

ARTIFICIAL INTELLIGENCE BASICS

A NON-TECHNICAL INTRODUCTION

Tom Taulli

Apress®

Artificial Intelligence Basics: A Non-Technical Introduction

Tom Taulli
Monrovia, CA, USA

ISBN-13 (pbk): 978-1-4842-5027-3
<https://doi.org/10.1007/978-1-4842-5028-0>

ISBN-13 (electronic): 978-1-4842-5028-0

Copyright © 2019 by Tom Taulli

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress Media LLC: Welmoed Spahr
Acquisitions Editor: Shiva Ramachandran
Development Editor: Rita Fernando
Coordinating Editor: Rita Fernando

Cover designed by eStudioCalamar

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail rights@apress.com, or visit <http://www.apress.com/rights-permissions>.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub via the book's product page, located at www.apress.com/978-1-4842-5027-3. For more detailed information, please visit <http://www.apress.com/source-code>.

Printed on acid-free paper

Contents

About the Author..... v

Foreword..... vii

Introduction ix

Chapter 1: AI Foundations 1

Chapter 2: Data.....19

Chapter 3: Machine Learning.....39

Chapter 4: Deep Learning69

Chapter 5: Robotic Process Automation (RPA)91

Chapter 6: Natural Language Processing (NLP)103

Chapter 7: Physical Robots.....125

Chapter 8: Implementation of AI.....143

Chapter 9: The Future of AI.....161

Appendix: AI Resources.....177

Glossary179

Index.....185

About the Author



Tom Taulli has been developing software since the 1980s. In college, he started his first company, which focused on the development of e-learning systems. He created other companies as well, including Hypermart.net that was sold to InfoSpace in 1996. Along the way, Tom has written columns for online publications such as businessweek.com, techweb.com, and Bloomberg.com. He also writes posts on artificial intelligence for Forbes.com and is the advisor to various companies in the AI space. You can reach Tom on Twitter (@ttaulli) or through his web site (www.taulli.com).

Foreword

As this book demonstrates, the adoption of artificial intelligence (AI) will be a major inflection point in human history. Like other similarly groundbreaking technologies, how it's administered and who has access to it will shape society for generations to come. However, AI stands out from the other transformative technologies of the nineteenth and twentieth centuries—think the steam engine, the electrical grid, genomics, computers, and the Internet—because it doesn't depend exclusively on critically expensive physical infrastructure to enable adoption; after all, many of its benefits can be delivered through existing hardware we all carry around in our pockets. Instead, the fundamental limiting factor when it comes to the mass adoption of AI technology is our shared intellectual infrastructure: education, understanding, and vision.

This is a crucial difference because, if handled correctly, AI can act as a sweeping democratizing force. It has and will eliminate from our lives the drudgery of the past and free up a tremendous amount of human energy and capital. But that "if" is far from certain. AI executed irresponsibly has the power to destabilize large parts of the world economy by causing, as many people fear, a shrinking workforce, reduced purchasing power for the middle class, and an economy without a wide and stable base fueled by an endless debt spiral.

However, before we succumb to pessimism on AI, we should take a look back. Historic though AI's transformative capacity may be—and it is historic—these same issues are and have been at play in the economic landscape for decades, even centuries. AI is, after all, an extension of a trend toward automation that has been at play since Henry Ford. In fact, Zoho itself was born from the tension between automation and egalitarian economic principles. Back in the early 2000s, we came to a realization that has shaped our approach to technology: regular people—small business owners, here and abroad—should have access to the same advanced business automations that the Fortune 500 companies have; otherwise, a huge swath of the population will be locked out of the economy.

At the time, powerful digital software was almost unanimously gated behind rigid contracts, exorbitant fee structures, and complicated on-premise implementations. Big companies could shoulder the burden of such systems, while smaller operators were locked out, putting them at a tremendous disadvantage. We sought to disrupt that by opening up the promise of technology to wider and wider audiences. Over the last two decades, we've endeavored to

increase the value of our products without increasing the price by tapping into the scalability of cloud technology. Our goal is to empower people at all levels of society by pushing down the price of business software while expanding the power of the tools. Access to capital shouldn't limit success; businesses should rise or fall based on the strength of their vision for the future.

Viewed this way, AI is the fulfillment of the promise of technology. It frees people from the constraints of time by enabling them to offload tedious or unpleasant rote labor. It helps them identify patterns at microscopic and macroscopic scales, which humans are not naturally well suited to perceive. It can forecast problems, and it can correct errors. It can save money, time, and even lives.

Seeking to democratize these benefits just as we did for general business software, Zoho has threaded AI throughout our suite of apps. We spent the last six years quietly developing our own internal AI technology, built on the bedrock of our own principles. The result is Zia, an AI assistant who is smart, but not clever. This is a crucial distinction. A smart system has the information and functionality to empower the unique vision and intuition of an active operator. A clever system obfuscates the internal workings of the process, reducing the human to a passive user who simply consumes the insights provided by the machine. AI should be a tool to be wielded, not a lens through which we view the world. To steer such a powerful tool, we must be equipped with the knowledge to understand and operate it without eroding the human quality of our human systems.

The need to stay current on this technology is exactly why a book like *Artificial Intelligence Basics* is so important in today's world. It is the intellectual infrastructure that will enable people—regular people—to tap into the power of AI. Without these kinds of initiatives, AI will tip the balance of power in favor of big companies with big budgets. It's crucial that the general population equip themselves with the skills to understand AI systems, because these systems will increasingly define how we interact with and navigate through the world. Soon, the information contained in this book won't be merely a topic of interest; it will be a prerequisite for participation in the modern economy.

This is how the average person can enjoy the fruits of the AI revolution. In the years to come, how we define work and which activities carry economic value will change. We have to embrace the fact that the future of work may be as foreign to us as a desk job would be to our distant ancestors. But we have to—and should—have faith in the human capacity to innovate new forms of work, even if that work doesn't look like the work we're familiar with. But the first step, before everything else, is to learn more about this new, exciting, and fundamentally democratizing technology.

—Sridhar Vembu, co-founder and CEO of Zoho

Introduction

On the face of it, the Uber app is simple. With just a couple clicks, you can hail a driver within a few minutes.

But behind the scenes, there is an advanced technology platform, which relies heavily on artificial intelligence (AI). Here are just some of the capabilities:

- A Natural Language Processing (NLP) system that can understand conversations, allowing for a streamlined experience
- Computer vision software that verifies millions of images and documents like drivers' licenses and restaurant menus
- Sensor processing algorithms that help improve the accuracy in dense urban areas, including automatic crash detection by sensing unexpected movement from the phone of a driver or passenger
- Sophisticated machine learning algorithms that predict driver supply, rider demand, and ETAs

Such technologies are definitely amazing, but they are also required. There is no way that Uber could have scaled its growth—which has involved handling over 10 billion trips—without AI. In light of this, it should be no surprise that the company spends hundreds of millions on the technology and has a large group of AI experts on staff.¹

But AI is not just for fast-charging startups. The technology is also proving a critical priority for traditional companies. Just look at McDonald's. In 2019, the company shelled out \$300 million to acquire a tech startup, Dynamic Yield. It was the company's largest deal since it purchased Boston Market in 1999.²

¹www.sec.gov/Archives/edgar/data/1543151/000119312519120759/d647752ds1a.htm#toc647752_11

²<https://news.mcdonalds.com/news-releases/news-release-details/dynamic-yield-acquisition-release>

Dynamic Yield, which was founded in 2011, is a pioneer in leveraging AI for creating personalized customer interactions across the Web, apps, and email. Some of its customers include the Hallmark Channel, IKEA, and Sephora.

As for McDonald's, it has been undergoing a digital transformation—and AI is a key part of the strategy. With Dynamic Yield, the company plans to use the technology to reimagine its Drive Thru, which accounts for a majority of its revenues. By analyzing data, such as the weather, traffic, and time of day, the digital menus will be dynamically changed to enhance the revenue opportunities. It also looks like McDonald's will use geofencing and even image recognition of license plates to enhance the targeting.

But this will just be the start. McDonald's expects to use AI for in-store kiosks and signage as well as the supply chain.

The company realizes that the future is both promising and dangerous. If companies are not proactive with new technologies, they may ultimately fail. Just look at how Kodak was slow to adapt to digital cameras. Or consider how the taxi industry did not change when faced with the onslaught of Uber and Lyft.

On the other hand, new technologies can be almost an elixir for a company. But there needs to be a solid strategy, a good understanding of what's possible, and a willingness to take risks. So in this book, I'll provide tools to help with all this.

OK then, how big will AI get? According to a study from PWC, it will add a staggering \$15.7 trillion to the global GDP by 2030, which is more than the combined output of China and India. The authors of the report note: "AI touches almost every aspect of our lives. And it's only just getting started."³

True, when it comes to predicting trends, there can be a good deal of hype. However, AI may be different because it has the potential for turning into a general-purpose technology. A parallel to this is what happened in the nineteenth century with the emergence of electricity, which had a transformative impact across the world.

As a sign of the strategic importance of AI, tech companies like Google, Microsoft, Amazon.com, Apple, and Facebook have made substantial investments in this industry. For example, Google calls itself an "AI-first" company and has spent billions buying companies in the space as well as hiring thousands of data scientists.

In other words, more and more jobs will require knowledge of AI. Granted, this does not mean you'll need to learn programming languages or understand advanced statistics. But it will be critical to have a solid foundation of the fundamentals.

³www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html

As for this book, the goal is to provide actionable advice that can make a big difference in your organization and career. Now you will not find deeply technical explanations, code snippets, or equations. Instead, *Artificial Intelligence Basics* is about answering the top-of-mind questions that managers have: Where does AI make sense? What are the gotchas? How do you evaluate the technology? What about starting an AI pilot?

This book also takes a real-world view of the technology. A big advantage I have as a writer for Forbes.com and an advisor in the tech world is that I get to talk to many talented people in the AI field—and this helps me to identify what is really important in the industry. I also get to learn about case studies and examples of what works.

This book is organized in a way to cover the main topics in AI—and you do not have to read each chapter in order. *Artificial Intelligence Basics* is meant to be a handbook.

Here are brief descriptions of the chapters:

- *Chapter 1—AI Foundations*: This is an overview of the rich history of AI, which goes back to the 1950s. You will learn about brilliant researchers and computer scientists like Alan Turing, John McCarthy, Marvin Minsky, and Geoffrey Hinton. There will also be coverage of key concepts like the Turing Test, which gauges if a machine has achieved true AI.
- *Chapter 2—Data*: Data is the lifeblood of AI. It's how algorithms can find patterns and correlations to provide insights. But there are landmines with data, such as quality and bias. This chapter provides a framework to work with data in an AI project.
- *Chapter 3—Machine Learning*: This is a subset of AI and involves traditional statistical techniques like regressions. But in this chapter, we'll also cover the advanced algorithms, such as k-Nearest Neighbor (k-NN) and the Naive Bayes Classifier. Besides this, there will be a look at how to put together a machine learning model.
- *Chapter 4—Deep Learning*: This is another subset of AI and is clearly the one that has seen much of the innovation during the past decade. Deep learning is about using neural networks to find patterns that mimic the brain. In the chapter, we'll take a look at the main algorithms like recurrent neural networks (RNNs), convolutional neural networks (CNNs), and generative adversarial networks (GANs). There will also be explanations of key concepts like backpropagation.

- *Chapter 5—Robotic Process Automation:* This uses systems to automate repetitive processes, such as inputting data in a Customer Relationship Management (CRM) system. Robotic Process Automation (RPA) has seen tremendous growth during the past few years because of the high ROI (Return on Investment). The technology has also been an introductory way for companies to implement AI.
- *Chapter 6—Natural Language Processing (NLP):* This form of AI, which involves understanding conversations, is the most ubiquitous as seen with Siri, Cortana, and Alexa. But NLP systems, such as chatbots, have also become critical in the corporate world. This chapter will show ways to use this technology effectively and how to avoid the tricky issues.
- *Chapter 7—Physical Robots:* AI is starting to have a major impact on this industry. With deep learning, it is getting easier for robots to understand their environments. In this chapter, we'll take a look at both consumer and industrial robots, such as with a myriad of use cases.
- *Chapter 8—Implementation of AI:* We'll take a step-by-step approach to putting together an AI project, from the initial concept to the deployment. This chapter will also cover the various tools like Python, TensorFlow, and PyTorch.
- *Chapter 9—The Future of AI:* This chapter will cover some of the biggest trends in AI like autonomous driving, weaponization of AI, technological unemployment, drug discovery, and regulation.

At the back of the book, you'll also find an appendix of resources for further study and a glossary of common terms related to AI.

Accompanying Material

Any updates will be provided on my site at www.Taulli.com.