

Introduction to

Machine Learning

A Beginner's Guide

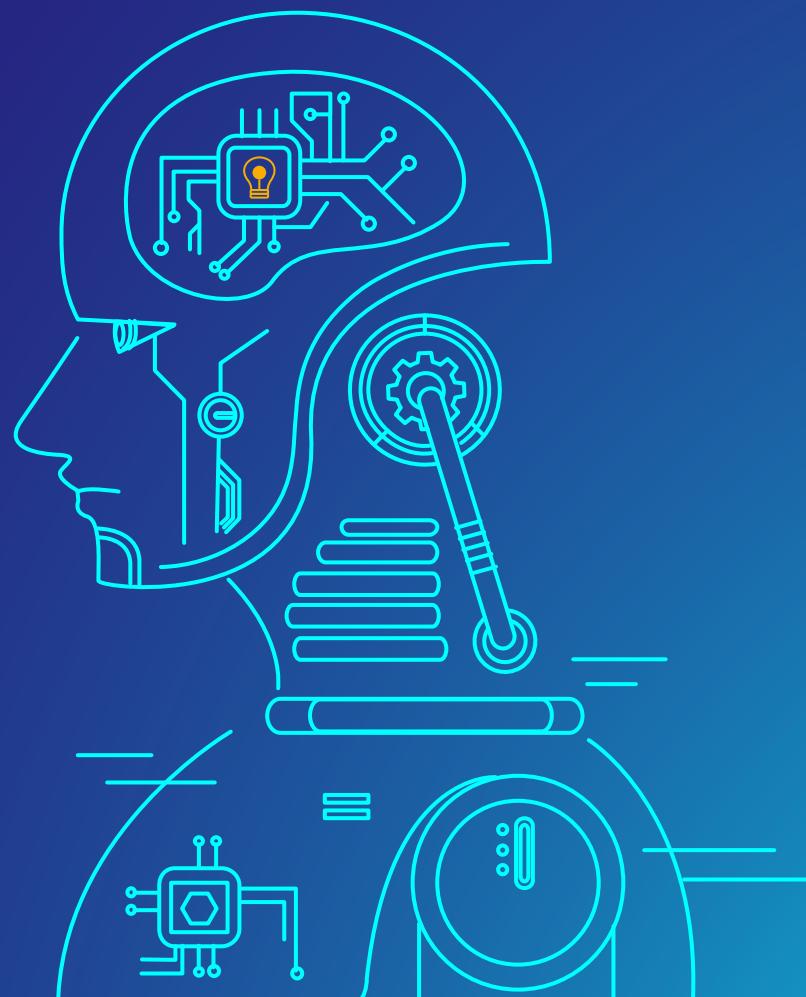


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INTRODUCTION

In 1959, Professor Arthur Lee Samuel, a pioneer in artificial intelligence (AI) and computer gaming, developed a game of checkers that could play professional gamers. The game was the world's first introduction to machine learning as the world saw for the first time how a computer could learn while running.

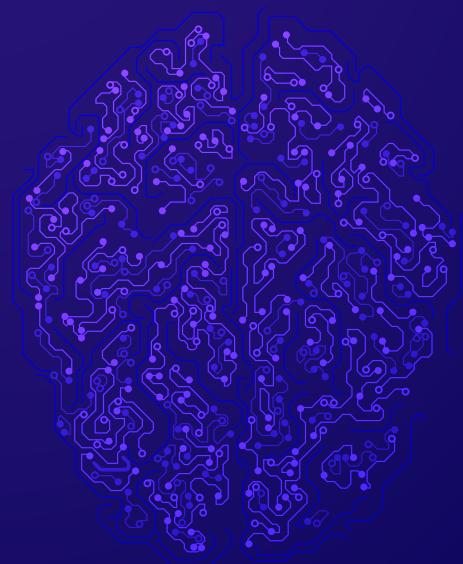
Since then, machine learning (ML) made significant inroads. Today, we see it everywhere — from Google Maps to personalized recommendations on Amazon, Facebook to AI-powered virtual assistants, and, not to mention, Google Search.

Gone are those days when we had to tell machines what to do to solve problems. With the emergence of machine learning technologies, computers can find solutions to problems by identifying specific patterns in data sets. Automatic analysis of hidden patterns and trends makes things easier for organizations to predict in advance a range of business-critical problems and their solutions.

According to a recent survey cited by KDnuggets, 54% of respondents had already implemented ML strategies, and almost 28% of companies considered themselves to be at a scale-up/transforming stage with their initiatives.

With more and more companies implementing ML in their business processes, it's opening up massive opportunity to hire ML engineers and data scientists to fuel the machine learning efforts within their teams. As a result, ML related jobs are high in demand and raking in huge pay packages. In fact, the leading job search platform, [Indeed.com](#), listed "Machine learning engineer" at the top of their list of highest paying jobs in 2019.

If you are looking to kick-start your career in machine learning, there is no better time than now. This machine learning basics handbook will give you a detailed overview of ML's industry applications and real-life use cases. It will also provide you with information on the courses you must take to succeed in this territory.



ABOUT MACHINE LEARNING

Machine Learning is a subset of Artificial Intelligence (AI), but the two are not entirely the same. While AI is the umbrella concept that deals with the creation of intelligent machines that can simulate human thinking capability and behavior, machine learning is an application that allows machines to learn from data without being programmed explicitly. In fact, machine learning, as a sub-field and a concept that branched out of AI, started to flourish in the 1990s. The focus of this field gradually shifted from only achieving artificial intelligence to tackling solvable problems of a practical nature.

Therefore, ML is a field of computer science that analyzes and interprets structures and patterns within datasets to enable informed decision-making with no human interaction.

In simple terms, ML allows users to input vast amounts of data into a computer algorithm, and then, lets the machine analyze the information to provide data-oriented suggestions based only on the information supplied.

Deep learning is a sub-field of machine learning, and quite similar to it, except that deep learning uses numerous layers of algorithms called an artificial neural network. It mimics the brain's neural network, which also has a layered architecture. Deep learning involves using these layers to look for patterns in the data. Google's LeNet model for image recognition is a deep learning application that counts 22 layers of network.

We'll explain the difference between machine learning and deep learning with the help of a simple example.

Let's say we have a huge collection of pictures of dogs and cats, and we want to separate the images — one containing cats and the other featuring dogs. Now let's see how machine learning and deep learning algorithms can help us do this.



In the case of machine learning, we need to label a set of photos in a way that defines the specific features of both the animals — this is structured/labeled data. When we feed this data to the machine learning model, it learns the characteristics of both animals through the labels and applies this learning to classify millions of pictures featuring dogs and cats.

Deep learning approaches the problem differently. It does not require labeled data; instead, it uses the different layers of its artificial neural network to define the images' specific features hierarchically. This allows the deep learning model to figure out the identifiers on its own with which it can classify the images.

With machine learning, businesses now have a greater chance of quickly identifying opportunities and risks by developing models that accurately analyze complex data on a large scale and deliver faster results.

Interest in machine learning is gathering unprecedented momentum because most companies working with enormous volumes of data are beginning to understand how real-time decision-making capabilities can optimize resources, streamline processes, shorten time-to-market, and outperform competitors.

INDUSTRY TRENDS AND PREDICTIONS

According to global research and advisory firm **Gartner**, the total value of the artificial intelligence business and related technologies, worldwide, will be 3.9 trillion dollars by the end of 2022.

In the same year, the International Data Corporation (IDC) **forecasts** that investments in AI and cognitive systems will exceed \$77.6 billion. IDC, a leading provider of advisory services and market intelligence, also claims that cognitive capabilities will have a significant impact on almost all IT functions.

The McKinsey Global Institute has shown in its **research** that by 2020, machine learning and artificial intelligence can add 2.6 trillion dollars in sales and marketing value, and over 2 trillion dollars in SCP (Supply Chain Planning) and manufacturing.

A report published by **Gartner** shows that artificial intelligence will generate 2.3 million ML jobs by 2020. In fact, the demand for machine learning professionals is much higher than the supply of candidates with the right skills, making ML, one of the biggest employment areas in the tech field.

Given the above figures, it is no surprise that machine learning is rapidly emerging as the most sought-after career option today.

INDUSTRY APPLICATIONS OF MACHINE LEARNING

As organizations become more data-driven, machine learning is rapidly gaining prominence across multiple sectors. Industries that have widely adopted this advanced technology include:



Retail

Retail sites that offer buying recommendations based on your previous purchases use machine learning technologies to analyze your shopping patterns. Today, leading retailers rely heavily on ML to capture and analyze buyer data to gain customer insights, optimize pricing, launch marketing campaigns, and to deliver a personalized shopping experience.



Energy

Oil and gas companies deploy machine learning to analyze subsurface energy sources, predict refinery failures, and streamline distribution systems to maximize profits. The scope of implementing machine learning in the energy sector is vast and expanding.



Financial Services

The application of machine learning in the financial sector is diverse. Banks and financial institutions not only implement machine learning technologies to help customers and investors in several ways, but they also use ML for detecting high-risk profiles, cyber surveillance, and fraud prevention.



Healthcare

Thanks to advancements in sensor technologies and medical wearable devices, machine learning is increasingly becoming an integral part of the modern-day healthcare ecosystem. The breakthrough technology helps healthcare professionals analyze data to determine trends in real-time, which leads to better diagnosis and improved treatment.



Transportation and Logistics

Data analysis, trend detection, and the modeling aspect of ML are crucial tools for transport organizations and delivery companies. The transportation and logistics industry uses machine learning to make more efficient routes and predict potential problems, translating into increased profitability.



Government

Government agencies have various data sources. From utilities to public safety, government agencies are mining Big Data to gain actionable insights for improving efficiency, lowering risks, and increasing savings. Many agencies are also adopting machine learning to detect fraud and curb identity theft.

REAL-LIFE EXAMPLES OF MACHINE LEARNING

In this section, we present real-world use cases of ML, which each of us encounters in our daily lives, but perhaps without realizing that machine learning drives these applications. The following are a few noteworthy examples.



Virtual Assistants

Apple Inc.'s Siri, Amazon's Alexa, and the Google Assistant are popular instances of virtual assistants. These AI-powered assistants, recognizing a user's voice, help them find relevant information via voice commands. Virtual assistants perform the assigned tasks by recalling related queries or collecting info from other apps and resources.

Machine learning plays a crucial role in boosting the efficiency of virtual assistants. The technology refines the delivery of information based on a user's previous interaction with these apps. Subsequently, ML uses the data set to render personalized results tailored to one's preferences.



Traffic Predictions

When we use the GPS navigation system, the service stores our current velocities and locations on a central server for traffic management. The stored data enables the creation of a map with the current traffic. Machine learning, conducting a congestion analysis, helps assess the congested regions based on daily experiences.



App-based Cab Networks

How does the Uber app calculate the cost of a trip and the waiting time when someone is booking a cab? Engineering lead at Uber, Jeff Schneider, revealed in an interview that machine learning plays a vital role throughout Uber's entire service cycle, especially in determining the price surge hours based on rider-demand predictions.



Video Surveillance

By tracking people's unusual behavior, for example, when they have been standing still for quite some time, dozing off, or stumbling, modern video surveillance systems, powered by artificial intelligence, help detect crimes and mishaps before they occur. AI-enabled video surveillance systems accomplish this using machine learning, working in the background.



Social Networking Service

From improving ads targeting to personalizing news feeds, top social media platforms use machine learning technologies to augment their own and the user's benefits. ML-backed social networking features that most people use without knowing include face recognition, similar pins, and "people you may know" on Facebook.



Email Malware and Spam Filtering

Cybersecurity experts detect over 3,25,000 malicious programs every day, with codes that are 90 percent–98 percent similar to previous versions. System security software, powered by ML, understands and identifies these coding patterns, and therefore, can quickly protect against new malware with a deviation of 2 to 10 percent. For filtering spam, Multi-layer Perceptrons (MLPs) and C 4.5 Decision Tree Induction are advanced spam filtering methodologies, backed by machine learning technology.



Online Client Support

In an era of downsizing, businesses hardly have live executives to respond to customer queries. Nowadays, human-like chatbots offer customer support, and they do this by extracting data from the company's website and presenting it to clients. Chatbots, fed with data continuously, get a better understanding of customer queries, which leads to better responses. ML algorithms make this possible.



Refining Search Engine Results

Leading search engines such as Bing, Yahoo, and Google are deploying ML to improve search results for users. Every time users perform a search, backend machine learning algorithms monitor how they respond to the results. If users click or tap on top results and stay on the website for a while, search engines presume that it displayed results in accordance with the user query. This is how ML improves search results.



Purchase Recommendations

When you receive buying recommendations on a shopping website for similar products you bought, be sure that ML is creating the magic. Machine learning analyzes consumer behavior, such as past purchases, brand preferences, and items added to the cart, refining shopping experiences, which, in turn, heighten customer satisfaction.



Fraud Detection and Prevention

From identifying online monetary fraud to tracking money laundering and illegal transactions, machine learning is demonstrating its enormous potential in making cyberspace secure. Banks, financial institutions, and online payment systems, such as Paypal, are increasingly adopting ML technologies to reduce risk and prevent fraud.

KEY MACHINE LEARNING TERMS

In this section, we'll briefly introduce you to some basic ML terms that you'll frequently encounter while dealing with this subject.



Bayesian networks

Graphical models for representing multivariate probability distributions are called Bayesian Networks. These are also known as causal networks, belief networks, and decision networks.



Neural Networks

Closely related to deep learning, neural networks are sequential layers of neurons that deepen the understanding of data collected from a machine to provide an accurate analysis.



Classification

Classification is a supervised learning algorithm technique that deals with building models that separate data inputs into distinct classes or categories.



Clustering

It is a form of unsupervised learning (learning with unlabeled data) that involves assembling data points according to features and attributes.



Natural Language Processing (NLP)

Natural language processing is the subfield of AI that's focused on the interactions between human language and computers.



Regression

Closely related to classification, regression allows us to estimate the relationships among variables and predicts future outcomes or items in a continuous data set by solving for the pattern of past inputs, such as linear regression in statistics.



Supervised learning

Deep learning can be supervised, semi-supervised, or unsupervised. A supervised learning algorithm evaluates the training data and draws inferences to perform functions, which can be used for mapping new examples.

GET STARTED WITH A CAREER IN MACHINE LEARNING

With the rise in innovation and the promises in machine learning that we'll see in the coming years, it's not hard to imagine that machine learning will become even bigger than it is today. As a result, the demand for trained machine learning professionals will only grow, and there's a wide skill gap in ML today. This is why it's a tremendous opportunity for tech talents to make their way into this career path. If you want to be one of those professionals, certifications are key to unlock these opportunities. The sooner you get yourself skilled through training, the sooner you will be a part of this exciting and rapidly changing field.

To help you acquire the right ML skills, this machine learning handbook strongly recommends you to explore the range of our comprehensive and expertly conducted ML certification courses.

The Machine Learning courses we offer:

- ✓ [**Post Graduate Program in AI and Machine Learning, in collaboration with Purdue University and IBM**](#)
- ✓ [**Introduction to Artificial Intelligence Course**](#)
- ✓ [**Data Science And Artificial Intelligence Dual Master's Program**](#)
- ✓ [**Machine Learning Certification Course**](#)



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Other related courses we offer:

- ✓ Introduction to Artificial Intelligence Course
- ✓ Artificial Intelligence Engineer Master's Program (in collaboration with IBM)



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