Introduction to AI and Machine Learning in Healthcare

Introduction to Healthcare

Artificial intelligence in healthcare is an overarching term used to describe the use of

- Machine-learning algorithms
- Software
- Artificial intelligence (AI)
- Mimic human cognition in the analysis
- Presentation
- Comprehension of complex medical
- Health care data
- exceed human capabilities by providing new ways to diagnose, treat, or prevent disease.

Specifically, AI is the ability of computer algorithms to approximate conclusions based solely on input data.

The major challenges of the healthcare system

- Elevating and standardising quality
- Optimising clinical workflows
- Personnel shortages and burnout
- Keeping up with advances in medical science and information
- Advancing health equity
- Patient safety

Issues in efforts to improve healthcare delivery and the healthcare system

Four major categories of errors contributing to substandard health care quality have been identified:

(1) avoidable errors

(2) underutilization of services

(3) overuse of services

(4) errors associated with wide variations in health care practices, including regional and small-area variations.

Introduction to Clinical Data

Clinical Data Management is the process of handling data from clinical trials. The inherent goal of any clinical data management system is to produce and maintain quality data.

The overall flow of clinical data handling is:

Source data are generated. Common examples of source data are clinical site medical records, laboratory results, and patient diaries.

If paper Case Report Forms (CRFs) are being used, the clinical site records are transcribed onto the CRFs.

Data from the CRFs, as well as other source data, are entered into the clinical trial database. Electronic CRFs (eCRFs) allow data to be entered directly into the database from source documents. Data from paper CRFs are often entered twice and and reconciled in order to reduce the error rate.

- The data are checked for accuracy, quality, and completeness, and problems are resolved. This often involves queries to the clinical site.
- The database is locked when the data are considered final.
- The data are reformatted for reporting and analysis. Tables, listings, and figures are generated.
- The data are analyzed, and the analysis results are reported. When significant results are found, this step may result in the generation of additional tables, listings, or figures.
- The results are integrated into high-level documentation such as Investigator's Brochures (IBs) and Clinical Study Reports (CSRs).
- The database and other study data are archived.

Current state

- **Inadequate Medical Infrastructure:** India has a shortage of **hospitals, particularly in rural areas,** and many existing healthcare facilities lack basic equipment and resources.
    - According to the **National Health Profile,** India has only **0.9 beds per 1000 population** and out of which only 30% are in rural areas.
- **Lack of Standardisation of Quality Care:** Quality of healthcare provided in India varies significantly, with **inadequate facilities and resources in rural areas and poor regulation** leading to substandard care in some private healthcare facilities.
- **Non-Communicable Diseases: Non-communicable diseases (NCDs)** are responsible for over **60% of all deaths in India,** with high rates of chronic illnesses such as **diabetes, cancer, and heart disease.**
    - As a result, **affordability concerns are also raised,** and poor people are more vulnerable as a result.

- **Lack of Adequate Mental Healthcare:** India has one of the **lowest numbers of mental health care professionals per capita.**
    - Government's spending on **mental health is also very low.** This has resulted in poor mental health outcomes and inadequate care for people suffering from mental illness.
- **Gap in Doctor-Patient Ratio:** One of the most critical concerns is the gap in the **doctor-patient ratio.** According to the **Indian Journal of Public Health** India needs **20 lakh doctors by 2030.**

Future trends

Artificial Intelligence in Healthcare

Remote Healthcare - Virtual Hospitals, Healthcare Communities, and Telehealth

Retail Healthcare

Wearable Medical Devices

Personalized Healthcare

7 Emerging Healthcare Technology Trends

- Rapid Change through Telehealth
- Digital Health to the Rescue
- Improvement in Data Science and Predictive Analytics
- The Cybersecurity Mesh
- Cloud Computing
- Blockchain
- Virtual, Augmented, and Mixed Reality
- Impact of Artificial Intelligence

Key stakeholders in healthcare system

Stakeholder is a person, group, organization or system who affects and can be affected by an organizational action.

Classification of Stakeholders: Depending on their source of origin and site of operations, stakeholders may be classified into the following classifications –

1. External Stakeholders
2. Interface Stakeholders
3. Internal Stakeholders

External Stakeholders: A health care organization must respond to large number of external stakeholders.

They fall into three categories in their relationships with the organization

a. Those that provide inputs to organization, includes suppliers, patients and financial community.

b. Those that compete with it. The competitor may be the direct competitor for patients (for example: other hospitals) or they may be competing for skilled personnel

c. Those that have particular special interest in how the organization functions.External stakeholders in third category are special interest group. These are the government regulatory agencies, private accrediting associations, professional associations, labor union, the media and political action groups.

Interface Stakeholders: Some stakeholders function on the interface between the organization and its environment. The major categories of interface stakeholders include the medical staff, the hospital board of trustees. The organization must provide sufficient inducements so that these groups of stakeholders continue to make appropriate contribution. The organization may offer professional autonomy, institutional prestige or political contacts, special services and benefits etc

Internal Stakeholders: These stakeholders exist almost entirely within the organization and typically include management, professional and nonprofessional staff. Management attempts to provide internal stakeholders and sufficient inducements to gain continual contribution from them. The stakeholders determine whether the inducements are sufficient for the contribution that they are required to make partly on the basis of alternative contribution offer received from competitors.