

Considering that public safety is on the line, auto regulations should be some of the strictest regulations in the modern world.

- **Public trust issues:** Most people do not yet believe that an autonomous car can keep them safe. Trust and consumer acceptance are the crucial factors. For example, if there is a situation when an autonomous car is being forced to choose between the life of a passenger versus that of a pedestrian, what should be done? Consumers may refuse the whole idea of driverless cars. No technology can be perfect, but the question is which company will be able to best convince its customers to entrust their lives to them.

Advances similar to those for self-driving cars are being explored in other autonomous vehicles. For example, several companies have already launched trials of self-driving trucks. Autonomous trucks, if ever fully deployed, will have a massive disruptive effect on jobs in the transportation industry. Similarly, self-driving tractors are being tested. Finally, autonomous drones and aircrafts are also being developed. These developments will have a huge impact on future jobs while creating other new jobs in the process.

Self-driving vehicles have become part of this world of technology in spite of related technical and regulatory barriers. Autonomous vehicles are yet to achieve the knowledge capabilities of human drivers, but as the technology improves, more-reliable driving vehicles will become a reality. Like many technologies, the short-term impact may be cloudy, but the long-term impact is yet to be determined.

► SECTION 10.7 REVIEW QUESTIONS

1. What are some of the key technology advancements that have enabled the growth of self-driving cars?
2. Give examples of regulatory issues in self-driving cars.
3. Conduct online research to identify the latest developments in autonomous car deployment. Give examples of positive and negative developments.
4. Which type of self-driving vehicles are likely to have the most disruptive effect on jobs, and why?

10.8 IMPACT OF ROBOTS ON CURRENT AND FUTURE JOBS

Robotics has been a boon to the manufacturing industry. Besides automation that is possible with robotics, new technologies such as image recognition systems are automating jobs that used to require humans for inspection and quality control.

Various industry experts report that by 2025, up to 25 percent of current jobs will be replaced by robots or AI. Davenport and Kirby's book *Humans Need Apply: Winners and Losers in the Age of Smart Machines* (2016) focuses on this topic. Of course, many other researchers, journalists, consultants, and futurists have given their own predictions. In this section, we review some related issues. These issues are relevant to AI in general and robotics in particular. Thus, Chapter 14 will also cover these issues, but we want to study these in the context of robotics in this chapter.

As a group activity, watch the following video: <https://www.youtube.com/watch?v=GHC63Xgc0-8>. Also watch <https://www.youtube.com/watch?v=ggN8wCWSIx4> for a different view. What are your takeaways from these videos? What is the most likely scenario in your view? How can you prepare for the day when indeed humans may not need to apply for many jobs?

IBM Watson's ability to digest vast amounts of data in the medical research literature and provide the latest information to a physician has been written about in the literature. Similar job enhancement opportunities in many other areas have been seen. Consider

this: AI-powered technologies such as narrative science and automated insights that can ingest structured data include visualizations generated by software such as Tableau and develop an initial draft of a story to narrate what the results convey. Of course, that would appear to threaten the job of a journalist or even a data scientist. In reality, this can also enhance that job by presenting an initial draft of a story. Then the storyteller can focus on more advanced and strategic issues related to that data and visualization.

The power of consistency and comprehensiveness can also be helpful in the completion of jobs. For example, as noted by Meister (2017), chatbots can likely provide much of the initial human resource (HR) information to new employees. Chatbots can also be helpful in providing such information to remote employees. A chatbot is more likely than a human to provide complete and consistent information each time. Of course, this implies that workers whose main job is to recite such information to each new employee or serve as the first source of information may not be needed.

Hernandez (2018) identified seven job categories into which robotics in particular and AI in general will expand. She also quoted several other studies. According to a McKinsey & Co study, AI could result in 20–50 million new jobs in the next 10–15 years. McKinsey also predicts that 75–375 million people may need to change jobs/occupations in the same time period because of robotics and AI. According to Hernandez, the following seven jobs are likely to increase:

1. **AI development:** This is an obvious growing area. As more companies develop products and services based on AI, the need for such developers will continue to increase. As an example, iRobot Co, which produces robotic vacuum cleaners, is shifting its hiring from hardware to software engineers as it works to develop its next generation of products that are more adaptive and AI based. Newer robot vacuums are going to be able to “see” a wall. They can also alert the owner to how long the cleanup took and the area swept.
2. **Customer–robot interactions:** As more companies deploy robots in these organizations, acceptance of such robots by both employees and customers is uncertain. A new job category has emerged to study the interactions between a robot and its coworkers and customers and to retrain the robot or take this information into account in designing the next generation. Clearly, the study of such interactions may enable the use of analytics/data science as well.
3. **Robot managers:** Although robots might do the bulk of their work in a specific situation, humans will still need to observe them and ensure that the work is progressing as expected. Further, if any unusual conditions arise, a human worker has to be alerted and respond to the situation. This would be true in many settings where the robots are performing the bulk of tasks in areas such as manufacturing. Hernandez (2018) gives an example of Cobalt robots, which work as security guards. These robots alert a human whenever an intruder is detected or they notice anything unusual. Of course, a human robot manager is typically able to supervise many more robots than human workers because the primary role of the manager is to supervise them and respond to unusual situations.
4. **Data labelers:** Robots or AI algorithms learn from examples. And the more examples they are given, the better their learning can be (see Chapter 5 for a longer description of this issue). For example, image recognition systems in virtually every setting (see Chapter 5 on deep learning for examples) require as many examples as possible to improve those systems’ recognition capability. This is crucial for not just facial recognition but also image applications to detect cancer from X-ray images, weather features from radar images, and so on. It requires that humans view the example images and label them as representing a specific person, feature, or class. This work is tedious and requires humans. Many companies have hired hundreds

of human labelers to view the images and tag them appropriately. As such image applications grow, the need for labelers will also increase. These workers are also needed for continuous improvement of the robot or AI algorithms by recording false positives or newer examples.

5. **Robot pilots and artists:** Robots in general and drones in particular are being used to provide action shots using overhead cameras or angles that would be difficult if not impossible for humans to do. Drones could also be dressed as birds or flowers and provide a unique overview as well as enhance a setting. Similarly, other robots might be dressed in unique outfits to create a cultural ambiance. Such designer/makeup artists are being hired by many companies that provide services for events such as concerts, weddings, and so forth. In addition, drone piloting has become a highly specialized skill for entertainment, commercial, and military applications. These jobs will increase as the applications evolve.
6. **Test drivers and quality inspectors.** Autonomous cars are already becoming reality. With each such automation of vehicles, at least for the foreseeable future, there is a growing need for safety drivers who monitor each vehicle's performance and take appropriate actions in unusual situations. Their jobs would not entail the use of remote controls as drone pilots employ but continuous watch of the vehicle's operations and response to emergent situations. Similar jobs also exist in other robotic applications as the robots are trained and tested to work in specific settings.
7. **AI lab scientists.** This brings us to the very first category of new jobs we identified—AI coders. While their job is to develop the algorithms for robots or AI programs, a similar category of highly specialized users is also emerging—folks who are trained and employed in using these hardware and software systems for special applications. For example, physicians have to undergo additional training to be certified in the use of robots in their surgeries, cardiology and urology practices, and so on. Another category of such specialists involves scientists who customize these robots and AI algorithms for their domain. For example, quite a few companies are using AI tools to identify new drug molecules to develop and test new treatment options for diseases. AI could speed such development. These scientists not only develop their domain expertise but also data scientists' knowledge or at least the ability to work with data scientists to create their new applications.

Although the preceding list identifies several categories of jobs that are likely to develop or increase, millions of jobs are likely to be eliminated. For example, automation is already impacting the number of jobs in logistics. When autonomous trucks become a reality, at least some of the well-paying jobs in transportation will likely be gone. There might be disagreements on when the massive change may occur, but the long-term impact on jobs is certain to occur. The major issue this time is that many of the knowledge economy “white-collar” jobs are the ones that are more likely to be automated. And this change is unprecedented in history. Many social scientists, economists, and leading thinkers are worried about the upheaval that this next wave of robotic automation will cause, and they are considering various solutions. For example, the concept of universal basic income (UBI) has been proposed. UBI proponents argue that giving every citizen a minimal basic income will ensure that no one goes hungry despite the massive loss of jobs that is likely to occur. Others, for example, Lee (2018), have argued that providing UBI may not satisfy human beings' need for meaningful achievements and contributions in life. Lee proposes a social investment stipend (SIS), which would recognize individuals' contributions to society for providing support and care, community service, or education. The stipend would be paid in recognition of an individual's service in one of these categories. Lee's book focuses on this issue and is one of the many ideas being proposed on how to plan for and address the upcoming disruption from automation. Our goal in this section is to simply alert you to these issues.

► SECTION 10.8 REVIEW QUESTIONS

1. Which jobs are most at risk of disappearing as the result of the new robotics revolution?
2. Identify at least three new categories of jobs that are likely to result in a significant number of new employees.
3. Are the tasks undertaken by data labelers just for one time or longer lasting?
4. Research the concepts of UBI and SIS.

10.9 LEGAL IMPLICATIONS OF ROBOTS AND ARTIFICIAL INTELLIGENCE

As we noted in the previous section, the impact of AI in general and robotics in particular is far and wide and can be studied both specifically in the context of robots and more broadly for AI. Legal implications of robotics and AI are discussed in this chapter and in Chapter 14. Many legal issues are yet to be untangled as we embrace and employ AI technologies, robots, and self-driving cars. This section highlights some of the key dimensions of legal impacts related to AI. The following material has been contributed by Professor Michael Schuster, assistant professor of Legal Studies at the Spears School of Business at Oklahoma State University. He is a noted expert in legal matters related to AI. He has also published extensively in this area.

Tort Liability

Self-driving cars and other systems controlled by AI represent a Pandora's box of potential tort liability (where a wrongful act creates an obligation to pay damages to another). Imagine that a motorcyclist is injured when a self-driving car veers into his lane and they collide. This was the alleged event that led to *Nilsson v. General Motors* (N.D. California, 2018)—a case with the potential to address difficult questions of AI-created tort liability. The suit settled, and thus did not clarify who should pay when someone is injured by an AI-controlled system. Potential candidates for liability include programmers of an AI system, manufacturers of a product incorporating AI, and owners of a product at the time it harmed another. Medical malpractice litigation may similarly be altered by new technologies. As doctors defer some decision making to AI, lawsuits for injurious medical care move from professional liability cases (against the doctor) to product liability (against manufacturers of AI systems). An early example of this phenomenon is the lawsuits over allegedly botched surgeries using the Da Vinci Surgical Systems robot.

Patents

The introduction of AI systems capable of independent or human-assisted invention raises a variety of questions about patenting these creations. Patents have traditionally been granted for novel inventions that would not have been an obvious improvement of a known technology as viewed through the eyes of an average party working in the relevant field. Accordingly, this standard has traditionally asked whether a new technology would have been obvious to a human, but as AI becomes ubiquitous, the scope of what is obvious expands. If the average person in an industry has access to an AI system capable of inventing new things, many improvements on known technologies can become obvious. Since these improvements would then be obvious, they would no longer be patentable. Inventing AI will thus make it harder for a human to get a patent as such technology becomes more commonplace. Moving beyond human inventions, a host of issues arise regarding AI that can *independently* invent. If a person does not contribute to the invention (but rather merely identifies a goal to be achieved or provides background