BIG DATA ANALYTICS IN MEDICAL IMAGING

ATHIRA REGHUNATH– W9561613

School of Computing, Engineering & Digital Technologies, MSc Data Science

RESEARCH PURPOSE

In recent years, one of the hottest topics of scientific discussion has been big data. An industry analyst sought to define big data in the early 2000 s using the three Vs: volume, velocity, and variability . With new technologies like Hadoop, it is now possible to store and use massive amounts of data that arrive at an unparalleled rate. This data is highly varied because it might be in a various formats, including text documents, voice or video recordings, and financial transactions. Science, sports, advertising, health care, genomic sequence data, and medical imaging have all proven to benefit from big data analytics. This research provides a high-level overview of big data analytics in medical imaging.

Research Question:

How Big Data Analytics works for Medical Imaging in Healthcare Sector?

BACKGROUND CONTEXT

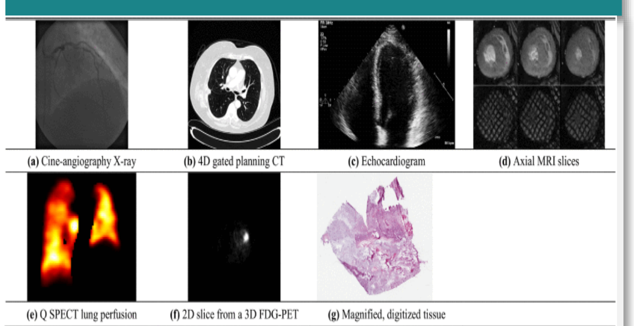


Fig 1 Typical medical imaging examples

The medical business has generated enormous amounts of data, both hard copy and soft copy. The primary focus is on storing, managing, and analysing large amounts of data. The size of medical photographs is rapidly increasing. Between 2005 and 2007, the Picture CLEFmedical image collections contained approximately 66,000 images, which had risen to approximately 300,000 images by 2013[1]. Images come in a variety of formats, modalities, dimensions, resolutions, and quality. As a result, new issues such as data extraction, data integration, and data mining emerge. For multimodal picture analysis,more study is required. For accurate data mining and analysis, unstructured medical images must be organised. Data about medical pictures can be gathered from a variety of institutes or organisations. To make use of this type of data, various crucial analytic models must be established and validated. Early detection of diseasesis achievable if sufficient data has been retrieved and reviewed from a huge database or big data, which minimises the risk of death and medical costs.

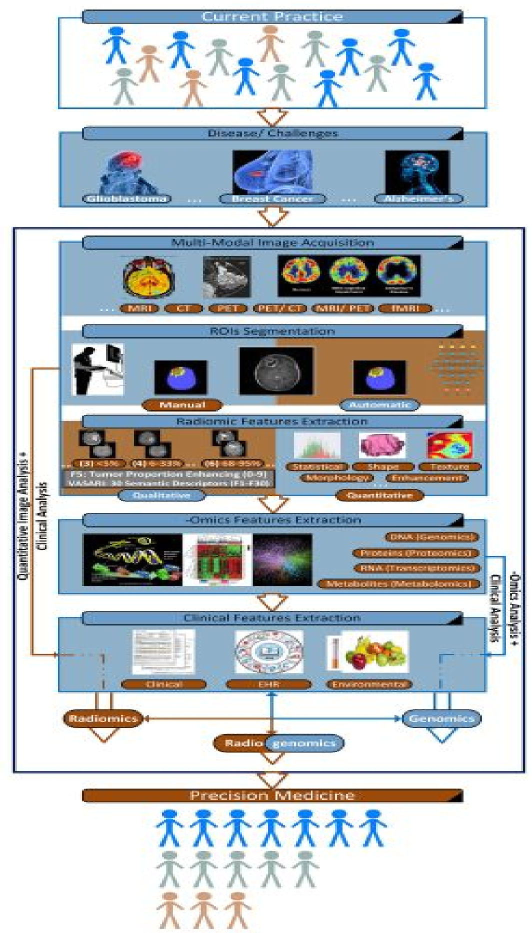


Fig 2 Radiogenomics System Diagram

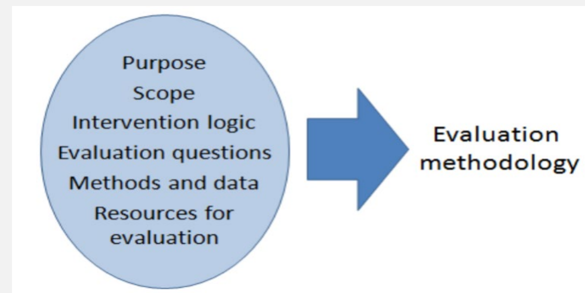
RESEARCH METHODOLOGY

- This research will be conducted on a qualitative basis, with data and information acquired from literature reviews of peer-reviewed journal papers used as references. This will be done using pre-determined structures and theories gleaned from peer-reviewed literature as references.
- This research will be based on current data, findings, and hypotheses gleaned via a review of reference journal articles. In order to maintain the validity and honesty of the data obtained from the journals studied, the philosophical perspective of this research will once again be objectivist.
- The data collection method utilised in this study will be Secondary Qualitative Data Collection from peer-reviewed journal publications that will be used as a starting point.

EVALUATION METHODOLOGY

Peer Review:

Third parties will be able to examine the finished product and highlight any gaps, defects, or problems that can be rectified using this evaluation process. The third party will consist of project supervisors, instructors, students, and a few project managers.



SCHEDULE AND PUBLISHING

From start to finish, the project will take about 13weeks to complete. The study will have a Waterfall approach, in which each phase must be completed, reviewed, and authorised before moving on to the next. The Magazine paper will be published in the Project Management Journal, the Project Management Institute's academic and research journal.

PERIOD / TASK	WEEK 1-2	WEEK 3-4	WEEK 4-6	WEEK 6-9	WEEK 10	WEEK 11-12	WEEK 13
Preparation & Planning	■						
Selected Research Topic and Started working on it		■					
Data Collection			■				
Database Research and Report Preparation				■			
Analysing all the shortlisted papers (Inclusion & Exclusion)					■		
Poster Creation						■	
Final Submission & Publishing							■

Fig 3 Project schedule chart

ISSUES

This research paper does not involve any human intervention, there are no substantial ethical or legal considerations. We use data that has previously been published with data and information acquired from literature reviews of peer-reviewed journal papers used as references., university students will be the ones evaluating the efficiency of the subsystem.

	Technology	Anatomies	Dimensionality	Cost per Scan*	Storage Requirements
X-ray	Produces images by measuring the attenuation of X-rays through the body, via a detector array [9].	Most organs	2D, 2D+t	$15-385	Up to ~1GB
CT	Creates 2D cross-sectional images of the body by using a rotating X-ray source and detector [25].	Most organs	2D, 3D, 4D	$57-385	Up to 10s of GBs
Ultrasound	A transducer array emits acoustic pulses and measures the echoes from tissue scatters [9].	Most Organs	2D, 2D+t, 3D, 4D	$57-230, $633-1483 (with endoscope)	Up to GBs
MRI	Use a magnetic field to align protons; RF and gradient pulses are used to selectively excite protons in tissues and blood in order to measure their spatially encoded nuclear magnetic resonance signals	Most organs	3D, 4D	$32-691	Up to 10s of GBs
Nuclear	Measures the emission of gamma rays through decay of radioisotopes introduced into the body via external detectors/Gamma cameras [9]	All organs with radioactive tracer uptake	2D, 3D, 4D	$182-1375	Up to GBs
Microscopy	Typically uses an illumination source and lenses to magnify specimens before capturing an image [9]	Primarily biopsies and surgical specimens	2D, 3D, 4D	$248-482, $642-1483 (with endoscope)	Can be >1TB

MRI: Magnetic Resonance Imaging, CT: Computer Tomography, RF: Radiofrequency.
*Actual costs vary across providers, countries, and specific imaging parameters. Cost estimates obtained from https://www.medicare.gov/.

Fig 4 TABLE Summary of Imaging Modalities Characteristics

REFERENCES

- Radiogenomics for Precision Medicine With a Big Data Analytics Perspective (Andreas S. Panayides; Marios S. Pattichis; Stephanos Leandrou; Costas Pitris; Anastasia Constantinidou; Constantinos S. Pattichis 2019)
- AI in Medical Imaging Informatics: Current Challenges and Future Directions Andreas S. Panayides; Amir Amini; Nenad D. Filipovic; Ashish Sharma; Sotirios A. Tsaftaris; Alistair Young; David Foran ()
- Survey on Big Data Analytics in Health Care (P. Saranya; P. Asha 2019)
- A Review on Big Data Analytics in Medical Imaging (SanjuktaMishra 2018)
- 5 - Big Data analytics in medical imaging (Siddhant BaggaSarthak Gupta Deepak KumarSharma 2021)
- The Use of Big Data Analytics in Medical Images: a Survey (Mohammed Shatnawi; Muneer Bani Yassein; Ibtihal Jalabneh 2020)