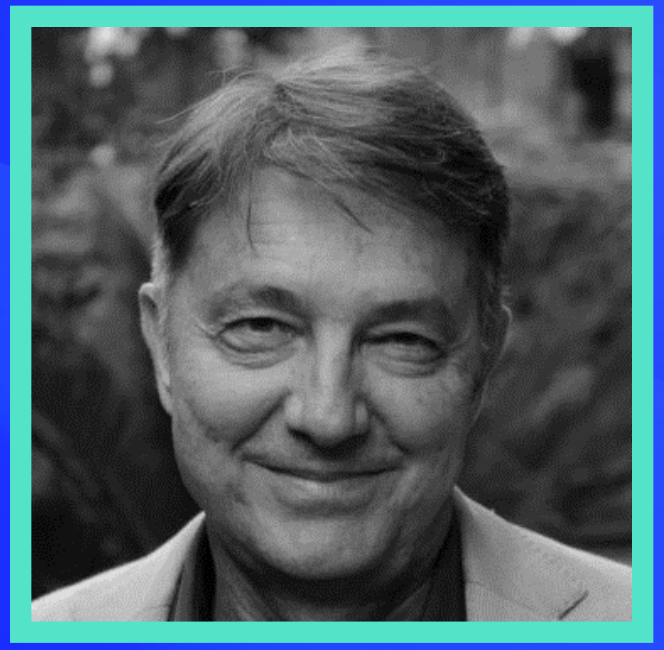
USE CASE
Using AI to overcome inequalities in healthcare for children



Alberto Tozzi

Head of Predictive and Preventive Medicine Research Unit

Bambino Gesù Children's Hospital, Rome

Using AI to overcome inequalities in healthcare for children

Alberto E Tozzi

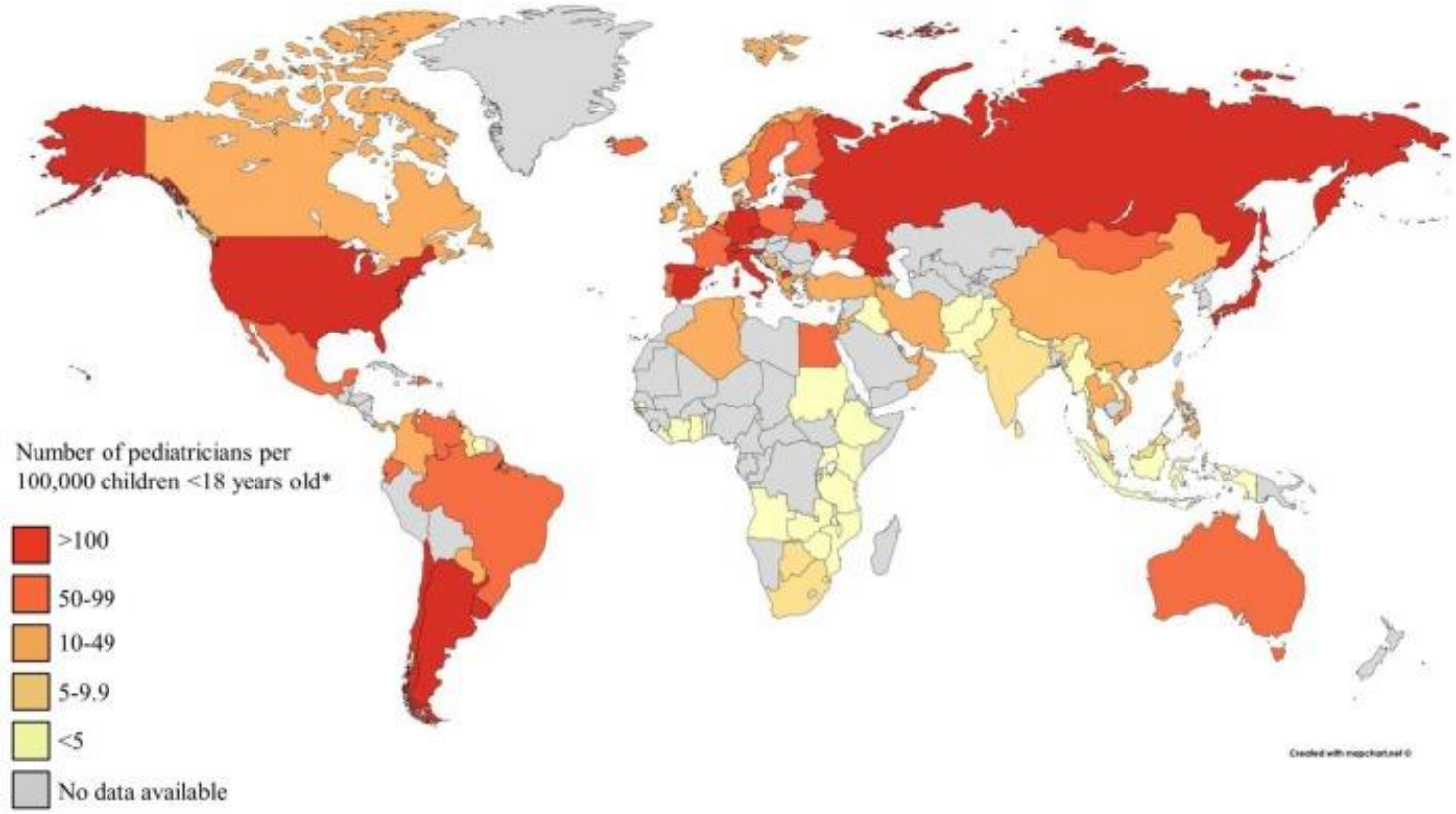
Predictive and Preventive Medicine Research Unit, Head

International Society for Pediatric Innovation, President

Bambino Gesù
OSPEDALE PEDIATRICO

INTERNATIONAL SOCIETY FOR Pediatric Innovation
ISPI

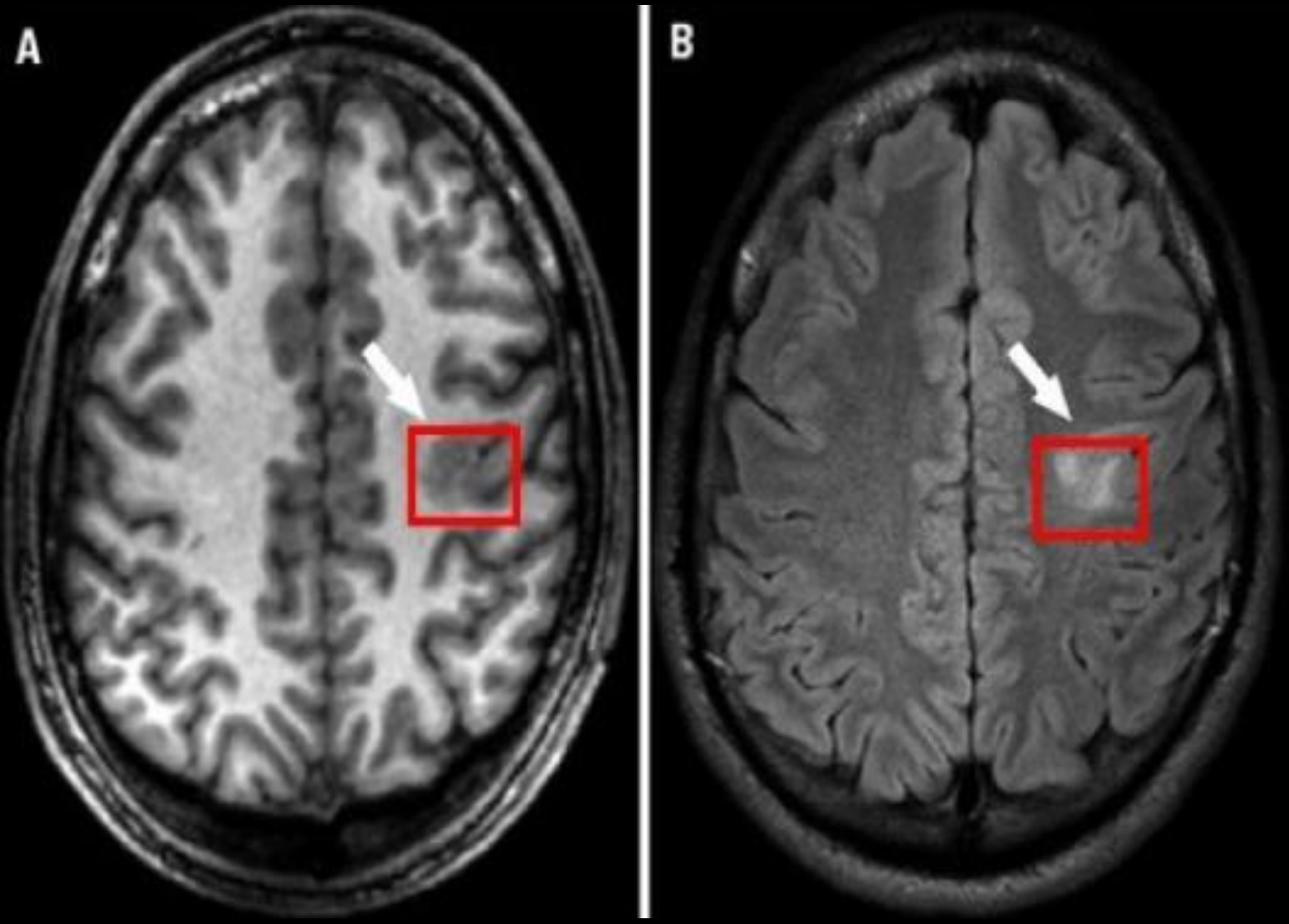
Number of pediatricians per 100,000 children



*Data Source: UNICEF Country Statistics

Can we increase the number of specialists as population grows?

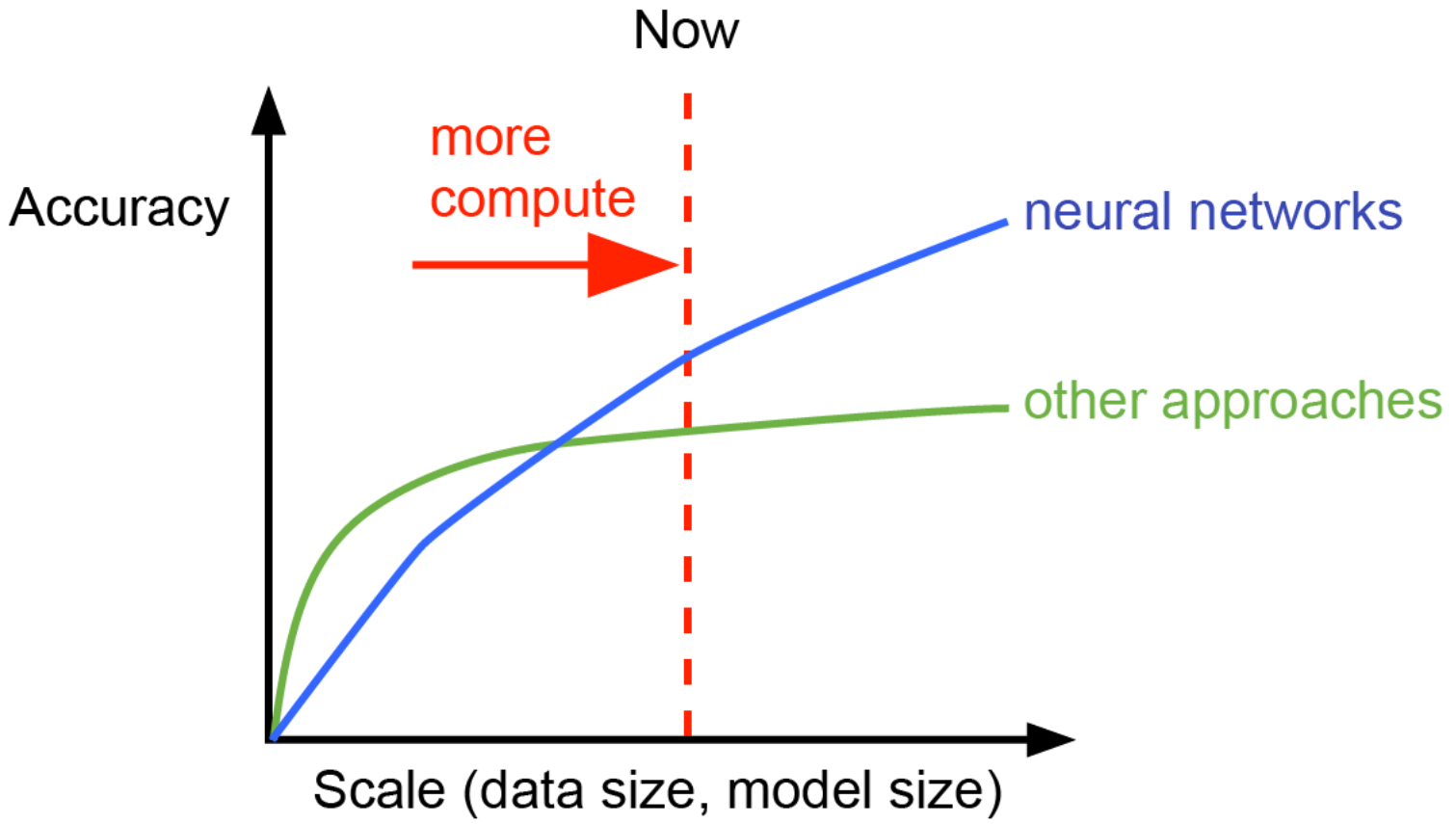
- US: 3000 pediatric cardiologists – pediatric population +4M per year
- Ontario, Canada: 50 pediatric cardiologists, none in Thunder Bay
- Mexico: Congenital heart disease (CHD) is the second most common cause of death in children under 5
- India: 300 pediatric cardiologists for a population of 1.39B people



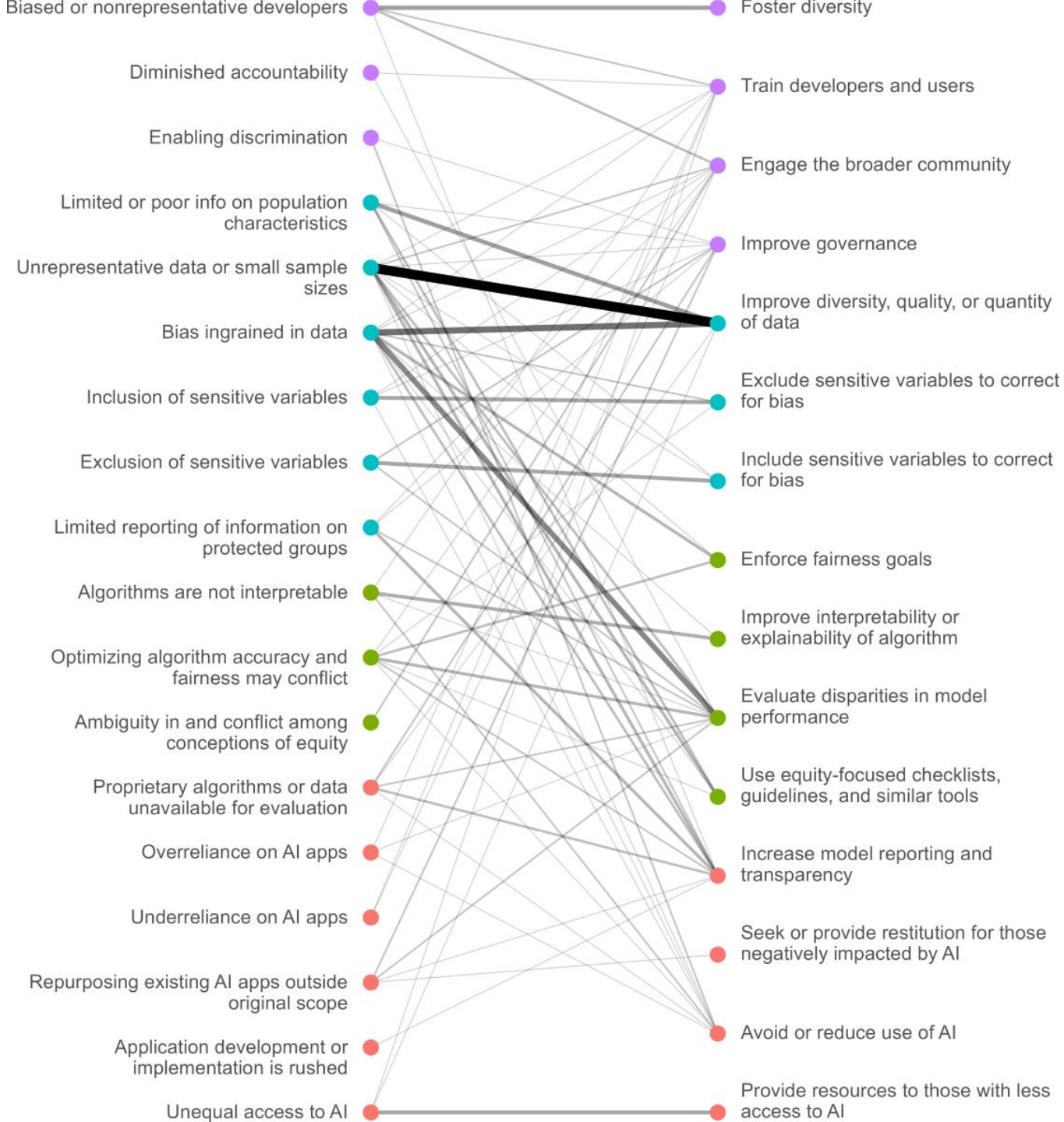
Focal Cortical Dysplasia

Brain Sci. **2023**, *13*(3), 487; https://doi.org/10.3390/brainsci13030487

Neural networks
More data + more compute = more accuracy



Courtesy, Jeff Dean, Google



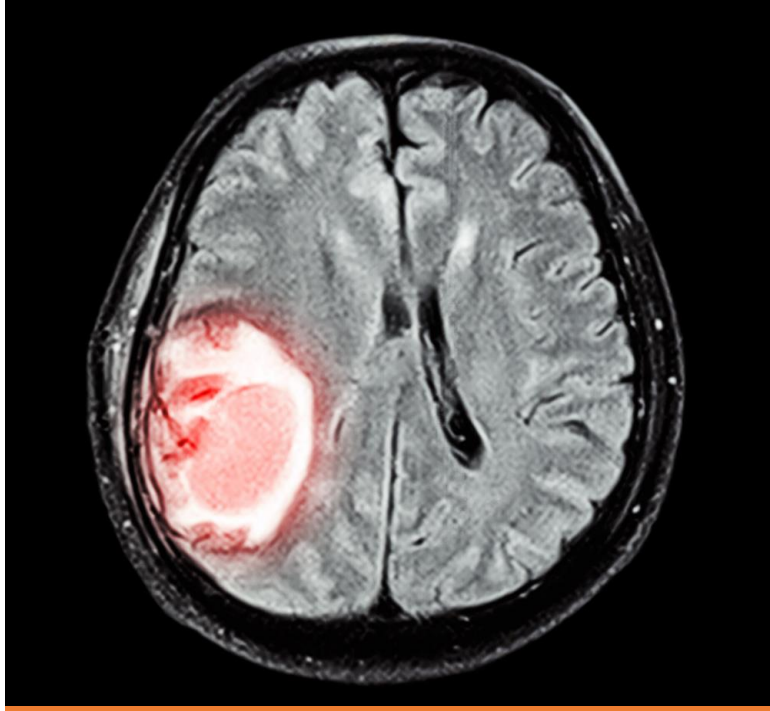
Berdahl C et al. JMIR AI 2023

Brittleness of deep learning

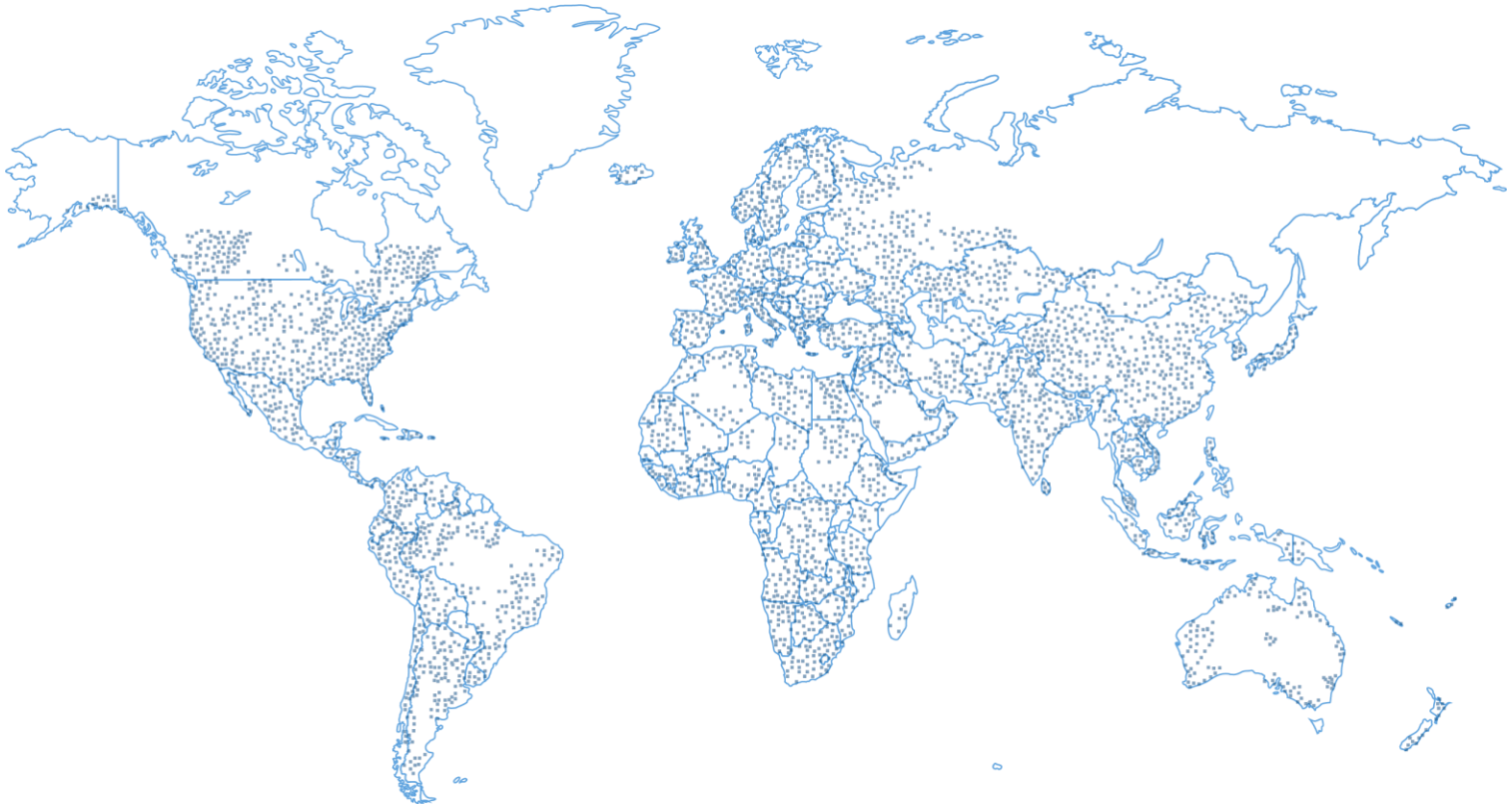
…the performance of models for brain tumor segmentation and chest radiographic interpretation ***worsens when the models are validated on external data connected at hospitals other than those used for model testing****.*

The Current and Future State of AI Interpretation of Medical Images
Pranav Rajpurkar, Ph.D., and Matthew P. Lungren, M.D., M.P.
June 2023

The NEW ENGLAND JOURNAL of MEDICINE

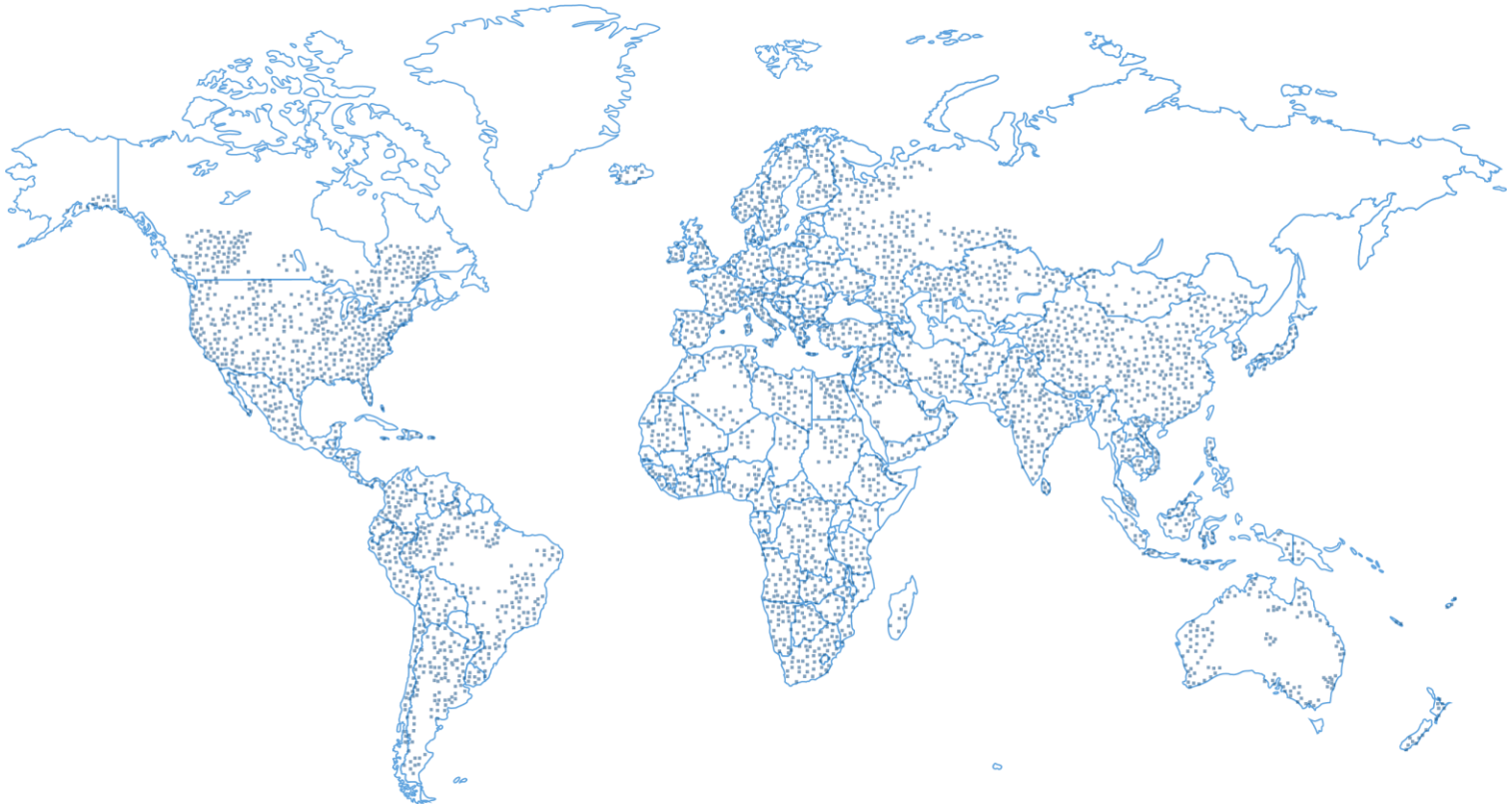


But there is plenty of data



The 500 children's hospitals echo labs generate ~6,000,000 TB of *labeled* image data per year

However centralized architecture will NOT work for AI in medicine



- Not network preserving
- Not real time
- Not privacy preserving

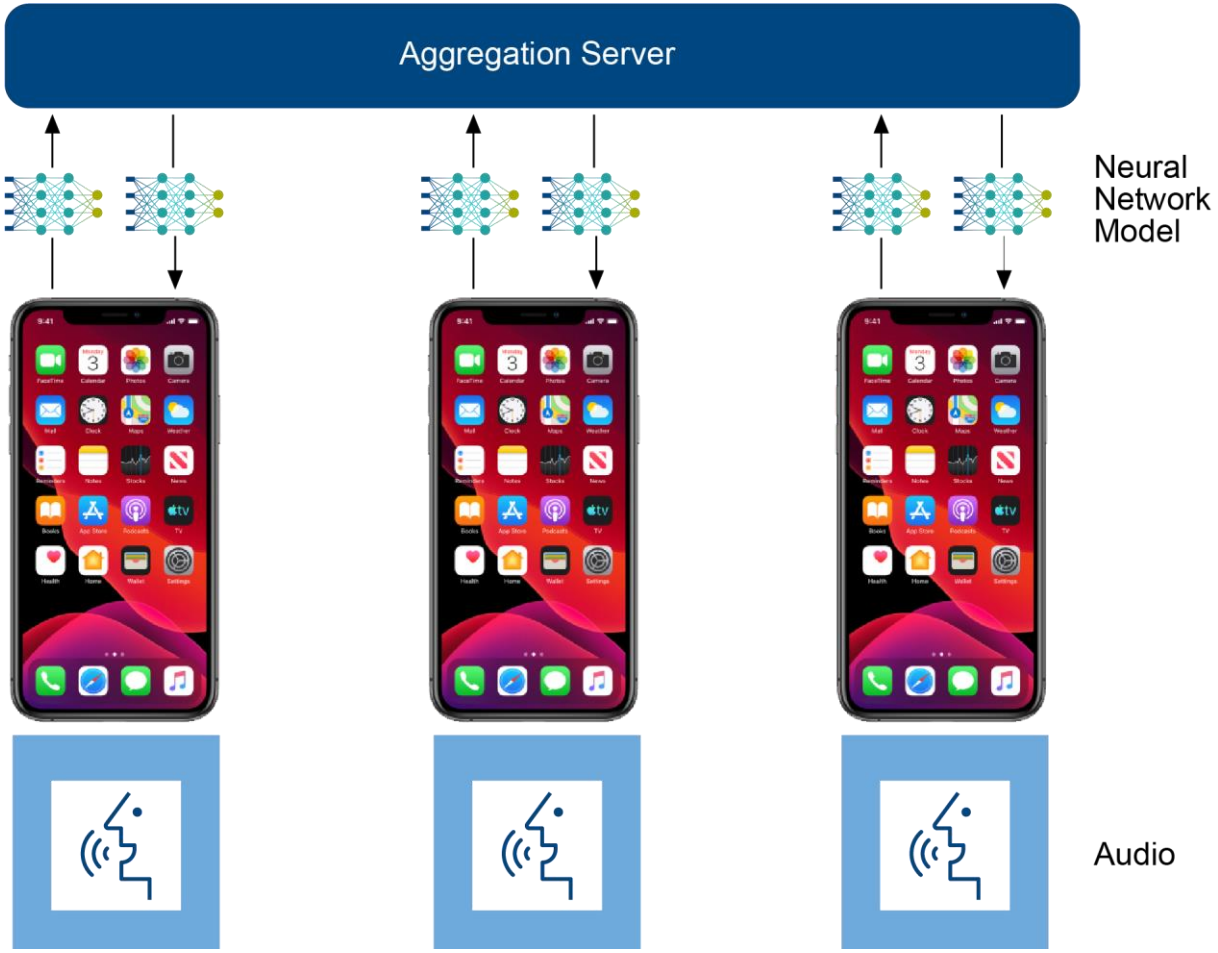

GDPR

Tymothy Chou, Stanford, USA

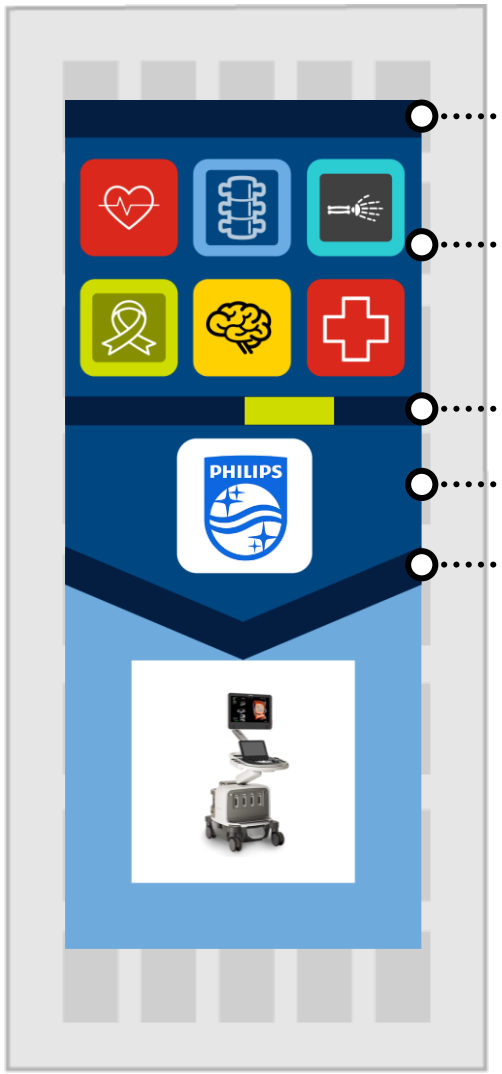
Anthony Chang, Orange County, USA

Consumer world has designed a way to learn while preserving privacy using federated learning

Siri improves accuracy not by sharing an audio recording centrally but instead learning locally and only sharing model parameters



Global, highly decentralized, in-the-building cloud service



- Edge Networking Service
- Pediatric Applications
- Edge Data Services
- Digital Twin Applications
- Edge Compute & Storage

Cardiology

Orthopedics

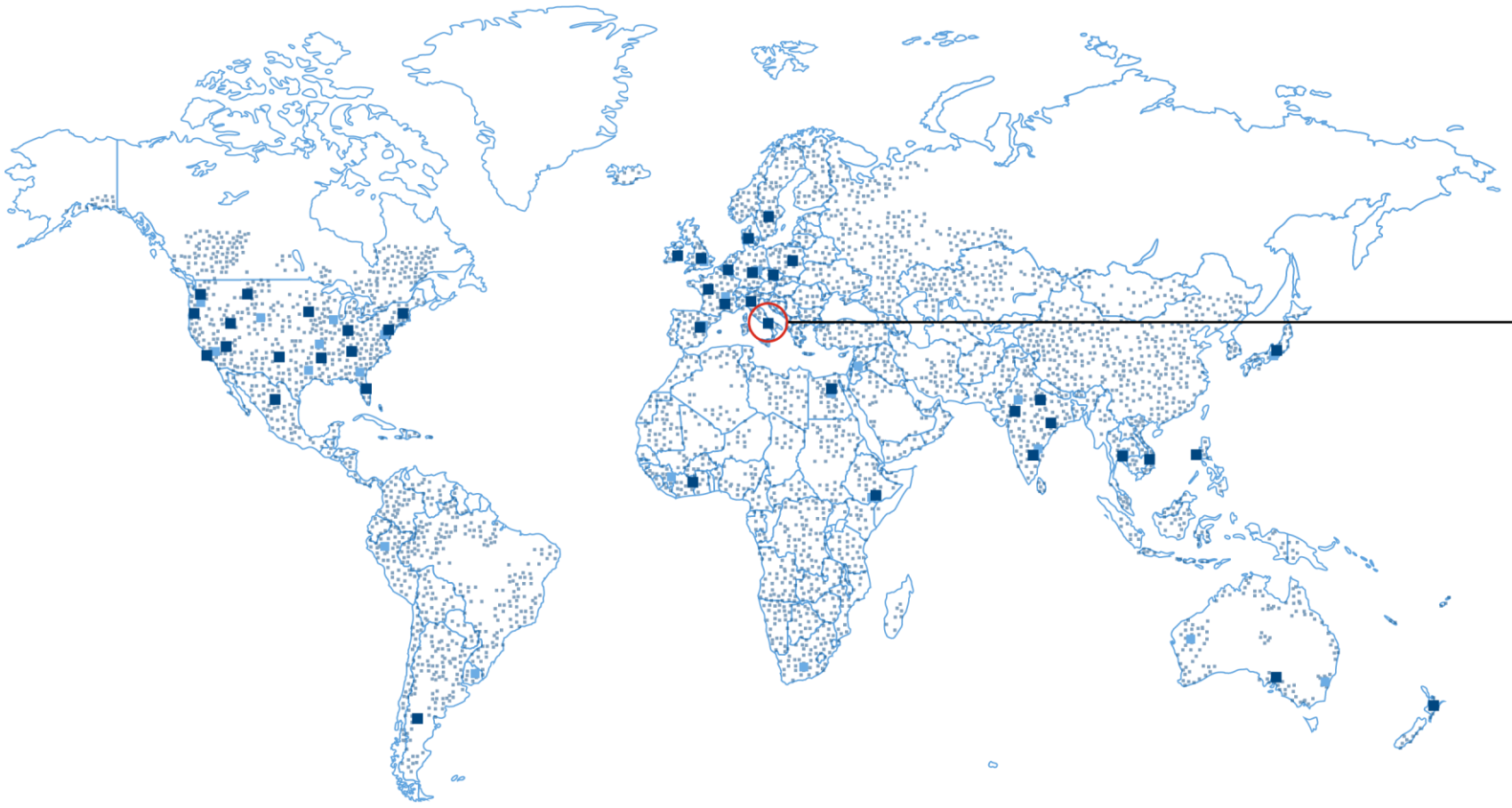
Radiology

Cancer

Neurology

Emergency Medicine

Deployed globally in-the-building



Applications

Cardiology | Orthopedics | Radiology

Cancer | Neonatology | Emergency Medicine

Edge Networking Service & Edge Compute & Storage

Each zone is private, secure.
Data stays in the building.

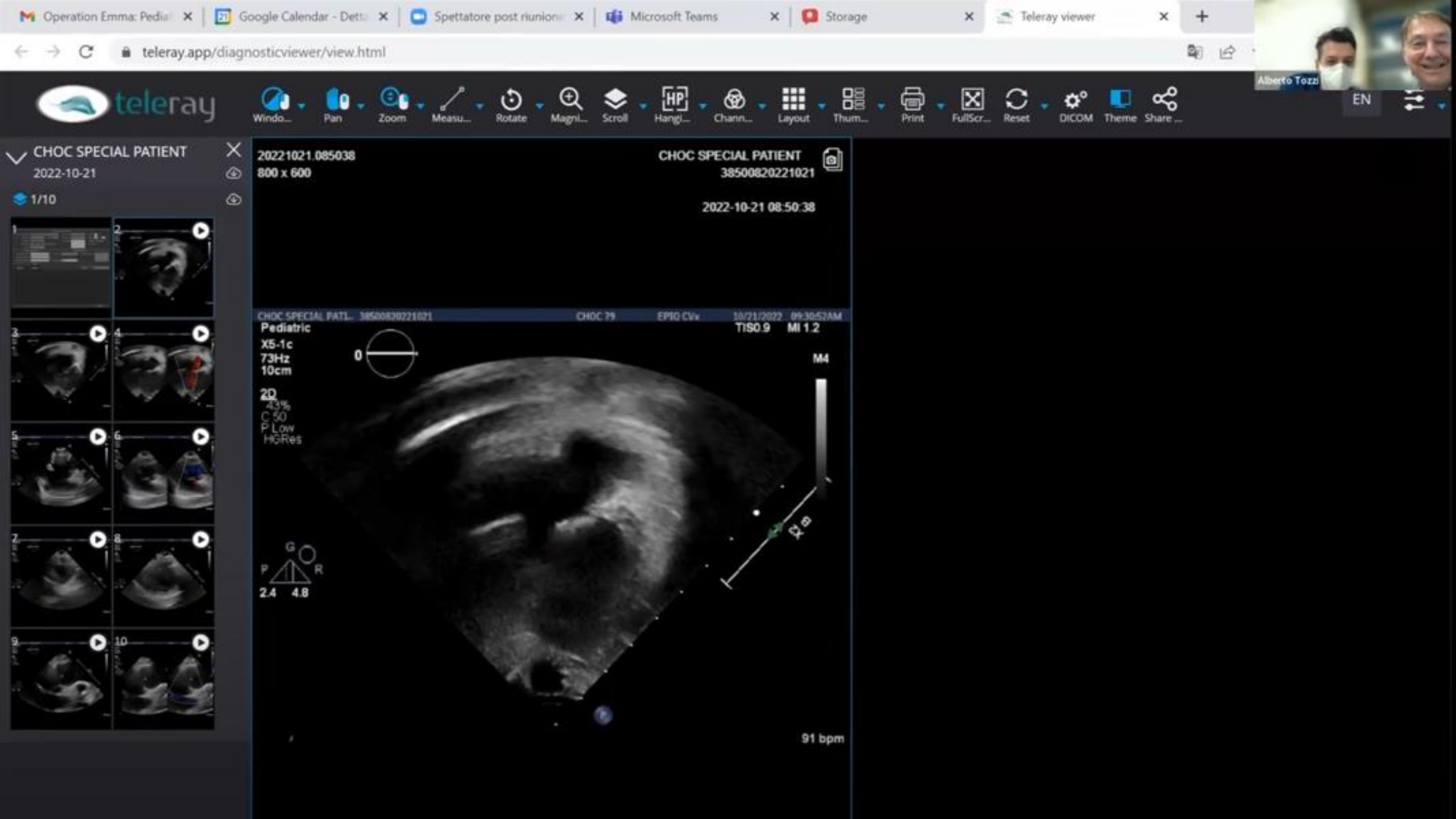
BevelCloud

Machine | PACs | EMR


Edge Server Home
24%
Apps
Oomnitza Clinical
Philips Ultrasound
PACS
Teleray Bridge App
Edge Data Services
GlendorPHISanitizer
BevelCloud Agent
Utilities
Network Analyzer
Speedtest
CHAMBER
OpenVPN Connect
System
AndroidHub
QuickSupport
Host

Simple Real-time, privacy-preserving real-time emergency image sharing (Instagram style)

Deidentified data
Independent of infrastructure (4G/5G)

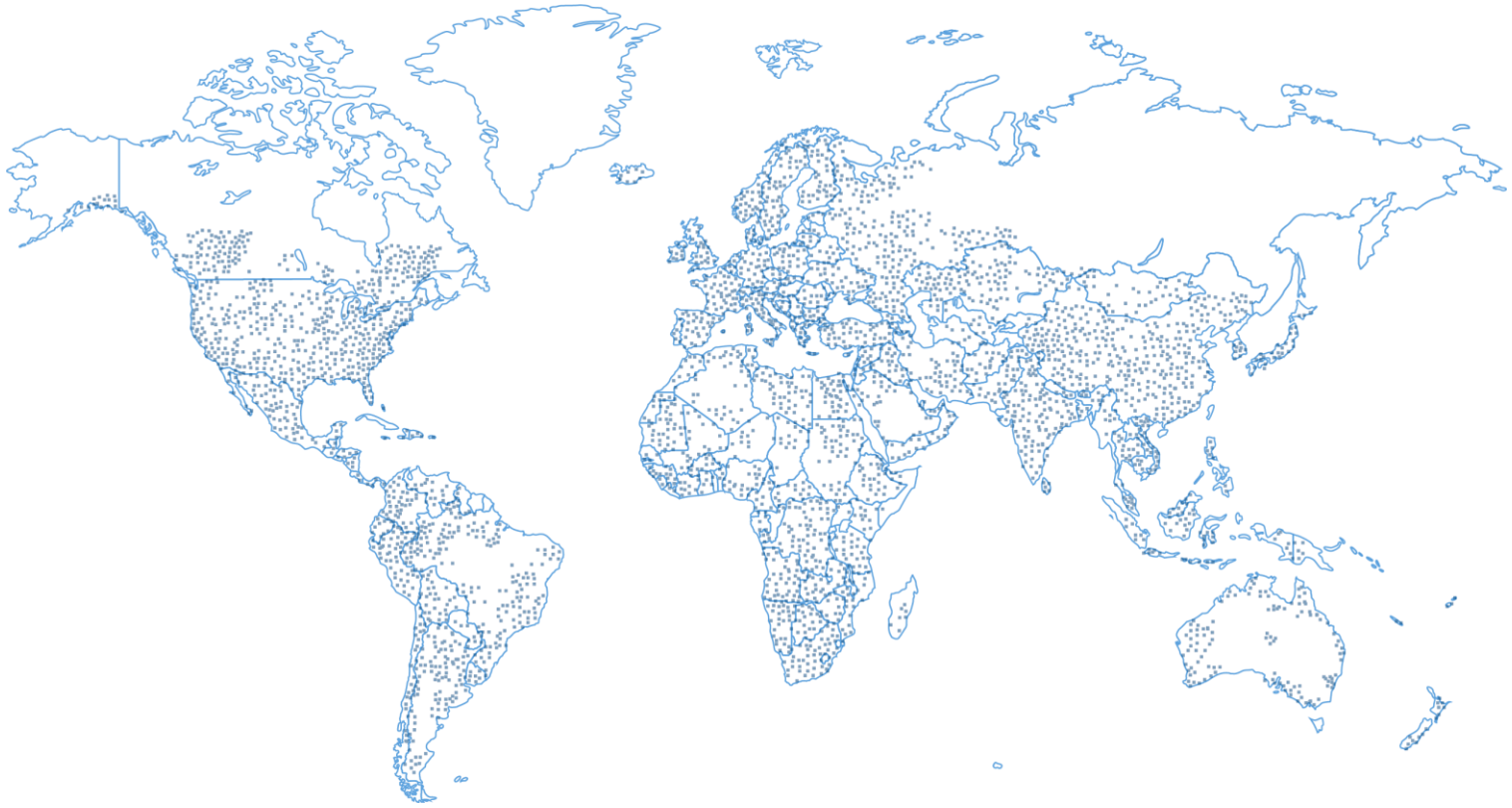

Operation Emma: Pedia
Google Calendar - Dett
Spettatore post riunione
Microsoft Teams
Storage
Teleray viewer
teleray.app/diagnosticviewer/view.html
Alberto Tozzi
teleray
Windo...
Pan
Zoom
Measu...
Rotate
Magni...
Scroll
Hangi...
Chann...
Layout
Thum...
Print
FullScr...
Reset
DICOM
Theme
Share ...
EN
CHOC SPECIAL PATIENT
2022-10-21
1/10
20221021.085038
800 x 600
CHOC SPECIAL PATIENT
38500820221021
2022-10-21 08:50:38
Pediatric
X5-1c
73Hz
10cm
TIS0.9
MI 1.2
M4
91 bpm

Pediatric moonshot

- A Decentralized in-the-Building Edge Cloud Service
- One Hundred Servers, One Hundred Twinned Ultrasounds
- Large, Continuous Diverse Data Sharing
- Open-Source Cardiology AI App as an Edge Cloud Application
- Multi-site, multi-country IRB

Phase 1

- Echocardiography in children
- Train an algorithm to estimate LVEF through federated learning
- Measure its accuracy vs human measure
- Six pediatric hospitals connected so far



AI in medicine could reduce healthcare inequity, lower cost and improve patient outcomes