Artificial Intelligence: The Big Picture of AI

by Matthew Renze

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Course Overview

Course Overview

Hi. I'm Matthew Renze with Pluralsight, and welcome to Artificial Intelligence: The Big Picture. Artificial intelligence has become extremely important in the past few years. From machine learning to deep learning to reinforcement learning, AI is taking over the IT industry. As a result, people with the ability to leverage artificial intelligence to solve business problems are in extremely high demand and commanding significant increases in salary as AI is revolutionizing the world around us. However, most software developers and IT professionals have not yet learned this valuable set of skills. In this course, we'll answer the following three questions, what is artificial intelligence, why is it important for you and your career, and how do you get started with AI? To answer these questions, we'll learn about artificial intelligence, how it works, and its potential impact on you, your organization, and our world. By the end of this course, you'll understand artificial intelligence and the tools, technology, and trends driving the AI revolution. As an introductory course, there are no prerequisites for this course. We'll be explaining everything you need to know along the way. So, please join us today at Pluralsight and learn how to become part of the AI revolution with Artificial Intelligence: The Big Picture.

Introduction

Introduction

Hi. I'm Matthew Renze, data science consultant, author, and public speaker, and welcome to Artificial Intelligence: The Big Picture. In this course, we'll learn what artificial intelligence is, why it's important, and how to get started. We'll also learn how AI will impact you, your career, and our world. But first, let's begin with a quick introduction to modern AI. Whether you realize it or not, our world is going through a major transition as we speak. We're entering the era of artificial intelligence and machine learning, a future where machines will be doing many of the jobs that humans are currently doing today. As a result, the software industry is preparing to go through a major transition as well. In the past, we'd have to explicitly program a computer step by step to solve a problem. This involved a lot of if/then statements, for loops, and logical operations. In the future, however, machines will teach themselves how to solve problems on their own, we just need to provide the data. Now, this is a radically different way of working with the computer than we're used to as software developers and IT professionals. While there's a growing demand for individuals with the skills necessary to implement artificial intelligence, there's currently a shortage of people capable of teaching machines how to solve problems in this new way. As a result, those with the skills necessary to leverage AI are commanding significantly higher salaries, and this trend doesn't seem to have any end in sight. So, you're probably wondering what is artificial intelligence and how does it work? Why is AI important for you, your career, and our world, and, where should you go to get started on your AI journey? This course will answer all three of these questions.

Overview

The purpose of this course is to learn about artificial intelligence from a high-level perspective. Artificial intelligence is a very broad topic that's been incrementally progressing since the mid-1950s. There's simply too much knowledge to cover everything in a single course. So in this course, we're just going to focus on the most essential aspects of AI, just the things that you need to know to get started today. As an overview of this course, first, we'll learn about artificial intelligence and the various types, components, and applications of AI. Next, we'll learn about the history of AI, the various booms and busts in classical, knowledge-based, and data-driven AI. Then we'll learn about modern AI, data-driven trends like machine learning, deep learning, and reinforcement learning. Next, we'll learn about AI in information technology, how you can leverage

AI in your day-to-day career in IT. Then, we'll learn about the future of AI, the potential impact that AI will have on our society, economy, and our ethics. Finally, we'll wrap things up for this course and discuss where to go to continue your AI training. The primary audience for this course are software developers and IT professionals, anyone in information technology that wants to understand artificial intelligence from a high-level perspective. This includes executives and managers wanting to understand how AI will impact their organization and their teams. There are no prerequisites for this course. We'll assume that you're new to AI throughout the entire course. In addition, this course will not require any programming knowledge. There will be no code demos, and the examples will be simple and easy to understand. Finally, you won't need to install any software to complete this course. This course will provide everything that you need to get started on your AI journey. By the end of this course, you'll understand the basics of artificial intelligence. In addition, you'll also understand how these technologies will impact you, your career, the IT industry, and our world. This foundational knowledge will help you get started in artificial intelligence. All right, we've got a lot to cover in this course, so let's get started.

Artificial Intelligence

Introduction

What is artificial intelligence? How do we even define intelligence in the first place? And what are the types, components, and applications of AI? To answer these questions, we need to learn about artificial intelligence. As an overview of this module, first, we'll learn about intelligence, the ability of an agent to act rationally to achieve a goal. Next, we'll learn about artificial intelligence, the ability of a machine to replicate natural intelligence. Then, we'll learn about the three types of AI, artificial narrow intelligence, artificial general intelligence, and artificial super intelligence. Next, we'll learn about the key components of AI, including perception, learning, knowledge, reasoning, and planning. Finally, we'll learn about the various applications of AI that exist in our world.

Intelligence

In order to understand artificial intelligence, we first need to define intelligence. So, what is intelligence? What makes a person, an animal or an organism intelligent? Intelligence is difficult to define; however, various fields of study have proposed numerous definitions over the years. Unfortunately, most of these definitions are often unclear, imprecise, untestable, and biased in a human-centric way. So, let's take a step back and start with a few examples of intelligence that we can all hopefully agree upon. For example, human intelligence, like a person solving a complex math problem to pass a math exam; animal intelligence, like a mouse remembering a path through a maze to eat a piece of cheese; and collective intelligence, like a colony of ants coordinating an attack on an invading insect. In each of these cases, there's some form of intelligence at work. They are all three very different kinds of intelligence; however, they all definitely share a few things in common. So, what do they all have in common? First, they all involve an agent of some kind, for example, a human, a mouse or an army of ants. Second, they all involve an environment of some kind, for example, a math exam, a maze or an ant colony. Third, they all involve a goal of some kind. For the human it's to pass the math exam, for the mouse it's to eat the cheese, and for the ants it's to protect the colony. Fourth, they all involve an agent perceiving its environment. The human reads the math question, the mouse sees the walls of the maze, and the ants smell the scent of the invading insect. Fifth, they all involve the agent taking an action. The human solves the math problem, the mouse navigates the maze, and the ants attack the invading insect. In all of these cases, we have an agent in an environment that is perceiving the environment and choosing actions that it expects will lead to a goal. Given these examples, a simple general definition of intelligence might look something like this. Intelligence is the ability of an agent to perceive its environment and to choose actions that increase its chances of achieving a goal of some kind. But, there's a lot of complexity hiding in this simple definition. It doesn't discuss several of the key components of intelligence, like learning, knowledge, reasoning, and planning. We'll get to these other components of intelligence shortly, but first we need to learn about artificial intelligence.

Artificial Intelligence

How do we define artificial intelligence? What makes artificial intelligence different from natural intelligence? There are two main types of intelligence, natural intelligence and artificial intelligence. Natural intelligence is the type of intelligence that living organisms are born with and acquire over their lives. This includes organic intelligence, like that of humans, animals, insects, and even bacteria. It also includes collective intelligence, like a school of fish, a swarm of bees or a colony of ants. Artificial intelligence, however, is a type of intelligence that is not naturally occurring. It is intelligence that was created artificially by humans using machines. Artificial intelligence is the ability of a machine to replicate natural intelligence. This includes replicating human-like intelligence, other organic intelligence or collective intelligence. Essentially, if a machine is capable of recreating the same decisions and actions that a natural intelligence would produce, then it is a type of artificial intelligence. More precisely, artificial intelligence is the ability of a machine to perceive an environment and to choose actions that maximize the expected likelihood of achieving a goal. We refer to this as the rational agent approach to defining artificial intelligence. But, this is a lot to digest at once, so let's break things down to make things easier to understand. In artificial intelligence, the agent is a machine of some kind. This includes software running on a computer, a robot or any other kind of man-made artifact. By environment, we could mean the physical world, as is the case with robots and self-driving cars; however, it could also mean virtual worlds like video games, a computer simulation or a set of data. By actions, we mean physical actions like moving, grasping, and speaking, or virtual actions like producing data as an output or making a decision or prediction of some kind. By expected likelihood, we mean the statistical probability of success that an agent associates with a given action. AI agents maximize their chances of success mathematically using software rather than organic brains. And by goal, we mean any objective that the agent was designed to achieve. This could include physical goals like cleaning your living room floor and driving you safely to work. Or, it could include virtual goals like winning a video game or solving a complex math problem. This rational agent view of artificial intelligence is what most AI researchers, practitioners, and academics use as their guide to define AI. However, the general public tends to have a quite different definition of AI than the experts. Their definition is constantly changing as technology is improving. Once some cutting-edge AI technology becomes mainstream, the general public typically stops referring to it as AI. In short, when most people say artificial intelligence, what they mean is anything that a human can do, but a machine cannot yet do. As a result, the general public's definition of artificial intelligence and what they classify as AI is constantly changing.

Types of A.I.

What types of AI exist, and how do we classify the various levels of artificial intelligence? There are three main types of artificial intelligence, artificial narrow intelligence, artificial general intelligence, and artificial super intelligence. Artificial narrow intelligence, or narrow AI, is a type of AI designed to solve a very narrow set of specific problems. For example, IBM's Watson can play Jeopardy, Amazon Alexa can respond to basic voice commands, and Google's Waymo is a self-driving car. This is a type of AI that currently exists, is growing quickly, and is rapidly changing our world. Artificial general intelligence, or general AI, is a futuristic type of general-purpose intelligence that can solve a wide variety of more general problems. General AI is commonly associated with sentient robots in books, TV, and film, like R2D2, Data from Star Trek or HAL 9000. This type of AI does not yet exist and is still likely many years, if not decades, from becoming a reality. However, this is the general direction of AI and the goal of many AI research projects. Artificial super intelligence, or super AI, is a type of futuristic AI that is smarter than all human or natural intelligence. Super AIs are typically the supervillains in sci-fi movies. For example, Skynet from the Terminator, Ultron from the Avengers, and the Architect from the Matrix. Once we achieve artificial general intelligence, it's believed that artificial super intelligence will emerge soon after. This is because general AI will be able to recursively self-improve and is not subject to the biological limitations of organic brains. If it ever does come into existence, super AI will most likely vastly exceed all forms of human intelligence. In fact, it will likely exceed all forms of natural intelligence combined. All three of these types of AI are very interesting topics to discuss for various reasons. However, in this course we're going to be focusing exclusively on artificial narrow intelligence. This is the type of AI that exists today. It's AI designed to solve a very narrow set of specific problems, but will likely revolutionize our world in the next few decades.

Components of A.I.

What components are necessary to create artificial intelligence? What does it take to make a machine intelligent? There are several key components to artificial intelligence. They include perception, learning, knowledge, reasoning, and planning. Each of these components corresponds to an aspect of natural intelligence that exists in organic brains. They also correspond to the major areas of study in AI research. While this isn't an exhaustive list, it covers the most important components of modern AI. So, let's take a look at each of these five components in more detail. First, we have perception. Perception is the ability of an agent to deduce a state of its environment from sensory data. Data comes into the agent via sensors like cameras, microphones, and radar. The agent makes sense of this stream of data by recognizing patterns in the data. Through these patterns, the agent is able to detect the features of the environment, like walls, objects, and people. The aspects of these features like their size, position, and velocity make up the current state of the environment. Second, we have learning. Learning is the ability of an agent to extract knowledge from a stream of data. Learning involves taking in data as input and producing a decision, prediction or an action as output. For AI agents, this involves learning how to map the state of the environment to actions that lead to a goal. We've seen a lot of progress in the space in recent years with advances in machine learning. Third, we have knowledge. Knowledge is the ability of an agent to represent what it has learned in a flexible way. Knowledge is a collection of information that the agent knows about its environment, including objects, their properties, and their relationships. An agent's knowledge can be represented symbolically as a statistical model or as a knowledge graph. Each of these types of knowledge representations has its own various pros and cons. Fourth, we have reasoning. Reasoning is the ability of an agent to infer conclusions from available knowledge. Reasoning agents employ inference techniques like deduction, which uses a set of premises to reach a specific conclusion, and induction, which generalizes from a set of observations to a more general rule. Reasoning is how we use knowledge to solve problems without having to resort to trial and error for each new situation. Finally, we have planning. Planning is the ability of an agent to set and achieve a goal. This typically involves constructing a set of sub-goals to achieve the primary goal as well. Planning involves an agent being able to visualize future states of the environment. The agent must be able to predict how a series of possible actions will change the state of the environment and laid it either closer to or further away from its goal. With this information, the agent can then choose the action that maximizes the likelihood of achieving its goal. Modern narrow AI applications do not require all five of these components of artificial intelligence. In fact, many successful narrow AI applications involve just one or two of these components. However, future general AI systems will almost certainly require all five of these components to become a reality.

Applications of A.I.

What are the current applications of modern artificial intelligence? How is this technology being used today? I'm sure we've all heard about the textbook examples of artificial intelligence, for example, robot vacuum cleaners, computers that play chess, and self-driving automobiles. However, there are many practical business applications of AI that most people are currently unaware of. Here are just a few examples of AI that are currently being used in modern business. In customer service, we have automated FAQ generators, customer support chatbots, and telephone voice assistants. In finance, we have stock market trading algorithms, fraud detection algorithms, and portfolio management agents. In healthcare, we have AI diagnostic tools, treatment recommendation, and prescription verification. In manufacturing, we have AI-assisted product design, industrial robots, and defect detection. In marketing, we have dynamic advertisement optimization, customer sentiment analysis, and product recommendation. And in transportation, we have warehouse robots, route optimization, and delivery drones. But, this is just the tip of the iceberg. There are so many possible applications of modern AI that it's pointless to try listing them all. Anywhere you see a human performing a simple, repetitive, dangerous or non-cost effective task, there's an opportunity for automation with AI. Artificial intelligence has applications in virtually every industry in our world. If your industry hasn't been disrupted by AI, it's just a matter of time until it is.

Summary

In this module, we learned about artificial intelligence, what it is, and why it's important. First, we learned about intelligence, the ability of an agent to act rationally to achieve a goal. Next, we learned about artificial intelligence, the ability of a machine to replicate natural intelligence. Then, we learned about the three types of AI, artificial narrow intelligence, artificial general intelligence, and artificial super intelligence. Next, we learned about the key components of AI, including perception, learning, knowledge, reasoning, and planning. Finally, we learned about the various applications of AI that exist in our world. In the next module, we'll learn about the history of AI and the previous booms and busts that led to where we currently are today.

History of A.I.

Introduction

Where did artificial intelligence come from, what advances have led to the modern AI that we see today, and what setbacks have occurred along the way? To answer these questions, we need to learn about the history of artificial intelligence. As an overview of this module, first, we'll learn about classical AI, the first AI boom based on symbolic computation. Next, we'll learn about the first AI winter, the setbacks and failures of classical AI research. Then, we'll learn about knowledge-based AI, the second AI boom based on expert systems. Next, we'll learn about the second AI winter, the collapse of the expert systems industry. Then, we'll learn about data-driven AI, the third AI boom based on machine learning. Finally, we'll discuss the possibility of a third AI winter based on a potential tech bubble in AI that may be growing.

Classical A.I.

How did the AI industry get started? What early advances and successes led to the first AI research boom? Artificial intelligence has been around for quite some time. In fact, the field of AI dates all the way back to the 1950s. Back then, the majority of all AI systems focused on manipulating symbols to replicate abstract thinking. This involved performing computer operations on abstract symbols like words, numbers, and mathematical operators. Many experts believed that human intelligence could be fully replicated in a computer this way. AI research at this time largely involved playing simple games like checkers and solving toy problems in highly constrained environments. We refer to this approach as classical AI, symbolic AI, or simply good old-fashioned AI. This era of AI saw several breakthroughs in many areas of computer science. First, there were advances in computational search. Heuristic search algorithms were able to find solutions to many problems involving a large number of states and actions. Second, there were advances in computational logic. Computers were able to write mathematical proofs, solve algebra problems, and verify electronic circuit design. Third, there were advances in natural language processing. Computers were able to crudely simulate human conversations with a few basic rules about words, sentence structure, and grammar. These advances led to several early successes in classical AI. First, a computer program, known as the General Problem Solver, was able to solve basic word problems and puzzles. It could take well-formed problems and search all possible action result branches until it found a solution to the problem. Second, the first text-based chatbot named ELIZA fooled many people into thinking it was actually a human. However, ELIZA had no real understanding of what it was saying. It was just replying with canned responses using basic rules of grammar. Third, a program called SHRDLU could solve simple problems in a constrained virtual environment called a microworld. You could type commands in English like pick up the small red block and put it on top of the large green block. The program would then display the resulting geometric world on the screen. You could also ask it questions like what is supporting the red block now, to which it would respond, the large green block. These early successes made it appear to many people that we were just a few years away from truly intelligent machines.

The First A.I. Winter

Why didn't we end up with truly intelligent machines during the era of classical AI? Why were these experts' predictions so wrong? Unfortunately, the era of classical AI was hindered by several significant limitations of the time. First, there was limited computer power and memory in the 1950s and '60s. This limited classical AI to solving trivial or toy problems in very constrained environments. Second, it was discovered that the complexity of AI problems explodes exponentially for any non-trivial problems. There are simply too many possible states and actions in even a simple game like chess to search all possible moves in a reasonable amount of time. Finally, symbolic AI is great for solving abstract problems like math and logic problems; however, most real-world problems like opening a door requires sub-symbolic forms of intelligence like sensation, perception, and motor control. As a result of these and other limitations, classical AI experienced several very public failures. First, in the late '50s and early '60s, there is considerable interest in machine translation of human languages. However, by 1966, the National Research Council concluded that machine translation was still more expensive, less accurate, and slower than human translation. Second, after initial excitement about early neural networks called perceptrons, severe limitations were discovered in the late '60s. As a result, almost no research was done on neural networks for an entire decade until these limitations could be overcome. Finally, in 1973, Sir James Lighthill released a report commissioned by the British Government on the state of AI research. His highly critical and pessimistic report about the current state and future of AI ended funding for AI research in almost all British universities. These limitations and public failures of classical AI led to what is now known as the first AI winter, a period of reduced funding and interest in AI research from 1974 to 1980. During this time, many AI research projects and AI startups lost their funding almost overnight. The heyday of classical AI had ended.

Knowledge-based A.I.

How did we recover from the first AI winter? What technological advances led to the next boom in AI? The 1980s experienced a resurgence of interest in artificial intelligence. Rather than focusing on symbolic computation, this era of AI focused largely on how to capture, represent, and infer knowledge. We refer to this as the era of knowledge-based AI, also known as the era of expert systems. There are several advances in artificial intelligence during this era. The biggest advance in knowledge-based AI was the development of expert systems. An expert system is a computer program that can answer questions or solve problems in a limited domain of knowledge. Knowledge was represented in a knowledge base as a set of facts and a set of rules that connected them. Human experts would input knowledge into a knowledge base in the form of facts and a set of if/then rules. In addition, there are also systems that represented knowledge as a graph of words and their semantic relationships. Expert systems use an inference engine to deduce new facts from known facts that are contained within the knowledge base. For example, if our knowledge base contains the facts all humans are mortal and Joe is a human, then the inference engine would conclude that Joe is mortal. These experts systems were able to perform tasks like diagnose diseases, detect chemical compounds from sensor readings, and manage an inventory of parts. There were many successful applications of knowledge-based AI during the 1980s. First, in the 1970s, Stanford University created an expert system for medicine called MYCIN. By answering a series of yes/no questions, MYCIN was able to diagnose blood infections and recommend a course of treatment on par with a human doctor. Second, in the 1980s, the Digital Equipment Corporation, DEC, developed an expert system for a computer parts inventory named XCON. By 1986, XCON had processed over 80,000 orders with 95 to 98% accuracy and was saving DEC over $25 million annually. Third, in 1974, Harold Cohen began creating an expert system for painting named AARON. By the 1980s, AARON was able to produce original artworks that are still exhibited and appreciated as fine art yet to this day. Because of these early successes, nearly every major corporation in the United States was either using or investing in expert systems in the 1980s.

The Second A.I. Winter

Why didn't knowledge-based AI live up to all the hype in the 1980s? What happened to all the amazing benefits that we were promised from expert systems? Unfortunately, there are several limitations to knowledge-based AI of the 1980s. First, knowledge-based AI systems were expensive to maintain. They required a domain expert and a knowledge engineer to manually input new facts and rules to update the system. Second, knowledge-based AI systems were very rigid and inflexible. They would often produce grossly incorrect errors when given unusual or novel inputs. Finally, knowledge-based AI systems were not very efficient. Expert systems with a large set of facts and rules were slow, which limited them to solving only simple problems. Throughout the 1980s, expert systems proved useful, but only in a few special cases. These limitations of knowledge-based AI led to several setbacks and failures in this era. First, early successes like MYCIN created tremendous optimism, which drove the expert system boom in the 1980s. However, by the end of the 1980s, neither MYCIN nor any of its successors ever made it into production use in any hospital. Second, in the 1980s, there was a growing market for computers specifically designed to run LISP, the most popular programming language for expert systems. However, by the end of the '80s, the entire LISP market had collapsed and almost all LISP machine companies went out of business. Finally, in 1982, Japan began its fifth generation computer systems project to create a new era of computer systems to enable future AI technologies. Unfortunately, at the end of this 10-year project, it had spent over 50 million yen, about 400 million in US dollars, and was terminated without having met any of its goals. Throughout the 1980s, there was once again inflated expectations about what expert systems would be able to accomplish. The AI industry had grown from a few million dollars in 1980 to billions of dollars by 1988. Unfortunately, knowledge-based AI systems were unable to live up to the hype and failed to meet expectations. As a result, the entire market for expert systems and general interest in artificial intelligence collapsed. This led to the second AI winter, a period of time from 1988 until the early 2000s where funding and research for AI dried up again.

Data-driven A.I.

What caused the second AI winter to end, and why are we now finally seeing practical applications of AI in our world? After the second AI winter, many researchers went back to the drawing boards in search of a new path to practical AI. The first two eras of AI were based on the assumption that intelligence could be hard coded into computers. However, the third era is based on the realization that knowledge can instead be learned from data. We refer to this type of artificial intelligence as data-driven AI, or simply machine learning. There were several advances that got us out of the second AI winter and into the third AI boom. First, we now have much more powerful computers. A desktop computer today is literally hundreds of millions of times more powerful than the best computers in the early 1950s. Second, we now have lots more data. A tremendous amount of low-cost, readily available digital information now exists to train AI models using machine learning. Third, we now have better algorithms for teaching machines with data. Modern machine learning algorithms are easier to train, can learn more complex patterns, and can generalize better to new scenarios. Finally, there's been a shift to a much more disciplined approach to AI. This much more rigorous, evidence-based data science approach has helped keep expectations based in reality rather than hype. As a result, there have been many notable successes in modern data-driven AI. First, in 2005, the Stanford Racing Team's self-driving car, Stanley, was the first vehicle to complete DARPA's Grand Challenge. Stanley was able to drive itself over 11 kilometers with more than 100 sharp turns through narrow tunnels and a winding mountain pass. Second, in 2011, IBM's Watson competed against the top two former contestants on the TV trivia show Jeopardy. The data-driven AI emerged victorious with a score of over 77,000 compared to the human players who scored 24 and 21,000 respectively. Third, in 2014, Google's DeepMind created AlphaGo, an AI that could beat humans at the board game Go, which is astronomically more complex than chess. By 2017, AlphaGo could beat the top human player in the world and its successor, AlphaZero, could teach itself to become a superhuman player in under 24 hours. These successes and more have led to a new wave of excitement and hype surrounding modern data-driven AI.

The Third A.I. Winter

Are we finally on a steady path to artificial general intelligence, or are we riding a new tech bubble that's about to burst leading to a third AI winter? There have clearly been some amazing success stories in the era of data-driven AI; however, modern AI still has some pretty significant limitations. First, while data-driven AI has become really good at pattern detection, it's still not able to reason very well. Reasoning about information and creating new plans to achieve goals is still a very difficult challenge for modern AI. Second, data-driven AI relies on large amounts of labeled training data. There's a significant cost to collect, prepare, and label these datasets for training. Third, data-driven AI only learns what you teach it. As a result, bad data produces bad results, biased data produces biased results. Garbage in, garbage out. Because of these current limitations and other issues, there have been some notable failures of data-driven AI. First, there have been a few incidents involving self-driving vehicles. These collisions have led to vehicular damage, human injuries, and, in a few cases, human fatalities. Second, in 2016, Microsoft developed a self-learning chatbot for Twitter named Tay. Unfortunately, within 24 hours, some users had taught it to respond with racist, misogynistic, and hateful comments. Third, IBM's Watson didn't live up to expectations when it was first used in medicine to diagnose and recommend treatments for cancer. Feedback from medical experts indicated that it often produced obviously inaccurate and unsafe cancer treatment recommendations. So, the question you might be asking yourself right now is whether we're on the verge of a third AI winter? We have definitely seen an increase in hype around data-driven AI in recent years. Will we end up in the same situation that caused the first two AI winters, or have we finally entered a sustainable growth phase for artificial intelligence? There are many reasons to believe that another AI winter may be just around the corner. However, there are also many reasons to believe that this time might be different. To understand why, we need to learn about the trends driving modern data-driven AI.

Summary

In this module, we learned about the history of AI. First, we learned about classical AI, the first AI boom based on symbolic computation. Next, we learned about the first AI winter, the setbacks and failures of classical AI research. Then, we learned about knowledge-based AI, the second AI boom based on expert systems. Next, we learned about the second AI winter, the collapse of the expert systems industry. Then, we learned about data-driven AI, the third AI boom based on machine learning. Finally, we discussed the possibility of a third AI winter based on a potential tech bubble in AI that may be growing. In the next module, we'll learn about modern artificial intelligence, AI systems built on machine learning.

Modern A.I.

Introduction

How does modern artificial intelligence work? What is this machine learning stuff we keep hearing so much about? And, why might this era of AI be different from the two previous eras? To answer these questions, we need to learn about modern data-driven AI. As an overview of this module, first, we'll learn about machine learning, a type of AI that allows machines to learn how to make predictions given a set of data. Next, we'll learn about deep learning, a type of machine learning that learns how to map complex inputs to complex outputs. Then, we'll learn about reinforcement learning, a type of machine learning that learns how to choose actions given the state of its environment and a set of rewards. Next, we'll learn about the other technological trends that are driving the modern era of AI. Finally, we'll learn about state-of-the-art AI systems that are able to outperform humans in a variety of tasks.

Machine Learning

How do we teach machines without having to explicitly program them? We teach them with data, a process called machine learning. Machine learning is a sub-field of artificial intelligence based on statistics. It involves a machine learning how to solve a problem without being explicitly programmed to do so. The machines are able to do this by detecting statistical patterns in data. Essentially, with machine learning, we use existing data and a training algorithm to learn a model of the data. We can then feed new data into that model that it's never seen before and make predictions about the new data. A machine learning model is essentially a function. It's simply a mapping from an input to an output. In this case, it takes data as an input and produces a prediction as an output. For example, imagine we have a conveyor belt of fruit of different sizes. We need to separate the apples from the bananas as they go by. However, we only have sensor readings of each fruit's length and height. How would we build a model to predict which fruit is an apple and which fruit is a banana? First, we would need to create a table of data called a training set. This dataset contains the lengths and heights of a bunch of randomly selected apples and bananas. When recording these data, a human would label each type of fruit in each row as either an apple or banana based on visual inspection. Next, we would feed these data into a machine learning training algorithm. The algorithm would inspect each row of data containing the length, height, and type of fruit. The algorithm would learn how length and height correlate with each type of fruit. Apples are more round, and bananas are more elongated. The machine learning training algorithm captures the statistical relationship as a mathematical model. Finally, if we've done everything correctly, we can use this data to make predictions. We can feed this model a new apple or banana that it's never seen before, and the model will tell us whether the new fruit is an apple or a banana. More precisely, it will tell us a statistical likelihood that the new fruit is either an apple or a banana. This is a vastly oversimplified explanation of machine learning. However, it captures the essence of what it is that we're attempting to accomplish. We feed a set of data into a training algorithm, the algorithm produces a model, then we feed new previously unseen data into that model and the model will predict what the data represent. However, real-world problems typically involve a lot more columns and rows of data. In addition, they typically involve solving much more difficult problems in classifying fruit based on their size. There are a lot of tasks that we can perform with machine learning. For example, classification, regression, clustering, and anomaly detection. Classification is where we make a decision or prediction involving two or more categories or outcomes. For example, deciding whether to accept or reject a loan based on a customer's financial history. Regression is where we attempt to predict a numeric outcome based on one or more input variables. For example, predicting the price of a house based on its features and the sale price of similar houses. Clustering is where we group objects together based on similarities in their data. For example, grouping customers into marketing segments based on their demographics. An anomaly detection is where we find observations in the data that are different from the normal data. For example, detecting an unusual spike in the number of negative comments about a new product that we've just released. Machine learning is artificial intelligence that gives machines the power to identify patterns, make decisions, and predict outcomes using data alone. This is quite powerful for helping you and your business make better decisions, create smarter products, and automate manual labor. However, it takes quite a bit of knowledge and practice to learn how to create good, reliable machine learning models. In addition, traditional machine learning has some serious limitations in terms of the complexity of problems that it can solve. To overcome these limitations, we need to learn about more advanced tools like deep learning and reinforcement learning.

Deep Learning

How do we overcome the limitations of traditional machine learning and learn how to solve more complex problems? Deep learning is a new type of data-driven AI. It stacks multiple layers of machine learning models, one on top of the other. This allows it to learn more complex inputs and produce more complex outputs. We typically create deep learning models using a neural network. A neural network is a graph of nodes and edges based roughly on the organization of neurons in an organic brain. The nodes represent neurons in the brain. The edges represent the connections between the neurons. First, we feed data into the neural network via its input neurons. Next, mathematical operations are performed on the data in each of the neurons. Then, each neuron forwards its resulting value to all of the other neurons that it's connected to. We repeat this process for all of the nodes in the hidden layer of the network, as well as all the edges in the hidden layer. Finally, the network produces a prediction from its output neurons. There's a bit of math involved to make this entire process work; however, we're going to skip over all the math to keep things simple. A deep neural network is a neural network with more than one hidden layer. Adding more hidden layers allows the network to model progressively more complex functions. For example, imagine we wanted to teach a deep neural network how to detect human faces. First, we'd feed a set of labeled images into the input layer of this network. We do this to teach the network the faces of each person and their corresponding name. The first layer of the neural network would learn to detect geometric primitives, for example, horizontal, vertical, and diagonal lines. The second hidden layer would learn to detect more complex facial features, for example, eyes, noses, and mouths. The third hidden layer would learn to detect the general pattern for entire faces. The output layer would detect the most abstract representation of a person, in this case the name of the person being recognized. Each layer learns to extract more complex features from the preceding layer. As a result, the data becomes more abstract with each additional layer in the network. However, we can also flip these deep neural networks around. This allows us to use abstract inputs, like a description of a person's facial features, in order to synthetically generate complex outputs like entire human faces. This is a technique used in generative adversarial networks, the technology behind deep fakes. Deep learning takes us beyond using simple tabular data as input and producing simple predictions as output. With deep learning, we can use complex data as input and produce complex data as output. This includes text, images, audio, video, and more. For example, we can perform object classification, video segmentation, and motion detection in real time, but we can also generate synthetic output as well. Watch as this deep neural network generates images of imaginary celebrities. All of these images are being created by an artificial celebrity generator trained on 200,000 images of real celebrities. Not a single image is a real person though, they're all completely synthetic. Deep learning allows us to perform machine learning on a much wider ray of data types. This can be a quite powerful tool for automating tasks that involve complex relationships between complex data. However, it still has significant limitations when it comes to solving multi-step problems. To solve these types of problems, we need to learn about reinforcement learning.

Reinforcement Learning

How do we overcome the limitations of deep learning to solve multi-step problems? Reinforcement learning is a type of machine learning that learns to solve problems by trial and error. It starts with an agent interacting with an environment. The agent is trying to achieve a multi-step goal within the environment. For example, a self-driving car might be trying to drive on the roads in the real world. Its goal is to get you from your home to your office while avoiding obstacles in its path. The environment has state, which the agent can observe. For example, the state includes the car's location, the conditions of the road, and the location of other vehicles. The agent senses a state of the environment through what it sees, hears, feels or senses via other means. The agent has actions that it can take, which modify the state of the environment. For example, an agent can drive forward, drive backward, turn left or turn right. All of these actions change the car's position on the road within the environment. In addition, these actions can affect other vehicles and obstacles if they collide. Finally, the agent receives reward signals as it moves closer to its goal. The agent uses these reward signals to determine which actions were successful and which actions were not. For example, we might give the agent a point for each unit of distance it drives you closer to your destination. We might subtract points for breaking traffic laws, going off course or colliding with obstacles. We repeat this state action and reward loop over and over until the agent learns by trial and error how to operate effectively within the environment. The objective for the agent is to learn how to always choose the right action given any state of the environment that leads it closer to its goal. In recent years, we've combined deep learning with reinforcement learning to create deep reinforcement learning. This has led to some pretty amazing breakthroughs in data-driven AI in the past few years. For example, in 2013, DeepMind taught a deep reinforcement learning agent to play 8-bit video games like Atari's Breakout. In this example, the paddle is the agent and the game is the environment. The agent can observe only the pixels on the screen, which represent the state of the environment. The agent can then perform the actions, go left, go right or stay put, to change the state of the environment. The agent is then fed the game's score as its reward signal. It's then told to maximize its score, and it learns how to play the game through trial and error. It starts with random actions, but eventually learns to keep the ball in motion. After a few hundred games, it learns the physics of the game and can eventually play at expert level. By 600 training episodes, the agent discovers on its own how to tumble up the side of the wall. It then uses a strategy, just like an expert, to improve its score and overall game play. But, this is just the beginning. Deep reinforcement algorithms have also been used to teach artificial bodies how to walk. Once again, the agents is not programmed, told or shown how to walk, it simply learns how to do so on its own by trial and error. Once you can get a virtual body to walk in a computer simulation, you're one very big step closer to getting an actual robot to walk in the real world. Today, most successful applications of reinforcement learning involve video games, computer simulations, and toy problems. However, this technology is beginning to move into the world of business. In the very near future, you will likely see these algorithms perform a variety of complex, multi-step tasks with in the real world. Jobs involving multi-step tasks as simple as flipping burgers to complex financial portfolio management could all be automated with this technology in the next few years. Reinforcement learning is artificial intelligence that can solve complex, multi-step problems on its own. The machines are able to learn how to solve these problems without the direct help of humans. This is extremely powerful technology that will likely shape the future of artificial intelligence for many years to come.

Other A.I. Trends

What other technology trends are driving the modern AI boom, and how is AI pushing these industry trends forward as well? Beyond the three main trends that we've discussed so far, there are several other industry trends helping fuel the AI revolution. For example, we have trends like data science, laying the foundation for data-driven AI with new tools, techniques, and datasets; the Internet of Things, providing a massive stream of real-time data to allow AI to sense the world around it; big data technology is providing computing infrastructure for training AI with datasets beyond the limitations of traditional computing architecture; computer simulations, providing virtual training environments for reinforcement learning agents to learn safely by trial and error; video games, advancing the state of the art by developing non-player character AIs and using games as virtual AI training environments; graphics hardware, providing highly parallel computing devices for training AI models through graphical processing units, GPUs, and leading to new computer architectures like neural processing units; and virtual reality and augmented reality, allowing humans to train AI via a demonstration in virtual environments. Each of these trends is helping drive modern artificial intelligence forward. In addition, modern AI is also driving many of these trends forward as well. It's this value adding feedback loop that has everyone so excited about AI these days. All of these trends and this feedback loop have led to the state-of-the-art AI systems that we have today.

State-of-the-Art A.I.

So where are we at today with modern data-driven AI technology? To answer this question, we're going to look at tasks that can currently be performed with AI, as well as or better than humans. By current, we mean as of the beginning of 2020 when this course was first released. Unless you keep up to date with the latest AI research, many of these AI milestones may be a bit of a surprise to you. First, we have games. AI is currently better than the best human players in the world at most board games like chess and Go, trivia games like Jeopardy, most card games like poker, and most classic Atari video games. AI is rapidly approaching superhuman performance at more complex video games like Dota 2, Starcraft II, and Quake III Arena. Second, AI is currently better than humans and many visual tasks, including object recognition, gender classification, age estimation, and emotion detection. AI is also approaching human performance with more complex visual tasks like facial recognition and visual Q&A. Third, AI is currently better than humans at many communication tasks such as speech recognition, speech generation, handwriting recognition, language translation, basic reading comprehension, and even lip reading. Fourth, AI is proficient at many creative tasks such as creating original works of art like this one in the style of artists like Rembrandt, recreating images from one style to another using style transfer, and generating classical music indistinguishable from human composers. Fifth, AI is currently better than humans at several medical tasks, including diagnosing various diseases like cancer, heart disease, and microfractures, treatment tasks like custom tailoring treatments based on patient genetics, and minimizing side effects from prescription interactions. And, predicting prognosis, including predicting heart attacks, staph infections, patient life expectancy, and even suicide. And data-driven AI is getting better at new tasks every day. However, this is just the state-of-the-art AI performance benchmarks as of 2020. In the very near future, even more tasks will be within the reach of modern artificial intelligence.

Summary

In this module, we learned about modern data-driven AI. First, we learned about machine learning, a type of AI that allows machines to learn how to make predictions given a set of data. Next, we learned about deep learning, a type of machine learning that learns to map complex inputs to complex outputs. Then, we learned about reinforcement learning, a type of machine learning that learns how to choose actions given the state of its environment and a set of rewards. Next, we learned about other technological trends that are driving the modern era of AI. Finally, we learned about state-of-the-art AI systems that are able to outperform humans in a variety of tasks. In the next module, we'll learn how AI will impact you and your career in the IT industry.

A.I. and I.T.

Introduction

How is AI changing the world of information technology? How will AI impact you and your career as an IT professional? And, how can you leverage the power of AI in your day-to-day work? To answer these questions, we need to learn about artificial intelligence in the IT industry. There are three main ways that you can leverage AI as an IT professional. First, you can train custom AI models using datasets, a simulation or by demonstration. Second, you can build AI applications using pre-trained AI modules. And third, you can use pre-built AI tools to become more productive with your day-to-day tasks. Let's take a look at each of these three approaches in more detail.

Training A.I. Models

The first way we can leverage AI as IT professionals is to train our own AI models. This is generally the most difficult of the three approaches to leveraging AI in your business. In addition, it currently requires quite a bit of knowledge of data science and machine learning. However, as we develop more user friendly tools, it will become much easier and more accessible to all IT professionals. There are three main approaches to training AI models, training via dataset, training via simulation, and training via demonstration. First, we can train AI models using our own data in the form of a training dataset. This approach is often used for supervised machine learning, which we saw earlier. All of the machine learning and deep learning examples that we saw in the previous module fall into this category. This approach involves tasks like collecting, cleaning, organizing, and labeling our data for training. In addition, it also involves tasks like training, selecting, verifying, and deploying our models into production. This is currently the most common of the three approaches to training AI models, but it is also one of the more difficult approaches. However, it's becoming easier every day with more powerful and user friendly tools like TensorFlow with Keras and AutoML. Second, we can train AI models using a computer simulation. This approach is often used for reinforcement learning. We train the agent in a computer simulation, which acts as a virtual sandbox for the real-world environment. Then, we fine tune the agent's behavior in a safe, real-world environment to iron out any training issues. Finally, we deploy the agent into the real world while we monitor its behavior and collect new data to further improve the model. All of the reinforcement learning examples we've seen so far fall into this category as well. This approach is currently less common, but is becoming more common for solving complex, multi-step problems. Unfortunately, this is typically the most difficult of the three methods of training AI models. Finally, we can train AI models by demonstration. With this approach, we physically show the agents how to perform the tasks we want completed. The agent observes the environment and the set of actions that we chose to get to the goal state.

Then, the agent learns to replicate our behaviors, compensating for variations and deviations with each new instance of the task. For example, we have collaborative robots, or cobots, which learn to complete tasks by manual instruction rather than explicit programming. This approach requires no programming or machine learning skills. All of that work has already been completed by someone else. Instead, this method is designed specifically for non-technical end users. It's currently the least common approach, but will likely become very popular as we develop better training tools and techniques. All three of these approaches have various pros and cons. In addition, one approach may work well for solving certain problems, but not at all for other problems. So, it's important to understand each of the three approaches and use the approach that makes the most sense for each situation.

Building A.I. Apps

The second way we can leverage AI as IT professionals is to build modular AI applications. Most modern AI applications are built by wiring together a set of smaller modules, each containing a specific pre-trained AI model. Each of these modules performs a much smaller AI task and feeds its results into other modules further down the chain. The result is an application that can perform much more complex AI tasks as a whole. For example, imagine that we work for a large soft drink company called Big Cola, Inc. Our marketing team needs to identify possible social media influencers to promote our brand. They currently do this manually by combing through social media posts, looking for positive mentions of our product. They manually verify that the post contains an image with our product, that the customers in the photo are happy, and that the sentiment about the product is positive. When they find a potential influencer, they post a reply, offering them free products to help promote our brand. This is definitely not something a programmer could automate easily without the help of artificial intelligence. However, by combining the right set of AI modules together, this is actually a relatively simple task to program. We start with the module that scans our followers' social media accounts for posts that mention our brand. If we find a post that mentions our brand, we feed the image into our product detection algorithm. If the module detects our product in the image, then we feed the image into our face detection module. If the module determines that the faces in the image are happy, then we feed the text into our sentiment analysis module. If that module determines that the sentiment of the text is positive, then we notify marketing about the potential product influencer. From there, the marketing team can verify and reach out to the potential influencer to offer them free products to help promote our brand. It's the combination of these small AI modules that will lead to many of the novel AI applications of the future. In addition, by adding these small AI modules into our current applications, we can breathe new life into our old apps. It will be up to us as software developers and IT professionals to create the next generation of applications using these pre-trained AI modules. There are a wide variety of off the shelf pre-trained AI modules available today that can perform a variety of AI tasks. They can detect objects, faces, emotions, sounds, gestures, and much more. And the list keeps growing every day. For software developers, it's likely that a large part of our jobs in the near future will be wiring together these small AI modules to build larger AI applications. We have a variety of pre-trained models available today from open source repositories on the internet. For example, Model Zoo, ModelDepot, and the Open Neural Network Exchange, or ONNX. We also have hosted, cloud-based AI services like Microsoft Cognitive Services, Google's Cloud AI services, and Amazon's AWS AI services. For non-developers, there are drag and drop tools in development like Microsoft's Lobe AI. These tools allow you to build simple, composable AI applications without having to write any code. You simply drag the pre-trained models onto the canvas, wire them together, test, and deploy your app. If you want to build modular AI systems as part of your day-to-day job, everything you need to get started is already available today. You should begin by learning about the various types of AI modules, their abilities, and their limitations. You need to know what tools you have available in your AI developer toolkit in order to build the cutting-edge AI applications of the future.

Using A.I. Tools

The third way that we can leverage AI as IT professionals is to use pre-built AI tools to become more productive employees. There's an old saying that if you can't beat them, join them. This statement couldn't be more true with artificial intelligence. Once an AI tool can perform a task more efficiently than a human, there simply is no hope trying to compete with it. Machines are simply cheaper, faster, more scalable, and more reliable at some tasks than humans. So, rather than trying to compete against AI, I strongly recommend that you learn to work with AI instead. You can do this by augmenting your human intelligence with artificial intelligence tools. For example, a human alone is no match for an AI at playing a game of chess. However, even an average human assisted by a chess-playing AI tool can beat even the best human chess grandmasters in many AI chess programs. Augmenting your intelligence with AI tools allows you to be more productive than your peers that are not using AI tools. To get an idea of what AI-powered tools look like, let's take a look at a few recent examples. For software developers, there are AI-powered tools to help you become a more productive programmer. For example, we have tools like Deep TabNine, which is like auto complete, but for entire lines of code. The software was trained on millions of lines of open source repository code. In addition, you can extend its training with your own code as well. It then accurately predicts what code you're likely to type based on all of the open source training data, all of the code you've previously typed, and the code you're currently typing. For data professionals, there are AI-powered tools to help you become more productive with your data. For example, there are automated data transformation tools like Microsoft Excel's Flash Fill and Power Query's Add Column by Example tools. These tools allow you to transform your data by providing them with a few examples of what you want your transformed data to look like. The tools then synthesize a new data transformation script and apply that script to the remaining values in the table. For managers and executives, there are AI-powered tools help you make better decisions. For example, we have AI-powered business intelligence tools like the Q&A tool in Microsoft's Power BI. This feature allows you to ask a question about your company's data in plain English. It then produces an answer to your question based on your data in the form of a table or data visualization. But this is just the beginning. There are so many new AI-powered tools on the horizon that I can't even begin to scratch the surface with just a handful of examples. What's most important is that you're learning how to use these tools now to stay ahead of the curve. These tools can help you be more productive, stay ahead of the competition, and remain employable in our new data-driven economy. Using these AI-powered tools will also eliminate some of the boring, tedious, and repetitive tasks, which will hopefully make your job more enjoyable as well.

Summary

In this module, we learned how AI is changing the world of information technology and how it will impact you and your career as an IT professional. First, we learned that you can train custom AI models using a dataset, a simulation or by demonstration. Next, we learned that you can build AI applications using pre-trained AI modules. Finally, we learned that you can use pre-built AI tools to become more productive with your day-to-day tasks. In the next module, we'll learn about the future of artificial intelligence and how it will affect our society as a whole.

Future of A.I.

Introduction

How will AI affect our society, what impacts will it have on jobs, and what new ethical challenges will it create? To answer these questions, we need to learn about the future of artificial intelligence. As an overview of this module, first, we'll learn about the potential impact of artificial intelligence on our society. Next, we'll learn how AI will affect jobs and our labor economy. Finally, we'll learn about the ethics of AI and how it will likely impact humanity as a whole.

A.I. and Society

How will AI affect our society and the world we live in? Our entire society, the world as we know it, is preparing to enter a new industrial revolution. An AI revolution. This revolution will likely be as profound as the agricultural, the industrial, and the information revolutions before it. For example, in the near future we'll have self-driving vehicles that will eventually replace all human drivers in automobiles, semis, boats, and airplanes. We'll have collaborative robots help us perform manual labor. They'll be taught to perform tasks by demonstration rather than explicit programming. We'll have virtual assistants to answer questions and perform digital tasks. They will learn your behaviors and your preferences to anticipate how best to assist you. We'll have smart buildings that will optimize their own energy efficiency and anticipate the needs of their occupants. We'll have advanced human/computer interfaces based on voice recognition, pose estimation, eye tracking, and eventually brain computer interfaces. AI will recognize complex patterns and sensor data that correspond to words, gestures, emotions, and intentions, and we'll eventually have smart cities that will optimize municipal resources like electricity, water, waste, and traffic without any human intervention. We'll embed artificial intelligence in almost every aspect of our environment. AI will likely become as common and pervasive in the infrastructure of our society as electricity is today. Essentially, artificial intelligence will just be woven into the fabric of our society. This is going to have a significant impact on our day-to-day lives. AI will likely bring about massive social, political, economic, legal, and ethical changes. Many of these changes will likely happen within our lifetimes. First, AI will likely lead to a much more nonlinear economy and power structures within our society. Those with smart machines are going to have even more power, and those without smart machines are going to have even less power. This will likely create much greater inequality in our society unless we implement policies to prevent this kind of nonlinear growth. In addition, data will likely become one of the most valuable resources in our information economy. Every sensor observation, business transaction, computer interaction, and social media post will all be used to train AI models. So, those with the most data will wield tremendous power in our information economy. In fact, there exists today datasets within private, for-profit companies that are currently valued at over a billion dollars. And these examples are just the beginning. Artificial intelligence will inevitably create fundamental transformations in our society in ways we can't even predict. During the previous technological revolution, the information revolution, we've seen personal computers, which led to the rise of the internet, which gave birth to social media, which led to the rapid adoption of smartphones. Just think how different our world is now than it was just a few decades ago before the internet. In fact, as of 2019, people in the United States now spend more time on the internet than they do watching television. At the beginning of the information revolution, it's unlikely that anyone could have predicted this fundamental change in our lives. It just wasn't even on anyone's radar at the time. In the same way, within our lifetimes there will likely be significant social, political, economic, legal, and ethical transformations caused by the AI revolution. Many of these changes we can't even see coming.

A.I. and Labor

How will AI impact our labor economy, what jobs are at risk of automation, and what jobs are safe? The emergence of modern AI is beginning to have a strong impact on our labor economy. In the near future, this impact on labor will likely be tremendous. AI will replace a significant number of jobs in the next few decades. Given the economics driving this trend, it's less a matter of if a given job will be replaced and more a matter of when. In fact, some experts are currently attempting to predict which jobs are most likely to be automated by AI. They do this by analyzing aspects of each job like the repetitiveness and complexity. In fact, we can even predict what type of AI technology will be necessary to automate a variety of occupational tasks. For example, we can see which retail jobs are likely to be automated in the coming years as AI continues to be applied to retail sales. Even the medical industry isn't immune to the coming wave of automation. While these medical tasks are generally more complex and less repetitive than most jobs, they're rapidly becoming within the reach of modern AI. We can then extrapolate this information to determine which sectors of our economy will be hit the hardest by AI automation. The length of the bars in the chart above represent the total number of workers in each type of employment in the United States as of 2016. The red bar segments represent the proportion of jobs likely to be automated in the foreseeable future. The blue bar segments represent the proportion of jobs that will still remain. As we can see, the future landscape of labor in the next few decades is going to look radically different than it currently does today. In fact, we can even use these data to predict which cities will be most impacted by unemployment from AI automation. As we can see, Las Vegas, Nevada, where I live, is currently at the top of the list. In fact, it's predicted that 65% of all jobs in Las Vegas are at risk of automation by 2035, and half of all jobs in the United States are at risk of automation in the next two decades. There are certainly some jobs that will be more resistant to automation. These jobs require more human aspects like creativity, empathy, and trust. However, there many jobs today that are unlikely to exist in the next few decades. This will create tremendous disruption to our labor economy with unemployment, retraining, and early retirement. On the other hand, it will create tremendous opportunities for new jobs that don't yet exist and the IT professionals that build these automation systems. The big question right now is whether AI will create more jobs than it eliminates. Historically, technological revolutions have created more job opportunities than they've destroyed. However, there's pretty compelling evidence to suggest that the AI revolution may be different. Imagine if you could ask a horse in the early 1900s how the automobile or tractor would have changed its life. It probably would have said that a car or a tractor is going to make things a lot easier. Unfortunately for the horse, these technologies also made them obsolete to the economy. In fact, we hit peak horse in 1915 just as the automobile and the tractor began to scale up in production. We're beginning to transition from an economy where most of the work of value is done by humans to one where most of the work of value will be done by machines. As a result, it's important to ask yourself which side of this new economy will your job be on, the side that's leading our new economy or the side that's being eliminated?

A.I. and Ethics

What new kinds of ethical issues will AI bring about? Will this technology ultimately benefit or harm humanity? The emergence of modern AI has led to some rather interesting ethical issues in recent years. For example, we now have facial recognition systems and mass surveillance that may be violating our right to privacy. We have AI-generated advertisements that use each consumer's unique behavioral profile to manipulate their purchase decisions. We have text generation software, like GPT-2, that can generate propaganda and fake news on a massive scale. We have deep fake technology that could be used to impersonate celebrities or politicians for nefarious purposes. We have deep nude technology that can digitally remove a person's clothing without their consent. And we have semi-autonomous weapons that are very close to becoming fully autonomous weapons. These are just a few of the current ethical issues that we're now facing with modern AI. And, please keep in mind that there are much more advanced and sophisticated AI technologies just over the horizon. Given this, the number and severity of these ethical issues is likely to increase significantly in the near future. To put it simply, we're going to have some very difficult ethical issues to deal with in our lifetimes. For example, what does privacy mean in a world with constant and pervasive AI-enabled surveillance? We currently have very little privacy, and we're about to get a lot less. How do we avoid bias and discrimination in our AI models? It's easy to accidentally or intentionally create biased AI models that will directly impact the lives of millions of people. Even more concerning, should we allow AI to be weaponized? Should we ban fully autonomous weapons before we enter a new AI arms race? And if so, how long until the conflict pressures a government to override this directive? How should we allocate resources in a post-human labor world? Some economists suggest that we will need a guaranteed basic income or a negative income tax. But, how should we pay for that? Should we tax robots in order to offset the inevitable unemployment from automation? How do we even begin to determine the true value of each robot's labor in order to tax them appropriately? And if we tax robots, what right should they have in our society? I mean, we fought wars over the idea of no taxation without representation. What will the machines, or the capitalists that own them, demand in return for paying their fair share of taxes? The most important of these ethical questions, though, is what does this all mean for humanity? What is our purpose in a world where machines do all of the work of real economic value? Does this technology set us free, or does humanity eventually become obsolete? Many experts think that we'll eventually have to merge with our technology or it'll inevitably destroy us. The idea may seem far fetched now, but these cell phones in our hands are already an extension of our brains, and the younger generation is ready and willing to have them connected directly to their minds if and when the technology finally exists. It may sound strange, but we're likely one of the last generations of homo sapiens to inhabit the earth. Whatever comes next will likely be very different than what we've known for the past 200,000 years. Technology is inherently amoral. It is neither intrinsically good nor evil. The same technology can be used to take mankind to the moon or it can be used to propel warheads into cities. As a result, it's going to be up to us as a society to choose whether we want to use AI to make the world a better place for everyone or to use it for our own profit, power, and control. The choice is ours to make. What will you choose?

Summary

In this module, we learned about the future of artificial intelligence and how it will impact our world. First, we learned that AI will have a profound impact on our society and our day-to-day lives. Next, we learned that AI will eliminate many jobs, but will also create new jobs and new opportunities. Finally, we learned about the ethics of AI and how this technology will likely impact humanity as a whole. In the next module, we'll learn where to go next and wrap things up for this course.

Conclusion

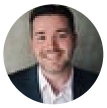
Next Steps

Now let's wrap things up for this course and learn where to go next to continue our AI journey. Where should you go next? What should you do to apply the knowledge that you've learned today? And, where should you go if you have any questions or feedback? First, I recommend that you practice to reinforce all of the information that you've just learned. So, please be sure to complete all of the learning check questions for this course before you move on. This will help you to retain the knowledge that you've learned and maximize the value that you derive from this course. Next, if you're interested in learning more, I recommend taking additional courses on data science, machine learning, and artificial intelligence. These courses will provide you with the next steps on your AI journey. You can find an up-to-date list of all of my courses on these topics and more at the following URL. There's plenty more to learn, so be sure to get started right away. Finally, I encourage you to engage with me and others in this online learning community, so please be sure to rate this course, ask questions in the discussion board, leave comments to let me know what you found valuable and what could be improved, and feel free to send me a message on social media if you'd like to provide me with feedback in public. All of my social media handles can be found on my website at the following URL.

Course Summary

In this course, we learned about artificial intelligence from a high-level perspective. First, we learned that AI is a technology that makes rational decisions in order to achieve a goal. Next, we learned about the various booms and busts in the history of AI that led us to where we are today. Then, we learned about modern data-driven AI, including machine learning, deep learning, and reinforcement learning. Next, we learned how you can leverage AI in your career as an IT professional by training AI models, building AI applications, and using AI tools. Finally, we learned how AI will likely impact our society, our labor economy, and our ethics. Thank you for joining me for this introductory course on artificial intelligence. I hope that you found this information valuable, and that it's helped you to move forward on your AI journey. Please be sure to keep in touch via my website and social media, and I hope to see you again in another course in the future.

Course author



Matthew Renze

Matthew is a data science consultant, author, and international public speaker. He has over 17 years of professional experience working with tech startups to Fortune 500 companies. He is a...

Course info

Level	Beginner
Rating	★★★★★ (34)
My rating	★★★★★
Duration	1h 14m
Released	13 Dec 2019

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