really just one subject. It is the combination of at least a few multifaceted fields: data mining, statistics and mathematics.

Data mining requires an understanding of machine learning and information retrieval. On top of this, mathematics and statistics must be applied to your business domain; be it marketing, actuary service, fraud, crime, or banking.

Most of the current materials on predictive analytics are pretty difficult to read if you don't already have a background in some of the aforementioned subjects. They are filled with complex mathematical equations and modeling techniques. Or, they are at a high level with specific use cases but with little guidance regarding implementation. We tried to include both, while trying to keep a wide spectrum of readers engaged.

The focus of this book will be developing a roadmap for implementing predictive analytics within your organization. Its intended audience is the larger community of business managers, business analysts, data scientists, and information technology professionals.

Maybe you are a business manager and you have heard the buzz about predictive analytics. Maybe you've been working with data mining and you want to add predictive analytics to your skill set. Maybe you know R or Python, but you're totally new to predictive analytics. If this sounds like you,

then this book will be a good fit. Even if you have no experience analyzing data, but want or need to derive greater value from your organization's data, you can also find something of value in this book.

Foolish Assumptions

Without oversimplifying, we have tried to explain technical concepts in non-technical terms, tackling each topic from the ground up.

Even if you are an experienced practitioner, you should find something new, and at the very least, you will gain validation for what you already know, and guidance for establishing best practices.

We also hope to have contributed a few concepts and ideas for the very first time in a major publication like this. For example we explain how you can apply biologically inspired algorithms to predictive analytics.

We assume that the reader will not be a programmer. The code presented in this book is very brief and easy to follow. Readers of all programming levels will benefit from this book, because it is more about learning the process of predictive analytics rather than learning a programming language.

Icons Used in This Book

The following icons in the margins indicate highlighted material that we thought could be of interest to you. Next, we describe the meaning of each icon that is used in this book.



The tips are ideas we would like you to take note of. This is usually practical advice you can apply for that given topic.



This icon is rarely used in this book. We may have used it only once or twice in the entire book. The intent is to save you time by bringing to your attention some common pitfalls that you are better off avoiding.



We have made sincere efforts to steer away from the technical stuff. But when we had no choice we made sure to let you know. So if you don't care too much about the technical stuff you can easily skip this part and you won't miss much. If the technical stuff is your thing, then you may find these sections fascinating.



This is something we would like you to take a special note of. This is a concept or idea we thought it was important for you know and remember. An example of this would be a best practice we think it is noteworthy.

Beyond the Book

A lot of extra content that is not in this book is available at www.dummies.com. Go online to find the following:

✓ **Online articles covering additional topics at**

www.dummies.com/extras/predictiveanalytics

Here you will find articles about advanced topics in predictive analytics, and an overview about learning data mining with R. We have also included top ten qualities for your data science team.

✓ **The Cheat Sheet for this book is at**

www.dummies.com/cheatsheet/predictiveanalytics

Here you'll find the necessary steps needed to build a predictive analytics model and some cases studies of predictive analytics.

✓ **Updates to this book, if we have any, are also available at**

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Where to Go from Here

Let's start making some predictions! You can apply predictive analytics to virtually every business domain. Right now there is explosive growth in predictive analytics' market, and this is just the beginning. The arena is wide open, and the possibilities are endless.

Part I

Getting Started with Predictive Analytics



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In this part . . .

- ✔ Exploring predictive analytics
- ✔ Identifying uses
- ✔ Classifying data
- ✔ Presenting information
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Chapter 1

Entering the Arena

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In This Chapter

- ▶ Explaining the building blocks
 - ▶ Probing capabilities
 - ▶ Surveying the market
-

Predictive analytics is a bright light bulb powered by your data.

You can never have too much insight. The more you see, the better the decisions you make — and you never want to be in the dark. You want to see what lies ahead, preferably before others do. It's like playing the game "Let's Make a Deal" where you have to choose the door with the hidden prize. Which door do you choose? Door 1, Door 2, or Door 3? They all look the same, so it's just your best guess — your choice depends on you and your luck. But what if you had an edge — the ability to see through the keyhole? Predictive analytics can give you that edge.

Exploring Predictive Analytics

What would you do in a world where you know how likely you are to end up marrying your college roommate? Where you can predict what profession will best suit you? Where you can predict the best city and country for you to live in?

In short, imagine a world where you can maximize the potential of every moment of your life. Such a life would be productive, efficient, and powerful. You will (in effect) have superpowers — and a lot more spare time. Well, such a world may seem a little boring to people who like to take uncalculated risks, but not to a profit-generating organization. Organizations spend millions of dollars managing risk. And if there is something out there that helps them manage their risk, optimize their operations, and maximize their profits, you should definitely learn about it. That is the world of predictive analytics.

Mining data

Big data is the new reality. In fact, data is only getting bigger, faster, and richer. It's here to stay and you'd better capitalize on it.

Data is one of your organization's most valuable assets. It's full of hidden value, but you have to dig for it. *Data mining* is the discovery of hidden patterns of data through machine learning — and sophisticated algorithms are the mining tools. *Predictive analytics* is the process of refining that data resource, using business knowledge to extract hidden value from those newly discovered patterns.

Data mining + business knowledge = predictive analytics => value

Today's leading organizations are looking at their data, examining it, and processing it to search for ways to better understand their customer base, improve their operations, outperform their competitors, and better position themselves in the marketplace. They are looking into how they can use that information to increase their market share and sharpen their competitive edge. How can they drive better sales and more effectively targeted marketing campaigns? How can they better serve their customers and meet their needs? What can they do to improve the bottom line?

But these tools are useful in realms beyond business. As one major example, government law enforcement agencies are asking questions related to crime detection and prevention. Is this a person of interest? Is this person about to commit a heinous crime? Will this criminal be a repeat offender? Where will the next crime happen?

Other industries, notably those with financial responsibility, could use a trustworthy glimpse into the future. Companies are trying to know ahead of time whether the transaction they're currently processing is fraudulent, whether an insurance claim is legitimate, whether a credit card purchase is valid, whether a credit applicant is worthy of credit . . . the list goes on.

Governments, companies, and individuals are (variously) looking to spot trends in social movements, detect emerging healthcare issues and disease outbreaks, uncover new fashion trends, or find that perfect lifetime partner.

These — and plenty more — business and research questions are topics you can investigate further to find answers to by mining the available data and building predictive analytics models to guide future decisions.

Data + predictive analytics = light.

Highlighting the model

A *model* is a mathematical representation of an object or a process. We build models to simulate real-world phenomena as a further investigative step, in hopes of understanding more clearly what's really going on. For example, to model our customers' behavior, we seek to mimic how our customers have been navigating through our websites:

- ✔ What products did they look at before they made a purchase?
- ✔ What pages did they view before making that purchase?
- ✔ Did they look at the products' descriptions?
- ✔ Did they read users' reviews?
- ✔ How many reviews did they read?
- ✔ Did they read both positive and negative reviews?
- ✔ Did they purchase something else in addition to the product they came looking for?

We collect all that data from past occurrences. We look at those historical transactions between our company and our customers — and try to make consistent sense of them. We examine that data and see whether it holds answers to our questions. Collecting that data — with particular attention to the breadth and depth of the data, its quality level, and its predictive value — helps to form the boundaries that will define our model and its outputs.

This process is not to be confused with just reporting on the data; it's also different from just visualizing that data. Although those steps are vital, they're just the beginning of exploring the data and gaining a usable understanding of it.

We go a lot deeper when we're talking about developing predictive analytics. In the first place, we need to take a threefold approach:

- ✔ Thoroughly understand the business problem we're trying to solve.
- ✔ Obtain and prepare the data we want our model to work with.
- ✔ Run statistical analysis, data-mining, and machine-learning algorithms on the data.

In the process, we have to look at various *attributes* — data points we think are relevant to our analysis. We'll run several *algorithms*, which are sets of mathematical instructions that get machines to do problem-solving.

We keep running through possible combinations of data and investigate what-if scenarios. Eventually we find our answers, build our model, and prepare to deploy it and reap its benefits.

What does a model look like? Well, in programming terms, a predictive analytics model can be as simple as a few `if . . . then` statements that tell the machine, “If this condition exists, then perform this action.”

Here are some simple rule-based trading models:

- ✔ If it's past 10:00a.m. ET and the market is up, then buy 100 shares of XYZ stock.
- ✔ If my stock is up by 10 percent, then take profits.
- ✔ If my portfolio is down by 10 percent, then exit my positions.

Here's a simple rule-based recommender system (for more about recommender systems, see Chapter 2):

- ✔ If a person buys a book by this author, then recommend other books by the same author.
- ✔ If a person buys a book on this topic, then recommend other books on the same and related topic.
- ✔ If a person buys a book on this topic, then recommend books that other customers have purchased when they bought this book.

Adding Business Value

In an increasingly competitive environment, organizations always need ways to become more competitive. Predictive analytics found its way into organizations as one such tool. Using technology in the form of machine-learning algorithms, statistics, and data-mining techniques, organizations can uncover hidden patterns and trends in their data that can aid in operations and strategy and help fulfill critical business needs.

Embedding predictive analytics in operational decisions improves return on investment because organizations spend less time dealing with low-impact, low-risk operational decisions. Employees can focus more of their time on high-impact, high-risk decisions. For instance, most standard insurance claims can be automatically paid out. However, if the predictive model comes across a claim that's unusual (an outlier), or if the claim exhibits the same pattern as a fraudulent claim, the system can flag the claim automatically and send it to the appropriate person to take action.

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