



MARKET STUDY ON ADOPTION OF ARTIFICIAL INTELLIGENCE(AI) IN MEDICAL IMAGING

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AGENDA



INTRODUCTION



LITERATURE REVIEW



METHODOLOGY



RESULTS



DISCUSSION



RECOMMENDATIONS



CONCLUSION

Introduction



Medical Imaging

A diagnostic procedure which creates visual aids and image representations of the human body thereby helping in monitoring the organ functioning of the human body



Artificial Intelligence

Artificial Intelligence (AI) is a branch of computer sciences that mimics human intelligence and actions in machines. It is developed using machine learning (ML) where large datasets (such as chest X-rays, MRI, CT scan) are put into an algorithm with some knowledge about the data (such as breast cancer or not). The algorithm processes this data, trains on it and then use this training to make predictions.



AI in Medical Imaging

The present advancements in technology in medical imaging are largely centred on the integration of AI into all equipment imaging modalities

Research Gap, Question and Objectives

What is the market trend over the last seven years for the adoption of AI in medical imaging?



// To find out the year wise number of AI medical imaging products from 2014-2020

// To identify the imaging modalities on which AI medical imaging products are used

// To identify the healthcare areas where AI medical imaging products are focused

// To identify the regions where the AI medical imaging companies are centred over the world map

Of all the literature relevant to this study, most of the data available was centred around the AI specified products in the market with respect to medical imaging. However, this study attempts to highlight the number of AI products in the medical imaging versus the actual number of AI medical imaging products approved by the FDA.

Literature Review

SL.NO.	RESEARCH STUDY	AUTHOR	DATE OF PUBLICATION	DESCRIPTION
1.	An Intelligent Future for Medical Imaging: A Market Outlook on Artificial Intelligence for Medical Imaging	Alexander A, Jiang A, Ferreira C, Zurkiya D.	January, 2020	Between the years 2014 and 2019, investments in AI-based medical imaging companies reached \$1.17 billion. Increase in the number of companies by almost thrice, in this market segment
2.	Global Artificial Intelligence in Medical Imaging Market – Industry Trends and Forecast to 2028	N/A	2021	AI in medical imaging market is dominated by North America and Europe because of increased advancements in healthcare technological infrastructure and high disposable income in these regions
3.	Global AI-Enabled Medical Imaging Solutions Market: 15 Countries Analysis - Analysis and Forecast, 2020-2030	N/A	2020	In the past five years, there have been about 134 joint ventures, collaborations, and partnerships, approximately 102 funding and investments, 101 product approvals, 54 product launches and enhancements, and six mergers and acquisitions in AI in medical imaging
4.	The ethical adoption of artificial intelligence in radiology	Mudgal KS, Das N	29 November, 2019	At present within radiology, most AI developments focus on detection of abnormality. Future AI developments are intended in molecular imaging, radio-genomics, and cancer screening for the entire population

Methodology (1/2)



SEARCH STRATEGY

Data Basis

Via online platform. The databases included FDA, Lancet, NCBI, medRxiv, PubMed and Research gate.

Search Criteria

- Key terms used: 'AI', 'AI adoption in medical imaging', 'Market trends in AI adoption in medical imaging', 'AI and medical imaging', 'AI adoption in radiological imaging', 'AI in radiology'
- Articles published in English language
- Only AI products that received FDA approval between 2014 to May 2021
- Medical imaging on modalities such as X-ray, CT, MRI, MRA, OCT, Ultrasound, Mammography, Electroencephalography, Electrocardiography, Positron Emission Tomography and Angiography
- Articles & research papers with market trend analysis on AI adoption in medical and radiological imaging

Inclusion Criteria

Exclusion Criteria

Articles and studies that analysed adoption of AI in healthcare in general

Methodology (2/2)



STUDY DATA

Study Design

Exploratory and deterministic analysis

Data Type

Secondary

Data Source

FDA 510(k) database

Data Size

126 FDA approved AI products in medical imaging

Data Measurement

Compiled and analysed on Microsoft Excel

Limitations

- 126 FDA approved AI radiology medical imaging products in radiology
- Data used was from the year 2014 to 2020
- Data for the year 2021 not included in this study

Method of Analysis

The AI products in medical imaging that have received FDA approval from 2014 to 2020 was calculated across different categories such as geography, imaging modality and care area

Data Representation

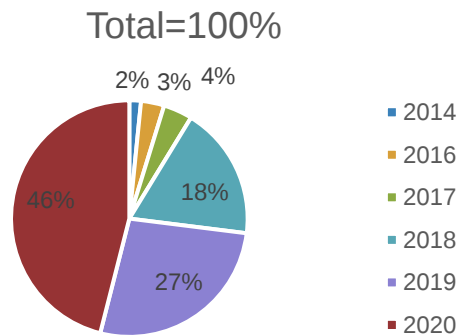
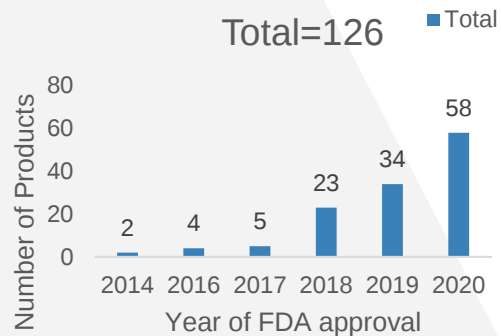
Table, Bar graphs & Pie charts were used to depict absolute count and %age split of AI products across different categories

Results (1/4)



YEAR WISE NUMBER OF AI PRODUCTS IN MEDICAL IMAGING FROM 2014-2020

Out of these 126 AI products, only 2 were approved in 2014, none in 2015, 4 were FDA approved in 2016, 5 AI products were approved by FDA in the year 2017, 23 were FDA approved in the year 2018, 34 were approved by FDA in the year 2019, 58 were approved by FDA in the year 2020. This indicates approximately 70% increase in FDA approval in the year 2020, about 47.8% increase in FDA approvals in the year 2019, about 360% increase in approvals in the year 2018 and 25% increase in 2017.



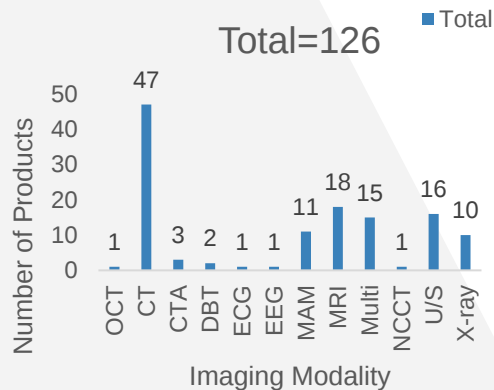
Year of FDA approval	Count of Product
2014	2
2016	4
2017	5
2018	23
2019	34
2020	58
Grand Total	126

Results (2/4)

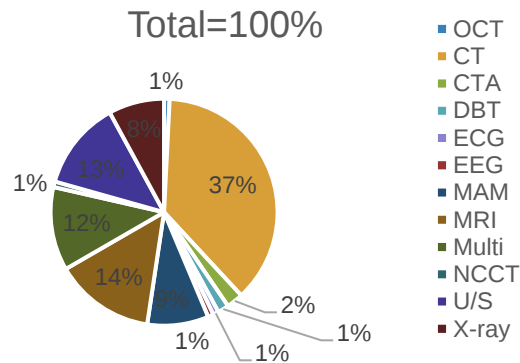


IMAGING MODALITIES ON WHICH AI MEDICAL IMAGING PRODUCTS ARE USED

Out of 126 FDA approved AI products, about 47 were focussed on Computed Tomography (CT) as the imaging modality, 18 on Magnetic Resonance Imaging (MRI), 16 Ultrasound, 15 multi-modality, 10 X-ray and rest on others.



Bar Graph depicting Imaging Modality wise count of FDA Approvals



Pie Chart depicting Imaging Modality wise % count of FDA Approvals

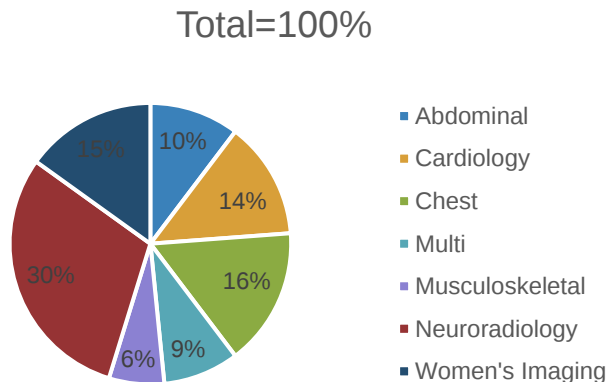
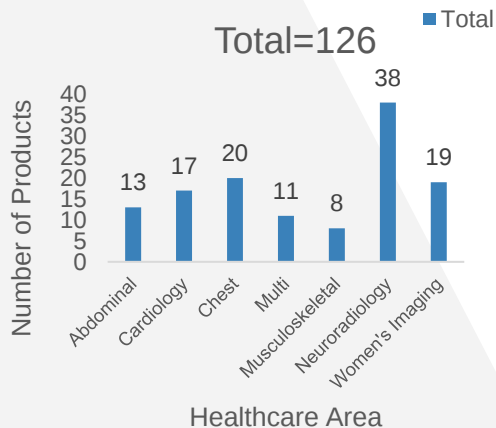
Imaging Modality	Count of Product
OCT	1
CT	47
CTA	3
DBT	2
ECG	1
EEG	1
MAM	11
MRI	18
Multi	15
NCCT	1
U/S	16
X-ray	10
Grand Total	126

Results (3/4)



HEALTHCARE AREAS WHERE AI PRODUCTS IN MEDICAL IMAGING ARE FOCUSED

Further, approximately 38 AI medical imaging products were adopted in neuroradiology care area, followed by 20 AI products specific to chest imaging. Additionally, 19 AI products were focussed in women's healthcare area which included breast imaging for screening and detection of lesions. About 17 AI products in cardiac care was adopted.



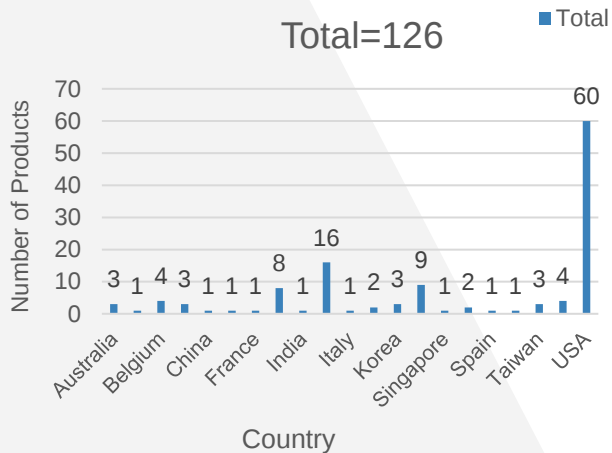
Healthcare Area	Count of Product
Abdominal	13
Cardiology	17
Chest	20
Multi	11
Musculoskeletal	8
Neuroradiology	38
Women's Imaging	19
Grand Total	126

Results (4/4)

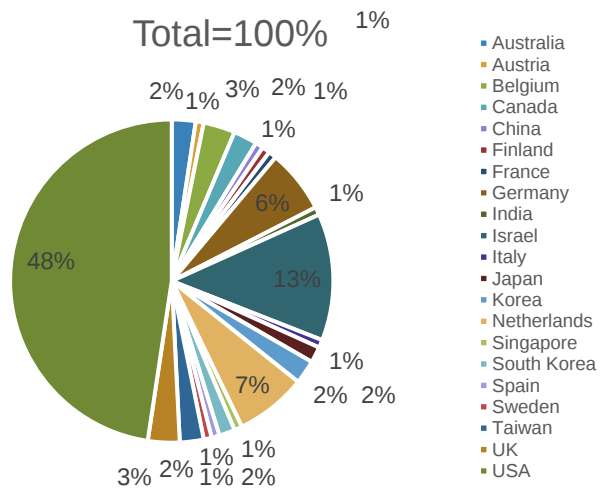


REGIONS WHERE AI MEDICAL IMAGING COMPANIES ARE CENTRED OVER THE WORLD MAP

About 60 AI products are from companies originating in USA, followed by 16 from Israel, 9 from Netherlands and 8 from Germany and rest belong to others.



Bar Graph depicting Country-wise count of FDA Approvals



Pie Chart depicting Country-wise count of FDA Approvals

Country	Count of Product
Australia	3
Austria	1
Belgium	4
Canada	3
China	1
Finland	1
France	1
Germany	8
India	1
Israel	16
Italy	1
Japan	2
Korea	3
Netherlands	9
Singapore	1
South Korea	2
Spain	1
Sweden	1
Taiwan	3
UK	4
USA	60
Grand Total	126

Discussion



Year Wise

The increased advancements in technology have led to increase in number of FDA approvals over the years. The pandemic itself has led companies to launch AI enabled products that can help radiologists to quickly analyse radiological images for detection of pneumonia patches due to COVID 19.



Country Wise

Countries in NA such as USA have more healthcare awareness, technologically advanced healthcare infra coupled with more income. Additionally, the existence of key market participants of the AI medical imaging market and favourable government regulations have propelled the demand for AI in medical imaging.



Imaging Modality

Growing prevalence of chronic lifestyle diseases such as cancer and cardiovascular conditions has been cited as the major reasons for AI adoption in Computed Tomography. The demand for advanced assessment tools in the emergency department has led AI companies to focus on CT as the imaging modality, to enable physicians to detect lesions that go un-noticed on an X-ray.



Healthcare Area

The increasing number of neurovascular disorders such as stroke and Alzheimer's disease, owing to the increasing stress level, have fuelled the requirement of AI in neurology space. The need for recognition of early warning signs for ischemia to prevent stroke, has made this care areas as one of the most researched for AI imaging.

Recommendations

- Image analysis should be cross verified and re-read multiple times by the radiologist, before the report is attached to an image
- Need to think on legal implications for inappropriate clinical outcomes through AI powered medical imaging
- Concerned radiologist must have the final verdict especially on critical decisions such a choosing between oncological treatment and commencing palliative care

Conclusion

- AI seems to play an important role in medical imaging
- It helps in managing the enormous workload by expanding the availability of resources and capabilities of overworked clinicians
- It can help improve the entire workflow process saving time and effort
- Use of AI in medical imaging provides insights and multiple perspectives by both patient and clinicians in continued monitoring of wellness and health
- AI algorithms can help offer a second opinion when there is a disagreement between the radiologists over a complicated medical image
- This practice would help decrease the stress level related to clinical decision making



THANK YOU!