Lesson 6
# ▷ ▐ Lesson 6: The Future of AI and Careers

## LESSON SKILLS

After completing this lesson, you will be able to:

- Explain how AI will benefit life in the future.
- Identify careers in AI.
- Describe what ethical considerations there will be in the future of AI.
- Identify global causes that AI will provide some solutions for.
- Discuss what "soft skills" will be needed in AI careers of the future.
- List companies and organizations that are paving the way for the future of AI.
- How some women in AI are leading its progress around the world.

## KEY TERMS

- AI Careers
- AI Organizations
- Ethical Consideration
- Global Causes
- Soft Skills
- Theory of Mind

## Points to Ponder

These Points to Ponder are designed to help you focus on key elements in this lesson. They are also suitable for use to spark discussions or individual research.

- What is "Theory of Mind" and why is it only a concept for the future?
- How are the most modern AI systems paving the way for the future?
- What global causes will be addressed by AI?
- What ethical considerations will need to be made for the future of AI?
- Identify some AI organizations.
- Describe ways that different fields will be impacted by AI.
- What are some entry level and advanced jobs in the artificial intelligence field?
- What are some companies that are at the forefront of AI development?
- Discuss some soft skills that are important to a career in AI.

**Overview**

This lesson introduces the future of AI and careers in the field. AI is developing at a rapid rate and new advancements and applications happen every day. It offers new careers in the future and redefines some occupations that already exist. AI's capabilities can benefit many people in their daily lives and can help provide solutions for many global problems. During this lesson, the exciting future of AI will be explored, and its possible advantages and challenges considered.

## ▷ ▐ AI Moving to the Future ●

*Objectives*
*1.1.1: Define Artificial Intelligence and how it relates to problem solving*
*1.1.6: Describe AI's significant impact in different areas*
*7.1.2: Explain how AI will help solve problems*
*8.1.1: Identify what ethical considerations will need to continue to be addressed in AI in the future*
*7.1.1: Explain why the "Theory of Mind" AI will be in the future*

AI is a very exciting field. It is defined as a branch of computer science that enables computers to mimic or copy human behavior. John McCarthy, who is considered the father of AI, defines it as such- "Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs." AI has the subsets of machine learning and deep learning. All areas of AI are growing rapidly and advancing. Although AI's Theory of Mind remains far into the future, it would result in AI systems being able to have independent thoughts and feelings, and they would be able to adjust their behavior and actions independently of humans. Thinking about the possibility of this happening very far into the future requires great consideration in the ethical areas of privacy, security, bias and responsibility.

AI's history has shown that it can be very helpful in many ways to the world and to mankind.

**Figure 6-1: A robotic prosthetic hand
playing the piano**

Advancements in medicine using AI include diagnosing patients, drug discovery and development, improving communication between physician and patient, transcribing medical documents, such as prescriptions, and remotely treating patients. Because AI has the ability to analyze very large data sets, it can put together insights and make predictions for the best patient care. In the future of medicine, it is predicted that AI will include tasks that range from simple to complex. Some examples of these are:

- answering the phone, talking to patients, making appointments
- reviewing medical records, finding health trends
- designing therapeutic drugs and devices
- reading radiology images
- making clinical diagnoses and treatment plans
- completing surgeries



**Figure 6-2: Surgical robotics**

Another important area of our lives that AI will continue to be part of in our future is recreation. Shopping, traveling, watching TV, listening to music, exercising, playing sports and social media use will all continue to develop as AI advances. Because AI can create unique personalized experiences, some ways that recreation will be impacted in the future are as follows:

- **Photography** – Be able to completely generate images and give them 3D features
- **Music** – Holographic live performances and touch responsive instruments
- **Restaurants** – AI culinary apps narrate your dishes and provide nutritional data
- **Gaming** – Cameras and sensors allow for a "full body" experience
- **Travel** – Interactive robot travel guides
- **Shopping** – Virtually try on clothes and simulate placing furniture in a home before making any purchases
- **Exercise** – Personalized trainers and equipment

> 🔗 **Link to Learn More**
>
> View these slides to learn more about its impact on social media
>
> - AI in Social Media 🔗 (Slideshow)

## ▷ 🔖 AI and the oceans　　　　　　　　　　　　　　　　　　　●

AI can be used to benefit people and our planet in many ways. It is helpful to the future of what makes up 70 percent of our earth's surface, the oceans. The oceans hold 96 percent of all earth's water. The oceans are very important to life on earth. They provide over half of the oxygen we breathe, provide food and regulate climate. Table 6-1 shows ways AI helps keep our oceans healthy and examples of the technology used and being developed for the future.

| Application | Technology | Example |
|---|---|---|
| **Exploring the Oceans** | Autonomous robots, scuba divers and ships can go where humans can't to ocean areas too deep or too dangerous | Like driverless cars – soon there may be skipperless ships exploring the oceans |
| **Collecting Data** | AI technology collects ocean data like temperature, marine life, and events like earthquakes and tsunamis | CRABSTER- AI powered robot from Korea also explores shipwrecks and maintains gas pipelines. |
| **Cleaning the Oceans** | AI satellites can identify where collections of plastics are then ocean cleanup can be deployed to those areas | OCEAN CLEANUP Organization uses this technology |
| **Studying and Saving Marine Life** | AI helps conservationists monitor endangered species. Unique species are identified by algorithms | OOI CLOUD PROJECT uses AI to share data with the scientific community to study climate change |
| **Maintain and Repair Oil/Gas Pipelines** | AI robots find leaks and can work on repairs | DIAKANT, a San Diego company, creates robots that can find and repair oil leaks in pipes |

| | | on the ocean floor. |
|---|---|---|
| **Create safe fishing** | AI apps can predict weather and monitor fish populations to lead fisherman to safe efficient work | SMALL_SCALE FISHERIES RESOURCE and COLLABORATION HUB is an online multilingual platform for fishers to use. |
| **Sustainable fishing practices** | AI technology used to help navigate underwater nets and attract certain kinds of fish. It can determine where and when to fish and even sort the fish once they are caught. | GAME OF TRAWLS project applies the latest AI technology to fishing gear including cameras and sensors. |
| **Locating Pollution** | AI Robot fish are used to determine where pollution is in the ocean and collect data on it to help plan clean ups. | Robo- Fish "work" in northern Spain to autonomously find contamination in water and send back the information that finds illegal dumping in real time. They serve as "harbor police fish"! |

**Table 6-1: Ways AI helps keep oceans healthy**



**Figure 6-3: SCUBA droid**

> 🔗 **Link to Learn More**
>
> Read more about ocean robots and future AI technology
>
> - 12 Robots that Could Make (or Break) the Oceans🔗
> - Google Searches for Its Voice🔗

**Suggested activities**

- AI for Oceans🔗 (Online)
- Research the Future of AI🔗 (Hands-on)
- Use Your Imagination🔗 (Teacher-Led)

**Demonstration videos**

- The Future of Music🔗 (SchoolTube 1 minute)
- Future Technology World 2050🔗 (YouTube 6 minutes)

# ▷🔖 AI and Careers ●

*Objectives*
*7.2.1: Identify careers that use AI*
*7.2.2: Explain some soft skills that people in AI careers will need to be successful*
*7.2.3: Explain ways career fields will be impacted by AI*
*7.2.4: Describe the skills and background needed to have a career in AI*
*7.2.5: Describe Career Paths in AI*
*7.2.6: Identify some companies that hire AI Professionals*

AI is playing a large part in our present-day activities and will certainly continue to impact our future. As AI has developed through time; careers have been impacted and new jobs created. The field of artificial intelligence has a tremendous career outlook, with the Bureau of Labor Statistics predicting a 30 percent increase by the year 2030. The skills needed for AI jobs of the future include soft skills like communications, collaboration and problem solving. Leadership and management skills will also be needed in AI positions as well as applied mathematics and programming knowledge. The in-demand job skills begin where AIs capabilities end. Even with the growth of AI in the categories of deep learning and general AI, humans still are needed and will be in the future to navigate AI's abilities, decisions and outcomes. AI is used in any industry where technology is used because AI is everywhere. Popular industries for AI include:

- technology
- business
- media
- gaming
- medicine

Figure 6-4: AI is used in many industries

## ▷ 🔖 Entry level and advanced jobs in AI ⬤

AI is a growing field with much room for career advancement. To get started, a background in computer science is needed. A career path in AI would include learning about coding, programming and algorithms. It should include learning about ethics as they relate to AI. The topics of data privacy, security and algorithmic bias should be studied. While working on a bachelor's degree, there are many entry-level jobs that help those getting started in AI gain experience and most annual salaries are above $40,000. Some of these entry-level jobs include:

- Software Engineer
- Junior Business Analyst
- Data Analyst
- Technical Support Specialist
- Data Scientist
- AI Research Scientist
- Product Analyst
- User Experience Expert



Figure 6-5: Woman using AI in her career

As AI continues to develop, it is projected that the job market will take off and many people will be in demand that have much-needed skills and knowledge in AI. There are two main focuses in careers in AI, data science and AI research and development. These advanced jobs require a bachelor's degree at minimum, but most expect a master's degree. Many companies will need AI professionals, including:

- MIT
- Lincoln Laboratory
- Walmart
- Amazon
- Nike
- IBM
- Samsung Electronics America
- Warner Bros. Entertainment
- Fidelity Investments
- PepsiCo

Let's look at ten top jobs in AI that are popular now and are expected to grow in the future (see Table 6-2).

| Career Title Medium Salaries as of 2020 | Facts and Job Description |
|---|---|
| **Data Science Engineer** $130,000 | Data science is the practice of collecting, analyzing, and interpreting datasets. Data engineers work to build systems that collect, manage and convert raw data into usable information. Their goal is to make data accessible so that organizations can use it to evaluate and optimize their performance. |
| **Data Mining Analyst** $140,000 | Data analytics is finding meaningful patterns in data. By investigating data from the past, data analysts can find patterns that help them make predictions about future data. |
| **Business Intelligence Developer** $92,000 | Business intelligence developers look at and analyze data sets to see trends in businesses and markets. |
| **Big Data Engineer** $150,000 | Big data engineers look through very large amounts of data to find smaller sets of information that are analyzed by other data science professionals. |
| **AI Advanced Researcher** $80,000 | AI researchers discover new ways to advance AI technology. They may work at companies, government agencies or universities. |
| **AI Software Engineer** $87,000 | AI software engineers develop programs that AI tools, such as smart cars and robots, need to function. Specialties in this area include machine learning and natural language processing. |
| **User Experience Specialist** | User experience (UE) specialists understand how people use technology and create more advanced |

| | |
|---|---|
| $77,000 | software that's easy to use. |
| **Natural Language Processing Specialist/Engineer** $100,000 | NLP makes it possible for computers to read text, hear speech, interpret it. Specialists design chatbot and other NLP items. NLP engineers create devices and systems that can understand the human language. |
| **Software Engineer** $75,000 | Software engineers develop the AI software and applications that a business might use. They program systems that will change to suit the business's needs based on the data collected and analyzed. |
| **Machine Learning Engineer** $90,000 | Machine learning engineers possess strong software skills, can apply predictive models and utilize natural language processing while working with massive data sets. |

**Table 6-2: Future jobs in AI**

🔗 **Link to Learn More**

View these slides to learn more about AI Jobs of the future.

- Future AI Career Fields🔗 (Slideshow)

**Suggested activity:**

- Popular AI Careers (See below)

🧠 Popuar AI Careers　　　　⤢ FULL SCREEN　⟳ RESET　☑ SUBMIT

▷ 🔖 Match the career title to the job description

**Career title**

1. User Experience Specialist
2. Natural Language Processing Specialist
3. Data Science Engineer
4. Big Data Engineer
5. Machine Learning Engineer
6. AI Advanced Researcher

**Job description**

A. Look through very large amounts of data to find smaller sets of information.

B. Apply predictive models and use NLP while working with massive data sets.

C. Understand how people use technology and create more advanced software that's easy to use.

D. The installed memory in each slot doesn't match for optimal performance

E. Build systems that collect, manage and convert raw data into usable information.

F. Discover new ways to advance AI technology.

# ▷ 🔖 Women leaders in AI ●

*Objectives*
*7.2: Describe some careers in AI*
*7.2.1: Identify careers that use AI*
*7.2.2: Explain some soft skills that people in AI careers will need to be successful*
*7.2.3: Explain ways career fields will be impacted by AI*
*7.2.6: Identify some companies that hire AI Professionals*

Women are making huge contributions in AI all around the world. Table 6-3 shows some women who are leading the way. The companies they work for hire AI professionals and are invested in hiring with equity. These women are not only skilled in the content of AI but also in the soft skills they have that make them effective leaders and contributors. They are creative problem solvers, innovative thinkers and determined to help the progress of AI in the world.
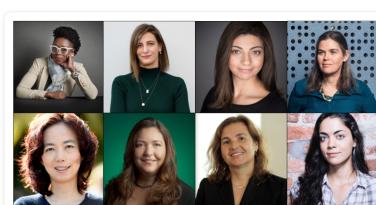


**Figure 6-6: Leading Women in the field of AI**

| Name | Contribution | Additional Info |
|---|---|---|

| | | |
|---|---|---|
| **Rana el Kaliouby** | -Researches facial recognition technology to identify emotions.<br>-Affectiva, a software company, at the MIT Media Lab. They build artificial intelligence that understands emotions and mental states by analyzing people's faces and voices. | Egyptian-American computer scientist who earned her Master of Science degree from the American University in Cairo, Egypt. Then she earned her Ph.D. at Newnham College in Cambridge, England. |
| **Daphne Koller** | -Insitro, a company that uses AI to discover new and better drugs.<br>-She and another Stanford professor named Andrew Ng developed Coursera, an online open course provider. | Koller earned a bachelor's degree at the Hebrew University in Israel at 17 and a master's degree at 18. Seven years later, she completed her PhD at Stanford University. |
| **Fei-Fei Li** | -ImageNet project, which is a large visual database to help computers recognize different objects in images.<br>-Co-founder of AI4ALL, an organization that helps bring AI education to students who have financial difficulties. | She was born in Beijing, China and moved to the United States when she was 12. She earned her B.A. in Physics at Princeton University and her PhD at the California Institute of Technology |
| **Claire DeLaunay** | -At NVIDIA Software Company<br>-ISAAC robotics initiative, an open-source project that provides algorithms and other tools used to develop robots.<br>-Leads team to help bring this technology to developers around the world. | She earned her master's in computer engineering from École Privée des Sciences Informatiques (EPSI), a private school for information technology in France. |
| **Temnit Gebru** | -Her work is mainly focused on ethics in AI<br>-She is the founder of Black in AI, a non-profit organization for black professionals and students in AI. They offer education, financial assistance, and mentorship programs. | She is from Ethiopia then moved to Massachusetts, where she received her Bachelor's and Master's degrees in electrical engineering and then her Doctorate at Stanford University |

**Table 6-3: Leading Women in the field of AI**

🔗 **Link to Learn More**

Read more about these women, Fei Fei Li and career paths in AI

- Women in AI🔗 (Slideshow)
- Fei-Fei Li facts🔗
- 14 AI Careers🔗

**Suggested activity:**

- Leading Women in AI (See below)

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▷ 🔖 Leading Women in AI     ↗ FULL SCREEN   ↻ RESET   ☑ SUBMIT

▷ 🔖 Choose the correct woman from the dropdown list to match with her contributions to the field of AI.

| Name | Contribution |
|---|---|
| Please Select ⌄ | Founded a company that uses AI to discover new and better drugs. |
| Please Select ⌄ | Developed a large visual database to help computers recognize different objects in images. |
| Please Select ⌄ | Focused on ethics in AI and offers education, financial assistance and mentoring programs. |
| Please Select ⌄ | Researches facial recognition technology to identify emotions. |
| Please Select ⌄ | Leads team to bring open-source algorithms and tools to develop robots around the world. |

**Demonstration videos:**

- 5 Career Paths in Artificial Intelligence🔗 (YouTube 6 minutes)

*Objectives*
*8.1.1: Identify what ethical considerations will need to continue to be addressed in AI in the future*
*8.1.7: Define ethical guidelines, organizations and principles that govern them*
*8.1.6: Explain how culture, beliefs, religion can create bias/conflict in AI*

As AI changes and careers are affected or created because of its growth, the topic of ethics will continue to be of utmost importance. AI ethics are a system of moral principles that guide the development of AI technology and its responsible use. Organizations are developing AI codes of ethics as products and services are developed. They guide ethical decisions when using AI. We recall from an earlier lesson, the Three Laws of Robotics by Isaac Asimov were developed to reduce risks for autonomous AI in the future. Here is a quick review:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.

2. A robot must obey orders given to it by human beings, except where such orders would conflict with the first law.

3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.



**Figure 6-7: Isaac Asimov (1920-1992)**

Recently, the Asilomar AI Principles have been developed by AI researchers, developers and scholars. There are 23 guidelines in three different areas; research, ethics and values, and longer-term issues. It includes guidelines of how AI technology should be deployed and continuously monitored. The policies guard against bias in algorithms and recommend tracking those who create algorithms for the purpose of responsibility.



**Figure 6-8: Asilomar AI Principles**

Because AI relies on big data, it is important that the data collected is not faulty or biased and that those who create the algorithms are responsible. AI codes of ethics should include policies, education and technology that are fair, responsible and morally sound. People's beliefs, religion, and culture can affect the way they create algorithms, collect and train data, and develop AI. Algorithmic bias is when there are errors that result in unfair outcomes, like one group is privileged more than others.

The guidelines in the Asilomar AI Principles work towards ensuring there is overall "fairness" in AI. A few of the categories in the Asilomar AI Principle under ethics and values area include:

- **Safety** – AI systems should be safe and secure throughout their operational lifetime, and verifiably so where applicable and feasible.

- **Responsibility** – Designers and builders of advanced AI systems are stakeholders in the moral implications of their use, misuse, and actions, with a responsibility and opportunity to shape those implications.

- **Personal Privacy** – People should have the right to access, manage and control the data they generate, given AI systems' power to analyze and utilize that data.

- **Value Alignment** – Highly autonomous AI systems should be designed so that their goals and behaviors can be assured to align with human values throughout their operation.

- **Human Control** – Humans should choose how and whether to delegate decisions to AI systems, to accomplish human-chosen objectives.

# ▷ 📑 AI Soft Skills   ●

*Objectives*
*7.2.2: Explain some soft skills that people in AI careers will need to be successful*
*7.2.3: Explain ways career fields will be impacted by AI*

AI is developing around the world and people are also developing their skills to meet the challenges. Figure 6-9 shows advancements in AI skills among people of different countries. The United States is leading the way. Students are learning and practicing these skills in their classrooms starting in Kindergarten and continuing through college and post-secondary experiences.



**Figure 6-9: Countries with AI skills**

The growth and development of AI will affect many careers and what people are required to have to obtain these careers. Not only will specific job task related skills be required, but soft skills will be of the utmost importance. There is a very good reason for this. Around the world AI companies are looking for people who can grow and adapt as quickly as AI and the field of computer science. People will often list their "hard skills" on their resumes such as what types of programming they have learned, what certificates and degrees they have or what awards they have won. It is easier to define and show these types of skills. Employers recognize that a person's soft skills will be the ultimate measure of their success in the future. Sometimes soft skills are referred to as future-ready skills, essential skills, personal skills, complex skills or human skills!

So what are some of these soft skills? Soft skills involve the ability to positively work with people, successfully accomplish tasks and adjust to changes easily.



**Figure 6-10: Using soft skills to work together**

Table 6-4 shows some of these soft skills and their definitions

| Soft skills | Definition |
|---|---|
| **Communication** | The ability to successfully send and receive ideas. |
| **Collaboration** | Working with others to produce or create something. |
| **Problem-Solving** | Finding solutions to difficult or complex issues. |
| **Adaptability** | The quality of being able to adjust to new conditions. |
| **Perseverance** | Continuing to do something despite its being difficult. |
| **Innovation** | Imagining and creating new products, methods and ideas. |
| **Integrity** | Trustworthy, honest, responsible, helpful and having pride in your work. |

**Table 6-4: Soft skills**

AI is an amazing branch of computer science that picks up where human capabilities leave off. It enables humans to concentrate on higher level work and on tasks that are innovative and creative while it takes care of things that humans cannot. It allows for speed of work that could never be attained without it. AI generates solutions from huge sets of data that would otherwise be unobtainable. It reduces errors and increases accuracy and precision. In that respect, it is a freeing technology. AI affords numerous benefits to the world and its people. It has shown since its development that its uses are widespread and varied.

Advancements in AI have changed the way in which we live and the information we receive daily. It makes our lives more efficient in all areas, from our school and work environments, connecting with our friends and families, to the way we get from one place to another and the recreation we participate in. AI greatly reduces the time taken to perform a task. It enables multi-tasking and eases the workload for existing resources. In the future, it will continue to challenge us with creating appropriate ethical uses and enable us to accomplish far more than we ever could without it.
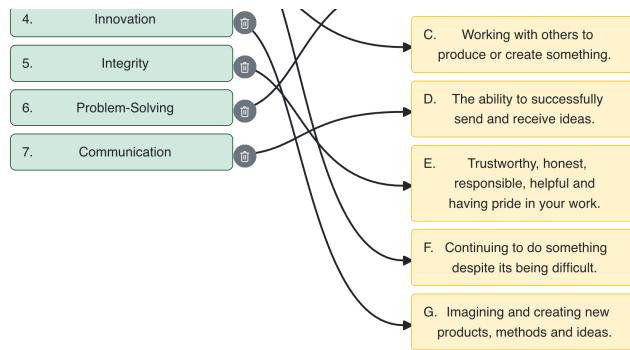


**Figure 6-11: Robot with flower**

**Suggested activities**

- AI Experiments🔗 (Online)  https://experiments.withgoogle.com/collection/ai
- Soft Skills (See Below)
- AI Asilomar Principles🔗 (Hands-on)
- Top 15 Words to Know in AI🔗 (Teacher-Led Slideshow)
- AI Job Interview Questions🔗 (Team)

| | | |
|---|---|---|
| 4. Innovation | | C.   Working with others to produce or create something. |
| 5. Integrity | | D.   The ability to successfully send and receive ideas. |
| 6. Problem-Solving | | E.   Trustworthy, honest, responsible, helpful and having pride in your work. |
| 7. Communication | | F.   Continuing to do something despite its being difficult. |
| | | G.   Imagining and creating new products, methods and ideas. |

**Demonstration videos**

- AI for Good- Ethics in AI🔗 (YouTube 3 minutes)

## Glossary

### Soft skills

Personal qualities, like teamwork and communication, that help you work well with others.

### AI Careers

Jobs that involve developing, applying, or managing artificial intelligence technologies.

### AI Organizations

Groups, companies, or institutions that develop, research, or promote artificial intelligence.

### Ethical Consideration

The careful thought about what is right, fair, and responsible when making decisions or taking actions.