

**BERNARD MARR** is the founder and CEO of Bernard Marr & Co and an internationally best-selling business author, futurist, keynote speaker and strategic advisor to companies and governments. He is one of the world's most highly respected voices and a renowned expert when it comes to topics such as artificial intelligence and big data. Marr advises many of the world's best-known organizations on strategy, digital transformation and business performance. He is the author of *Big Data in Practice: How 45 Successful Companies used Big Data Analytics to Deliver Extraordinary Results* and *Big Data: Using SMART Big Data, Analytics and Metrics To Make Better Decisions and Improve Performance*, both published with Wiley.

**MATT WARD** is the research lead for Bernard Marr & Co. Matt has a background in investigative journalism and spent the last few years working closely with Bernard Marr on the latest technology topics. Matt is an expert and experienced writer in the field of business technology and artificial intelligence, where he has worked with companies such as IBM, Intel, Citibank and NASA.

## ADOPT AI-SOLUTIONS TO MEET REAL-WORLD BUSINESS PROBLEMS

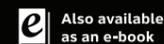
*Artificial Intelligence in Practice* is a practical resource that demystifies how Artificial Intelligence (AI) and machine learning can be used to solve common business challenges and open the door to opportunities that often exceed expectations. The book is filled with insights from some of the most important AI giants including Google, Microsoft, Amazon, Alibaba, and other forward thinking industry leaders. It also presents compelling case studies from traditional businesses and startups, that detail how AI is being applied in the real world of business.

Bestselling author and AI expert Bernard Marr offers detailed examinations of 50 companies that have successfully integrated AI into their business practices. He provides an overview of each company, describes the specific problem AI addressed and explains how AI offered a workable solution. Each case study contains a comprehensive overview, some technical details as well as key learning summaries.

Artificial intelligence and machine learning are the most important modern business trends that are driving today's (and tomorrow's) successes. As the book's myriad cases demonstrate, AI can be used in industries ranging from banking and finance to media and marketing. By adopting AI technology, any business, no matter what size, sector or industry, can advance innovative solutions to their most demanding challenges.

Cover Design: Wiley  
Cover Image: © mattjeacock / iStock.com

WILEY



£29.99 UK / \$38.00 USA / \$45.00 CAN



MARR

ARTIFICIAL INTELLIGENCE IN PRACTICE

# ARTIFICIAL INTELLIGENCE IN PRACTICE

HOW 50 SUCCESSFUL COMPANIES  
USED AI AND MACHINE LEARNING  
TO SOLVE PROBLEMS

BERNARD  
MARR

WITH MATT WARD

WILEY

WILEY

**W**ritten by AI expert, Bernard Marr, *Artificial Intelligence in Practice* is a hands-on guide that illuminates how trailblazing companies use AI and machine learning to tackle real-world problems, and advance their business interests. The book's 50 examples demonstrate how AI can be applied in innovative ways to transform industries and deliver results beyond expectations.

The book's savvy business leaders use AI to change the way they understand and interact with their customers and offer more intelligent products and services, whilst improving and automating their business processes. *Artificial Intelligence in Practice* examines examples from a wide range of industries – retail, media, telecom, financial, healthcare, manufacturing and more – which clearly show how a strategic approach to AI can help a company soar.

*Artificial Intelligence in Practice* is an insightful and informative exploration of the transformative power of technology in today's complex business environment.

# **ARTIFICIAL INTELLIGENCE IN PRACTICE**



# **ARTIFICIAL INTELLIGENCE IN PRACTICE**

**HOW 50 SUCCESSFUL  
COMPANIES USED ARTIFICIAL  
INTELLIGENCE TO SOLVE  
PROBLEMS**

**BERNARD MARR**  
**with MATT WARD**

**WILEY**

This edition first published 2019  
© 2019 Bernard Marr

*Registered office*

John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom

For details of our global editorial offices, for customer services and for information about how to apply for permission to reuse the copyright material in this book please see our website at [www.wiley.com](http://www.wiley.com).

The right of the author to be identified as the author of this work has been asserted in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

Wiley publishes in a variety of print and electronic formats and by print-on-demand. Some material included with standard print versions of this book may not be included in ebooks or in print-on-demand. If this book refers to media such as a CD or DVD that is not included in the version you purchased, you may download this material at <http://booksupport.wiley.com>. For more information about Wiley products, visit [www.wiley.com](http://www.wiley.com).

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The publisher is not associated with any product or vendor mentioned in this book.

Limit of Liability/Disclaimer of Warranty: While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. It is sold on the understanding that the publisher is not engaged in rendering professional services and neither the publisher nor the author shall be liable for damages arising herefrom. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

A catalogue record for this book is available from the Library of Congress.

A catalogue record for this book is available from the British Library.

ISBN 978-1-119-54821-8 ISBN 978-1-119-54896-6 (ePDF)

ISBN 978-1-119-54898-0 (ePub)

10 9 8 7 6 5 4 3 2 1

Cover Design: Wiley

Cover Image: © [mattjeacock](http://mattjeacock.com) / [iStock.com](http://iStock.com)

Set in 11/14pt MinionPro Light by Aptara, New Delhi, India

Printed in Great Britain by TJ International Ltd, Padstow, Cornwall, UK

# CONTENTS

Introduction	1
<b>Part 1 Artificial Intelligence Trailblazers</b>	
<b>1 Alibaba:</b> Using Artificial Intelligence To Power The Retail And Business-To-Business Services Of The Future	13
<b>2 Alphabet and Google:</b> Maximizing The Potential Of Artificial Intelligence	21
<b>3 Amazon:</b> Using Deep Learning To Drive Business Performance	29
<b>4 Apple:</b> Integrating AI Into Products And Protecting User Privacy	37
<b>5 Baidu:</b> Machine Learning For Search Engines And Autonomous Cars	43
<b>6 Facebook:</b> Using Artificial Intelligence To Improve Social Media Services	49
<b>7 IBM:</b> Cognitive Computing Helps Machines Debate With Humans	55
<b>8 JD.com:</b> Automating Retail With Artificial Intelligence	61
<b>9 Microsoft:</b> Making Artificial Intelligence Part Of The Fabric Of Everyday Life	69
<b>10 Tencent:</b> Using Artificial Intelligence To Power WeChat And Healthcare	75

**CONTENTS****Part 2 Retail, Consumer Goods and Food  
and Beverage Companies**

<b>11</b>	<b>Burberry:</b> Using Artificial Intelligence To Sell Luxury	83
<b>12</b>	<b>Coca-Cola:</b> Using Artificial Intelligence To Stay At The Top Of The Soft Drinks Market	87
<b>13</b>	<b>Domino's:</b> Using Artificial Intelligence To Serve Up Hundreds Of Thousands Of Pizzas Every Day	93
<b>14</b>	<b>Kimberly-Clark:</b> Using AI To Make Sense Of Customer Data	99
<b>15</b>	<b>McDonald's:</b> Using Robots And Artificial Intelligence To Automate Processes	105
<b>16</b>	<b>Samsung:</b> Automating The Home And Workplace With Artificial Intelligence	111
<b>17</b>	<b>Starbucks:</b> Using Artificial Intelligence To Sell Millions Of Coffees Every Day	117
<b>18</b>	<b>Stitch Fix:</b> Combining The Power Of Artificial Intelligence And Humans To Disrupt Fashion Retail	123
<b>19</b>	<b>Unilever:</b> Using Artificial Intelligence To Streamline Recruiting And Onboarding	129
<b>20</b>	<b>Walmart:</b> Using Artificial Intelligence To Keep Shelves Stacked And Customers Happy	135

**Part 3 Media, Entertainment and Telecom Companies**

<b>21</b>	<b>The Walt Disney Company:</b> Using Artificial Intelligence To Make Magical Memories	143
<b>22</b>	<b>Instagram:</b> Using Artificial Intelligence To Tackle Online Bullying	149
<b>23</b>	<b>LinkedIn:</b> Using Artificial Intelligence To Solve The Skills Crisis	155
<b>24</b>	<b>Netflix:</b> Using Artificial Intelligence To Give Us A Better TV Experience	161
<b>25</b>	<b>Press Association:</b> Using Artificial Intelligence To Cover Local News Stories	167

**CONTENTS**

<b>26</b>	<b>Spotify:</b> Using Artificial Intelligence To Find New Music You Will Love	173
<b>27</b>	<b>Telefonica:</b> Using Artificial Intelligence To Connect The Unconnected	179
<b>28</b>	<b>Twitter:</b> Using Artificial Intelligence To Fight Fake News And Spambots	185
<b>29</b>	<b>Verizon:</b> Using Machine Learning To Assess Service Quality	191
<b>30</b>	<b>Viacom:</b> Using Artificial Intelligence To Stream Videos Faster And Improve Customer Experience	197
 <b>Part 4 Services, Financial and Healthcare Companies</b>		
<b>31</b>	<b>American Express:</b> Using Artificial Intelligence To Detect Fraud And Improve Customer Experience	205
<b>32</b>	<b>Elsevier:</b> Using Artificial Intelligence To Improve Medical Decisions And Scientific Research	211
<b>33</b>	<b>Entrupy:</b> Using Artificial Intelligence To Combat The \$450 Billion Counterfeit Industry	217
<b>34</b>	<b>Experian:</b> Using Artificial Intelligence To Make Mortgages Simpler	221
<b>35</b>	<b>Harley-Davidson:</b> Using Artificial Intelligence To Increase Sales	227
<b>36</b>	<b>Hopper:</b> Using Artificial Intelligence To Travel For Less	233
<b>37</b>	<b>Infervision:</b> Using Artificial Intelligence To Detect Cancer And Strokes	239
<b>38</b>	<b>Mastercard:</b> Using Artificial Intelligence To Cut Down The “False Declines” That Cost Businesses Billions Each Year	245
<b>39</b>	<b>Salesforce:</b> How Artificial Intelligence Helps Businesses Understand Their Customers	249
<b>40</b>	<b>Uber:</b> Using Artificial Intelligence To Do Everything	255

CONTENTS

**Part 5 Manufacturing, Automotive, Aerospace and Industry 4.0 Companies**

<b>41</b>	<b>BMW:</b> Using Artificial Intelligence To Build And Drive The Cars Of Tomorrow	263
<b>42</b>	<b>GE:</b> Using Artificial Intelligence To Build The Internet Of Energy	269
<b>43</b>	<b>John Deere:</b> Using Artificial Intelligence To Reduce Pesticide Pollution In Agriculture	275
<b>44</b>	<b>KONE:</b> Using Artificial Intelligence To Move Millions Of People Every Day	281
<b>45</b>	<b>Daimler AG:</b> From Luxury Personal Cars To Passenger Drones	287
<b>46</b>	<b>NASA:</b> Using Artificial Intelligence To Explore Space And Distant Worlds	293
<b>47</b>	<b>Shell:</b> Using Artificial Intelligence To Tackle The Energy Transition	299
<b>48</b>	<b>Siemens:</b> Using Artificial Intelligence And Analytics To Build The Internet Of Trains	305
<b>49</b>	<b>Tesla:</b> Using Artificial Intelligence To Build Intelligent Cars	311
<b>50</b>	<b>Volvo:</b> Using Machine Learning To Build The World's Safest Cars	317

**Part 6 Final Words and Artificial Intelligence Challenges**

<b>51</b>	Final Words And Artificial Intelligence Challenges	323
	<i>About the Author</i>	329
	<i>Acknowledgments</i>	331
	<i>Index</i>	333

# INTRODUCTION

One thing is very clear, artificial intelligence (AI) is going to change our world forever. And the change is likely to be more profound than most people realize today. No matter what job you are in, no matter what business or industry you work in, AI is going to augment, if not completely transform, it.

AI is giving machines the power to see, hear, taste, smell, touch, talk, walk, fly and learn. This in turn means businesses can develop completely new ways to interact with their customers, offer them much more intelligent products and service experiences, automate processes and boost business success.

Having said that, we also know there is a massive amount of hype and confusion about AI. Some see it as the ultimate threat to our civilization, while others believe AI is the savior that's going to solve humanity's biggest challenges, from tackling climate change to curing cancer. The aim of this book is to cut through the hype and scare-mongering, and provide a cutting-edge picture of how AI is actually being used by businesses today.

By sharing some of the latest and most innovative real world use cases from across many industries, we hope to demystify AI while at the same time inspiring you to see the immense opportunities AI is offering. We have written this book for anyone who would like to better understand AI and have therefore tried hard to keep the technical details to a level anyone can understand. At the same time, we have

## ARTIFICIAL INTELLIGENCE IN PRACTICE

attempted to include just enough techie stuff to make it informative for people who already work in the field of AI.

In this book, you will of course gain insights into how some of the AI giants such as Google, Facebook, Alibaba, Baidu, Microsoft, Amazon and Tencent use it, but you will also learn how many traditional incumbent companies across most industries as well as innovative start-ups use AI. Our hope is that this will provide a realistic picture of the current state of the art: where the AI trailblazers are rolling full steam ahead, leaving many traditional businesses behind in the starting blocks; where traditional businesses are working hard at reinventing themselves and using AI to stay competitive; and where start-ups are using AI to challenge both the AI trailblazers and traditional businesses.

### **The Most Powerful Technology Of Mankind**

AI is the most powerful technology available to mankind today and the biggest mistake anyone can make is to ignore it. Leaders of nations and businesses alike are seeing both the magnitude of opportunities AI brings and the risks of being left behind in the AI goldrush.

In the United States, the White House has released numerous policy documents that emphasize the strategic significance of AI. In 2016, under President Barack Obama, the White House issued the first report “Preparing for the Future of Artificial Intelligence”,<sup>1</sup> which laid the foundation for a US AI strategy. In 2018, under Donald Trump, following an AI summit at the White House, the administration issued “Artificial Intelligence for the American People”<sup>2</sup> in which President Trump states: “We’re on the verge of new technological revolutions that could improve virtually every aspect of our lives, create vast new wealth for American workers and families, and open up bold, new frontiers in science, medicine, and communication.” The goal of the US Administration is to maintain American leadership in AI by accelerating AI research and deployment, and by

## INTRODUCTION

training the future American workforce to take full advantage of the benefits of AI.<sup>3</sup>

Russia's President Putin said: "Artificial intelligence is the future, not only for Russia, but for all humankind. [...] Whoever becomes the leader in this sphere will become the ruler of the world."<sup>4</sup> China has arguably developed the most ambitious plan to make use of AI with a goal of becoming the world leader in AI by 2030.<sup>5</sup> In Europe, the European Commission released its AI strategy in 2018, in which it states: "Like the steam engine or electricity in the past, AI is transforming our world, our society and our industry. Growth in computing power, availability of data and progress in algorithms have turned AI into one of the most strategic technologies of the 21st century. The stakes could not be higher. The way we approach AI will define the world we live in."<sup>6</sup>

Business leaders agree. Amazon CEO Jeff Bezos believes we have entered the "golden age" of AI that allows us to solve problems that once were the realm of sci-fi.<sup>7</sup> Google co-founder Sergey Brin said: "The new spring in AI is the most significant development in computing in my lifetime"<sup>8</sup> and Microsoft CEO Satya Nadella calls AI the "defining technology of our times".<sup>9</sup> The founder and executive chairman of the World Economic Forum, Klaus Schwab, together with many others, believes that AI (especially when combined with all other technological innovations) has triggered a fourth industrial revolution that is going to transform all parts of business and society.<sup>10</sup>

## What's Artificial Intelligence? The Rise Of Deep Machine Learning

AI is nothing new and nothing magical. The first developments in AI date back to the 1950s. AI refers to the ability of computer systems or machines to display intelligent behavior that allows them to act and learn autonomously. In its most basic form, AI takes data, applies

## ARTIFICIAL INTELLIGENCE IN PRACTICE

some calculation rules (or algorithms) to the data and then makes decisions or predicts outcomes.

For example, the data could be images of handwritten words, letters or numbers. The algorithm would be a computer program written by a human that contains rules such as the common shapes of each letter and spacing between words. This then allows a computer to analyze scanned images of handwritten text, apply the rules and make predictions about which letters, numbers and words it contains, enabling machines to recognize handwriting. This type of AI has been used, for example, by the US Postal Services to automatically read addresses on letters from as early as 1997. For narrow applications this kind of AI worked well.

This rule-based AI runs into difficulties when tasks are more complex or when we humans can't easily explain the rules and therefore can't program them into algorithms. Speaking our language, walking around and recognizing a friend in a crowd are all examples of skills that we have acquired through experience but for which we can't easily explain the rules.

We have learned those skills via a network of neurons in our brain that have been programmed to, for example, recognize a face by looking at the face from lots of different angles over a period of time, or we have learned how to walk and talk through trial and error. In modern AI, we basically replicate this process using artificial neural networks and instead of having humans programming the rules, we let the machines create the rules by themselves, similarly to how our brain learns from experience. We refer to this as machine learning.

In machine learning, we train AI with data by, for example, feeding it thousands of images that either contain human faces or don't contain human faces. The computer then takes in the information and creates its own algorithm either completely independently (unsupervised machine learning) or with help from humans (supervised

## INTRODUCTION

or semi-supervised machine learning). When machine learning uses multiple layers of artificial neural networks to learn from training data (which makes them more powerful), we refer to it as deep learning.

Deep learning has given us many of the recent advances in AI, such as the ability for computers to see and recognize what or who is in an image or in a video (machine vision). Or it has given machines the ability to understand and reproduce written text or spoken words, which we call natural language processing and see in website chatbots or home smart speakers like Amazon's Echo.

There are two key reasons why deep learning is thriving today:

1. We have data: Data is the raw material that is fuelling AI and in today's big data world we are generating more data than ever before. The digitization of our world means that almost everything we do leaves a data trail and we are increasingly surrounded by smart devices that collect and transmit data. This is causing exponential growth in the volume and types of data we can now use to train AI.
2. We have computing power: We now have the ability to store and process vast amounts of data. Breakthroughs in cloud computing allow businesses to cheaply store almost unlimited volumes of data and use distributed computing to analyze big data in near real time. What's more, advances in chip technology mean AI computations can now be performed on devices such as smartphones or other smart connected devices. We refer to this as edge computing on Internet of Things devices.

We humans continuously learn and improve through experience. This "learning by doing" approach can now also be replicated by machine learning algorithms via reinforcement learning. Similarly to how toddlers learn to walk by adjusting actions based on the outcomes they experience, such as taking a smaller step if the previous

## ARTIFICIAL INTELLIGENCE IN PRACTICE

broad step made them fall, AI uses reinforcement learning algorithms to determine the ideal behavior based upon feedback from the environment. Reinforcement learning gives machines (for example, robots) the ability to walk, drive or fly autonomously. Many leading-edge applications of machine learning combine deep and reinforcement learning techniques.

If you would like to learn more about any of these fascinating topics, head to [www.bernardmarr.com](http://www.bernardmarr.com) where you can find hundreds of articles and videos explaining and discussing everything you need to know about AI and machine learning.

### **Artificial Intelligence Opportunities In Business**

There are three key use cases for AI in business, which can overlap to some degree, but help to segment the opportunities. Businesses can use AI to: (1) change the way they understand and interact with customers, (2) offer more intelligent products and services, and (3) improve and automate business processes.

**Customers:** AI can help businesses better understand who their customers are, predict what products or services customers are likely to want, predict market trends and demands and provide more personalized interactions with customers. In this book, we will look at companies like Stitch Fix and Facebook, which use AI to really get to know their customers.

**Products and services:** AI can help businesses create more intelligent products and services to offer to their customers. Customers want more intelligent products such as smarter phones, smarter cars and smarter home devices. In this book, we will look at how Apple, Samsung and car companies such as Tesla and Volvo use AI to create smarter products and we explore how others like Spotify, Disney or Uber use AI to deliver more intelligent services to their customers.

## INTRODUCTION

Automate processes: AI can improve and help automate business processes. In this book, we will look at examples such as JD.com that is using autonomous drones, automated fulfillment centers and delivery robots to transform its retail operations. We will also look at how AI can automate medical diagnosis in the Infervision and Elsevier case studies, and even the pizza quality checks at Domino's.

### **The Strategic Use Of Artificial Intelligence In Business**

Exploring the applications of AI in any business will often lead to a business model refresh or even a complete transformation of the business approach. It is important that companies don't use AI to automate and improve a business model that is no longer relevant during the fourth industrial revolution.

The starting point for any use of AI should be an AI and data strategy that identifies the biggest strategic opportunities and threats for any business and then pinpoints the most impactful applications. It is important to recognize that simply experimenting with AI around the edges is not going to deliver the necessary effects on business success.

### **Artificial Intelligence In Practice**

In this book, you will find 50 company use cases and within them even more leading-edge examples of how these companies have used AI in practice to solve real world problems. We have divided the book into five parts.

Part 1 contains case studies from the AI trailblazers. These tech companies are the ones that have grabbed hold of the AI opportunities and are running with them to transform industries and deliver mouth-watering business results. Most of them have made innovative applications of AI part of all aspects of their business and therefore provide great insights into the art of the possible.

## ARTIFICIAL INTELLIGENCE IN PRACTICE

We could have segmented the remaining case studies in different ways, by AI application or by industry. Based on the feedback we received, we opted for the following industry segmentations.

In Part 2 we look at retail, consumer goods and food and beverage companies. In Part 3 we explore how media, entertainment and telecom companies use AI. Part 4 looks at the services sector, including financial services and healthcare. Finally, in Part 5 we look at manufacturing, automotive, aerospace and industry 4.0 case studies.

You can simply read this book cover to cover or dip in and out to explore the case studies or industries you are most interested in. We hope you will enjoy it!

## Notes

1. Preparing for the Future of Artificial Intelligence, Executive Office of the President, National Science and Technology Council, National Science and Technology Council Committee on Technology, October 2016: [https://obamawhitehouse.archives.gov/sites/default/files/whitehouse\\_files/microsites/ostp/NSTC/preparing\\_for\\_the\\_future\\_of\\_ai.pdf](https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf)
2. Artificial Intelligence for the American People, The White House: <https://www.whitehouse.gov/briefings-statements/artificial-intelligence-american-people/>
3. Summary of the 2018 White House Summit on Artificial Intelligence for American Industry, The White House Office of Science and Technology Policy 10 May 2018: <https://www.whitehouse.gov/wp-content/uploads/2018/05/Summary-Report-of-White-House-AI-Summit.pdf>
4. “Whoever leads in AI will rule the world”: Putin to Russian children on Knowledge Day: <https://www.rt.com/news/401731-ai-rule-world-putin/>
5. A Next Generation Artificial Intelligence Development Plan: [http://www.gov.cn/zhengce/content/2017-07/20/content\\_5211996.htm](http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm) and Three-Year Action Plan to Promote the Development of New-Generation Artificial Intelligence Industry: <http://www.miit.gov.cn/n1146295/n1652858/n1652930/n3757016/c5960820/content.html>
6. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and

## INTRODUCTION

Social Committee and the Committee of the Regions, Artificial Intelligence for Europe, Brussels 2018: <https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe>

7. A.I. is in a “golden age” and solving problems that were once in the realm of sci-fi, Jeff Bezos says, CNBC: <https://www.cnbc.com/2017/05/08/amazon-jeff-bezos-artificial-intelligence-ai-golden-age.html>
8. Google’s Sergey Brin warns of the threat from AI in today’s “technology renaissance”: <https://www.theverge.com/2018/4/28/17295064/google-ai-threat-sergey-brin-founders-letter-technology-renaissance>
9. Microsoft CEO Satya Nadella on the rise of A.I.: “The future we will invent is a choice we make”: <https://www.cnbc.com/2018/05/24/microsoft-ceo-satya-nadella-on-the-rise-of-a-i-the-future-we-will-invent-is-a-choice-we-make.html>
10. The Fourth Industrial Revolution: what it means, how to respond, Klaus Schwab, World Economic Forum: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>



# Part 1

# **ARTIFICIAL INTELLIGENCE TRAILBLAZERS**



# 1

# ALIBABA

## *Using Artificial Intelligence To Power The Retail And Business-To-Business Services Of The Future*

Alibaba Group is a Chinese multinational conglomerate that operates the world's largest e-commerce network through its web portals, which include Alibaba.com, Taobao, Tmall and Ali Express. With global sales that dwarf those of Amazon and eBay combined,<sup>1</sup> the business took what it learned from building a global online retail platform and has applied it to enterprises in just about every area of business and technology. Alibaba's success in delivering e-commerce and retail services, electronic payment, as well as business-to-business cloud services, has earned it a market cap in excess of US\$500 billion.

Its customers use artificial intelligence (AI) tools to help them find what they want when they shop at its online portals, and as one of the world's largest cloud computing providers it also licenses platforms, tools and cloud services to other businesses to help them leverage AI.

Beyond that, Alibaba is rolling out AI across the wider society, with projects involving turning entire cities into "smart cities". They are also planning on revolutionizing China's (and perhaps the world's) agricultural industries to ease the burden of feeding a growing population.

## ARTIFICIAL INTELLIGENCE IN PRACTICE

### How Does Alibaba Use Artificial Intelligence?

The Chinese government has strongly supported efforts by businesses to adopt AI, clearly believing that it has enormous potential for driving economic growth. Its goal is to foster a \$1 trillion industry and be the world leader in AI by 2030.<sup>2</sup>

This, combined with the fact that the country's enormous population gives companies access to huge amounts of data on customers' lives, makes the country a fertile ground for AI development.

Alibaba's e-commerce portals use sophisticated AI to choose which items to display to customers when they visit and search for products they want to buy. It does this by building a custom page view for every visitor, aimed at showing them items they will be interested in, at prices that seem right.

By monitoring customer actions – whether they make a purchase, browse to a different item or leave the site – it learns in real time to make adjustments to these page views to increase the probability of the visit ending in a purchase.

To train its e-commerce portals to show visitors pages that are likely to result in a sale, Alibaba has deployed a form of semi-supervised learning known as reinforcement learning on its Taobao portal.<sup>3</sup>

Because collecting enough user data to train unsupervised learning algorithms from real-time customer actions would take a long time, and involve real business risks, a virtual Taobao was built, with customer behavior simulated from hundreds of thousands of hours' worth of historical customer data.

This mass of data meant that it was possible for the algorithms to be exposed to a far wider range of customer behaviors, in a far shorter time span.

## ALIBABA

Alibaba also has its own AI-powered chatbot – Dian Xiaomi – that answers more than 350 million customer enquiries a day, successfully understanding more than 90% of them. These tools are necessary to help it deal with the huge spikes generated by special occasions such as the Alibaba-created “Singles’ Day” shopping event.<sup>4</sup>

### Automated Sales Copy

With millions of different items on sale across its sites, Alibaba has invested in automated content generation to ease the burden of writing descriptions for everything it sells. The tools are also available to third-party sellers on its platforms.

Its AI copywriter uses natural language processing algorithms running on deep learning neural networks to produce 20,000 lines of copy in a second.<sup>5</sup>

Traditionally, sales copywriters have had to spend hours researching keywords and click-through rates to understand what is likely to make a customer click their link in a page of product search results. The AI copywriter allows Alibaba and others selling through its platforms to do it at the click of a button.

This is done by creating multiple versions of adverts and running them through algorithms trained on customer behavior data. The system works out which combination of words is most likely to result in customer clicks, and uses them to create its copy.

### Cloud Services

Just like Amazon and Google, Alibaba offers artificially intelligent services through the cloud to its business customers. Its cloud service business is the largest of all the Chinese tech giants.<sup>6</sup>

Alibaba’s AI offering is called Machine Learning Platform for AI, which offers solutions for businesses wanting to take advantage of

## ARTIFICIAL INTELLIGENCE IN PRACTICE

cognitive computing functions such as natural language processing and computer vision, without the upfront costs of directly investing in infrastructure.

Alibaba's natural language processing technology was the first in the world to beat a Stanford University test designed to assess whether a machine can beat a human at reading comprehension.

In 2018, its deep neural network language processing technology passed the 100,000 question test with a score of 82.44 – narrowly beating the human score of 82.3.<sup>7</sup>

### Smart Cities

Alibaba has developed a suite of cloud-based AI tools designed to carry out essential jobs like managing traffic flow, lighting and waste collection in cities where infrastructure is connected through smart online technology.

Alibaba City Brain already tracks and manages traffic flow on every street of Hangzhou, a city with a population of 9.5 million. The system is reported to have reduced traffic jams by 15%<sup>8</sup> and is soon expected to be deployed in Kuala Lumpur, Malaysia.

City Brain monitors the flow of traffic and builds up models that it can use to predict when congestion is likely to occur. When it recognizes signs that there is a high probability of this happening, it can alter traffic light patterns to speed up or control the flow of traffic, so jams are less likely to form.

Alibaba's AI also powers the smart ticket kiosks at Shanghai's subway stations. The kiosks give customers route information when asked, and check customer identification using facial recognition technology.<sup>9</sup>

## ALIBABA

### Smart Farming

Alibaba has developed an AI system for monitoring farm herds, crops and orchards.

As the world's biggest supplier and consumer of pork, Chinese pig farmers have access to technology that records activity and health levels of herds, automating decision making over when to increase feed or provide animals with more exercise.<sup>10</sup>

Facing the challenge of feeding an ever-growing population, the system allows farmers to optimize breeding rates by raising a healthier herd and reducing newborn death rates. The system also has applications in crop growing and land management.

### Academy For Discovery, Adventure, Momentum And Outlook

Alibaba's AI strategy is based around distributing its cutting-edge machine learning and deep learning solutions to businesses and customers through its cloud services.

Its business AI platform is delivered through its Alibaba Cloud subsidiary, which operates 18 global data centers. These host the hardware that powers the AI algorithms and data processing technology, which is provided as a service.

In 2017 it announced it would invest \$15 billion over the next three years, expanding its global network of AI research and development facilities.

It calls this program the Academy for Discovery, Adventure, Momentum and Outlook – DAMO – and will involve recruiting 100 researchers for its labs in Beijing and Hangzhou, China, and San

## ARTIFICIAL INTELLIGENCE IN PRACTICE

Mateo and Bellevue in the United States, as well as others in Moscow, Tel Aviv and Singapore.<sup>11</sup>

Research at the labs will focus on machine learning, natural language processing, Internet of Things, human/machine interaction and quantum computing.

### Key Challenges, Learning Points And Takeaways

- Alibaba is China's biggest investor in research and development, which has given it a strong start in the race to become the world leader in AI.
- Its model for rolling out AI to millions of customers and businesses is to deploy its services through the cloud. This cuts customer risk and infrastructure cost, while giving Alibaba access to valuable data about how its customers behave.
- By applying technology designed to drive sales at its retail portals to other problems in business and society, it identifies new use cases for AI, within and outside its established business operations.

### Notes

1. Institutional Investor, Ali Baba vs The World: <https://www.institutionalinvestor.com/article/b1505pjf8xxy75/alibaba-vs-the-world>
2. CNBC, China is determined to steal A.I. crown from US and nothing, not even a trade war, will stop it: <https://www.cnbc.com/2018/05/04/china-aims-to-steal-us-a-i-crown-and-not-even-trade-war-will-stop-it.html>
3. Virtual-Taobao: Virtualizing Real-world Online Retail Environment for Reinforcement Learning: <https://arxiv.org/abs/1805.10000>
4. SCMP, Alibaba lets AI, robots and drones do the heavy lifting on Singles' Day: <https://www.scmp.com/tech/innovation/article/2119359/alibaba-lets-ai-robots-and-drones-do-heavy-lifting-singles-day>

**ALIBABA**

5. BBC, The world's most prolific writer is a Chinese algorithm: <http://www.bbc.com/future/story/20180829-the-worlds-most-prolific-writer-is-a-chinese-algorithm>
6. Data Center News, Alibaba gives AWS, Microsoft and Google a run for their cloud money: <https://datacenternews.asia/story/alibaba-gives-aws-microsoft-and-google-run-their-cloud-money/>
7. Bloomberg, Alibaba's AI Outguns Humans in Reading Test: <https://www.bloomberg.com/news/articles/2018-01-15/alibaba-s-ai-outgunned-humans-in-key-stanford-reading-test>
8. Wired, In China, Alibaba's data-hungry AI is controlling (and watching) cities: <https://www.wired.co.uk/article/alibaba-city-brain-artificial-intelligence-china-kuala-lumpur>
9. Technology Review, Inside the Chinese lab that plans to rewire the world with AI: <https://www.technologyreview.com/s/610219/inside-the-chinese-lab-that-plans-to-rewire-the-world-with-ai/>
10. Financial Times, Alibaba brings artificial intelligence to the barnyard: <https://www.ft.com/content/320fb98a-69f4-11e8-b6eb-4acfcfb08c11>
11. CNBC, Alibaba says it will invest more than \$15 billion over three years in global research program: <https://www.cnbc.com/2017/10/11/alibaba-says-will-pour-15-billion-into-global-research-program.html>

