Artificial Intelligence in Radiology

India Perspective

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Telerad Tech
Smarter Healthcare On Demand

Teleradiology SOLUTIONS

SOCIETY FOR EMERGENCY RADIOLOGY
INDIA

Current Challenges in Radiology

- Increasing imaging volumes
- Shortage of radiologists
- Demand-supply mismatch
- Increasing expectations
- Diminishing reimbursements

- Europe--- 12:100,000
- USA---10:100,000
- Singapore – 1: 20,000
- Japan – 1: 35,000
- **India - 1: 100,000**
- Nepal– 1: 200,000
- Bangladesh – 1: 1,000,000

Kalyanpur A. Commentary-radiology in India: the next decade. Indian J Radiol Imag 2008
Chong ST, Robinson JD, et al. Emergency Radiology: Current challenges and preparing for continued growth. JACR2019
Levin DC, Parker L, et al. Recent trends in imaging use in hospital settings: implications for future planning. JACR2017
Hanna TN,et al. Emergency Radiology practice patterns: shifts, schedules and job satisfaction. JACR2016

RADIOLOGIST

Hospita

Send Images

Modiality

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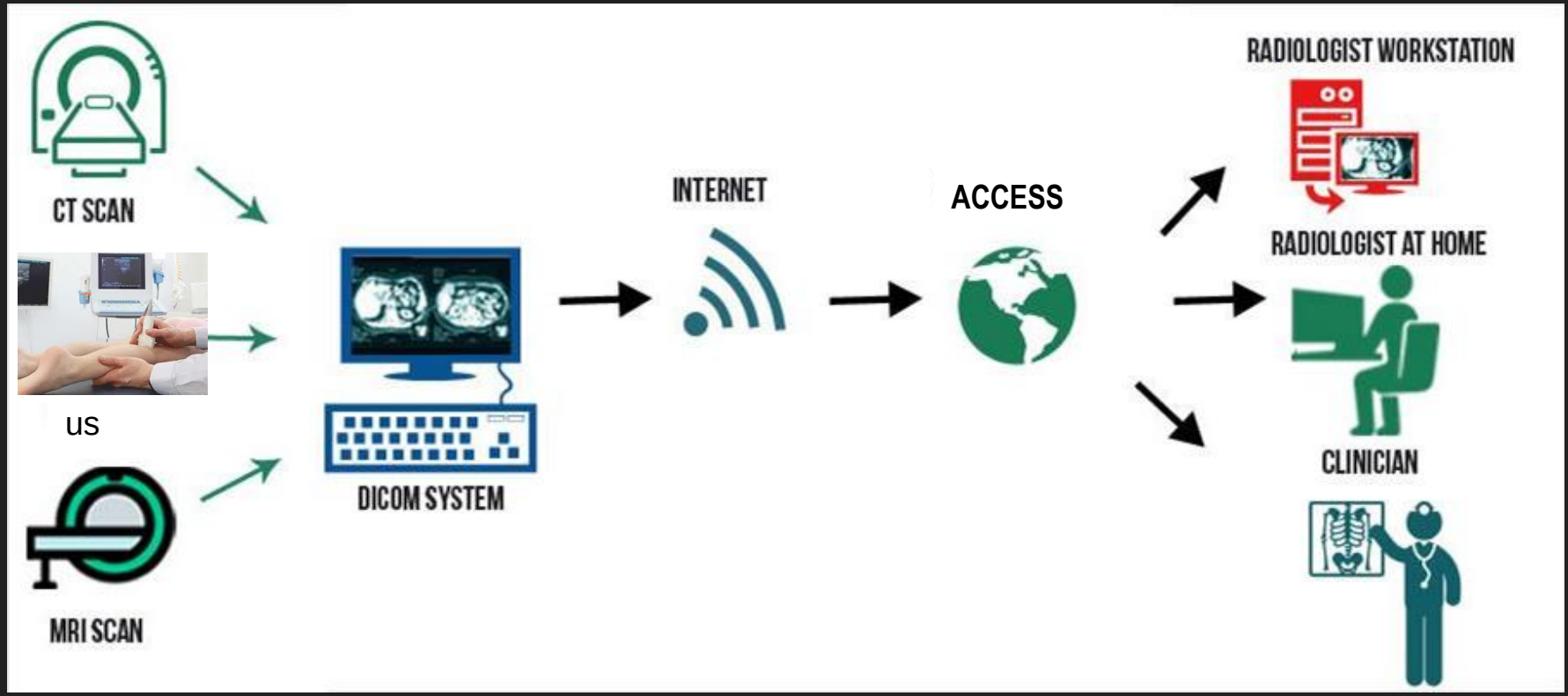
Radiologist

BURN OUT!!

TELERADIOLOGY



CT INTERPRETATION FOR A REMOTE AREA

Only 1 CT scanner, 2 radiologists for a tribal population of 1 million

JTT-09-RW-07

EDUCATION & PRACTICE — Technology

Teleradiology in an inaccessible area of northern India

Amit Char, Arjun Kalyanpur, V N Puttanna Gowda, Anjan Bharathi and Jasbir Singh

Teleradiology Solutions Pvt. Ltd, Bangalore, India

Summary

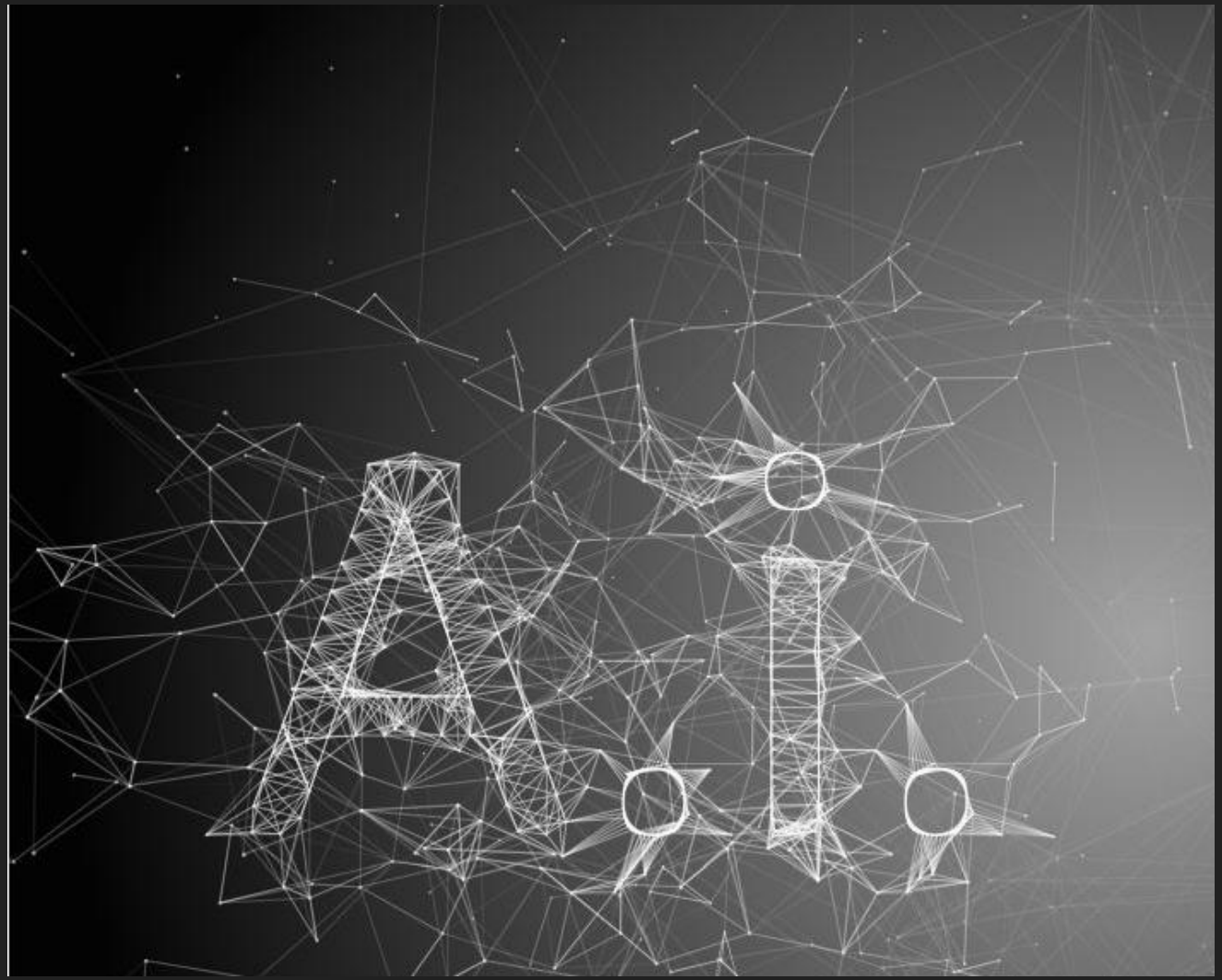
Teleradiology can be used to provide health care to rural populations, especially where there is a scarcity of resources, including on site radiologists. We have established a network link between a commercial teleradiology provider in Bangalore, south India and the Ramakrishna Mission Hospital (RKMH), located at over 3000 km away in the north east of India. Image files were transferred to Bangalore via an ADSL connection using secure file transfer protocol. In the 12-month period beginning in August 2007, a total of 962 studies was sent to Bangalore from the RKMH. The average turnaround time for the report to reach the hospital once the images had been received in Bangalore was 6 hours for non-emergency cases. For emergency cases the turnaround time was consistently below 30 minutes. Because the RKMH was a charitable institution providing rural patients with free or low cost treatment, no charge was made for the reporting. Our experience demonstrates that remote implementation of teleradiology is possible in rural India. The service has proved valuable for the remote hospital concerned.

Teleradiology SOLUTIONS

TELERAD Foundation

International Teleradiology: Boon or a bane?

16 Countries and over 100 hospitals in the United States


AI

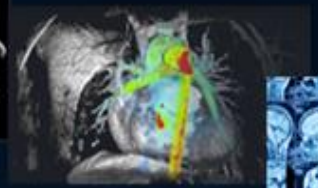
AI Improves Entire Radiology Workflow

From acquisition to prognosis

Acquisition

Image Reconstruction

Processing Visualization



Analysis

Pathology Detection

Diagnosis CAD

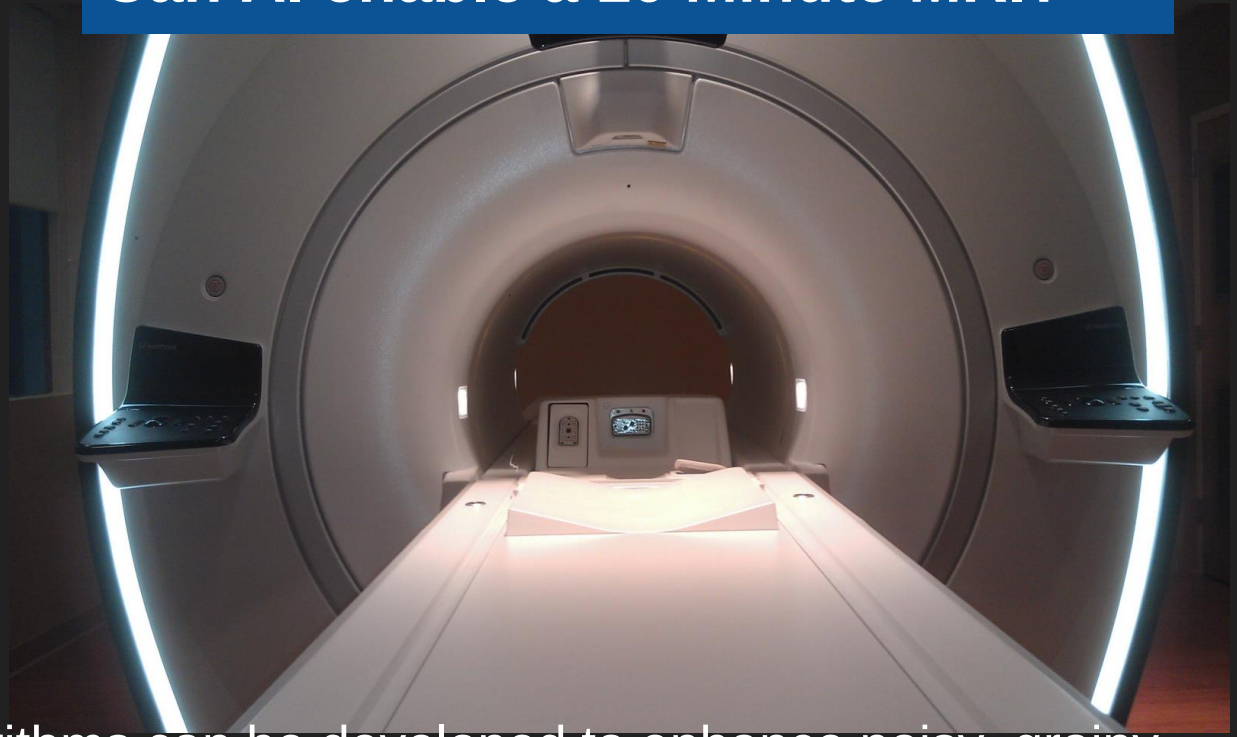
Treatment Prognosis

https://subtlemedical.com/

Image Acquisition

- ➔ Decrease imaging time
- ➔ Decrease radiation dose
- ➔ Decrease contrast dose
- ➔ Reduce artifacts

Can AI enable a 10 Minute MRI?



- Algorithms can be developed to enhance noisy, grainy undersampled MRI images produced in shortened time frames
- Potential to reduce time spent in the MRI scanner by up to 2/3rds!
- **Increase patient throughput**

USE CASES

T2 AI Products

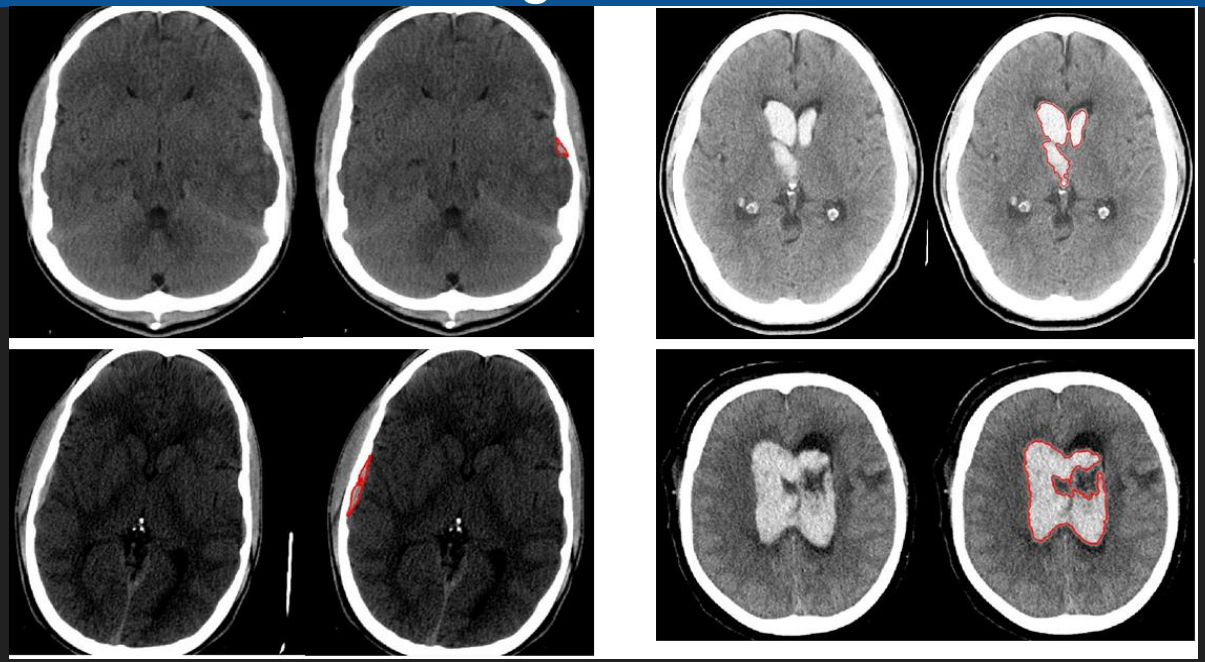
Mammo Assist

1. AI Platform to Assist Radiologist for Screening Mammography Programs
2. Diagnostics Assistant for Radiologist to identify critical clinical findings for improved accuracy.

Neural Assist

- AI Platform to **Prioritize Positive Cases** with Critical Values
- AI Platform for Emergency Radiology to Assist Radiologist in **Ischemic / Hemorrhagic strokes**

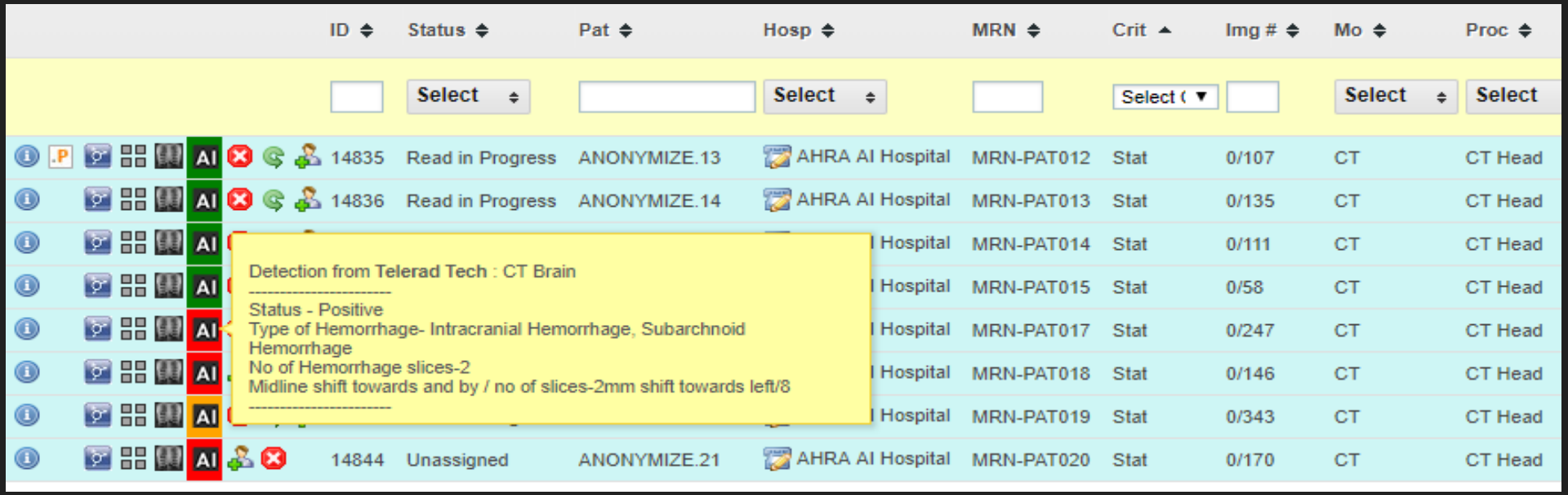
Detection of Intracranial Hemorrhage using Artificial Intelligence Algorithms



Developing Artificial Intelligence Algorithms for Detection of Intracranial Hemorrhage. Anjali Agrawal, Prashant Akhawat, Arjun Kalyanpur

European Society of Emergency Radiology Annual Meeting, Poland, October 2018

AI Integrated with Workflow for Triage and Assist



Critical findings highlighted with color code and with a tooltip summary

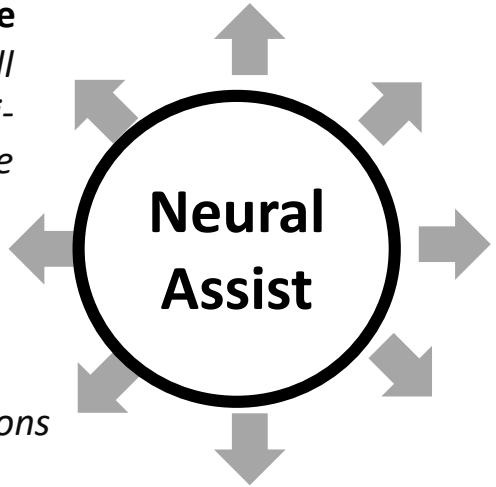
Neural Assist™ - Detection Capabilities (ER Setting)

Midline Shift & Mass Effect

Brain Hemorrhage
IPH, IVH, SAH, SDH, EDH, Small Hemorrhagic Contusions, Muti-compartmental Hemorrhage

Location, Area, Size, Shape, Volume

Bleed and Infarct Annotations



Ischemic Strokes
Acute / Subacute Infarct

Skull Fracture
Linear Fracture

Artifact Elimination

Structured Report

MammoAssist Detection Capabilities

BI-RADS Categorization

Lesion Analysis

High & Iso Density lesions
Fibroadenoma Size &
Shape Analysis

Breast Parenchyma Composition

Type 1: Entirely Fat
Type 2: Scattered Fibro Glandular
Type 3: Heterogeneously Dense
Type 4: Dense Fibro Glandular

Location & Density

Measurements,
Location, Count,
Annotations

Architectural Distortion

Bilateral Asymmetry

Focal Asymmetry

Lymph Nodes

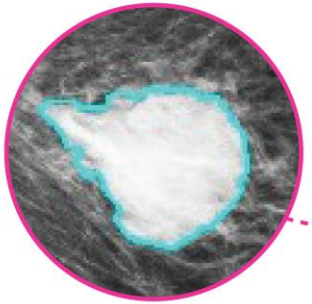
Auxiliary & Abnormal
Lymph Nodes

Calcification Analysis

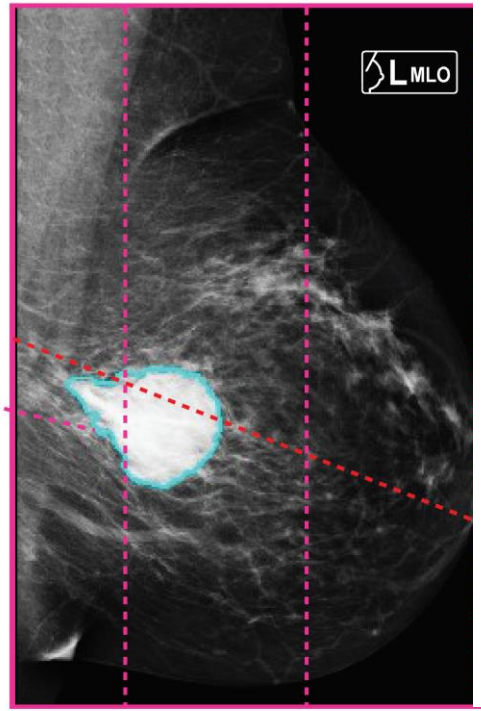
Micro & Macro, Vascular, Clustered Calcification – Amorphous

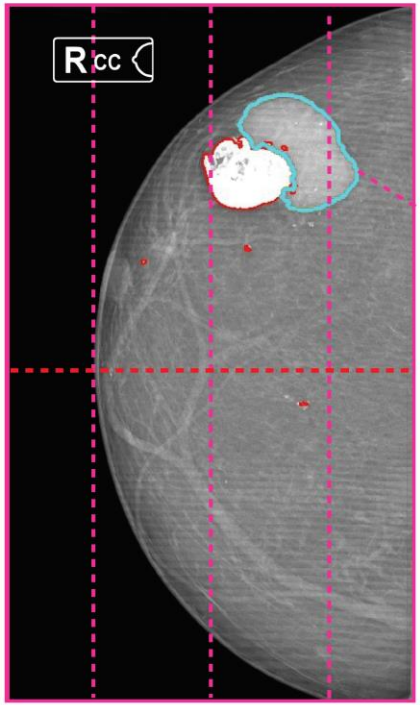
Automated Structured Reporting, Multiple Languages, PACS Integration

Size, Shape, Location Density

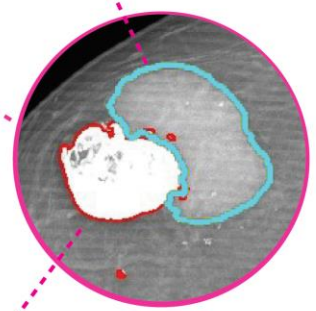


Lesion
Shape: Partially Round
Size: 2.398 cm x1.560 cm
Density: High Dense
Location: Superior Middle





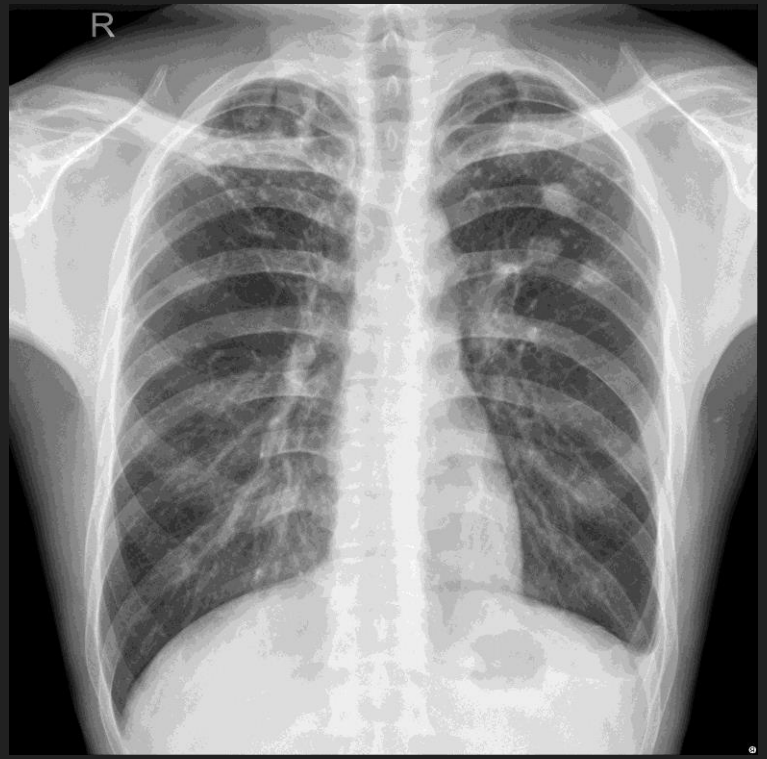
Lesion
Shape: Partially Round
Size: 4.030 cm x 2.530 cm
Density: High Dense
Location: Middle Lateral

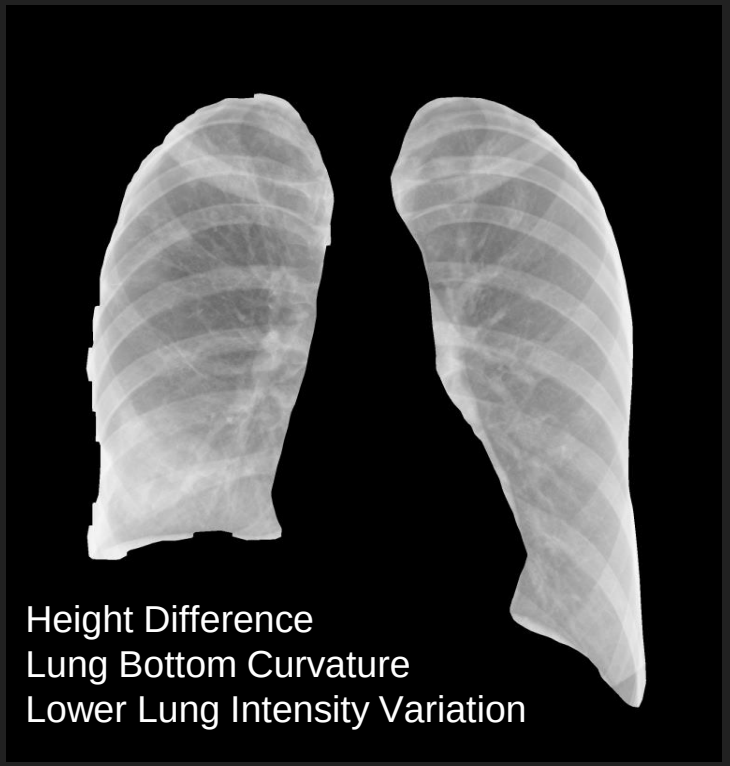


CALCIFICATION
OVERLAPPING LESION

Macro Calcification
Count: 1
Size: 2.401 cm x 2.250 cm
Location: Middle Lateral

Pleural Effusion

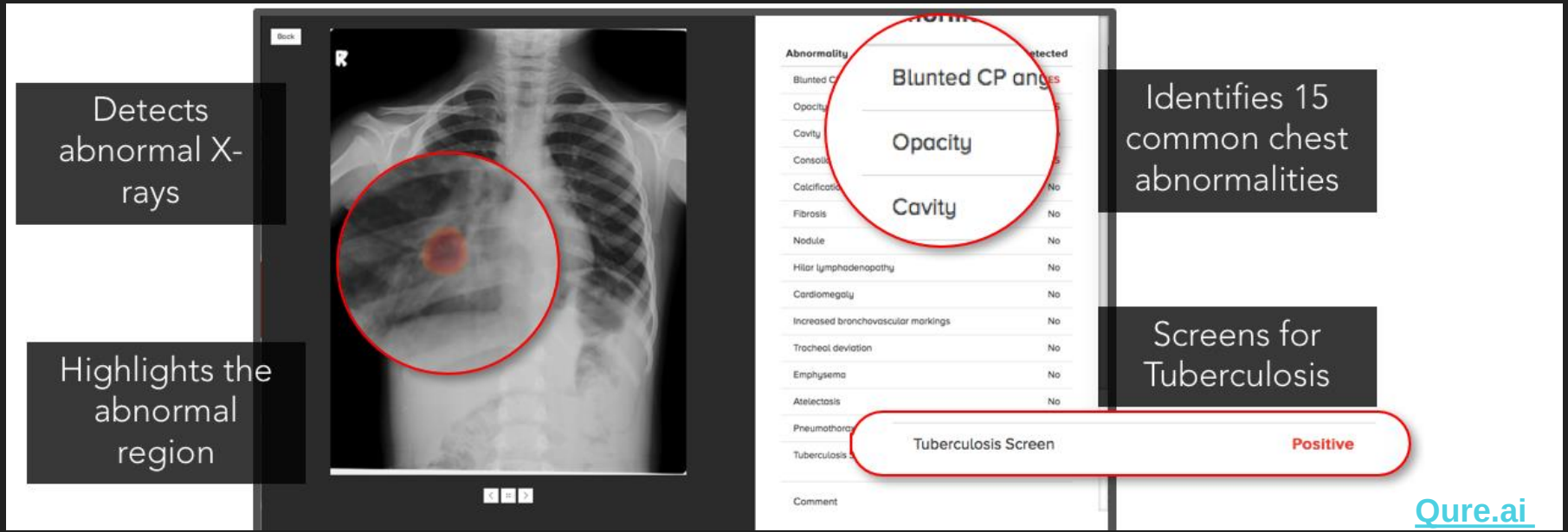




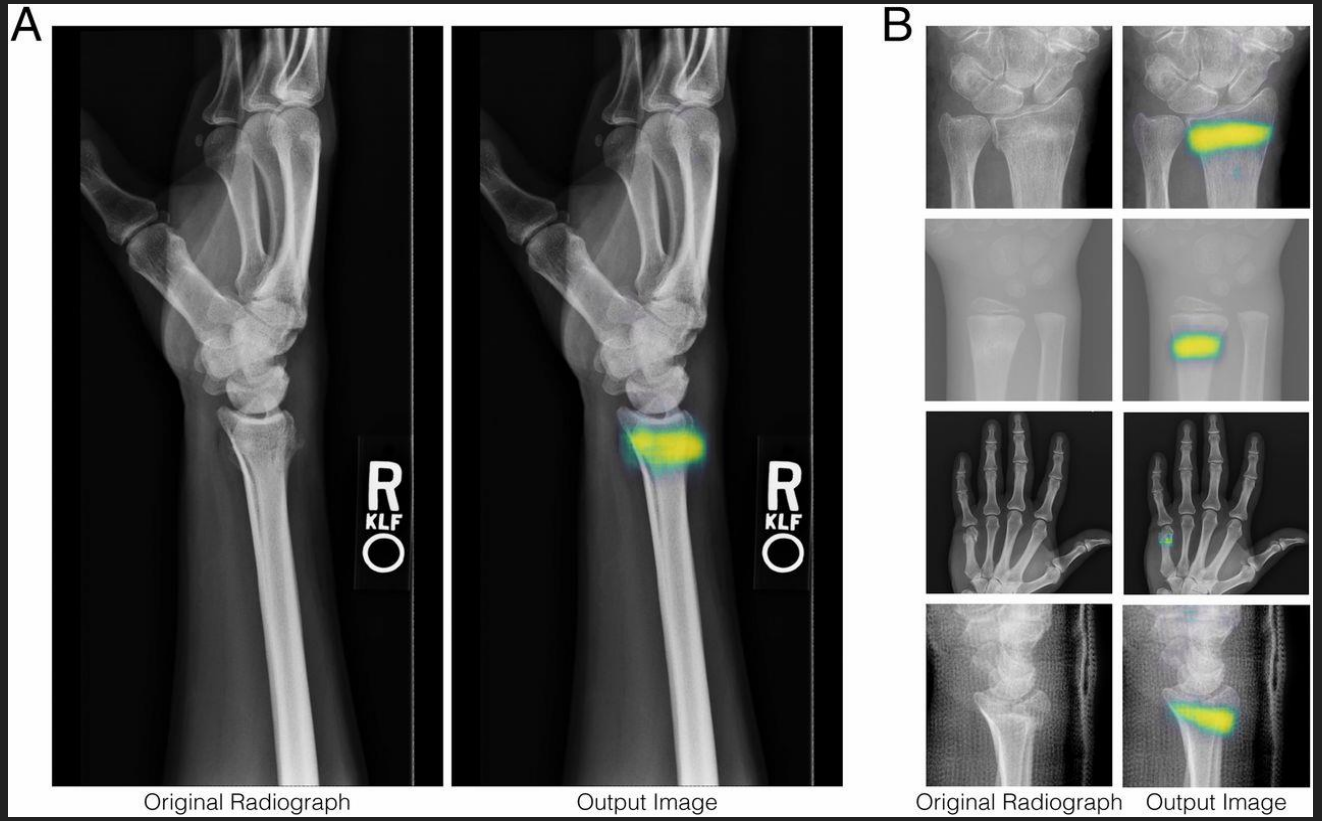
Validation and fine tuning of the Computer Aided Diagnosis of Pulmonary Tuberculosis Model for the Indian Subcontinent. DJ Christopher, CMC Vellore; Brejesh Lall, IIT-Delhi; Anjali Agrawal, TRS

Automated CxR screening for TB

- 80 million CxR s in India- majority unreported by a radiologist, delayed reporting (up to 15 days), errors of up to 25%!



Intelligence Augmentation-Fracture detection



Sensitivity 91.5 % aided and 81% unaided. Specificity 94% vs 88% unaided

Relative reduction in misinterpretation rate of 47%

Lindsey R, et al. Deep neural network improves fracture detection by clinicians. PNAS September 2018

Medical Ultrasound

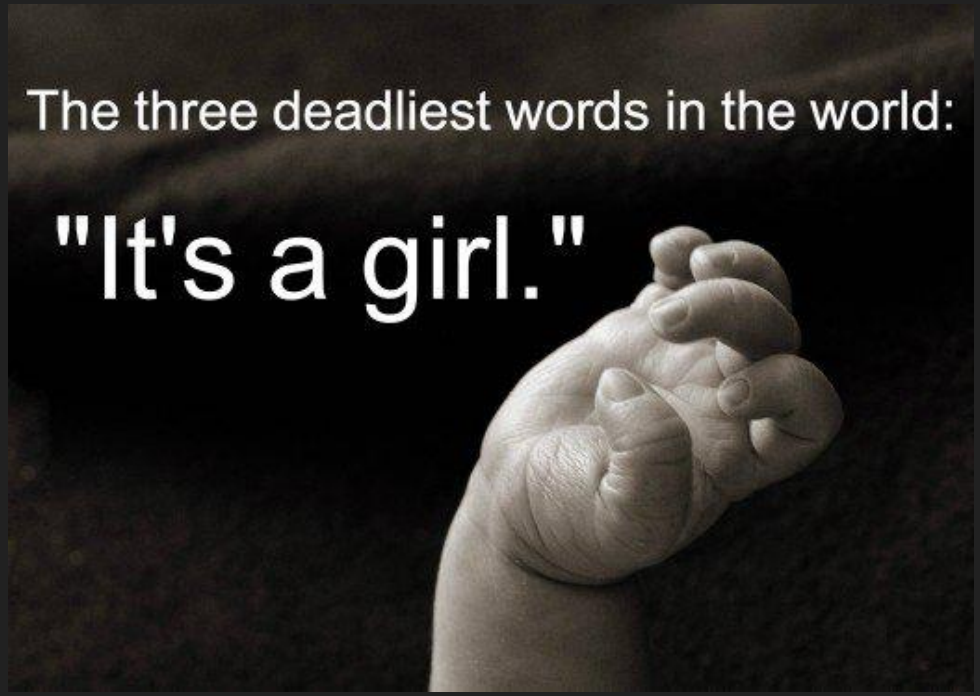
- Core and first line diagnostic imaging modality
- Challenges- **High inter- and intra-operator variability** and **limited image quality control**
- Opportunities- miniaturization of devices, growth in compute power
- Point-of-care applications- real-time scan, portable, no radiation, no special infrastructure

Brattain L J, et al. Machine Learning for Medical Ultrasound: Status, Methods, and Future Opportunities. Abdom Radiol April 2018
Akkus Z, et al. A Survey of Deep-Learning Applications in Ultrasound: Artificial Intelligence-Powered Ultrasound for Improving Clinical Workflow. JACR Sep 2019

“Smart” Technology on a Chip

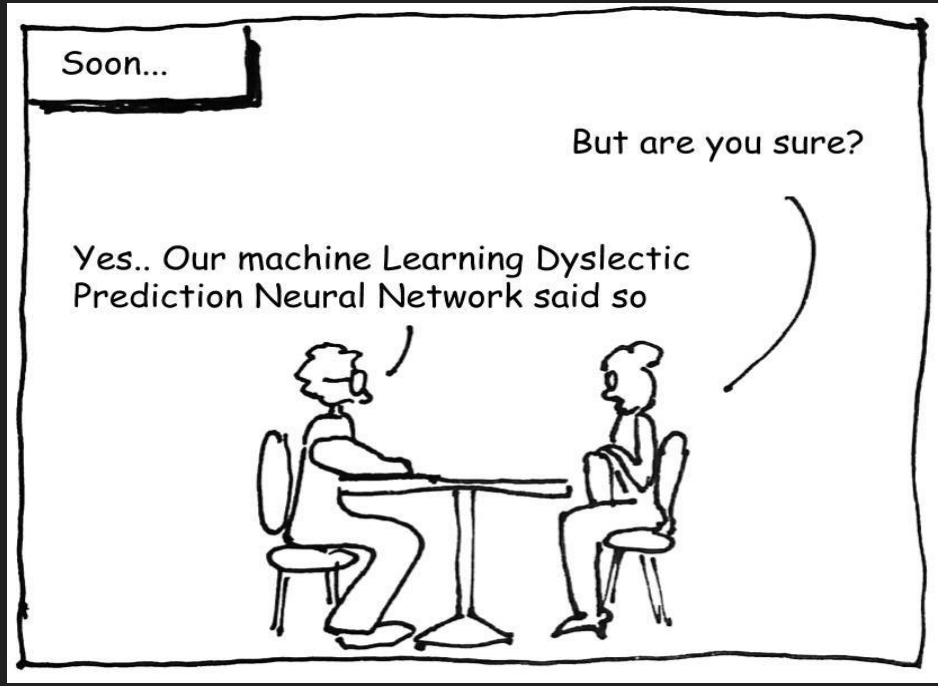
Butterfly iQ

Technology can only enable, intent is key!
Female foeticide as an unintended consequence



Challenges

- “Black box” systems not trained on Indian data



Challenges

Quality control and monitoring

Our team:

Sincere thanks-
Dr Arjun Kalyanpur and
Mr Prashant Akhawat

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