TO STUDY THE ROLE OF BIG DATA AND DATA SCIENCE IN CRITICAL CARE UNIT

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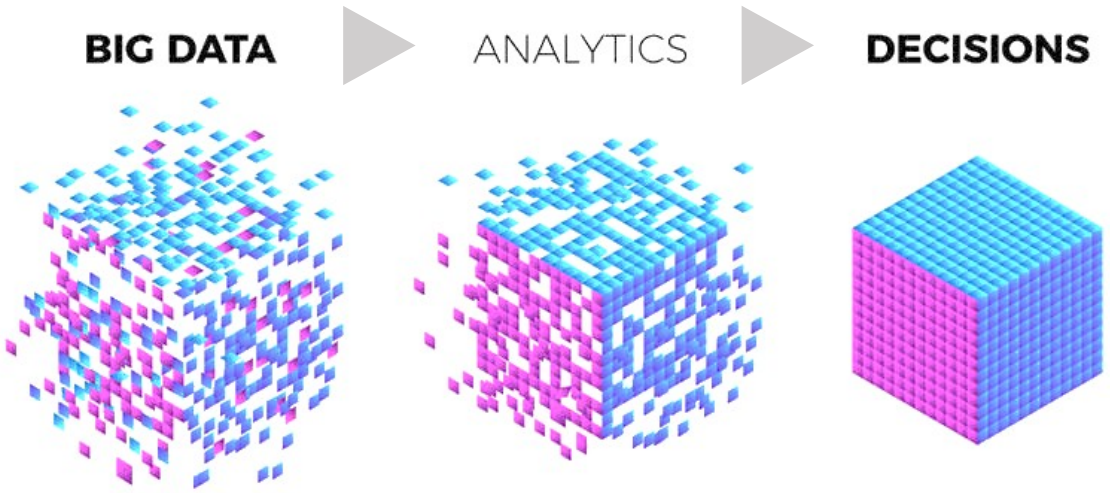
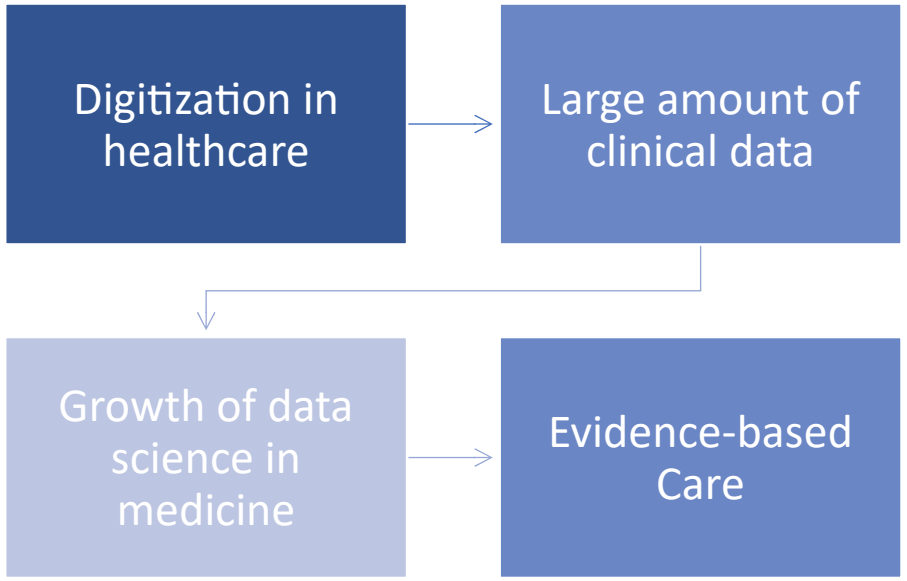
INTRODUCTION

What is Big Data?

Big data can be defined as a combination of structured, semi-structured and unstructured data which is collected by organizations and can be mined for information and use in machine learning projects, predictive models, and other advanced analytical applications.



Big Data in Healthcare



- Despite this, few successfully implemented data-driven systems in the ICU have been implemented.
- However, physicians need to be familiar with the opportunities and challenges presented by big data and data science.

AIM & OBJECTIVES

AIM

The aim of this study is to analyze how can big data be helpful in management of critical care units in the healthcare industry in a more efficient and effective way. And, to understand the major challenges in harnessing big data for the same?

OBJECTIVES

- To study the role of big data in Critical Care Units
- To study the benefits of big data in Critical Care Units
- To study the challenges of big data in Critical Care Units

METHODOLOGY

10 articles obtained from 3 different online databases i.e., ScienceDirect, PubMed, Google Scholar, were used to extract information for this study.

A narrative synthesis was done to determine the status of Big Data presently in healthcare and its benefits for managing a critical care unit and to find out about the risks involved in the same.

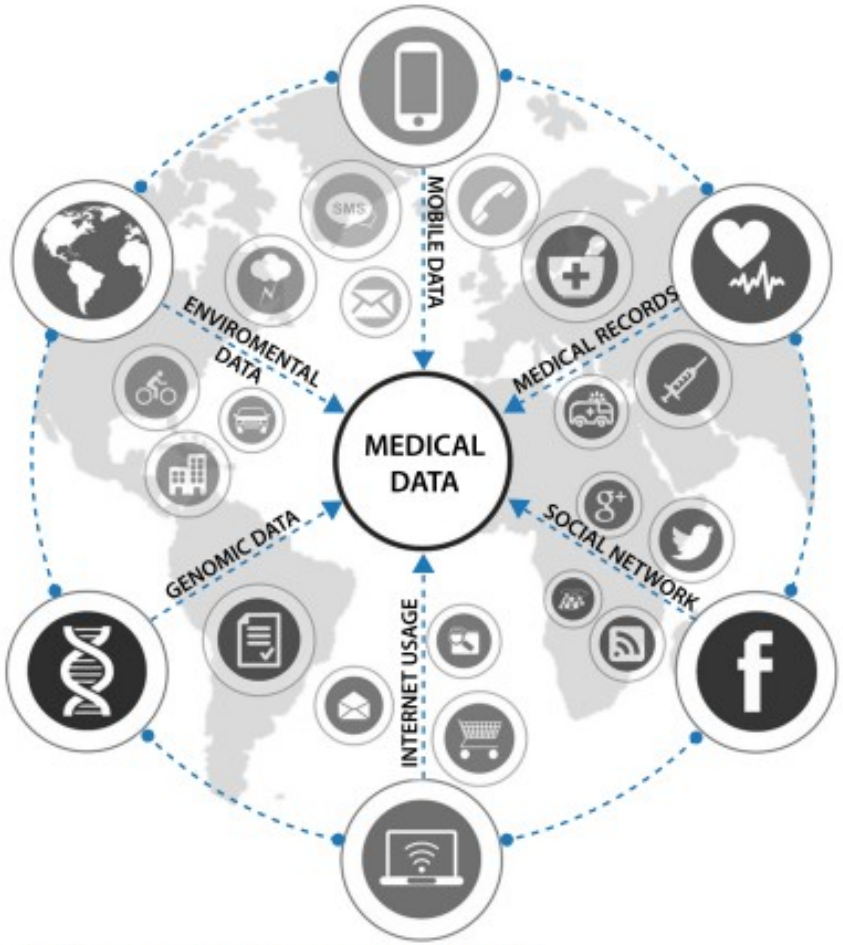
The articles were searched thoroughly for relevant information that fulfils all the three objectives of the study. The given results were obtained by the information gathered using these selected 10 articles.

RESULTS & DISCUSSION

Sources of big data in Critical Care Unit

- Electronic Medical Records
- Social Network
- Internet Usage
- Genomic Data
- Environmental Data
- Mobile Data

These are continuously generating new minable data.

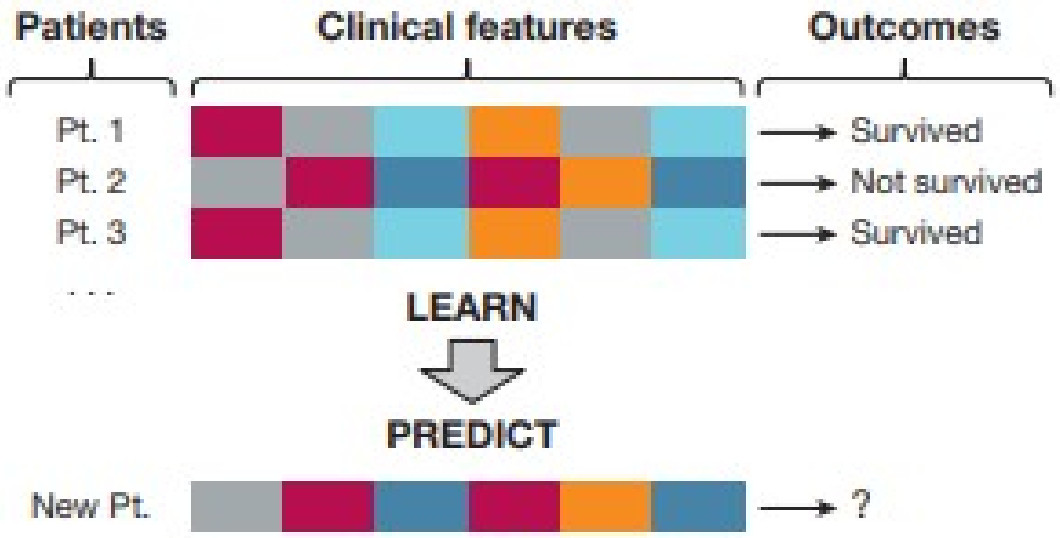


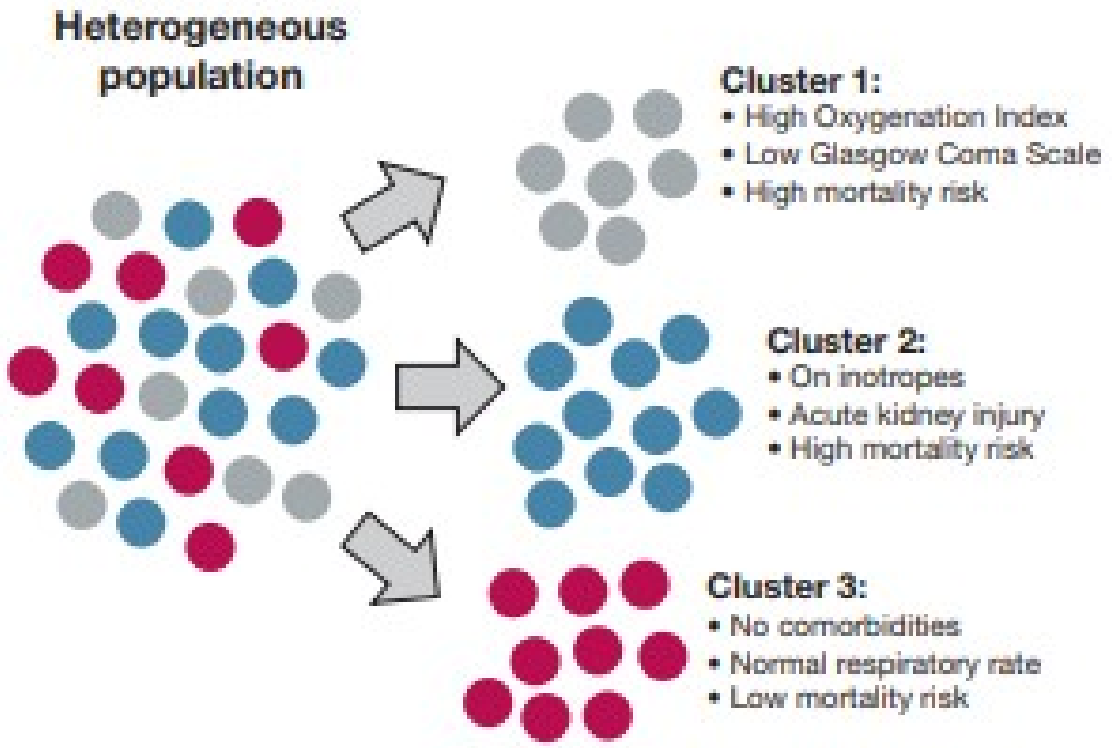
ROLE OF BIG DATA IN CRITICAL CARE UNIT

Application of data science in critical care includes:

Predictive and Prognostic Models

- Predictive models are usually trained to predict conditions, events, or responses. Example: In oncology, biomarker-based models are used to diagnose subtypes of cancer that respond to targeted therapies.
- Prognostic models are specially trained to estimate potential disease-related endpoints or outcomes. Example – APACHE scores are used to estimate the risk of mortality for patients in the intensive care unit.





Clustering and Phenotyping

Unsupervised learning algorithms in critical care have mainly been used to uncover naturally occurring subgroups or clusters of patients who share similar clinical and/or molecular characteristics. These are often called as phenotypes, subphenotypes, or subtypes.

Application with non-traditional data types:

Natural language processing (NLP)

Unstructured data like progress notes, discharge summaries, nursing notes, diagnostic reports can be analyzed using NLP. It extracts features from texts that can then be used in task-specific algorithms for different purposes. Certain types of patients can be identified using NLP.

Physiological waveform analysis

Data from bedside monitors and wearable devices, example - electrocardiography, photoplethysmography, impedance pneumography, invasive arterial manometry, end-tidal capnography, and electroencephalography is known as Physiological waveform data.

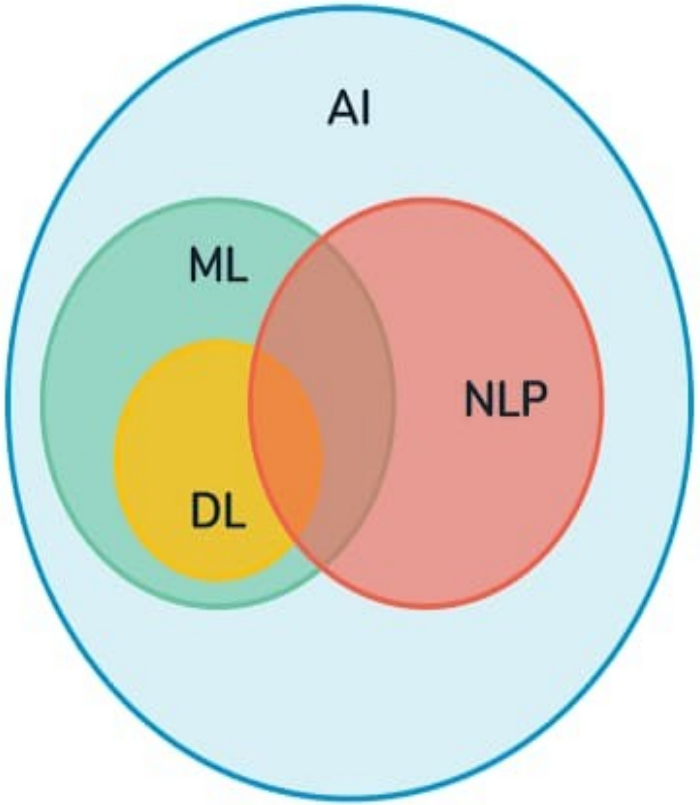
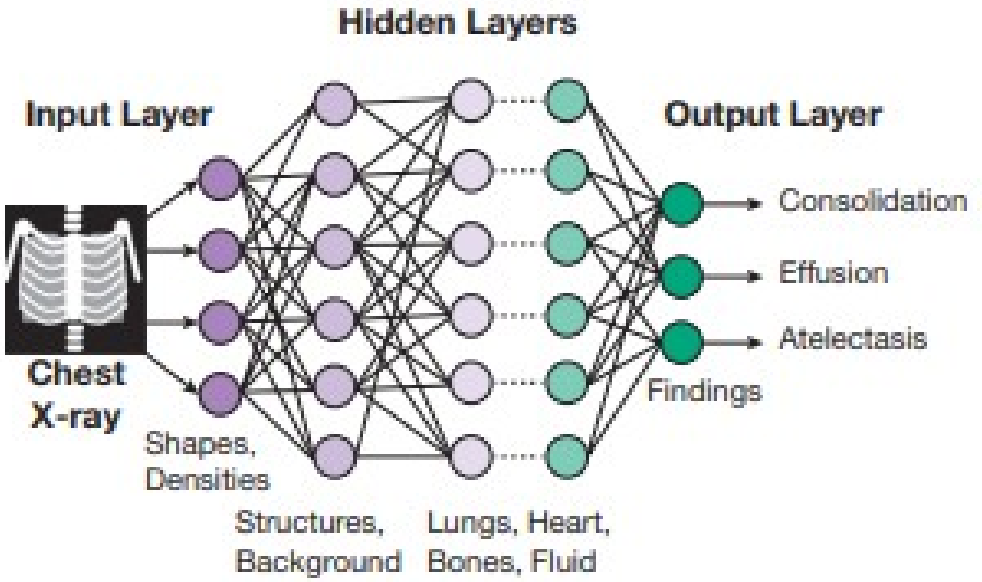


Image Analysis

Advancement in Image Analysis techniques through deep learning to different pathologies and could be particularly helpful in ICUs with limited availability of specialists who can accurately interpret radiographic images in a timely fashion. But their effectiveness and safety should first be thoroughly evaluated before any clinical implementation is considered.



THE BENEFITS OF BIG DATA IN CRITICAL CARE UNIT

- Healthcare professionals have an improved access to the entire medical history of a patient.
- Automatic reminders and prompts regarding vaccinations, abnormal laboratory results, cancer screening, etc.
- Electronic authorization and immediate insurance approvals due to less paperwork.
- Faster data retrieval and facilitate reporting of key healthcare quality indicators to the organizations and improve public health surveillance by immediate reporting of disease outbreaks.
- mHealth devices can detect and monitor different parameters. Analyzing these data provide insightful individual health patterns, and support delivery of proper and customized care.
- Prescribing medicines and predicting diseases could be easier for doctors with big data. This could help in surveillance of epidemics and in the response and take necessary precautions at the right time before the situation worsens.
- Big data may increase healthcare service coverage to remote areas of India where medical professionals are scarce.
- EHRs, EMRs, PHRs, MPM software's have the potential to improve the quality, service efficiency, and costs of healthcare along with the reduction of medical errors.

CHALLENGES OF BIG DATA IN HEALTHCARE

- Storage of large volume of data
- Cleaning
- Unified format
- Accuracy
- Image Pre-processing
- Security
- Meta-Data
- Querying
- Visualization
- Data sharing

Ethical and Legal Issues:

1. The biggest concerns in using Big Data for medical research is invasion of privacy and identification of an individual without consent.
2. Anonymizing data may only take us as far as linked datasets might pose the risk of reidentification. Also, insisting on formal consent of big data research may lead to a participation bias which can render any analysis results useless.
3. It is important that we have measures in place to safeguard the patient's privacy before we begin researching with Big Data.

Limitations:

1. Chance – Testing multiple hypotheses and analyzing various subgroups may give more false positives.
2. Error – Big data is not always collected for research; hence, it can be compromised with respect to quality, accuracy, and completeness.
3. Bias and Confounding – Data collected from a certain source may sometimes exclude people from different ethnicities, age, background, etc.

RECOMMENDATIONS

Clinicians and researchers need to maintain sound skepticism and work together as a team, this is essential for interdisciplinary communication.

Development of a system with clinical informatics that starts, updates, improves, and extends evidence and clinical decision support tools through crowdsourcing.

Using individual data to benefit the population and population data to benefit the individuals. This type of work can identify and extend best practices and bring significant benefits to human health and the rational use of medical resources.

Organizations and researchers must create methods and processes that address some of our most pressing concerns like who oversees the shared data, who owns the clinical data, and how to combine heterogeneous and superficially non-interoperable data sources.

CONCLUSION

We are at the dawn of a new era of critical care, where computers that perform data integration and analysis support clinical decision making.

Data-driven systems and clinicians need to work together. Large amounts of data are analyzed by computer systems to make them available to bedside clinicians in the form of manageable, interpretable, and actionable knowledge that enhances the decision-making ability of clinicians.

As big data becomes mainstream, it becomes important to ensure data security, governance, and confidentiality aspects.

Big data has the potential to improve healthcare and significantly reduce costs by both personalizing healthcare and combining multiple data sources for each individual patient.

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THANK YOU!