9

Artificial Intelligence in Healthcare

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9.1 Introduction

Artificial intelligence is making knowledgeable machines by collecting data from several sources, learning from them, and creating intuitive decision-making capacities. Through the AI paradigm, we are outsourcing human-based capabilities to machines. In Industry 4.0, we have seen digitization, automation, and robotic process in healthcare. With the use of Internet of Things (IOT) devices, healthcare professionals could get patient information and use these data to make decisions specific to the patient. IOT is any electronic device that transmits data to the internet without human interventions—they are generally goal-oriented task devices that collect information and transmit these to the server to extract business processing information.

For example, smartwatches can collect data regarding pulse rate, blood pressure, heart rate, and step counts of a person. These data can be used by healthcare professionals to analyze the patient's problem (psychological disorder, sleep, or stress problems). By using machine learning algorithms, we are training the machines with several data sets, analyzing the patterns of data, and giving suggestions. With the data collected from different patients, machine learning could help find patterns in the patient's disease—its root cause and the impact of its symptoms. In Industry 5.0, the collaborative effort of man and machines, with the use of artificial intelligence technologies, would help give suitable solutions for specific patients. Humans are creative people, so the focus of future human labor would be on the creative side, while repetitive tasks will be given to a robot. Doctors are expected to exercise their analytical skills rather than prescribing drugs on patient symptoms. Healthcare professionals would benefit from AI machine learning technology as they make better decisions with several options. These machines can also suggest proper precautions the patients can take in the future. Moreover, error on machine learning tools are less than human professionals. The future of healthcare and insurance is

an AI-based customizable solution for patients. Medical professionals can use the AIML to know the pattern of a child psychological disorder, people's writing patterns (left- or right-handedness), patient's dietary solution, therapy, and medications. For example, the sleeping habit of a person can be analyzed through mobile phones, giving access to the timing and trends of that person's sleeping pattern.

The healthcare insurance industry will have major changes in their premium and policy plans with the customized solutions. Currently, basic healthcare insurance policies rely on the average age group and package premiums are quoted through the analysis of risks based on the history of groups of people. For example, health insurance policies consider age as a major criteria for the premium (younger people pay less premium than older ones). With the use of customer-specific biodata, insurance companies can come up with a proper risk assessment with their customer's daily habits—AI and machine learning could suggest risk predictions of customers. The future of the Insurance industry in healthcare would consist of less customer interactions and more technology-oriented decisive solutions. There would be more personalized and customized insurance plans available to the public. The risk assessment quantifiable would be automated by ana-lyzing the customer data collected through several IOT devices and mobile app inter-actions with the big data analytics system of the insurance company. The data collected by Growth Enabler in Figure 9.1 under market overview (Gartner/World bank) shows that IOT devices have already surpassed human population in 2017, and by 2020, there will be more than 20 billion IOT devices.

Some of the reasons for the rapid growth of IOT devices are:

- Fast computing power;
- Small size of IOT devices;
- IOT devices are made with user suggestive assistance that gives fast feedback to

Growth of IOT devices v/s World Population
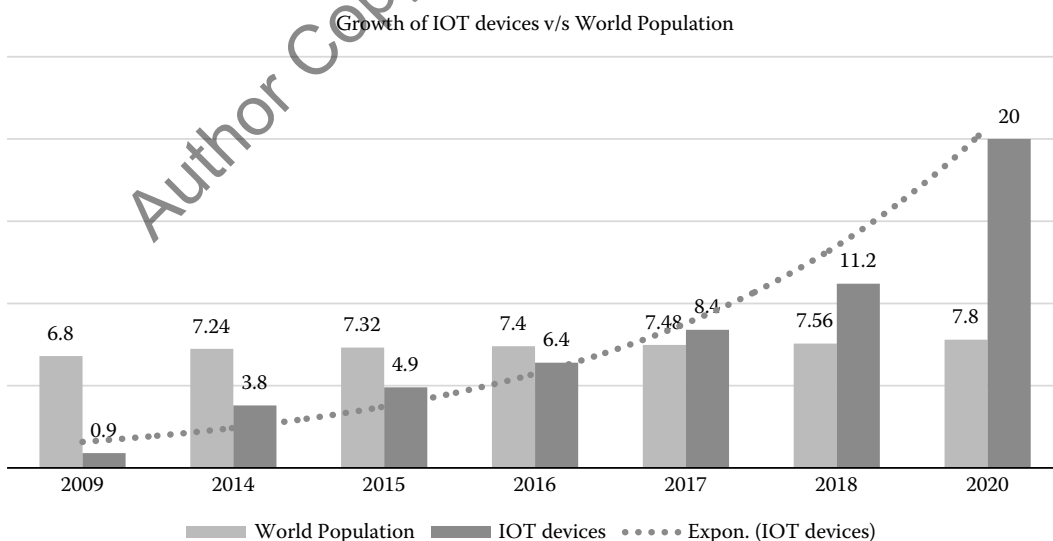
FIGURE 9.1
Market overview (number in billion).

humans (calories burned through step count), health monitor (blood pressure, heart rate);

- Efficient patient care management through real-time data tracking; and
- Reduced human errors (IOT devices are automated with input and output functions, so no human interventions are needed, and patient reports error-free which provides precise decisions for doctors).

Moore's Law states that the number of transistors on integrated circuits doubles approximately every two years. Thus, the technological progress has been growing exponentially rather than linearly (Figure 9.2).

9.2 Technological Changes that Impact Human Lifestyle Changes

Until recently, we have viewed the impact of technological changes as linear, as they produce more efficient outputs and never really replace humans. However, with the advance in AI and machine learning algorithms, there can be a crucial shift in the type of jobs humans and machines are assumed to take. In terms of error, for several job categories, machine and automated work has done better (healthcare). For example, machines taking a blood sample of patients, putting the patient code, and then automating the process of
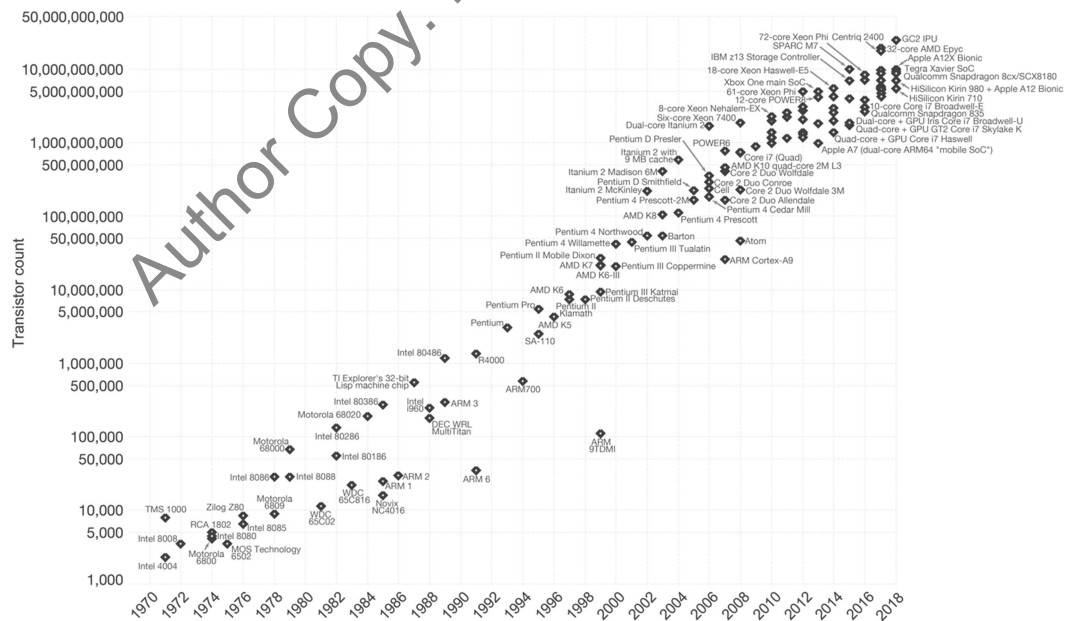

FIGURE 9.2
Moore's Law: Technological progress in integrated circuits with transistor count.

blood test would show better precision, whereas human errors like incorrectly encoding the patient name or code can happen. More powerful computers at a lower price create more impact on human lifestyle changes. The following graph shows the amount of power consumers could purchase for a price of $1,000. It is especially insightful if one wants to understand how technological progress matters as a driver of social change (Figure 9.3).

With the increase of processing power, the price for electronic items has dropped; other consumption needs such as college tuition fees and healthcare have increased over time. The graph shows the changes in the prices of computers relative to other consumer goods (Figure 9.4).

People who use the internet are expected to triple from 2015 to 2022, hitting 6 billion. 90% of the human population, ages six and above, will be online by 2030 as shown in Table 9.1.

9.3 Data Generation Trends

In over five years, around 95% of data has been created in the world, and an enormous amount of data is currently generated due to the rise of several IOT devices and machine learning (Figures 9.5 and 9.6).

9.4 Data Generation by AI in Healthcare

The machine learning algorithm uses a lot of data to train machines to think. These are comprised of several types of data and come from various sources (human-generated data and from IOT devices). Business analytics and ML algorithm are used in the
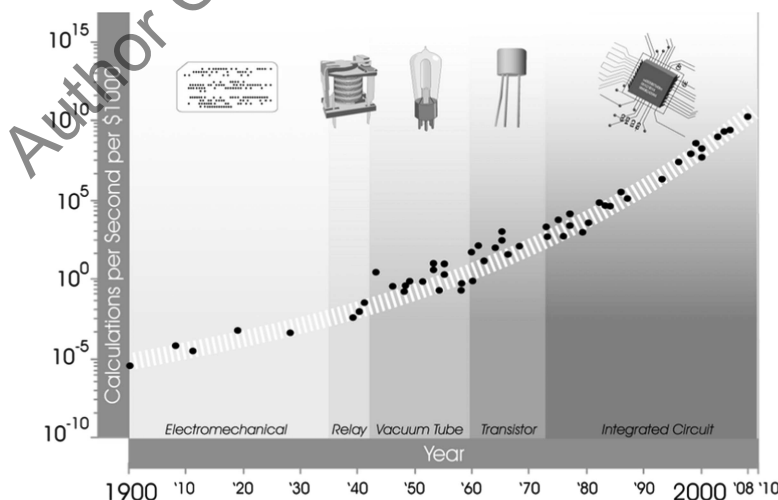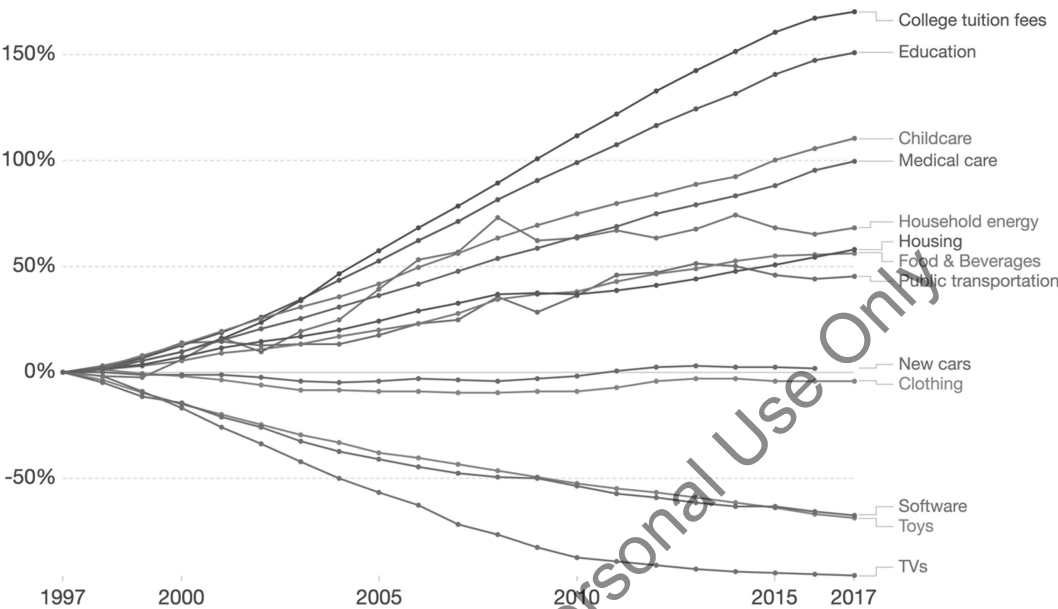

FIGURE 9.3
Exponential growth of computing in 110 years.

Price changes in consumer goods and services in the USA

Price change in consumer goods and services in the USA, measured as the percentage change since 1997. Data is measured based on the reported consumer price index (CPI) for national average urban consumer prices.
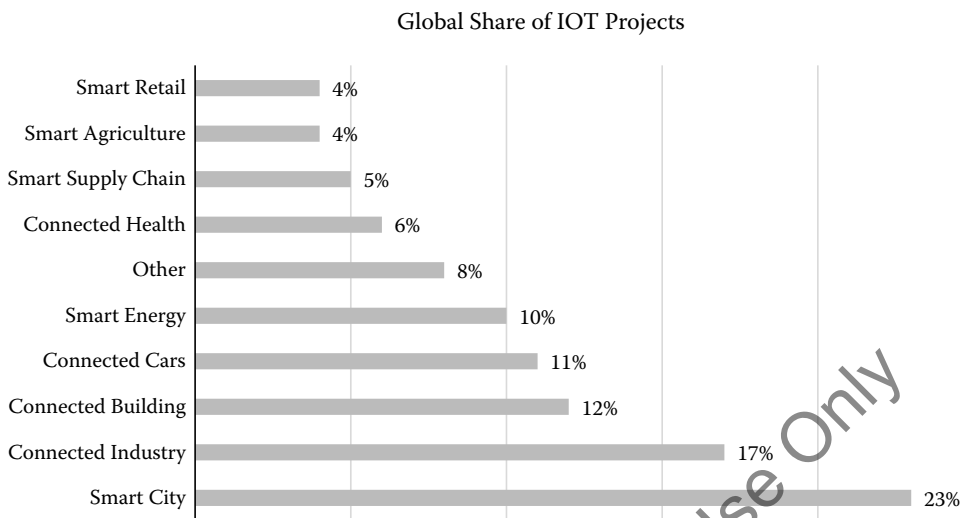
Our World in Data

FIGURE 9.4

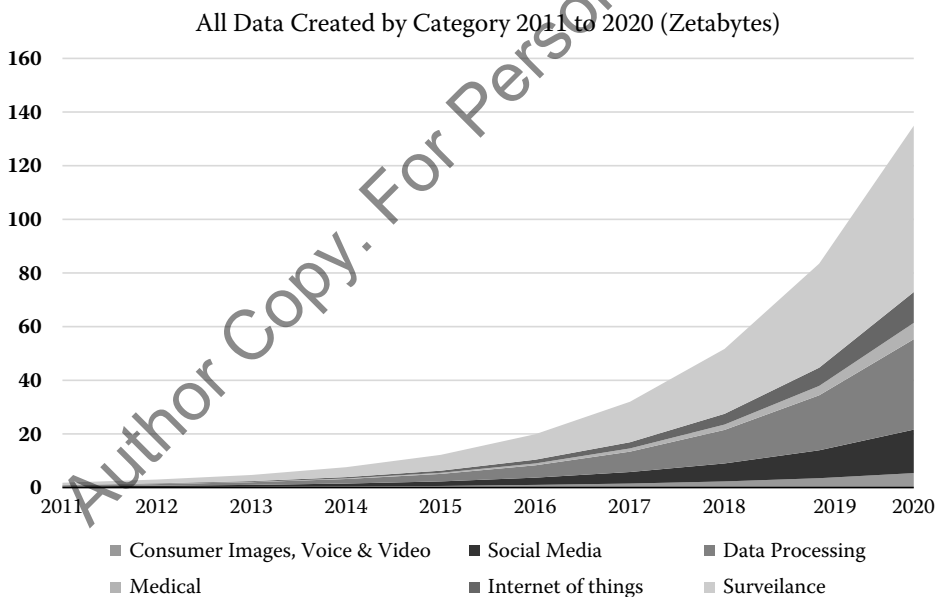Price changes in consumer goods and services in the USA.

TABLE 9.1

Approximate Percentage of People Connected to the Internet

Country	Population (Billion)	Percentage of People Connected
China	1.4	63%
India	1.3	54%
United States	0.32	90%
Indonesia	0.27	64%
Brazil	0.211	67%
Pakistan	0.216	36%
Nigeria	0.2	66%
Bangladesh	0.16	62%
Russia	0.14	79%
Mexico	0.12	76%

background of data processing to find hidden patterns from data that will add value to organizations. AI can be used to identify medical fraud (whether the patient is really sick or not). Since we get the data from several IOT sources and customer habits, prediction of sickness can be estimated by AI tools. 5G technology would transfer data 100 times faster compared to current cellular network speed. The rapid data transmission from client to

Global Share of IOT Projects

Category	Percentage
Smart Retail	4%
Smart Agriculture	4%
Smart Supply Chain	5%
Connected Health	6%
Other	8%
Smart Energy	10%
Connected Cars	11%
Connected Building	12%
Connected Industry	17%
Smart City	23%

FIGURE 9.5
Large-scale use of Internet of Things (IoT).

All Data Created by Category 2011 to 2020 (Zetabytes)

■ Consumer Images, Voice & Video   ■ Social Media   ■ Data Processing
■ Medical   ■ Internet of things   ■ Surveilance

FIGURE 9.6
Data created from 2011–2020.

server would help AI to process the task quicker. 5G would help take more real-time decisions as the algorithm can be optimized with more real-time data to give instantaneous suggestions to the user. With an increase in the number of sensors that collects data from human, the business healthcare sector can segregate people by health risk and formulate common policy.

9.5 Conclusion

The responsible use of artificial intelligence technology in the healthcare industry would be beneficial to both hospitals and patients. Doctors can get help to give optimal solutions with several options suggested by AI. The drug success rate on patients can be predicted by AI solutions. The insurance company can get a prediction of health risks on patients and inform them beforehand to do a health checkup and take required medications to prevent diseases. The dark side of AI technology would be the possibility of fake data created by users shared with different third-party consumers (hospital or insurance companies) that could impact their business, so a more effective policy and data usage by the AI and machine learning technologies [1–9] are suggested.

Suggested Reading

Online Documents

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