

## “Integration of Artificial Intelligence in Medical Coding”

Sanidhya S. Gulhane<sup>1</sup>, Abhishek A. Kale<sup>2</sup>, Dr. A. V. Shrirao<sup>3</sup>, Prof. (Dr.) A.V. Chandewar<sup>4</sup>.

Department of Pharmacology  
Students<sup>1-2</sup>, Guide<sup>3</sup>, Principal<sup>4</sup>

Pataldhamal Wadhawani College of Pharmacy, Yavatmal, Maharashtra, India

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### ABSTRACT

Artificial intelligence (AI) is a powerful and disruptive area of computer science, with the potential to fundamentally transform the practice of medicine and the delivery of healthcare. In this review article, we outline recent breakthroughs in the application of AI in healthcare, describe a roadmap to building effective,

reliable and safe AI systems, and discuss the possible future direction of AI augmented healthcare systems.

**Key-words:** AI, digital health

### I. INTRODUCTION:

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines. In medical coding, AI can process vast amounts of data, recognize patterns, and improve decision-making, thus enhancing the overall coding process.

Inpatient prior-authorization denials

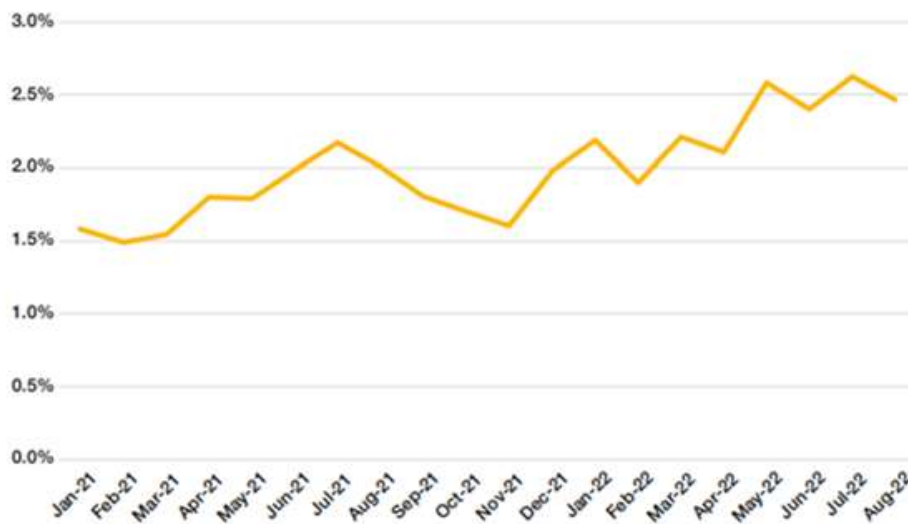


Figure 1- Inpatient prior-authorization details

Healthcare systems worldwide face challenges in achieving the 'quadruple aim' of improving population health, improving patient experience, enhancing caregiver experience, and reducing rising costs<sup>1</sup>. As populations age, chronic diseases become more prevalent, and healthcare costs rise, governments, payers, regulators, and providers must innovate and transform healthcare delivery models globally<sup>1</sup>. The global pandemic

has prompted healthcare systems to prioritize both delivering effective, high-quality care and transforming care at scale. This involves incorporating real-world data into patient care<sup>1</sup>. The pandemic has highlighted healthcare workforce shortages and inequities in access to care, as previously identified by The King's Fund and the World Health Organization.

**History:**

Alan Turing introduced the idea of simulating intelligent behavior and critical thought with computers in 1950. Turing outlined a straightforward test—later dubbed the "Turing test"—in his book *Computers and Intelligence* to ascertain whether computers were capable of human intelligence.

John McCarthy defined artificial intelligence (AI) as "the science and engineering of

making intelligent machines" six years later. Over several decades, artificial intelligence (AI) has evolved from a basic set of "if, then rules" to more sophisticated algorithms that function similarly to the human brain. Similar to medical specialties, artificial intelligence (AI) has many subfields, including computer vision, deep learning, and machine learning (ML, DL, Table 1).

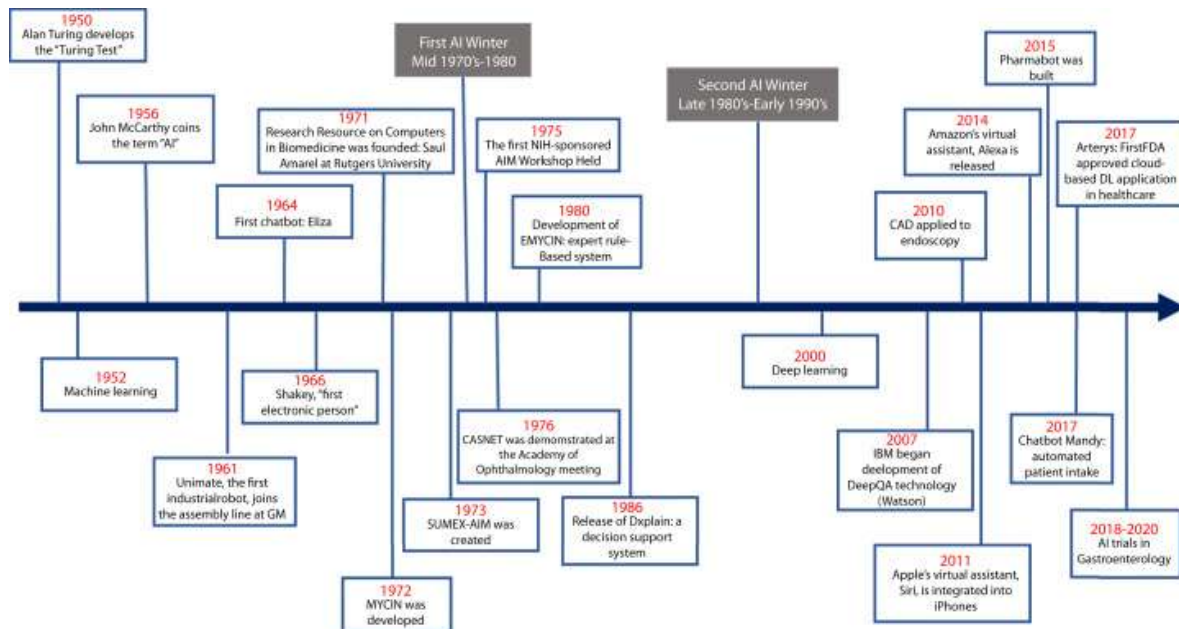


Figure 2- Timeline of the development and use of artificial intelligence in medicine.

AI, Artificial intelligence; DL, deep learning; FDA, U.S. Food and Drug Administration; CAD, computer-aided diagnosis

**Advantages of AI's in Medical Coding :**

AI can streamline the medical coding process by automating code assignment, reducing manual input, and increasing accuracy. This leads to faster processing times and more reliable coding, allowing healthcare providers to focus on patient care.

Benefits of AI Integration Integrating AI into medical coding offers numerous benefits, such as increased efficiency, reduced costs, and enhanced accuracy. With AI, healthcare organizations can achieve better compliance with regulations and improve their overall coding performance.

**1. Errors in Billing and Insurance Fraud**

One of the most significant challenges in traditional medical coding is the potential for errors in billing. A single mistake in a code can result in rejected or denied claims, leading to financial losses for healthcare providers. Additionally, incorrect coding can open the door to insurance fraud, where inaccurate claims are submitted to exploit government and insurance programs.

In the United States alone, healthcare fraud costs the industry over \$68 billion annually. Accurate coding is essential to combating this issue, and AI-powered solutions can help reduce these errors by automatically detecting anomalies in the billing process.

**2. Misinterpretations of Medical Documents**

Medical coders are tasked with interpreting complex medical documents to assign the correct codes. This process is made even more difficult when documentation is incomplete or unclear, leading to inaccurate coding that can

negatively impact patient care and financial reimbursement.

### 3. Outdated Manual Processes

A significant portion of medical coding still relies on manual processes, which are slow,

inefficient, and prone to error. Many healthcare providers are still using outdated coding systems that are unable to keep up with the ever-growing amount of data being generated in the industry. This results in inefficiencies that ultimately affect patient care.

### AI is Transformation

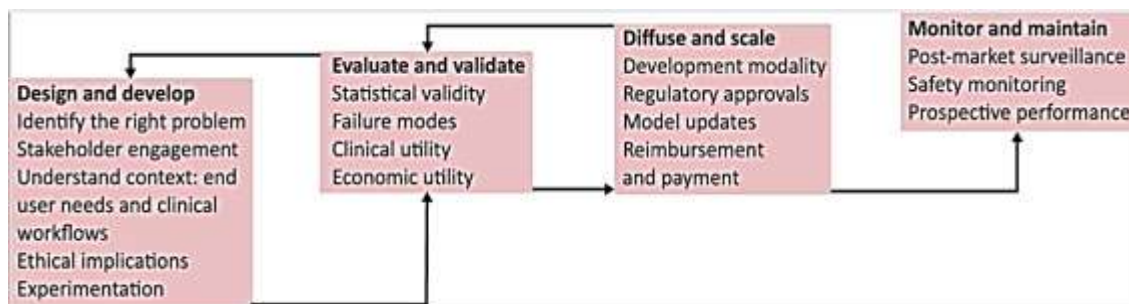


Figure 3 - Multi-step, iterative approach to build effective and reliable AI-augmented systems in healthcare<sup>13</sup>

AI has the potential to address the many challenges facing traditional medical coding. By automating the coding process, AI can reduce human error, improve accuracy, and save time. Here's how AI is making a difference in 2024:

### Benefits of AI in Medical Coding for Healthcare Providers

AI offers numerous benefits for healthcare providers and the medical coding industry. These benefits not only enhance the efficiency of medical coding but also improve patient outcomes and reduce costs.

#### 1. Enhanced Accuracy and Reduced Errors

AI is revolutionizing the healthcare industry by improving accuracy in medical coding. By using machine learning and deep learning algorithms, AI systems can identify patterns in the data and learn from them, ensuring that codes are generated correctly. This reduces the likelihood of errors and improves the quality of patient care.

In a recent survey by the American Health Information Management Association (AHIMA), 94% of healthcare professionals said that the use of AI in medical coding has significantly improved coding accuracy.

#### 2. Significant Time Savings for Healthcare Professionals

Medical coding is a time-consuming task, particularly when done manually. AI can automate much of the coding process, freeing up healthcare professionals to focus on more complex tasks that require their expertise. This not only reduces the administrative burden on physicians but also helps prevent burnout among both doctors and coders.

For example, a study by the Mayo Clinic found that the integration of AI into the medical coding process reduced coding time by 40%, allowing healthcare professionals to spend more time with patients.

#### 3. Improved Compliance with Coding Standards and Regulations

Proper medical coding is essential for maintaining compliance with healthcare regulations and preventing fraud. AI can help healthcare providers stay compliant by ensuring that codes are generated accurately and that billing processes adhere to the latest industry standards. This not only reduces the risk of penalties but also improves patient care by ensuring that healthcare providers are operating within the bounds of the law.

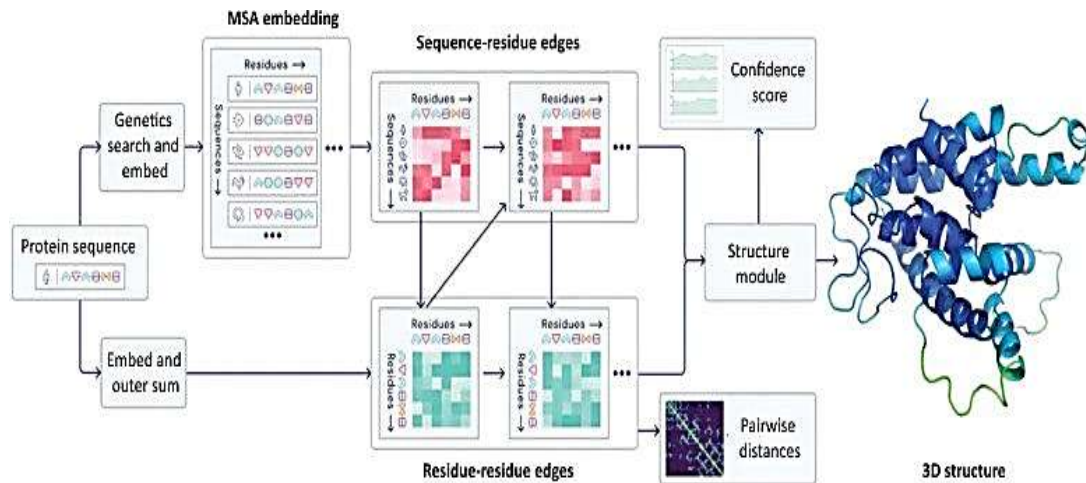


Figure 4 - An overview of the main neural network model architecture for Alpha Fold

## Practical Use Cases of AI in Medical Coding

### 1. El Paso Children's Hospital

El Paso Children's Hospital, based in Texas, faced challenges with its documentation process, which relied heavily on manual input. To address this issue, the hospital implemented an AI-driven Clinical Documentation Integrity (CDI) platform. The results were impressive: the hospital saw a 5% improvement in its case mix index (CMI), a 50% increase in productivity, and a 95% reduction in the time needed to manage daily tasks.

The introduction of AI not only improved documentation accuracy but also enhanced the hospital's financial performance, demonstrating the power of AI in transforming medical coding.

### 2. Geisinger Health System

Geisinger, a leading healthcare provider in the United States, has been using AI to improve patient care and reduce the administrative burden on physicians since 2019. By automating the coding process, Geisinger has saved nearly 500,000 hours of manual work, allowing doctors and care teams to spend more time with patients<sup>20</sup>.

This implementation of AI has resulted in improved patient satisfaction, better healthcare outcomes, and significant cost savings for the organization.

## Disadvantages Of AI In Medical Coding:

### 1.Data Collection Concern:

The first issue is that pertinent data is not easily accessible. For ML and DL models to accurately classify or predict a broad range of tasks, massive datasets are necessary. The industries with easy access to large datasets have

seen the biggest advancements in machine learning's capacity to produce more accurate and sophisticated algorithms. Information accessibility is a complicated problem for the healthcare industry. Institutions are naturally reluctant to share health data because patient records are frequently considered confidential. Data might not always be easily accessible after an algorithm has been used for the first time, which presents another challenge<sup>21</sup>. Ideally, as more data were added to their training set, ML-based systems would continuously get better. This may be challenging to accomplish due to internal corporate resistance.

It has been said that a paradigm shift from treating patients as individuals to improving healthcare is necessary for the effective application of information technology and artificial intelligence in the healthcare industry. In contrast to multimodal learning, some contemporary algorithms might be able to function on a unimodal or smaller scale, and the inverse issue of storing these constantly growing datasets might be mitigated by the growing popularity of cloud computing servers.

### 2.Algorithms Developments Concerns:

Biases in data collection processes can lead to distorted outcomes in AI models, such as under-representation of minorities due to racial biases. While methods exist to combat this bias, AI models can deal with bias on their own, such as the stereotype neural network. However, it remains to be seen whether these strategies are successful in eliminating bias in the real world.

AI technology also presents challenges such as overfitting, where algorithms learn

unimportant associations between patient features and outcomes, leading to inaccurate predictions. This can occur when there are too many variables influencing the results, causing the algorithm to function well within the training dataset but provide inaccurate results when projecting future events. Data leakage is another concern, as the method's ability to foretell occurrences beyond the training dataset is diminished if the algorithm achieves extremely high predicted accuracy.

The "black-box" problem is a common criticism of AI systems, as deep learning algorithms often lack convincing explanations for their forecasts, making it difficult for scientists to understand how data connects to their predictions. This can cause people to lose faith in the medical system. The development of AI systems that can be understood by humans is still an active field of study, with Google recently publishing a tool to help with this.

### 3. Ethical Concerns:

Artificial intelligence (AI) has been a subject of ethical concerns since its inception, with the main issue being accountability. The current system requires someone to be held accountable when poor decisions are made, especially in the medical field. Many people view AI as a "black box," as it is difficult to understand how an algorithm reached a certain conclusion. However, the issue becomes more important when considering AI applications that aim to enhance medical outcomes, particularly when errors occur<sup>22</sup>. The lack of standard guidelines for the moral use of AI and ML in healthcare has worsened the situation. The Food and Drug Administration (FDA) has attempted to establish criteria for evaluating the security and efficacy of AI systems, while the NHS is drafting standards for showing the effectiveness of AI-driven solutions. Both efforts are ongoing, making it more difficult for courts and regulatory agencies to approve actions based on AI. Public conversation about these ethical dilemmas is crucial to arrive at a universal ethical standard that benefits patients<sup>23</sup>. The absence of standard guidelines has only exacerbated the situation, making it difficult for courts and regulatory agencies to approve AI-based actions.

### 4. Social Concerns:

People have always worried that their jobs could be replaced by artificial intelligence (AI) in the healthcare industry. Because they fear being

replaced, some people are hostile toward and skeptical of AI-based projects. But a lot of this viewpoint is predicated on a misreading of artificial intelligence in all of its forms. The introduction of AI does not mean that jobs would become obsolete, but rather that they will need to be re-engineered. This is even assuming that we ignore the amount of time it will take for AI to advance to the point where it can successfully replace healthcare personnel. Medical procedures are inherently unpredictable and human-centered, so they will never be as precise or well-organized as an algorithm.

### 5. Clinical Implementation Concerns:

The primary barrier to the successful implementation of AI-based drugs is the absence of empirical evidence confirming their efficacy in planned clinical trials. The majority of research on the application of AI has been done in the business context, so we don't know much about how it impacts patients' outcomes in the end. Most AI research in healthcare to date has been conducted in non-clinical environments. This makes it possible that generalizing research findings will be difficult. The gold standard in medicine, randomized controlled trials, is unable to show how AI improves healthcare. Businesses are reluctant to adopt AI-based solutions because of the lack of useful data and the inconsistent quality of research.

If artificial intelligence had been widely accepted, it may have been integrated into medical process for more efficient use. Effective load reduction relies on the usability of information systems. AI-based treatments must not slow down clinicians while examining or exploring electronic medical data. The price tag includes the investment of time and resources required to train medical professionals to effectively use the technology. Few instances of successfully incorporating AI into clinical therapy have been shown so far, with most cases remaining in the experimental phase. Stakeholder participation in the development phase has been the key barrier to successful integration in many examples of innovation adoption. Getting input from a wide range of people is crucial to developing a solution that can be seamlessly integrated into clinical practice. Many AI advancements were made in the wake of the SARS and Ebola pandemics with the goal of bettering outcomes by means such as more accurate epidemiological forecasting or faster diagnosis<sup>23</sup>. There are limitations to these rapidly evolving advances, however, since their usefulness in

healthcare depends on their seamless incorporation into existing procedures without confusing or slowing down clinicians who lack training in AI

and beside this the clinical research also faced issues related to the algorithms.

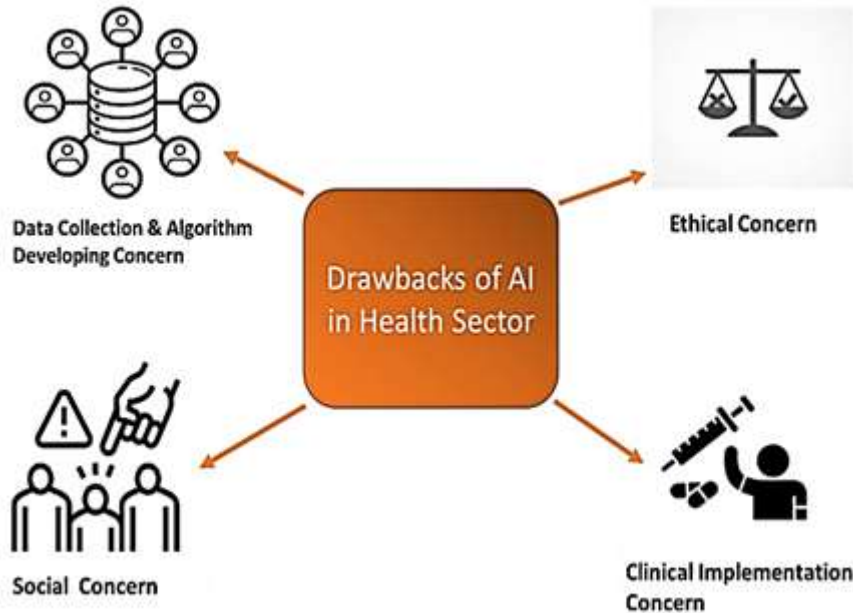


Figure 5-Drawbacks of Artificial Intelligence

### 5.Future Scope Of AI In Medical Coding:

As AI continues to evolve, we can expect to see even more advancements in medical coding technology. Here are a few trends to watch for in 2024 and beyond: 1. Increased Automation with AI will increasingly automate day-to-day coding tasks, allowing coders to focus on more complex cases that require human judgment. This shift toward automation will help healthcare providers manage larger volumes of data more efficiently.

### Integration with Electronic Health Records (EHRs)

In the future, we expect systems would face significant challenges. Inaccurate codes can lead to denied insurance claims, delayed payments, financial losses for healthcare providers, and even the potential for legal penalties. Furthermore, coding errors can distort patient records, skewing critical health data that's used to assess disease prevalence, treatment effectiveness, and public health trends.

Medical coding also plays a pivotal role in streamlining healthcare workflows. By using codes instead of lengthy narratives, healthcare providers can simplify documentation, allowing for quicker billing and more efficient management of

healthcare services. But despite its importance, traditional medical coding processes are still bogged down by manual tasks that are prone to error. This is where artificial intelligence steps in, offering a transformative solution for businesses looking to develop AI-driven medical coding systems.

## II. CONCLUSION

In conclusion, AI for medical coding is a transformative force that enhances efficiency, accuracy, and patient care in healthcare settings. Embracing AI technologies enables healthcare organizations to thrive in an increasingly complex and data-driven environment. With the introduction of more innovative and new generation AI tools, healthcare is more advanced in the sense of more awareness, efficiency in delivering care, identification of developing complications, accurate diagnosis of diseases ahead of time, and most recent approaches for interventions.

Artificial intelligence is set to revolutionize the medical coding industry, offering businesses the opportunity to develop cutting-edge solutions that enhance accuracy, reduce costs, and improve patient care. From autonomous coding systems and

NLP-powered tools to real-time error detection and continuous learning, AI is transforming the way healthcare providers handle medical coding. As AI technology continues to evolve, its role in healthcare will only expand, making it an essential tool for businesses looking to innovate in the medical coding space. By embracing AI, businesses can not only streamline the coding process but also help healthcare providers deliver better patient care, improve compliance, and drive greater financial performance. As we move into 2024, the potential for AI in medical coding is boundless, and those who invest in this transformative technology will be well-positioned to lead the future.

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