Machine Learning for Decision Makers

Cognitive Computing Fundamentals for Better Decision Making

Patanjali Kashyap

Apress®

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Printed on acid-free paper

To my late father, Dr. Damador Prasad Singh*, who had serious doubts that I would matriculate and get a job.*

And to my mother, Dr. Meena Singh*, who always believed that one day I would be able to bring moon on Earth.*

Contents

About the Author

Dr. Patanjali Kashyap holds a PhD in physics and an MCA. He currently works as a technology manager at a leading American bank. Professionally he deals with high-impact mission-critical financial and innovative new-generation technology projects on a day-to-day basis. He has worked with the technology giants, like Infosys and Cognizant, on technology solutions. He is an expert of the Agile process, machine learning, Big Data, and the cloud computing paradigm. He possesses a sound understanding of Microsoft Azure and cognitive computing platforms like Watson and Microsoft cognitive services. The .NET technologies are his first love. Patanjali has worked on a spectrum of .NET and associated technologies, including SQL Server and component-based architectures, since their inception. He also enjoys working on SharePoint (content management in general), as well as dealing with knowledge management, positive technology, psychological computing, and the UNIX system. He is very experienced in software development methodologies, application support, and maintenance.

He possesses a restless mind that's always looking for innovation and he is involved in idea generation in all areas of life, including spirituality, positive psychology, brain science, and cutting-edge technologies. He is a strong believer in cross/inter-disciplinary study. His view of "everything is linked" is reflected in his work. For example, he filed a patent on improving and measuring the performance of an individual by using emotional, social, moral, and vadantic intelligence. This presents a unique novel synthesis of management science, physics, information technology, and organizational behavior.

Patanjali has published several research and whitepapers on multiple topics. He is involved in organizational initiatives, such as building world-class teams and dynamic cultures across enterprises. He is the go-to person for incorporating positivity and enthusiasm in enterprises. His fresh way of synthesizing Indian Vedic philosophies with the Western practical management insight for building flawless organizational dynamics is much appreciated in corporate circles. He is an implementer of ancient mythologies in the modern workplace. Patanjali is also involved in leadership development and building growth frameworks for the same.

Apart from his MCA, Patanjali holds a Masters in bioinformatics, physics, and computer science (M.Phil.).

About the Technical Reviewer

Jojo Moolayil is a data scientist and the author of the book: *Smarter Decisions – The Intersection of Internet of Things and Decision Science*. With over five years of industrial experience in data science, decision science, and IoT, he has worked with industry leaders on high-impact and critical projects across multiple verticals. He is currently associated with General Electric, the pioneer and leader in data science for Industrial IoT, and lives in Bengaluru—the silicon valley of India.

He was born and raised in Pune, India and graduated from the University of Pune with a major in Information Technology Engineering. He started his career with Mu Sigma Inc., the world's largest pure play analytics provider, and worked with the leaders of many Fortune 50 clients. One of the early enthusiasts to venture into IoT analytics, he converged his knowledge from decision science to bring the problem-solving frameworks and his knowledge from data and decision science to IoT analytics.

To cement his foundation in data science for industrial IoT and scale the impact of the problem solving experiments, he joined a fast-growing IoT analytics startup called Flutura based in Bangalore and headquartered in the valley. After a short stint with Flutura, Moolayil moved on to work with the leaders of Industrial IoT—General Electric, in Bangalore, where he focused on solving decision science problems for Industrial IoT use cases. As a part of his role in GE, Moolayil also focuses on developing data science and decision science products and platforms for industrial IoT.

Apart from authoring books on Decision Science and IoT, Moolayil has also been the technical reviewer for various books on machine learning, deep learning, and business analytics with Apress. He is an active data science tutor and maintains a blog at http://www.jojomoolayil.com/web/blog/.

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I would like to thank my family, friends, and mentors.

Foreword

"The world is one big data problem".

—Andrew McAfee, Center for Digital Business at the
MIT Sloan School of Management

Machine learning, big data, AI , cognitive and cloud computing is already making a large impact across several social spheres and is increasingly being applied to solve problems in almost all spheres from technology, consumer ehavior, healthcare, financial markets, commerce, transportation and even in providing civic amenities to town and cities.

As a part of my profession, I get numerous opportunities to interact with many senior executives across organizations on topics that are on top of their mind and the problems that they are trying to solve for their organizations. During many of these discussions with senior leaders across organizations, I have come to realize that almost all of them recognize the potential of machine learning and its associated technologies. Many of them are also aware that these technologies are being used to solve some of the most exciting problems in today's world including some within the organizations that they work for. However, it is striking how few of them actually understand the fundamental concepts behind these technologies. Knowing more about these important concepts will enable them to apply these technologies better and thereby drastically improve decision-making in their organizations.

I can't blame you if you are one such decision maker for your enterprise, who knows little about the underlying concepts behind these technologies. I am one too (or atleast I was too till I read this book). There are very few resources, books or papers that deal with this complex topic in a way that makes it easier for the readers to comprehend. The existing publications address this topic from the perspective of a technologist or a big data scientist and hardly ever from the perspective of a decision maker who wants to apply these technologies. This book, on the other hand, addresses it from the perspective of a decision maker in an enterprise while still covering the concepts in detail and the use cases for them.

I am glad that Dr Patanjali Kashyap decided to write a book on this topic. Having known him for several years now, I believe that Dr. Kashyap is uniquely placed to address this large and complex topic. As a part of his professional experience he has played several roles including the role of a machine learning expert as well that of a senior decision maker for an enterprise. In this book, he has been able to present the concepts in a language that any decision maker and senior executive in a corporation will be able to appreciate.

Hope this book changes the way you apply these advanced technologies to improve decision-making for your enterprise.

By Ashish Singh
Sr. Director - HR at Myntra
XLRI Jamshedpur
B. Tech, IIT (BHU)

For a number of years now machine learning has been talked about in the technology world but it has remained a bit of a mystery to the C-level suite who do not understand the myriad of acronyms used and what they should care about it. In this book Dr Kashyap has de-mystified the whole concept and provided holistic insights to decision makers to help them to grasp the concepts of machine learning and associated technologies. This book should be read by anyone who runs a business so that they can understand the benefits of machine learning and how it can be applied to their individual business model.

As any business owner is aware; new technologies disrupts the status quo and there is no doubt that machine learning in combination with IOT and big data analytics are disrupting existing business models. It can create new services or enhance ways of delivering existing services that all adds up to creating new areas of revenue for the firm. For example in manufacturing industries smart systems would be able to predict machine failure before it happens. This alone has the potential to save a lot of money. Marketing analytics makes marketing team smart enough to map customers' expense habits, so that personalized shopping experiences are provided to the customers. In summary machine learning can incorporate intelligence and smartness everywhere. This will make a holistic system of smarter applications, products and experiences for users, employees, clients and customers.

As well as the fundamental concepts and architectures associated with machine learning, this book is crammed with useful use cases and real life scenarios. I found that this helps to bring the subject to life and helps the reader visualise what it means for their business.

I strongly recommend this book for anyone who wants to gain a broad perspective on the subject of machine learning and associated technologies.

—Selvan

Preface

Technology is growing quicker than ever. Social media, the Internet of Things, Big Data, mobile devices, cloud computing, and machine learning are changing the way we live and do business. The whole world and everything in it is getting linked. For example, more than three billion Internet, billions of mobile, and billion devices users are linked to each other and have created a web of data and a collaborative communication ecosystem. Machine learning is the next most important movement of innovation, which is guided by developments in computing power and based on the solid foundation of mathematics. Its capability of accumulation of huge sizes of data in the cloud at nominal cost, and laidback access to sophisticated algorithms, is changing everything around us. Machine learning is the most disruptive and influential technology in the recent time and it's also able to make changes to the complete business ecosystem.

Today, almost every enterprise is willing to integrate machine learning into the fabric of commerce in order to succeed. However, until a few years ago, machine learning was out of scope for businesses. The high cost to incorporate machine learning solutions to the business was backed by scarcity of talent availability, infrastructure, and imperfect data. But innovations in the field of storage devices, microprocessing technologies, and availability of tiny networking devices flipped the dynamics and business sentiment. This sparked the Internet of Things, which is flora and fauna of digitally linked devices.

Riding on the wave of IOT, new sets of devices, equipment, and products—like mobile phones, toothbrushes, shirts, light bulbs, cars, and so on—can now interact and talk to each other. These devices—along with the connected ecosystem of machines, people, and processes—generate huge volumes of data. Businesses need that data for effective decision making for their growth, customers, and clients. This needs to be smart, intelligent, and relevant in the market forces enterprises to come up with new way to gather, digest, and apply data for useful purposes. Therefore, this data becomes the main enabler of IoT and machine learning. The impact of machine learning, IoT, and Big Data analytics is not limited just to the business; ultimately it can go miles ahead to provide satisfaction to the customer and create new avenues of profit generation that matter most to the business. Machine learning made it possible to generate a complete universe of business applications, products, and capabilities that serve customers and enhance life experiences of the individuals across domains, verticals, and industries. This includes finance, manufacturing, retails, sales, service, marketing, and so on....

Machine learning has a strong impact and consequences for and every area of business. For example, the sales team will be able to forecast prospects and emphasize the most likely leads in a timely manner. Customer service teams can send subsequent generations of service proactively to the users, clients, customers, and other businesses. In the manufacturing industries, smart systems can predict machine failure before it happens. Marketing analytics make the marketing team smart enough to map customers expense habits, so that personalized shopping experiences are provided to the customers. Machine learning can potentially incorporate intelligence everywhere. This will create a holistic system of smarter applications, products, and experiences for users, employees, clients, and customers.

In this context, this book is written to provide holistic insights to the decision makers to enlighten them. The book will help you grasp the concepts of machine learning and associated technologies in a fast, efficient, and reliable way, so you can make effective, smart, and efficient business decisions. This book covers almost all aspects of machine learning, ranging from algorithms to industry applications.

Wherever possible, required practical guidelines and best practices related to machine learning and associated technologies are also discussed. Architects and technical people can use this book to understand machine learning, IoT, Big Data, and cognitive computing in a collective way. This book is written to make the audience future-ready and help them cope with any challenges related to machine learning.

Here is a brief outline of the book's chapters.

Chapter 1: Let's Integrate with Machine Learning

This chapter sets the stage. It talks about the main technologies and topics used in the book. It also provides a brief description of IoT, Big Data/analytics, machine learning, and cloud and cognitive computing. It presents a comprehensive model of these technologies.

Chapter 2: The Practical Concepts of Machine Learning

This chapter explains the fundamental concepts of ML in detail, including its evolution and history. It throws some light on the multi-disciplinary nature of machine learning and its relationship with artificial intelligence, neural networks, statistics, and brain science (with the backdrop of cognitive and cloud computing). The chapter also covers fundamental architectures and other important aspects tied to machine learning.

Chapter 3: Machine Learning Algorithms and Their Relationship with Modern Technologies

This chapter discusses in detail the common methods and techniques for machine learning. The main subject of the chapter is the algorithm. Therefore, it covers some main stream algorithms in detail, including relevant use cases, advantages, disadvantages, and practical applications.

Chapter 4: Technology Stacks for Machine Learning and Associated Technologies

This chapter discusses the technology stacks of machine learning and associated technologies, like Big Data, Internet of Things (IoT), and cognitive and cloud computing in detail. It also provides an overview of technology offerings from different leading vendors in the areas of machine learning and allied fields. It presents ample amounts of practical use cases.

Chapter 5: Industrial Applications of Machine Learning

This chapter talks about business challenges associated with machine learning (ML) technologies. It also discusses a few real-time scenarios and use cases. Apart from this, it will throw light on applications of ML across industries, including manufacturing, health care, finance and banking, customer services, retail and so on. About 20 domains and industries are covered in the chapter.

Chapter 6: I Am the Future: Machine Learning in Action

This chapter discusses real-time case studies, scenarios, and points of views related to machine leaning. Multiple products, applications, and services are described in the project.

Chapter 7: Innovation, KPIs, Best Practices, and More for Machine Learning

This chapter discusses metrics, performance measures, and KPIs for machine learning. The chapter also discusses best practices, patterns, and practices for machine learning.

Chapter 8: Do Not Forget Me: The Human Side of Machine Learning

This chapter discusses the people and cultural aspects of machine learning or innovation-oriented organizations. The focus of this chapter is to highlight key requirements of building a great place to work in new generation enterprises and to provide guidelines, methods, and tricks. It also provides a brief roadmap of incorporating emotional, moral, spiritual, and social intelligence in the workplace.

Chapter 9: Let's Wrap Up: The Final Destination

This chapter concludes the concepts in the book and showcases the connections among them.

Acknowledgments

In the summer of 2016, as I was returning from Rameswaram on a pilgrimage with my mother, wife, and son, Celestin (Senior Manager of Editor Acquisition at Apress) called and asked me if I was interested in writing a book on machine learning for Apress. I was not expecting this question and told him that I would get back to him. I asked my mother and wife Amrita whether I should take the offer. I asked the same question to my one-year-old son Maheer and my dog Simba. Trapped in this dilemma of go/no-go, I called Aditya, my friend who works with me, and asked for his advice. Reponses from everywhere were positive and encouraging. Unanimously, I was told to take the offer. I thought for a few seconds and then picked up the phone to accept the offer.

When I look back now, everything that has happened in the last year was an extraordinary journey of acquiring intellect and learning for me. While writing these acknowledgments, I want to thank my wife, mother, and son for their cooperation. I want to acknowledge that, due to this book and my job, I felt guilt for missing out on spending time with my son. There were occasions when he was standing by the closed door of my study room asking me to open it and I did not open the door because I was busy writing. Numerous other incidents like this happened. Similar incidents happened with my dog Simba as well. I confined his life to his room because of my lack of time, but he never complained and remained as companionable and affectionate as ever. Simba, my apologies and thanks for your patience and unconditional love.

There are many other people I want to thank, because without their best wishes, this book would never have been realized. One of those people is my mother. She was a university professor by profession. She groomed me to become what I am now. She always encouraged me to do something different. Writing a book is one of those things that she always believed I would do. She is the only person in the world who has complete faith in my potential. Without her continuous moral and emotional support, this book would have been impossible…so thanks Ma. I want to thank my sisters, Poonam and Indra, for their encouragement as well.

I want to thank my niece, Apala, who is doing her MBBS and drew some critical drawings for my book. Also, while she visited Bangalore on vacation, she took the time to review "ornamental" aspects of a couple of chapters in the book. Thanks, Apala. I would like to thank Abhuday as well for his support.

I would like to thank Srini who is my boss, but is also a nice human being outside of work. As a friend, he always encouraged me to give my best. Also, I want to thank Sushil for reviewing the contract and providing me with insights on the latest research and happenings in the world of machine learning during informal communications and conversations. I want to thank Aditya from the bottom of my heart for his suggestions, advice, reviews of the chapters, and so on—he was involved in every aspect of the book from the beginning. Thanks Aditya, for everything you did.

I also want to thank two very special people who were not involved directly in my endeavor of writing, but they have always been an integral part of it—my sister-in-law Swati and my brother, Sumukh. When I started working on this book, Swati started her battle with cancer. Her courage to fight the monster with a smile gave me perspective. Sumukh, knowingly or unknowingly, was always with me in my journey of writing this book.

I am thankful to the complete Apress team for giving me this opportunity to explore my hidden potential. Especially to Sanchita and Matt, who were always calm and accommodating during this ride of writing.

I am thankful to some of the brightest minds across the globe who did their internship under me on multiple diversified subjects and topics. I want to call out especially those names who contributed their intellectual insights to my endeavor of discovering machine learning, holistic intelligence, practical Indian methodology, and moreover the hidden secrets of life. Thanks to Angela Ruohan Wang (Solutions Architect at Amazon Web Services, Mount Holyoke College), Kristin Emodi (Medical Student at NYU School of Medicine), Sabin Park (iOS Developer at Mint.com, San Francisco Bay Area), Simisola Otukoya (Mechanical/Structural Engineer, King's College London), and Neil Sharma (University of Pittsburgh School of Medicine and University of Oxford, London).

I would also like to thank the authors of the Indian sacred texts *Bhagwat Gita,* the *Vedas*, and other literature for providing such intellectually enlightening reading to help uplift individual and social lives. Whenever I felt tired, frustrated, and lost, these texts come to my rescue by energizing me and bringing me back to the mainstream physical world.

Finally, I would like to thank my father, the late Dr. Damador Prasad Singh. Without his paranormal and spiritual support, this book would not have become reality. He helped me in all situations, even when he was not present in the physical world. Especially when I was trapped in a situation in which there seemed to be no way ahead. Thanks, Dada…

Introduction

Tools for Thought and Creativity: Yours, Mine, and Ours

This section gives you information about using the book in a nutshell. I have taken an unusual approach to explain the concepts related to targeted technologies and subject matter of the book. Generally, this type of approach is not seen in mainstream books, especially in the technology space. There might be multiple reasons for that. One prominent reason, however, is that readers are not willing to experiment. They prefer to go with the tried, tested, and established presentation methodologies. I dared to "experiment" because the target audience of the book is "out of the box thinkers" and hence their thought process is more likely disruptive in nature.

To explain innovative experiments, uniqueness, and disruptions, some "unusual" tools and techniques are required, which must be intuitive in nature. Hence, multiple innovative, unseen, underutilized, informal tools, techniques, and methodologies are used in this book. They are definitely helpful in explaining the concepts and ideas related to machine learning and associated technologies. My thought has been to consolidate and present the zest of all the tools and techniques used in this book, in one place and discuss them in brief. This approach will help the reader know more about them. This introduction also tells a brief story of all the upcoming chapters, which I am going to cover in the book. This overview will help the readers get an overview of the subject matter.

I enjoyed writing this book and hope that reading it will be a pleasurable and knowledgeable experience for you as well. Ideas contained in the book will help you continuously innovate and find new pathways. I tried to trigger that disruptive thought process in this book. Having said that, now it is high time to go into the subject matter. So, let's start with the tools and techniques used in the book.

Mind Maps

The concept of mind mapping was invented by Tony Buzan. He is an advocate of the techniques of mind mapping and mental literacy. In this book, mind map techniques are used to summarize, visualize, and explain some important concepts. However, the maps can be used as an effective remembering and note taking technique as well. Mind maps have great value, especially when you are trying to make a decision. As most of our decisions are made and acted on in a fraction of seconds, we generally do not have much

choice but to select one option out of two or more alternatives. If we practice mind map techniques, then our brain circuits, commonly known as neurons, will be rewired and we can create new intelligent pathways. This would enable us to visualize any situation quickly and make decisions at lightning speed.

Making business decisions is crucial and critical and generally demand quick reaction time. Mind map facilitates achieving a quick reaction time. The mind map is a whole-brain technique, as it uses the right and left hemispheres of the brain. Details presented in the form of mind maps are easy to remember because they follow the brain's pattern of thought.

Both parts of the brain have their own sets of functions and responsibilities. In short, the right hemisphere of the brain is responsible for creativity, whereas the left is for logic. If you use both parts of your brain ("the whole brain") in balance with their full potential, instead of using just one part in dominance, you will be in a better position to make efficient and effective decisions. Integrating images, graphics, colors, and emotions with text enables you to gain maximum benefit of your brain.

According to Tony Buzan's official website A *mind map* is a powerful graphic technique that provides a universal key to unlock the potential of the brain. It harnesses the full range of cortical skills—word, image, number, logic, rhythm, colors, and spatial awareness—in a single, uniquely powerful manner. In so doing, it gives you the freedom to roam the infinite expanses of your brain. The mind map can be applied to every aspect of life where improved learning and clearer thinking will enhance human performance.

You can draw mind maps by hand with the use of a pen and paper for multiple purposes and occasions, like attending a meeting, participating in discussions, brainstorming, for summarizing facts, creating project plans, and so on. You can also create one using the software and tools available in the market, such as Mindjet Manager (see Figure 1 for steps to create mind map).

Mind maps are very effective tools for visual representation of facts. Hence, I have used them in this book to provide a snapshot. I sincerely believe that it will provoke your creative thinking. Mind maps are placed at the end of each chapter to provide brief summaries. However, you can create your own mind maps, apart from the ones provided in the book, to get a better grasp of the subject matter. You can also use them for further customization and personalization of the content. I strongly recommend that you use mind maps during your professional activities like problem solving and taking meetings notes. Mind maps are a great tool for brainstorming sessions and project management as well. Mind maps available in the book can be used for remembering concepts and facts, wherever required.

You will discover that the mind mapping technique helps you make the decisions you want to endorse to others.

Here are the steps for creating a mind map:

1. In the middle of the paper, enclose the main idea.
2. Add a branch from the center for each point; use colors.
3. Write an important word/phrase on each branch of your diagram, which will help you add details.
4. Add symbols and illustrations.
5. Use legible CAPITAL letters.
6. Make important ideas larger.
7. Personalize your mind map.
8. Underline words and use bold letters.

Creativity is a key while drawing mind maps, so be creative and outrageous. It is always good to construct your mind map horizontally, because it will give you extra room for your work. On top of everything, try to bring some emotional content to your drawing, because our brains are wired and designed to pay attention to emotional biochemistry.

Adding a little surprise, humor, and interest will definitely improve your overall mind map and learning experience.

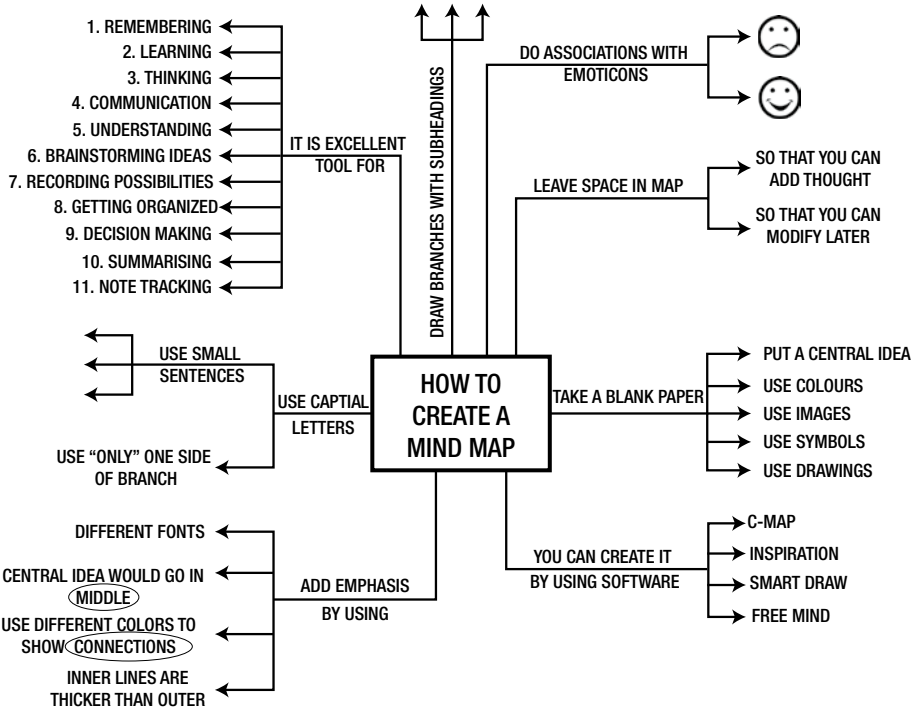

Figure 1. *How to create a mind map*

In Figure 2, software testing is the theme of this particular mind map, and a variety of associated sub-themes originate from it, such as black box testing, functional testing, non-functional testing, and so on. These are based on requirements and you could go to multiple levels of sub-themes.

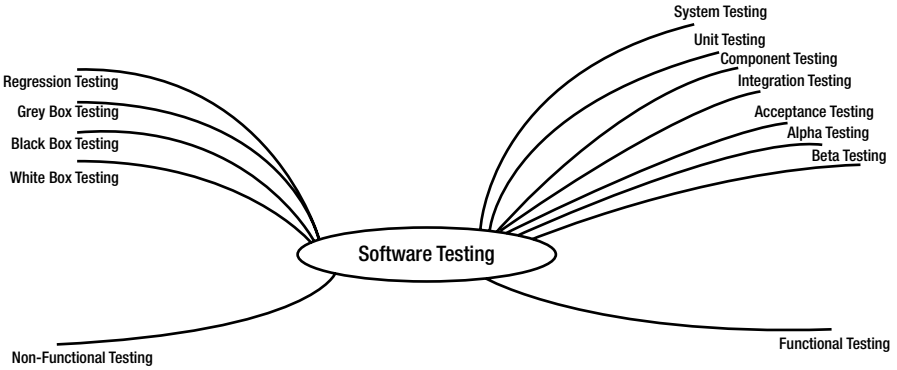

Figure 2. *Example of a mind map (software testing)*

Some common uses of mind maps:

- *Creating summaries of books, chapters, or other concepts and important facts:* Mind maps can be used to summarize almost anything, including books, chapters, requirement specification documents, business meetings, point of views, etc. I used mind maps in the book to summarizing and highlight the contents of a particular chapter. However, they can also summarize concepts and topics.

- *Brainstorming and idea generation:* Mind maps are good during brainstorming and idea generation sessions. You can also use collaborative mind mapping techniques (this is when mind maps created by different people and teams are combined to make one consolidated and comprehensive "master mind map").

- *Problem solving:* Mind maps are often used by business teams to help highlight the connections among different parts of a complex problem. Solving them effectively and efficiently leads the team to a solution. The process begins by writing down the different characteristics of the problem on paper or any other media type (as agreed upon by individuals or the groups/teams), then drawing associations and expanding the details. This process can be repeated over and over until the problem becomes clear and a solution becomes apparent.

- *Integrated analysis and decision making:* By writing down all the variables and features about a decision in a visual top-down format, you can see how they all are interrelated. These mind maps are similar to those used for problem solving, but there is often a coating of analysis and explanation added through the use of associations and callouts.

- *Discover new ideas:* You may come up with ideas that you never thought of by using a mind map. This is the beauty of a mind map; it can enable you to "discover" hidden relations and associated facts. This happens because while you're using or creating mind maps, you are actually using both parts of your brain (the creative right brain and the logical left brain).
- *Relating different ideas:* Since you can now visualize how different ideas relate, you are in a good position to associate two or more ideas. This gives you the power to combine the best of the available options and customize them according to your needs.

Other important areas where mind maps can be used are during content creation, when taking notes, during project management, and when planning.

Visual and Textual Summary of the Topics/ Chapters

When an idea or concept is conveyed in terms of visuals, it is known as a visualized concept or idea. However, if it is extended for providing an overview of the written, visual, or verbal material or opinion, it may be called a visualized summary. I used these techniques in the book to emphasize concepts and topics. But did not explain each concept or topic that is used. I have used them wherever I felt they added value. Also, for summarizing some chapters, they are used along with mind maps. Now the obvious question is—why a combination of two techniques (mind mapping and visual and text summary) to represent associated facts in the form of snapshots or visuals? The answer is multi-fold; a few answers are described here:

- Mind mapping is an informal technique of summarizing and representing facts, whereas visual and text summary is the formal way. It gives you a choice to select the appropriate method, based on convenience, comfort, and need.
- Mind mapping techniques are still not very popular. Also, they take some time to learn, especially if you're not familiar with the concept. So, if you are in a hurry and do not want to waste your time learning and practicing a new learning method and technique, you could stick to something you are good and comfortable.
- Traditional block diagrams (Figure 3) are also a good way to present visual facts. However, most of us are not familiar with its real potential. We can realize the power, when it is paired with an innovative textual way of representation (attaching emoticons with bulleted text). In combination, they become an extraordinary tool. In this book, I tried to exploit them for various purposes and did not confine myself only to summarizing. I have used them to explain concepts and ideas, as well as to represent facts, information, knowledge, and wisdom.

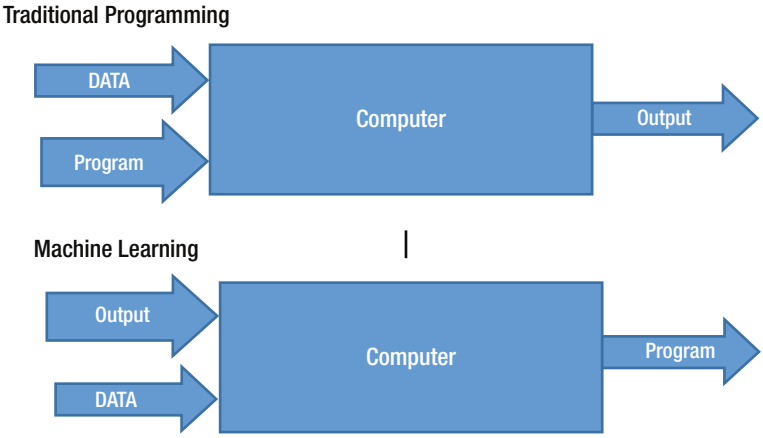

Figure 3. *Block diagram*

I personally prefer redundancy, which is saying and repeating the same things in multiple ways (if possible and required) with different media types and multiple senses. This approach increases the chances that content gets coded in more than one area of your brain. If you do not believe in redundancy, you must associate yourself with the traditional way of fact representation.

Images and visuals generally convey more and accurate information. This fact is established and supported by numerous researches in the field of brain science and psychology. So in a nutshell, we can confidently say that "visual is the new verbal". Following this concept provides you with a powerful tool for innovative thoughts and creativity.

Ready-to-Use Presentations/Slides for Decision Makers

Generally, decision makers and managers have to give presentations at multiple places, forums, and conferences to communicate and present their vision and thoughts. Typically, they prepare PowerPoint slides to do this. The idea behind incorporating this concept into the book is to provide decision makers some ready-to-use generic slides, so that they use them. You will find them on this book's page of the Apress website. If required, you can customize and personalize them based on your needs.

Important Questions and Answers

While reading a technical book, we generally encounter a lot of technical material. However, during this journey of reading, a few concepts need more precise, to the point, and focused answers. Also, some frequently asked questions need instant responses. The notion of including a section of important questions and their answers in the book is to provide the reader with quick answers to some important questions. These answers are based on my knowledge of the subject, paired with market research and the wisdom of the industry.

Customer Stories, Case Studies, Use Cases, and Success Stories

Customer stories, case studies, use cases, and customer success stories are tools. They can be used to analyze and show vendor capabilities. Their benefits are many if they are used correctly. I use them in the book to provide real-time situations, problems, issues, and the actions taken on them.

- Case studies are detailed and in depth, and they explain in detail a customer's situation, their problems, and the process by which those problems were addressed. Case studies sometimes include use cases, but often they are more condensed than a use case would be if available on its own. Case studies can be released independently, listed on a web site, made available on your blog, or even presented in the form of videos.
- The focus of success stories is on the success or outcome. Typically, customer stories or customer success stories are shorter in comparison to case studies. Nowadays talking about customer stories has become a trend. Every company has a separate section on their website for this. In this book, I kept my focus on real customer stories and used them as and when required.
- Finally, let's talk about use cases. A use case explains a particular application for the user's product or service. It typically describes exactly how the application is implemented and why the product is the best for the job. Use cases are truly good from marketing to technical addressees, particularly for specialists who may have a great knowledge and understanding of technology, but not understand the specific product to know why it's the best fit for a particular scenario or situation. By understanding use cases, decision makers can learn more about how the product is exactly differentiated.

Quick Tips and Techniques

This section is used to provide quick tips on the topic under discussion. For example, I often highlight an effective technique related to the topic at hand, with the goal of helping the readers get a better grasp of the subject matter.

Jargon Busters

Jargon refers to a collection of domain-specific terminology with precise and specialized meanings. This section demystifies some commonly used jargon that's specific to machine learning, IoT, virtual reality, and cognitive and cloud computing. The Jargon Buster sections are very important in a book like this, as there is a lot of jargon associated with these technologies. This section is meant to help readers understand and decode specific terminology in a quick and precise way.

Latest Trends and Research

Machine learning and its associated fields are happening and evolving fields. Something new is taking shape all the time, around the clock, across the industries, enterprises, and research laboratories. This section compiles the most relevant research and trends, especially from businesses such as retail, automotive, health, etc., and places them in the chapters at the appropriate places. These details will help you make good decisions.

Industry Bites

Machine learning, IoT, quantifiable self, cloud, and cognitive computing are evolving and growing fields of study. The industries and enterprises around them are maturing, dying, and expanding at a very rapid rate. Hence it is natural that decision makers of these industries are on a crossroad of dynamic decision making. This situation requires alignment of their visions and ideas with the thought process of the industry. However, to listen to other voices, visualizing peer strategies become very important. Unfortunately, not much information is available in consolidated and centralized form in the available literature and resources (including online), so these sections cover that gap. They provide relevant and contemporary information at the appropriate places. Apart from that, some quick statements from core industries (such as leadership, management, organizational psychology, and behavior) are mentioned in this section.

Audio and Video Links

In this section, you'll find audio and video links for some of the resources used in this book. Also, I have intentionally made this chapter specific, so that you can get pointed resources about the topic at hand, instead of scattered ones.

Start-Ups for Thought

In this section, you will find brief descriptions of promising start-ups in the areas of machine learning, IoT, quantitative self, virtual reality, AI, and cloud and cognitive computing. The descriptions include a primer of their products, services, strategies, and vision.

Summary

This introduction provided an overview of all the tools and techniques used in book. It also explained in brief the upcoming chapters.

Mind Map