



सत्यमेव जयते



AI4H – Indian perspective

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Indian IT & ICT sector

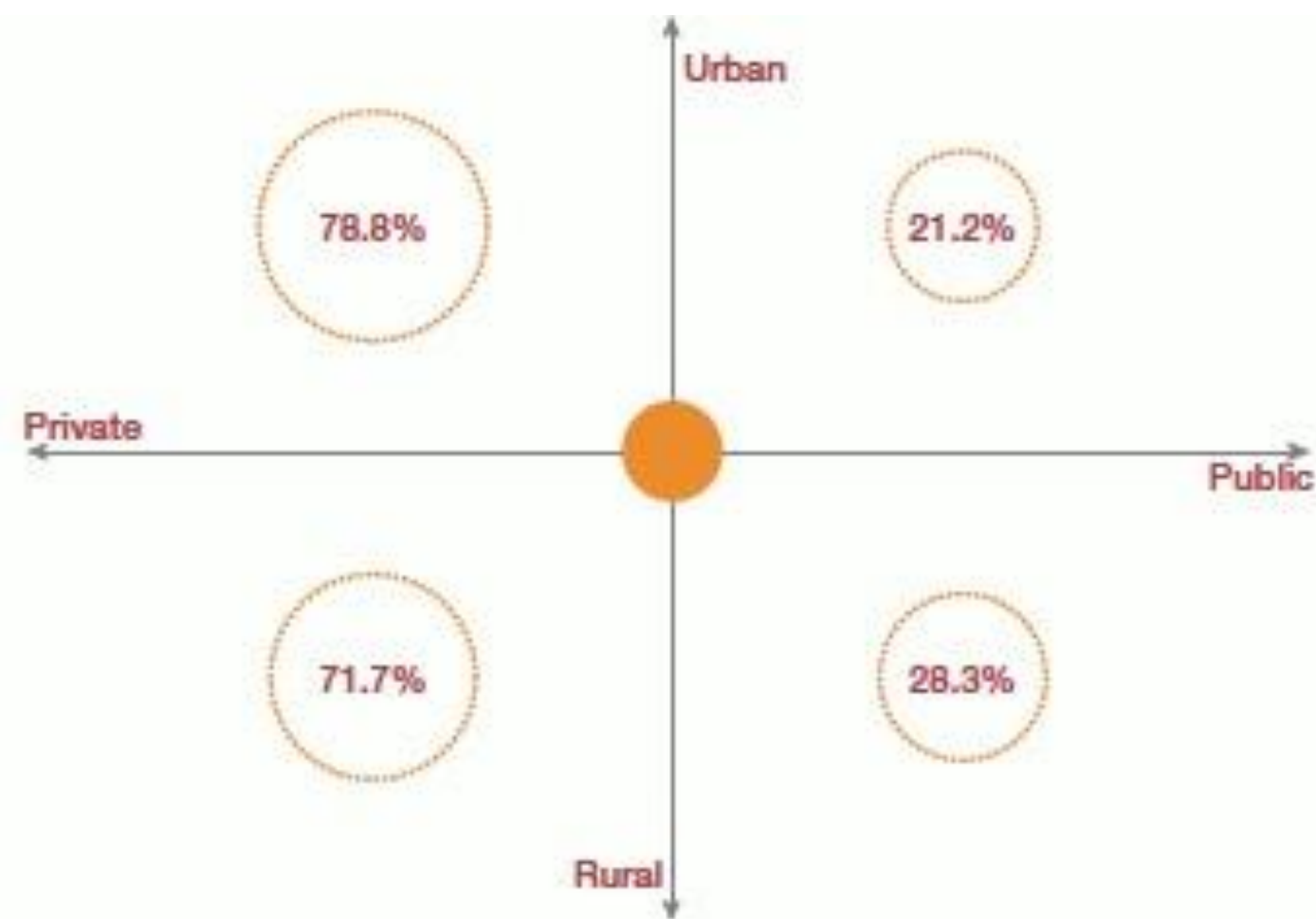
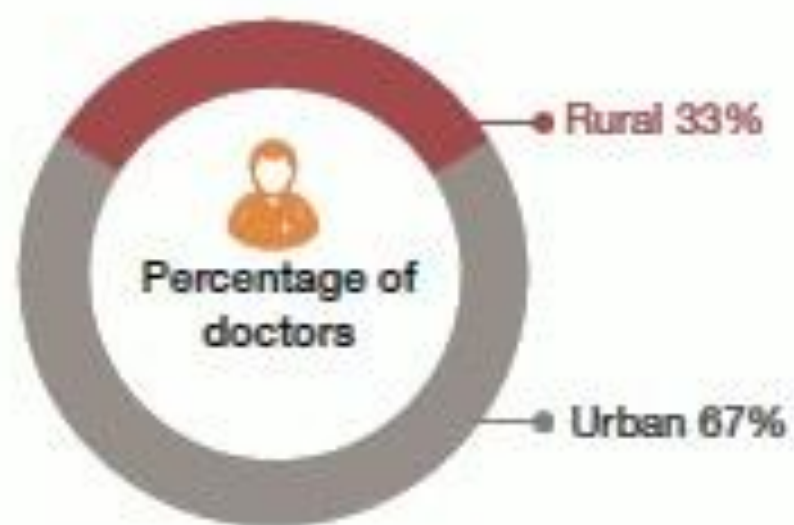
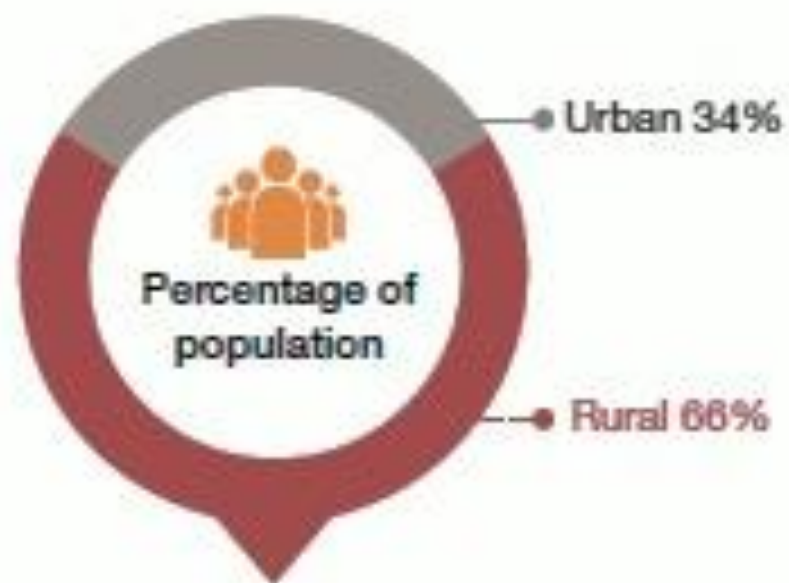
- ❑ India has the 2nd largest telecommunication network in the world
- ❑ 900 Million Indians are expected to use mobile internet by 2025
- ❑ India has a large pool of experts in IT & ICT sector

Indian healthcare – strengths

- ❑ World class facilities exists - an estimated 0.9 million allopathic doctors
- ❑ Indian doctors have established themselves globally

Indian healthcare – challenges

- ❑ Access to quality healthcare remains an issue
 - ❑ There is only 1 doctor for every 1668 people
 - ❑ ~75% doctors practice in urban areas servicing only 28% population
 - ❑ Thus, 25% doctors caters to 76% population





Indian healthcare – challenges

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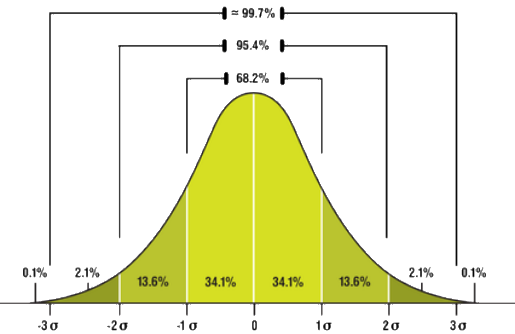
- ❑ One of the highest out of pocket expenditure for healthcare

Challenges in quality healthcare

- ❑ Exponentially increasing patient data
- ❑ Exponentially increasing super-specialization of healthcare
- ❑ No standard policy of data keeping and data sharing
- ❑ Problems of human nature
 - ❑ Bias related to recent experiences
 - ❑ Therapeutic illusion

Unfortunately..

- ❑ Modern healthcare is no where close to 'sigma six'
- ❑ Medical errors remains 3rd most common cause of death
- ❑ We continue to rely on "one size fits all" approach



What AI can offer at this stage

- Descriptive –

- Permits understanding of huge amount data being generated
- Most feasible in short term

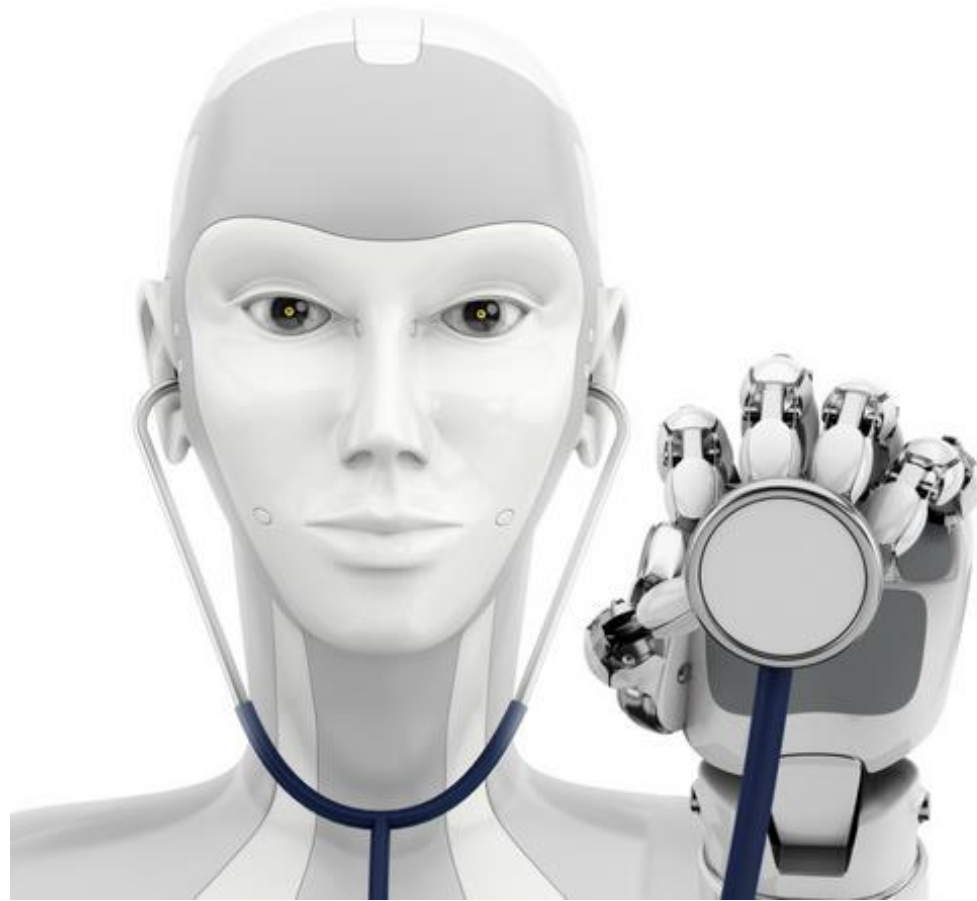
- Predictive –

- To assist management planning
- Medium term

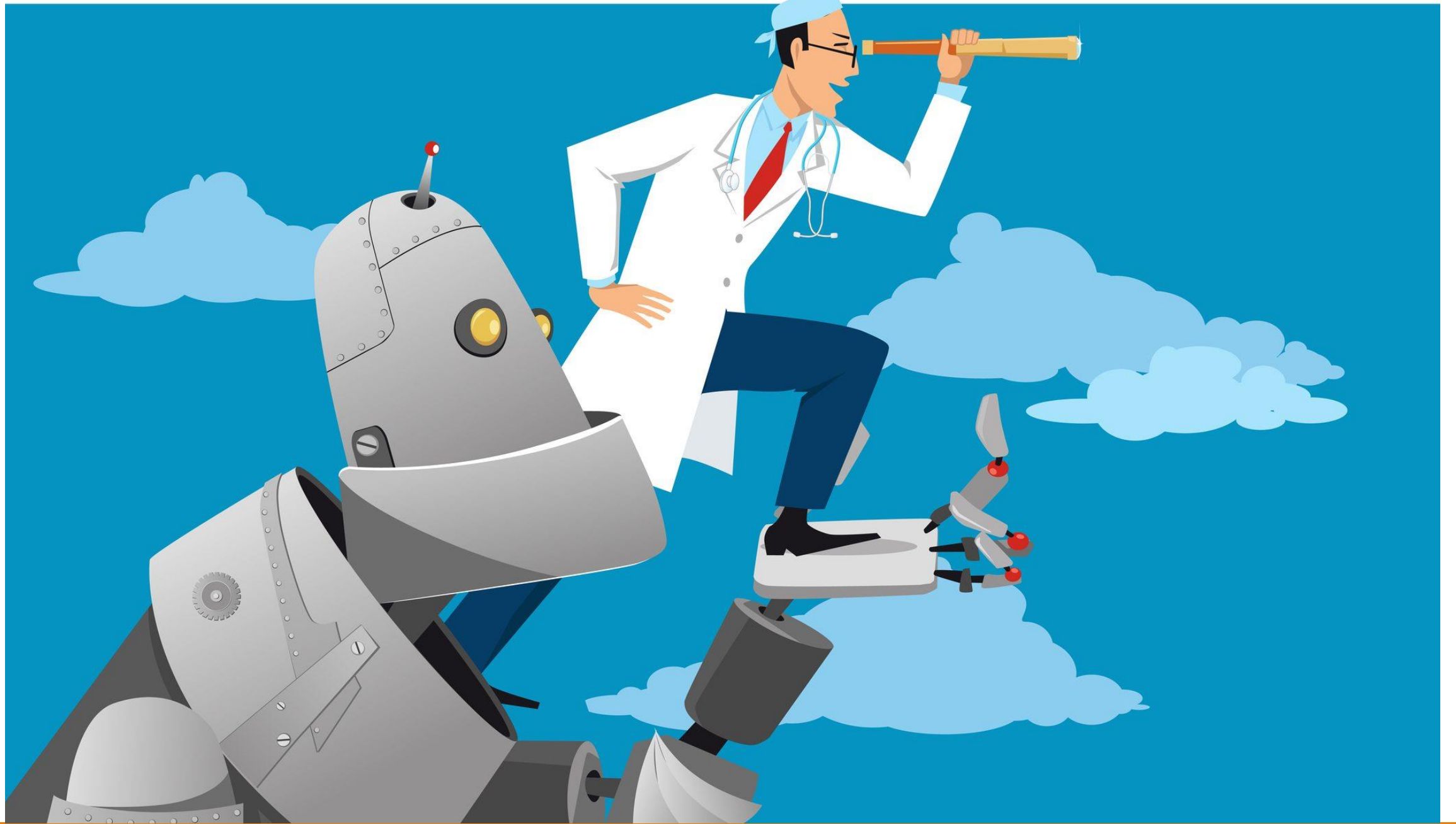
- Prescriptive –

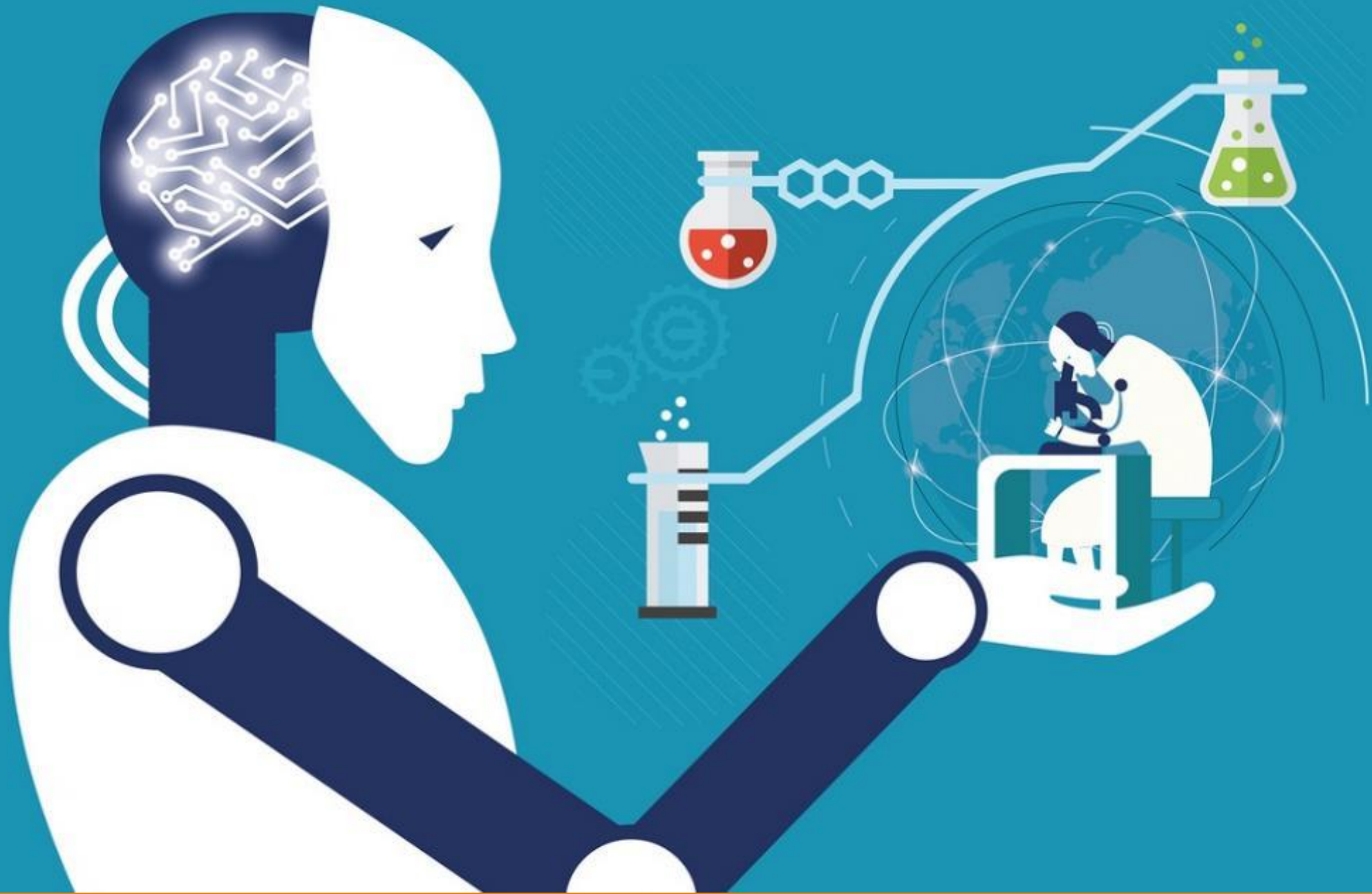
- Guide the healthcare sector in identifying and defining the unknown

Health professionals are anxious



Instead, we should aim for ..





AI4H in India

- ❑ A large pool of IT, ICT and health professionals makes it ideal
- ❑ AI adopted & applicable in India - applicable to 40% of world's population
- ❑ An environment of innovations have prompted many startups to join

AI4H in India – focus areas

- ❑ Bridging the problems of access to quality healthcare
- ❑ Providing preventive healthcare and early diagnostics
- ❑ Standardization of data collection and maintenance

AI4H in India – a success story in making

- ❑ Public and private sectors have joined hands to bring about the change
- ❑ Experts from all sectors are coming together to make best use of AI

AI4H in India – GOI initiatives

- ❑ NeHA (National eHealth Authority) formulated in 2015
- ❑ MHFW & National law school – Health data privacy & security act
- ❑ AI task force was created in 2017
 - ❑ National Institution for Transforming India (NITI Aayog)
 - ❑ Ministry of Electronics & information technology
 - ❑ Department of Science & Technology
 - ❑ Unique Identification Authority of India (UIDAI)
- ❑ New National IPR policy themed ‘Creative India; Innovative India’ in 2016

AI4H in India – Indian hospital's initiatives

- ❑ Aravind eye care systems collaborated with Google brain for retina scans
- ❑ Manipal hospitals collaborated with IBM Watson

As a result....

AI4H is in the forefront of startup industry

□ Digital India program July 2015

□ Atal Innovation Mission 2017

□ Multitude of funding agencies to support technological innovation

<http://www.qure.ai>

qXR

qXR detects abnormal chest X-rays, then identifies and localizes 15 common abnormalities. It also screens for tuberculosis, and is used in public health screening programs.

[Learn how qXR is used for TB screening](#)

qXR was trained with over a million curated X-rays and radiology reports, making it hardware-agnostic and robust to variations in X-ray quality.

Read about algorithm accuracy rates and clinical validation studies.

[Validation studies](#)



qXR is CE certified. Available in the US for investigational use only.

Validation Study I

At Qure, our diverse dataset contains about 1.2 million x-ray images collected from various centers, each with their associated clinical reports.

From these images, 1.15 million images are used for training our algorithms and the rest 75,000 make our test set (QXR-75k dataset)

AUCs

Finding	QXR-75k
Fibrosis	0.9172
Cardiomegaly	0.9502
Consolidation	0.9301
Cavity	0.9264
Infiltration	0.8862
Hilar Prominence	0.9097
Blunted Costophrenic Angle	0.9231
Pleural Effusion	0.9682
Any Abnormality	0.8741



qER

Head CT scans are a first line diagnostic modality for patients with head injury or stroke. qER is designed for triage or diagnostic assistance in this setting. The most critical scans are prioritized on the radiology worklist so that they can be reviewed first. It detects critical abnormalities such as bleeds, fractures mass effect and midline shift, localizes them and quantifies their severity.

Read about the abnormalities detected, our clinical validation studies and accuracy rates.

[Learn More](#)

Deep learning algorithms for detection of critical findings in head CT scans: a retrospective study



Sasank Chilamkurthy, Rohit Ghosh, Swetha Tanamala, Mustafa Biviji, Norbert G Campeau, Vasantha Kumar Venugopal, Vidur Mahajan, Pooja Rao, Prashant Warier

Summary

Background Non-contrast head CT scan is the current standard for initial imaging of patients with head trauma or stroke symptoms. We aimed to develop and validate a set of deep learning algorithms for automated detection of the following key findings from these scans: intracranial haemorrhage and its types (ie, intraparenchymal, intraventricular, subdural, extradural, and subarachnoid); calvarial fractures; midline shift; and mass effect.

Methods We retrospectively collected a dataset containing 313 318 head CT scans together with their clinical reports from around 20 centres in India between Jan 1, 2011, and June 1, 2017. A randomly selected part of this dataset (Qure25k dataset) was used for validation and the rest was used to develop algorithms. An additional validation dataset (CQ500 dataset) was collected in two batches from centres that were different from those used for the development and Qure25k datasets. We excluded postoperative scans and scans of patients younger than 7 years. The original clinical radiology report and consensus of three independent radiologists were considered as gold standard for the Qure25k and CQ500 datasets, respectively. Areas under the receiver operating characteristic curves (AUCs) were primarily used to assess the algorithms.

Findings The Qure25k dataset contained 21 095 scans (mean age 43 years; 9030 [43%] female patients), and the CQ500 dataset consisted of 214 scans in the first batch (mean age 43 years; 94 [44%] female patients) and 277 scans in the second batch (mean age 52 years; 84 [30%] female patients). On the Qure25k dataset, the algorithms achieved an AUC of 0.92 (95% CI 0.91–0.93) for detecting intracranial haemorrhage (0.90 [0.89–0.91] for intraparenchymal, 0.96 [0.94–0.97] for intraventricular, 0.92 [0.90–0.93] for subdural, 0.93 [0.91–0.95] for extradural, and 0.90 [0.89–0.92] for subarachnoid). On the CQ500 dataset, AUC was 0.94 (0.92–0.97) for intracranial haemorrhage (0.95 [0.93–0.98], 0.93 [0.87–1.00], 0.95 [0.91–0.99], 0.97 [0.91–1.00], and 0.96 [0.92–0.99], respectively). AUCs on the Qure25k dataset were 0.92 (0.91–0.94) for calvarial fractures, 0.93 (0.91–0.94) for midline shift, and 0.86 (0.85–0.87) for mass effect, while AUCs on the CQ500 dataset were 0.96 (0.92–1.00), 0.97 (0.94–1.00), and 0.92 (0.89–0.95), respectively.

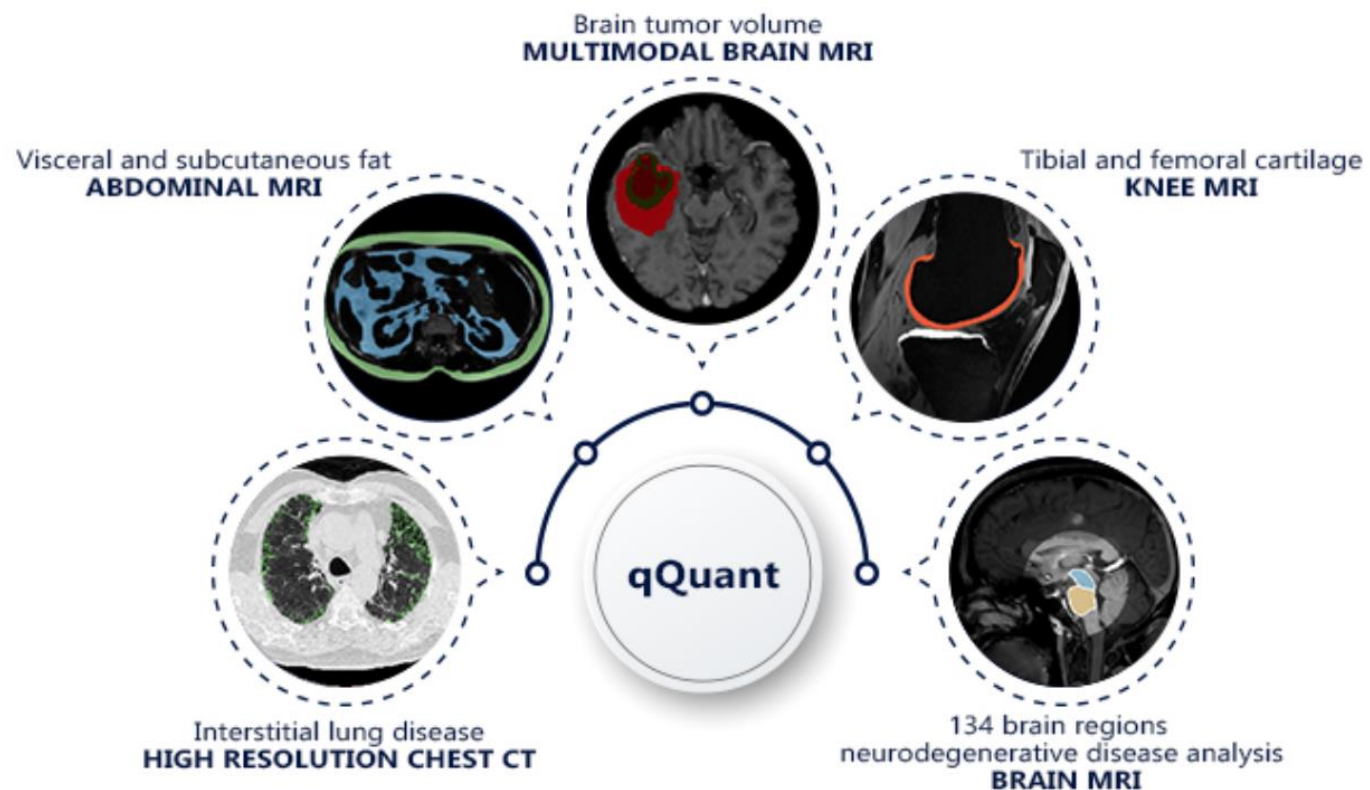
Interpretation Our results show that deep learning algorithms can accurately identify head CT scan abnormalities requiring urgent attention, opening up the possibility to use these algorithms to automate the triage process.

Funding Qure.ai.

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See Online/Comment
[http://dx.doi.org/10.1016/S0140-6736\(18\)31925-1](http://dx.doi.org/10.1016/S0140-6736(18)31925-1)
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qQuant

qQuant is a suite of quantification and progression monitoring products for CT and MRI scans. Each product features fully automated detection, quantification and 3D visualization. The level of precision and reproducibility offered by qQUANT is useful in evaluating pharmaceutical clinical trial outcomes.



qQuant is not intended to aid in diagnosing a medical condition.

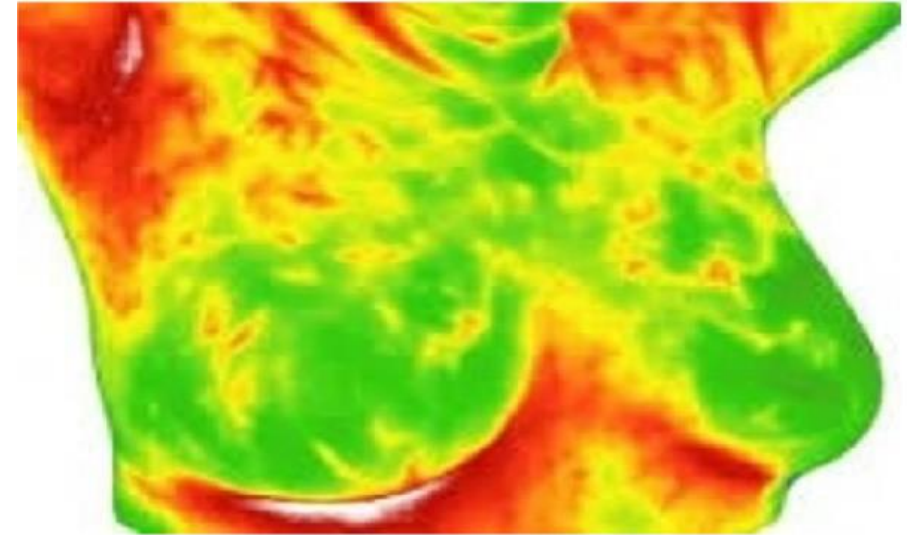
<https://www.wysa.io>

- ❑ A chatbot to help people with mental health problems
- ❑ Enable searly detection & suggestion to visit physician

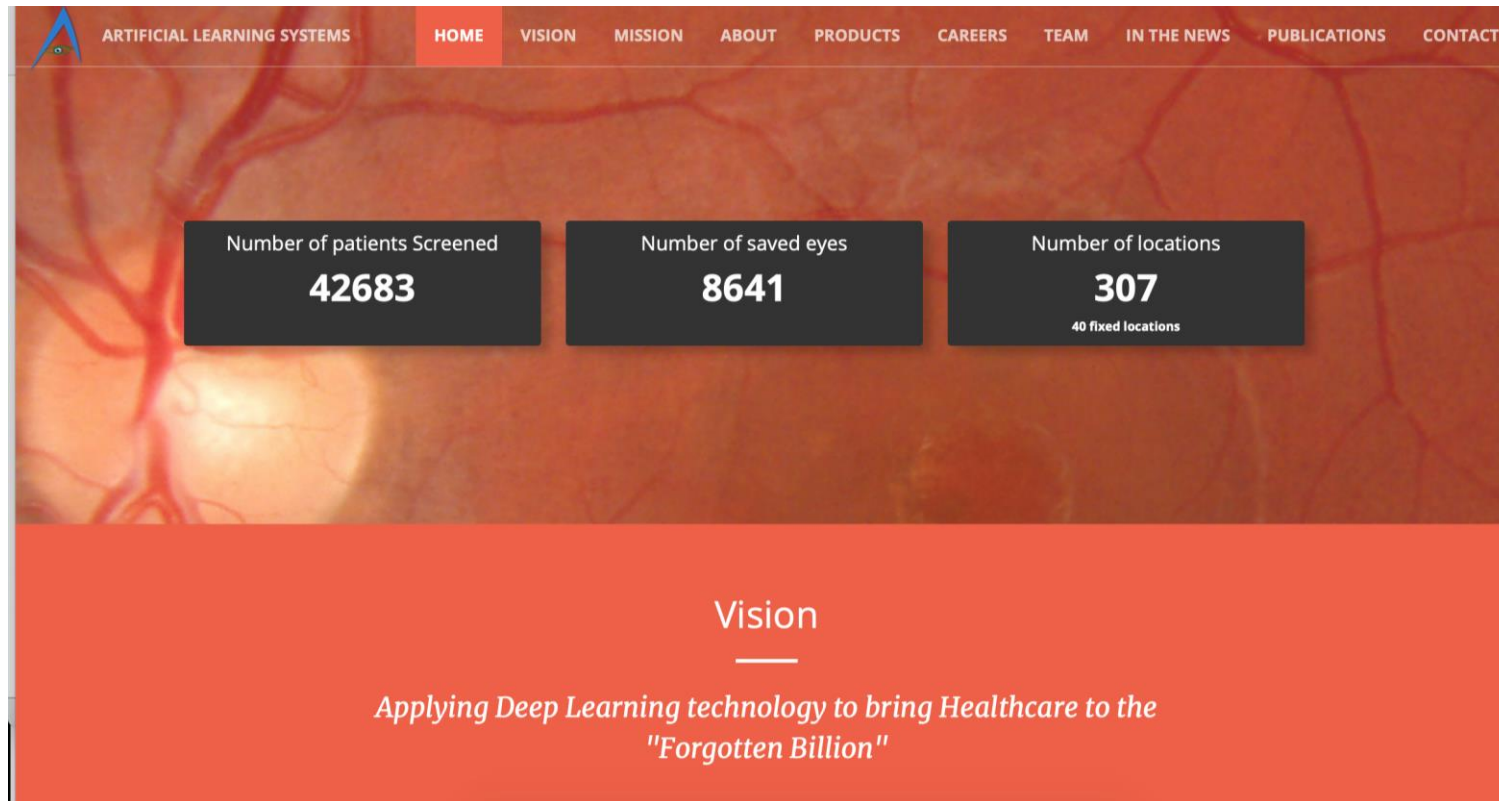


<https://www.niramai.com>

- ❑ Early detection of breast cancer by non-invasive thermography
- ❑ Uses patented Thermolytix & SMILE tool
- ❑ Award winner
 - ❑ Amazon AI conclave 2017
 - ❑ Aegis Graham Bell award 2017
 - ❑ Axilor summer summit Award 2017



<http://artelus.com>



And at least 50 more AI4H companies

- ❑ Advenio technosys – medical images
- ❑ Orbuculum – predicting cancer, diabetes, CVD using genomic data
- ❑ Cureskin – skin lesions diagnosis
- ❑ Ten3T – wireless patch for monitoring HF patients
- ❑ Singtuple – analysis of blood slides to generate pathology reports

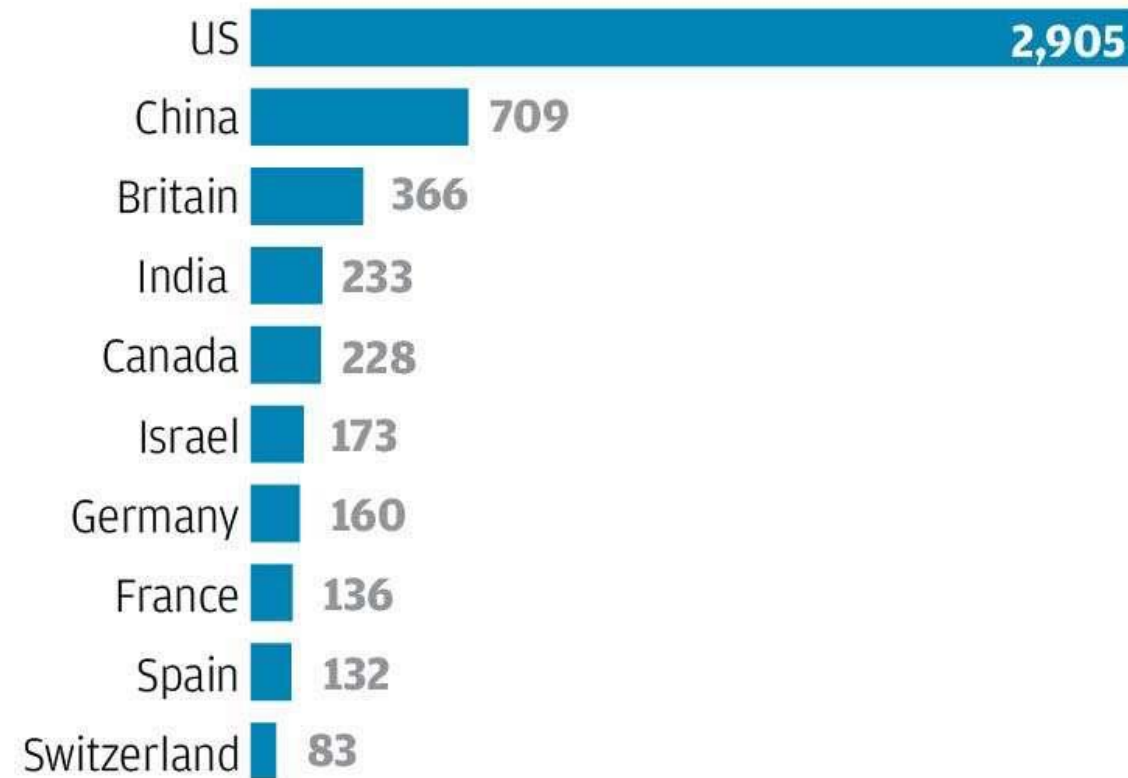
- ❑ ICMR funded AI tool for detection of cervical cancer

ICMR guided AMR surveillance network

- AI based prediction of antibiogram – 90% accuracy

AI companies

Total number of artificial intelligence companies



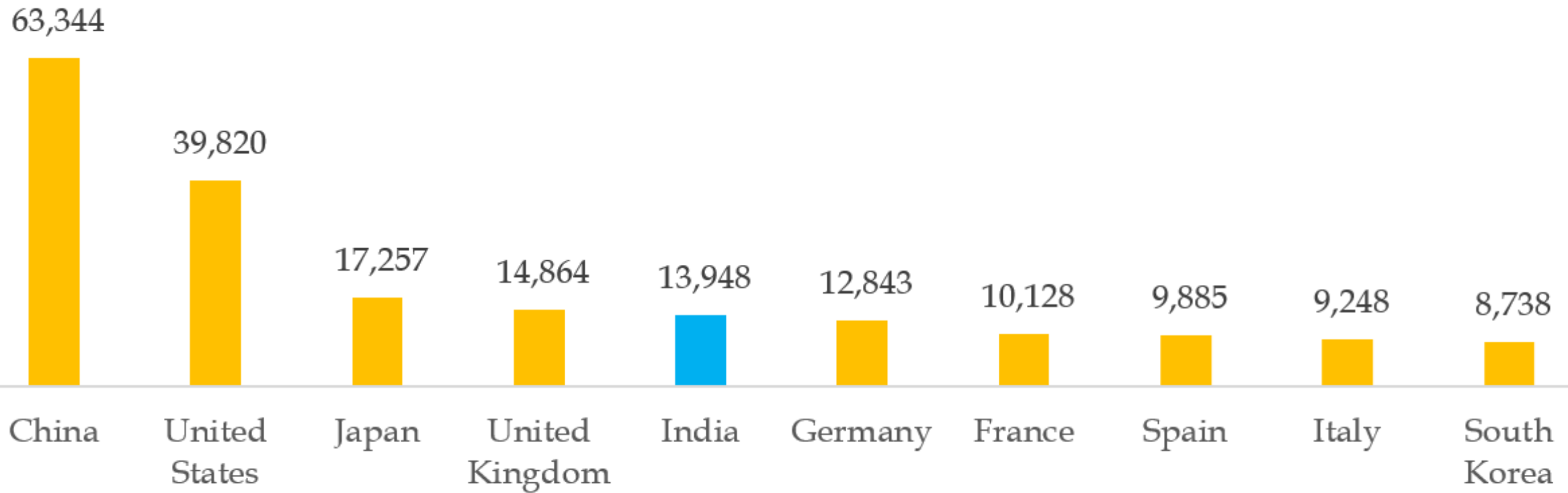
Source: Wuzhen Institute

SCMP

Academia is not behind..

- ❑ Masters in AI is at leading IT institutions – both public & private
- ❑ Postdoc fellowships for doctors is becoming common
- ❑ Bachelors in AI is being adopted rapidly

Citable research in AI (2010- 2016)



Scimago Journal and Country Rank (SJR)

Data management

- Data is the smallest and probably the most important unit of AI ecosystem



1.19 Billion AADHAAR cards

AIRAWAT

(AI research, Analytics and knowWledge Assimilation plaTform)



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MINISTRY
OF HEALTH &
FAMILY WELFARE
Government of India



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Ministry of Electronics and
Information Technology
Government of India



सत्यमेव जयते

Department of Science and Technology
Ministry of Science and Technology
Government of India



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नीति आयोग

Different IIT's in INDIA



icmr
INDIAN COUNCIL OF
MEDICAL RESEARCH
Serving the nation since 1911

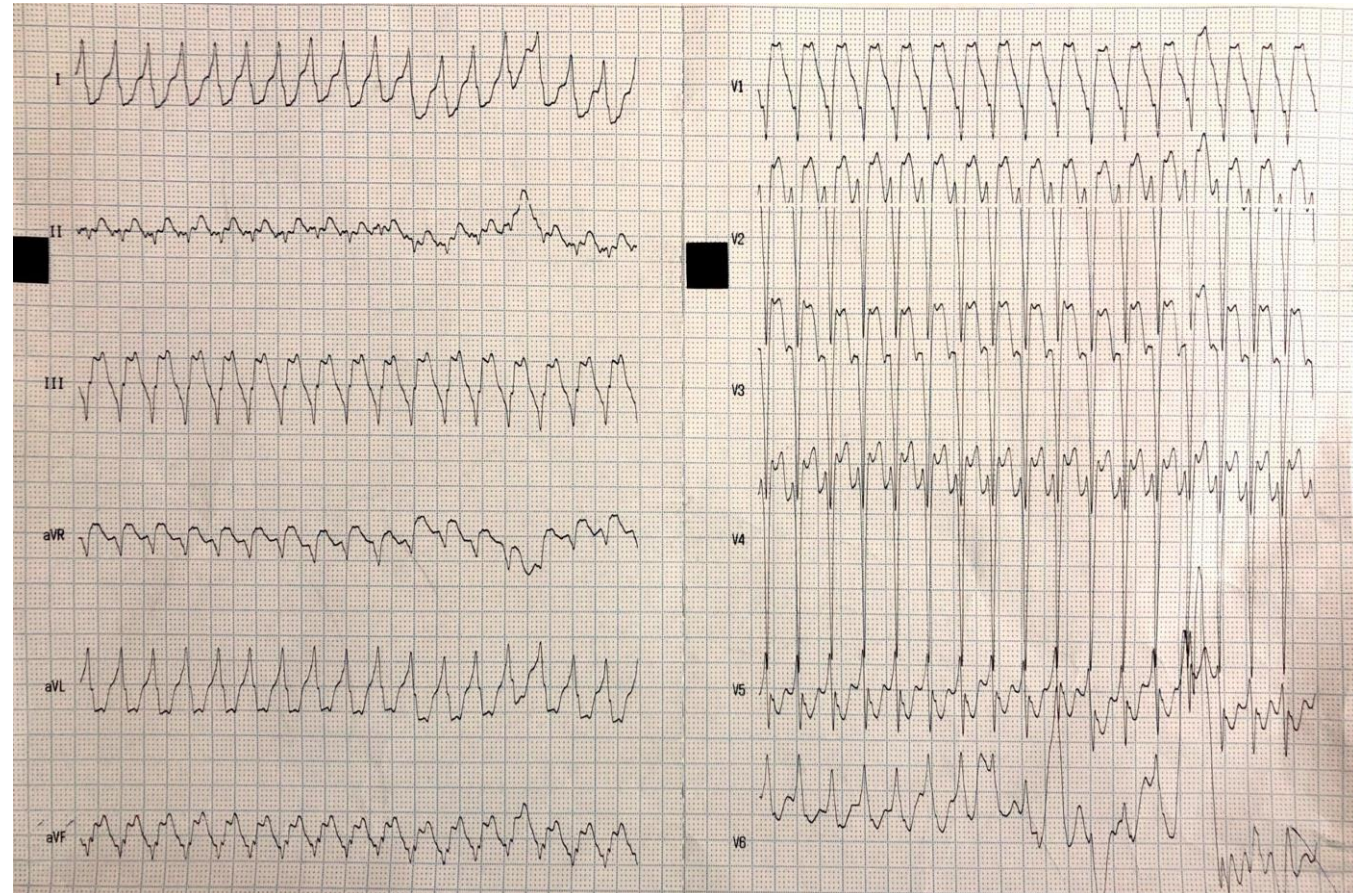


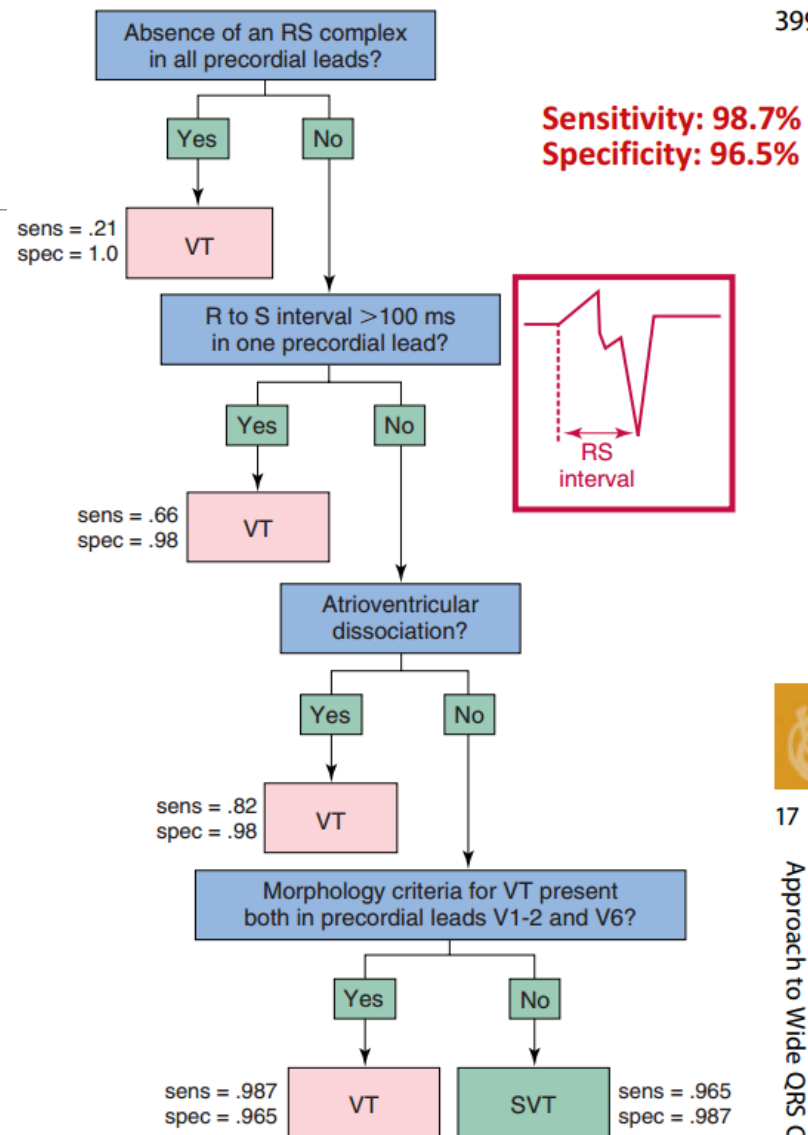
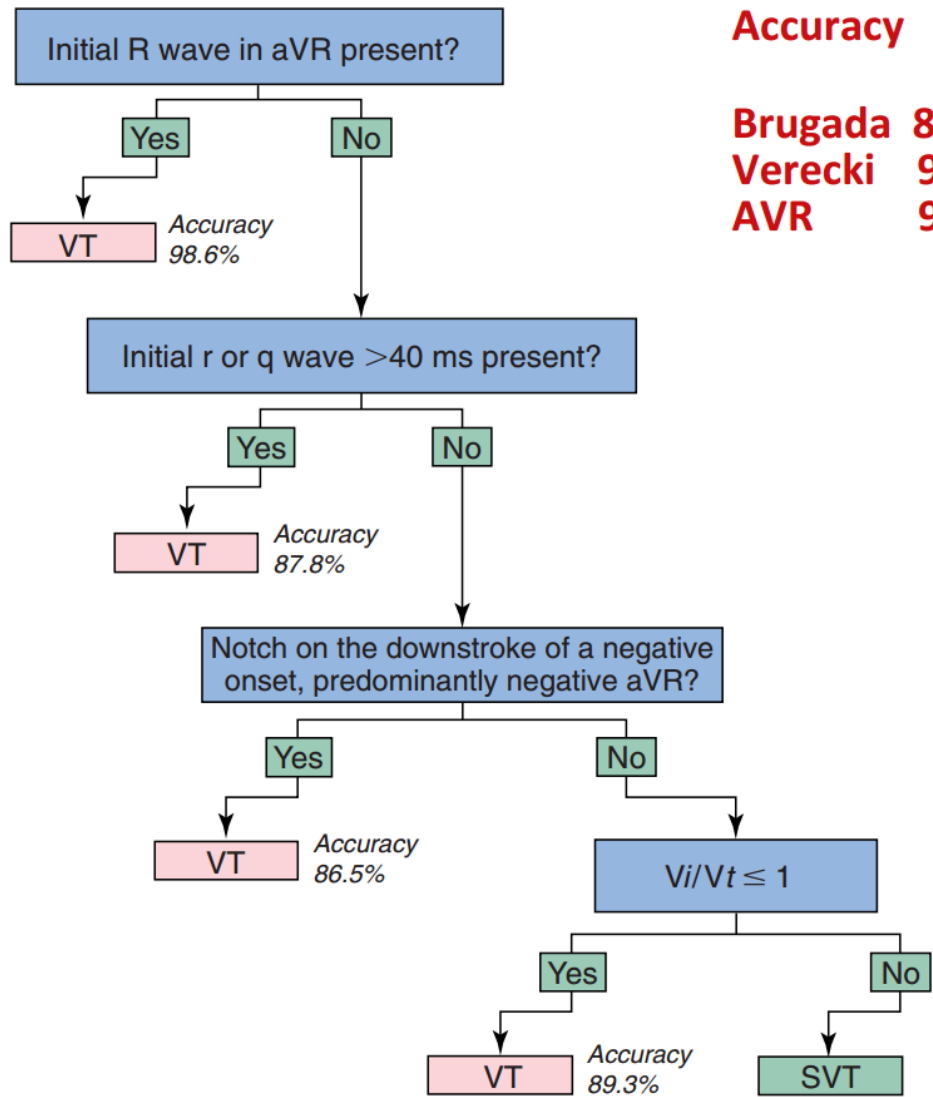
अखिल भारतीय आयुर्विज्ञान संस्थान
ALL INDIA INSTITUTE OF MEDICAL SCIENCES

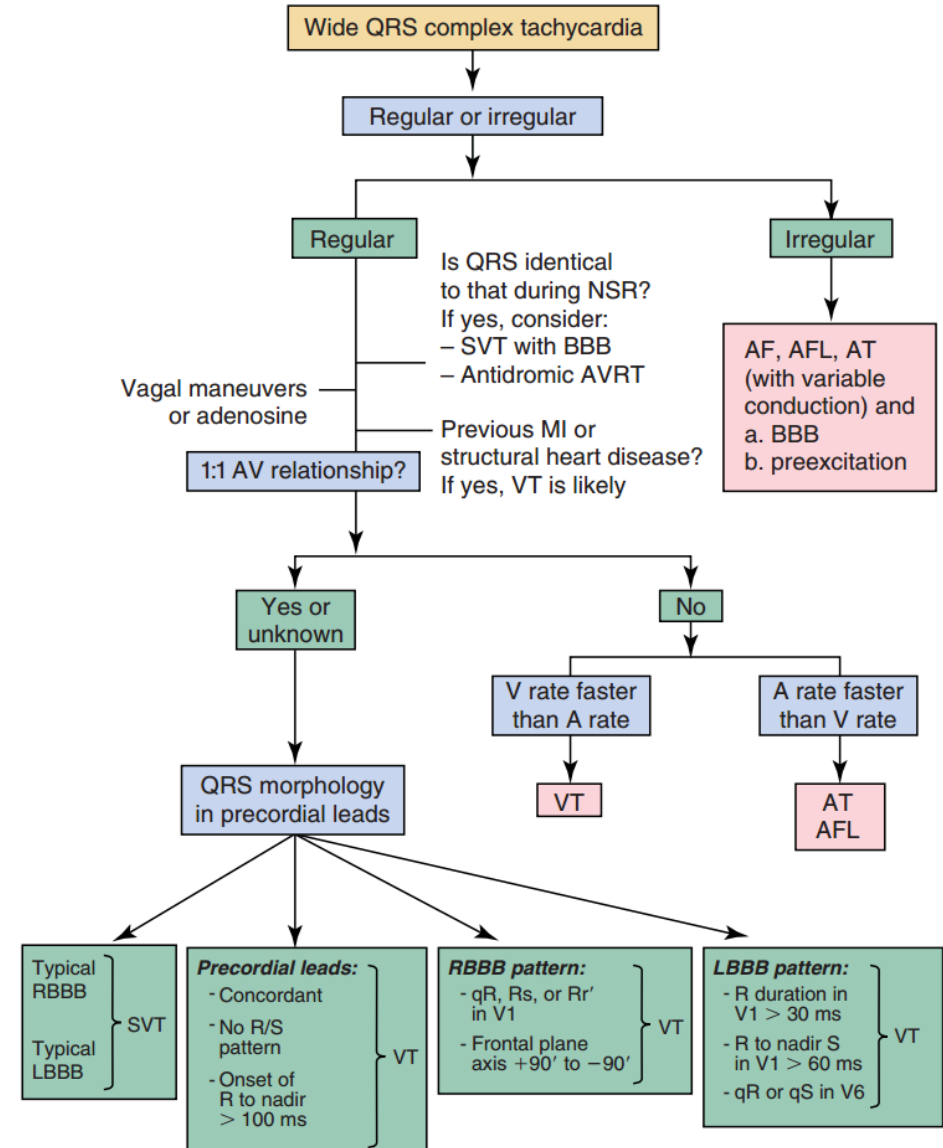
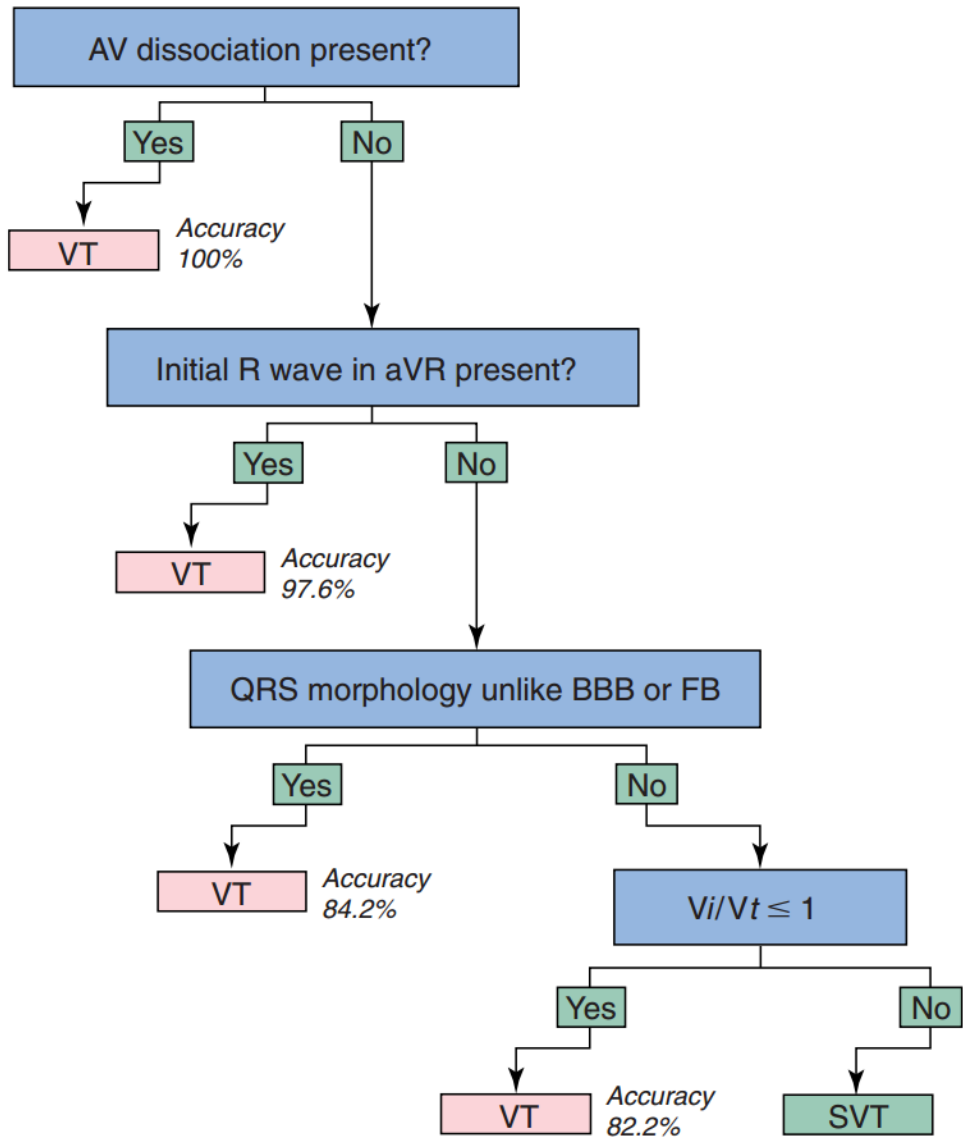
Some other proposed clinical area for AI

- ❑ Complex decision making analysis – cardiac electrophysiology

Differentiating VT (life threatening) from SVT







Some other proposed clinical area for AI

- ❑ Enhanced 3D visualization of cardiac structural malformations
 - ❑ Improved understanding of cardiac morphology obviating heart specimens
 - ❑ For better surgical/ interventional planning



Summary

- ❑ AI provides 'once in a life-time opportunity to bring change
- ❑ Indian public & private sector is committed to develop
Accurate, creditable, responsible and preferably explainable AI4H
- ❑ AI validated in India is directly applicable to nearly half of the World
- ❑ Data privacy, sharing and security issues remains to be answered

In nutshell..

India is ready, willing and able to develop and deploy AI4H

Thank you