



# AI-based Video Technology for Reshaping the Future of Australian Healthcare

Presenter: Pubudu Sanjeeewani (PhD, MIEAust)  
Machine Learning Engineer - Smart AI Connect Pty Ltd  
27/04/2023

# About Myself

- A PhD in Artificial Intelligence (AI) from Central Queensland University (CQUni) (Thesis title: A Deep Learning Technique for the Analysis of Road Safety Attributes)
- A Bachelor of the Science of Engineering degree with honors specializing in Electrical and Information Engineering from the University of Ruhuna, Sri Lanka

## ► Awards and Scholarships

- A recipient of an Australian Research Council (ARC)'s Linkage Projects Funding Scheme (Project Number: LP170101255) Stipend Scholarship
- An International Excellence Award (100% Tuition Fee Scholarship)

## ► Research Collaboration

- Centre for Intelligent Systems (CIS) at CQUni, QLD, Australia
- The Department of Transport and Main Roads (DTMR), QLD, Australia
- The Australian Road Research Board (ARRB)
- MaxusAI, Australia
- VeracityAI, Sri Lanka
- SmartAIConnect, Australia
- Datarwe, Australia
- KJR, Australia

## ► Projects

- AusRAP attributes detection project
- An automatic hooning detection project
- A Personal Protective Equipment (PPE) non-compliance detection project
- A Slip, Trip, and Fall (STF) detection project
- Rock art detection project
- Asia's first-ever smart street lamp pole project in Sri Lanka



LinkedIn: <https://www.linkedin.com/in/pubudu-sanjeewani-phd-mieaustr-397162228/>

} For the Australian National Security Exhibition + Conference held in Sydney, Australia, 2022 by SmartAIConnect with Maxus AI, Australia.

# RMIT Partnership

Azadeh is a lecturer in AI at RMIT University, PhD in AI, Masters in IT and a Bachelor of Applied Mathematics.

During the last decade, she has developed novel machine learning algorithms and applied them to real-world problems such as person identification, bioinformatics and medical image analysis while working / collaborating with variety of research institutes, such as:

- ▶ Baker Heart and Diabetes Institute (Melbourne)
- ▶ Honorary Fellow - University of Melbourne
- ▶ Honorary Fellow - Northern Health
- ▶ Research Scholar - University of Maryland (USA)
- ▶ The University of Queensland (UQ)
- ▶ The Queensland University of Technology (QUT)
- ▶ Latrobe University
- ▶ National ICT Australia Ltd (NICTA)



Some of her publications related to surveillance system and medical image/data analysis are as bellow:

- ▶ *Z. Liu, A. Alavi 1, M. Li, X. Zhang, "Self-Supervised Contrastive Learning for Medical Time Series: A Systematic Review", Sensors, Vol. 23, np. 09, PP. 4221 - 2456 2023*
- ▶ *A. Alavi, D.B. Ascher, "DHS-Crystallize: Deep-Hybrid-Sequence based method for predicting protein Crystallization ", NurolPS 2020.*
- ▶ *A. Kumar, A. Alavi, R. Chellappa, "KEPLER: Keypoint and Pose Estimation of Unconstrained Faces by Learning Efficient H-CNN Regressors," IEEE Face and Gestures, 1 2017.*
- ▶ *A. Alavi, H. Akhoundi, "Deep Subspace Analysing for Semi-supervised Multi-label Classification of Diabetic Foot Ulcer", Diabetic Foot Ulcers Grand Challenge: Second Challenge, DFUC 2021, Held in Conjunction with MICCAI 2021, Strasbourg, France, September 27, 2021*



# Overview

- ▶ Introduction to SmartAIConnect
- ▶ Use Case Health  
SmartAIConnect and Datarwe
- ▶ RMIT, SmartAIConnect and  
Datarwe Collaboration



# Introduction

SmartAIConnect facilitates the fusion with

- i-PRO AI edge-capable IP security cameras,
- AI/ML models,
- Video Management Systems (VMSs), and
- IoT data platforms.

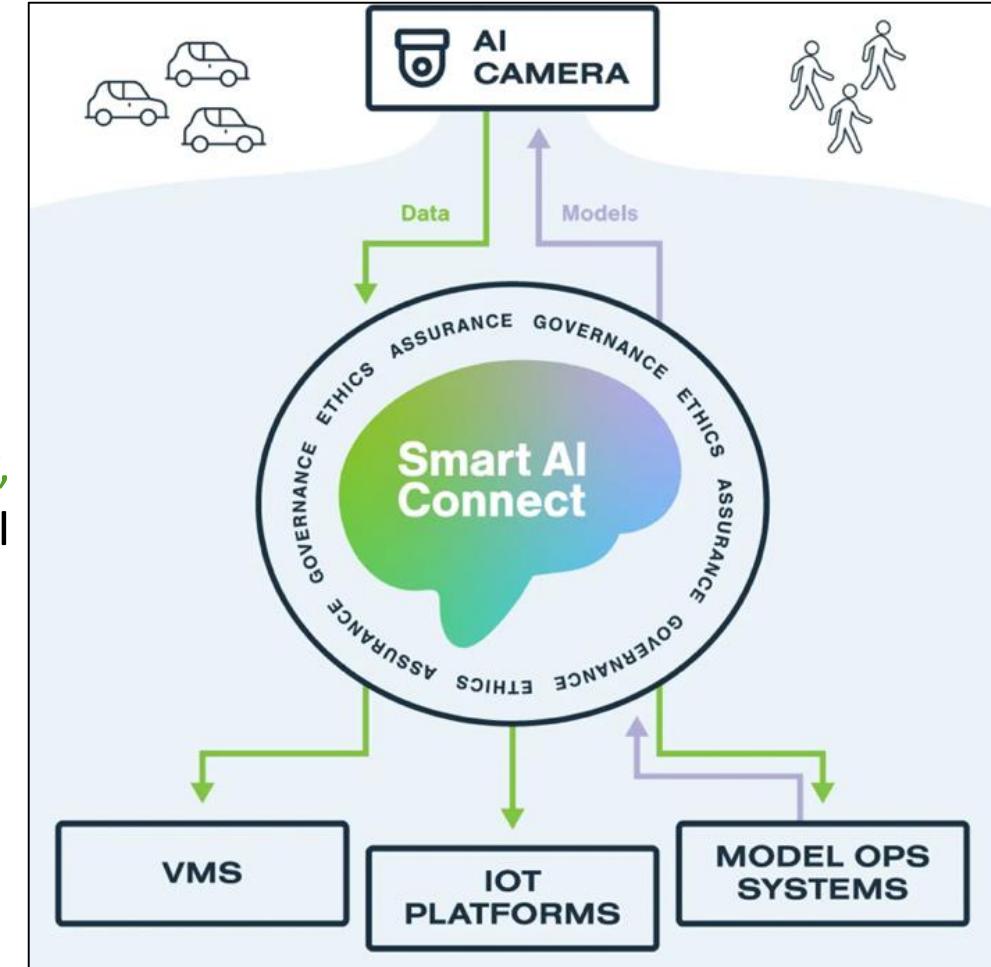
In providing this fusion of systems, the data interoperability, security, ethics, compliance, and governance of AI applications on edge devices can be merged & monitored.



**Christopher Lane**  
CEO - SmartAIConnect



**Dr. Mark Pedersen**  
Software Assurance & Ethics Advisor  
SmartAIConnect,  
CTO - KJR



SmartAIConnect: <https://smartaiconnect.com/>  
KJR: <https://kjr.com.au/>



# Key Sectors



# SmartAIConnect Partners



**datarwe**

**i-PRO**  
The Power of Truth



Queensland AI Hub



VeracityAI

**LOCATRIX**

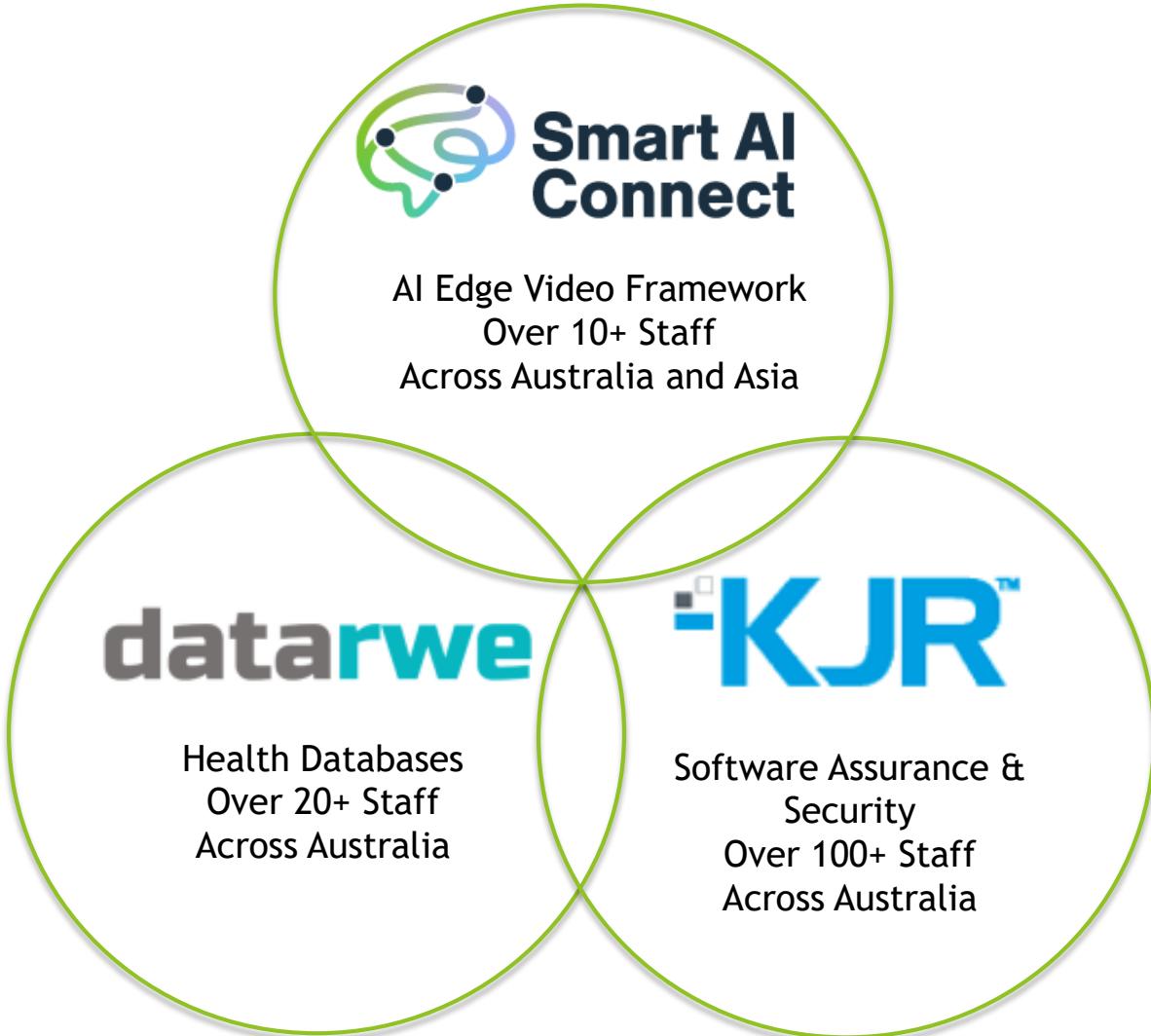


**lendlease**



**MaxusAI™**

# Internal Partners





# Users and Stories



## Business User

Request a model is switched on and receive data from the model



## Integrator (Hardware and Software Installer)

Choose a model, configure for input and output, and deploy it to cameras



## Technical Officer (Support)

Ensure that cameras and models are running



## Auditor

Oversee compliance of data and AI regulations of the organization



## CIO/CTO

Responsible for IT infrastructure of the organization



## Model Builder

Builds AI/ML models and wants to run them on cameras under contract with organization

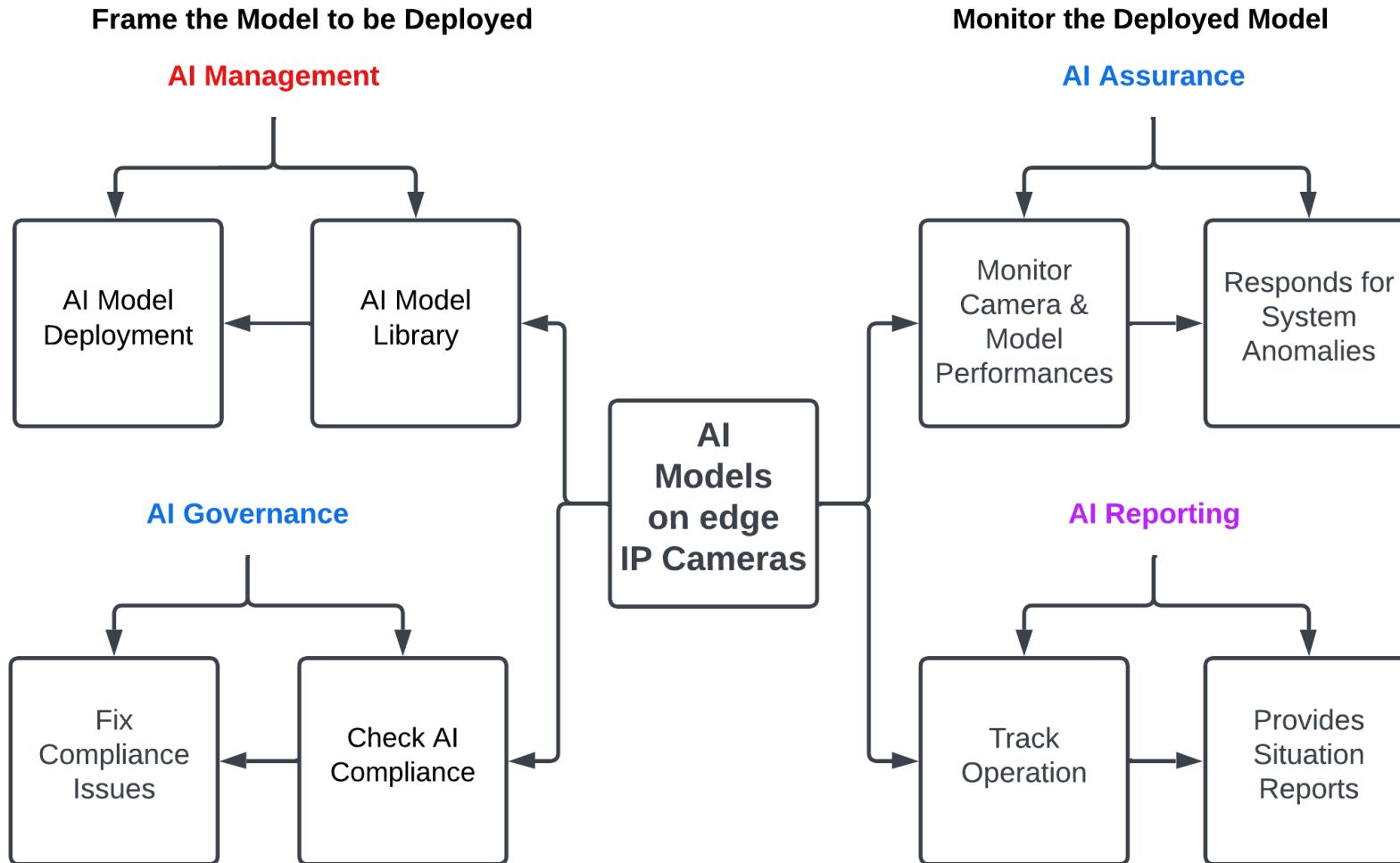
- i-PRO Models
- MaxusAI and SmartAIConnect models
- Upload third-party models

# SmartAIConnect AI Framework



# AI Framework Solution (ModelOps)

## Why Do We Need AI Management and Distribution Framework for IP Cameras





**Smart AI  
Connect**

## Monitoring Dashboard

**Overall Compliance:** Non-compliant

**Organization Questionnaire(s):** Completed (4/9 44%)

**Model Questionnaire(s):** 4/9 44%

**Gateways Online:** 1/4 25% (View gateways)

**Cameras Online:** 1/3 33% (View cameras)

**Deployments Running:** 6 (View deployments)

## AI Compliance Dashboard

**Organisational Compliance:** 4/9 44%

**Model Compliance:** 4/9 44%

**Overall Compliance:** 4/9 44%

**Camera Deployment Compliance:** 4/9 44%

**Camera Compliance Status:** Compliant: 2, Warning: 1, Non-compliant: 0, Unknown: 0

**Line Chart:** Camera Compliance Status from Jan 23 to Mar 23.

## Monitoring Dashboard Geospatial

## Cameras Dashboard

Name	Location	Status	IP Address	Make	Camera Model	AI Model	Compliance
360	Locatrix	Online	192.168.110.101	i-PRO	WV-S4176	Warning	Status Edit
Dome	Locatrix	Online	192.168.110.102	i-PRO	WV-S2236L	Compliant	Status Edit
Fire Exit	Locatrix	Online	192.168.110.103	i-PRO	WV-S71300-F3	Compliant	Status Edit

## Camera Status

**360:** Online (Last contact: 0 seconds ago)

**i-PRO WV-S4176:** IP Address: 192.168.110.101 (Firmware Version: 2.23, Latest Version: Up To Date)

**Memory (GB):** 1.30/2.05

**CPU Used (%):** 32

**GPU Used (%):** 53

**Apps On Camera:** 2 out of possible 2

App Name	Version	Compliance	Date Installed	Origin	Lens	Mem	CPU
AI-VMD and AI People Counting	1.41 (latest 1.50)	Warning	23/02/2023 11:03:19 pm	i-PRO	1	45724	11.45
AI Privacy Guard	1.10	Warning	23/02/2023 11:03:19 pm	i-PRO	1	0	0

Name	Version	Date	Application Type	Architecture	
i-PRO AI People	3	24/02/2023 9:32:00 pm	i-PRO AI Person	1.30	<a href="#">View</a>
i-PRO AI Privacy Guard	1	01/03/2023 8:51:32 am	i-PRO Privacy Guard	1.10	<a href="#">View</a>
i-PRO AI Privacy Guard for Fisheye Cameras	1	01/03/2023 8:59:05 am	i-PRO Privacy Guard 360	1.10	<a href="#">View</a>
i-PRO AI-VMD	4	04/03/2023 2:59:18 pm	i-PRO AI-VMD	3.20	<a href="#">View</a>
i-PRO AI-VMD and People Counting for Fisheye Cameras	2	01/03/2023 8:09:01 pm	i-PRO AI-VMD 360	1.50	<a href="#">View</a>
PPE by MaxusAI (Beta)	4	01/03/2023 9:07:10 am	SmartAI Object Detection	1.18.2	MobileNetV2SSD <a href="#">View</a>
SAIC i-PRO Sidecar	3	01/03/2023 8:48:41 am	SmartAI Object Detection	1.18.2	Unknown <a href="#">View</a>
Slip and Fall by MaxusAI (Beta)	1	01/03/2023 11:55:18 am	SmartAI Object Detection	1.18.2	MobileNetV2SSD <a href="#">View</a>
WMGB by MaxusAI (Beta)	6	01/03/2023 8:47:13 am	SmartAI Object Detection	1.18.2	MobileNetV2SSD <a href="#">View</a>

## Deployments

Model	Status	Date Deployed	Approved By	Cameras	Destinations
i-PRO AI-VMD v4	Running	27/02/2023 6:10:46 pm	John Fitzgerald	1	0
i-PRO AI-VMD v4	Stopped	24/02/2023 12:09:39 pm	John Fitzgerald	1	0
i-PRO AI-VMD v4	Stopped	24/02/2023 12:02:30 pm	John Fitzgerald	1	0
AI People by i-PRO v4	Stopped	20/02/2023 6:01:03 pm	John Fitzgerald	1	1
i-PRO AI-VMD v4	Stopped	9/3/2023 9:07:30 pm	John Fitzgerald	1	0
i-PRO AI-VMD v4	Stopped	4/3/2023 3:00:40 pm	John Fitzgerald	2	1
WMGB by MaxusAI (Beta) v6	Stopped	2/3/2023 11:43:02 am	John Fitzgerald	1	1
i-PRO AI-VMD v3	Stopped	1/3/2023 4:39:46 pm	John Fitzgerald	1	1
AI People by i-PRO v3	Stopped	1/3/2023 4:39:00 pm	John Fitzgerald	1	1
PPE by MaxusAI (Beta) v4	Stopped	1/3/2023 11:50:03 am	John Fitzgerald	1	1

**Overall Status:** Non-compliant

**Organization Questionnaire(s):** Completed

**Model Questionnaire(s):** 4 / 9 44%

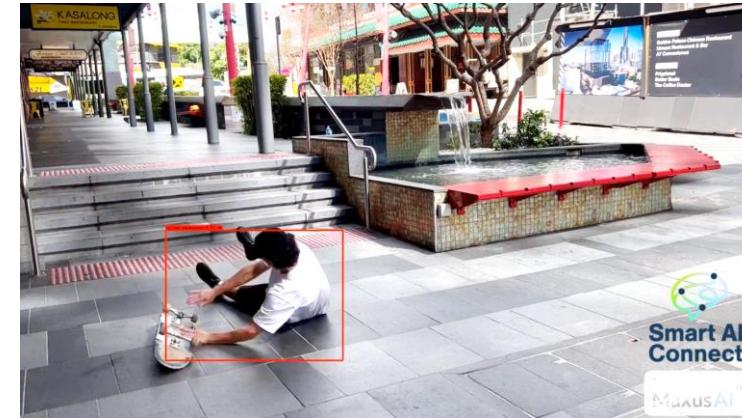
Report	Created At	Score
Compliance Report 1	2023-01-02	97%
Compliance Report 2	2023-01-02	87%
Compliance Report 3	2023-01-02	100%
Compliance Report 4	2023-01-02	21%
Compliance Report 5	2023-01-05	21%
Compliance Report 6	2023-02-20	34%

**AI  
Compliance  
Reports**

# Top 5 AI Applications (AI Model Store)



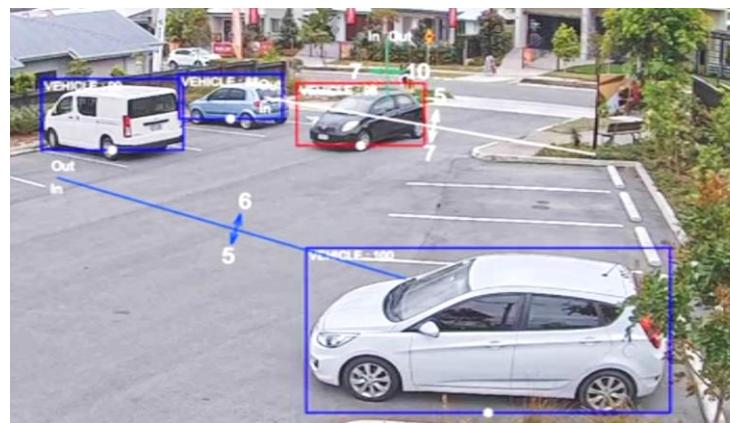
Reckless Driving



Slip, Trip & Fall



PPE Non-Compliance



Vehicle Counting & Grouping



People Counting & Grouping



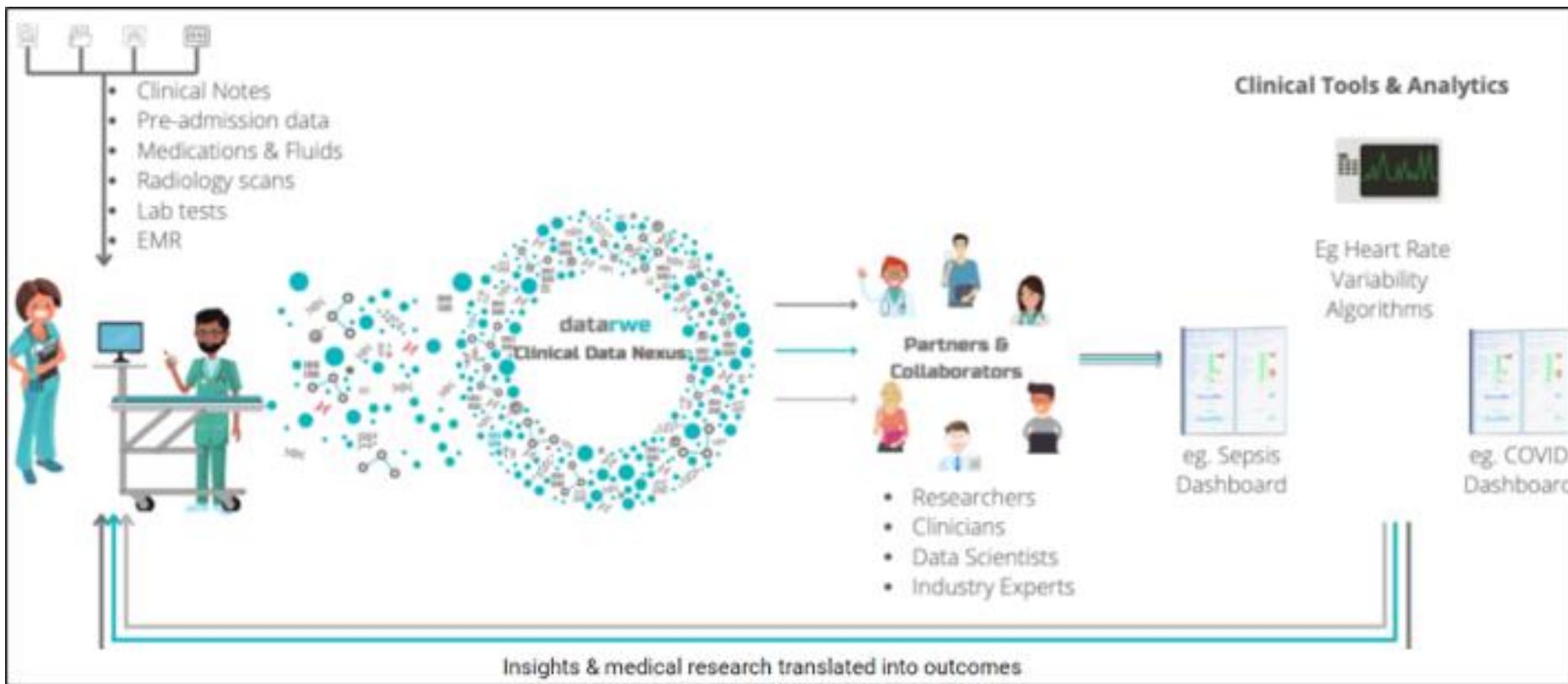
**datarwe**

Use Case Health  
SmartAIConnect  
and  
Datarwe



# Introduction to Datarwe

Datarwe is developing a health database with **real-world data** for AI-enabled medical innovation. Datarwe connects hospitals, researchers, clinicians, and developers with curated, enriched data through their **Clinical Data Nexus (CDN)**. Datarwe reduces the time and economic costs for clinical, academic, and commercial med-tech/life-science collaborators to access **cleansed, labelled, validated, real-world, clinical data**, thereby more rapidly translating the outcomes of their research and product development lifecycles.



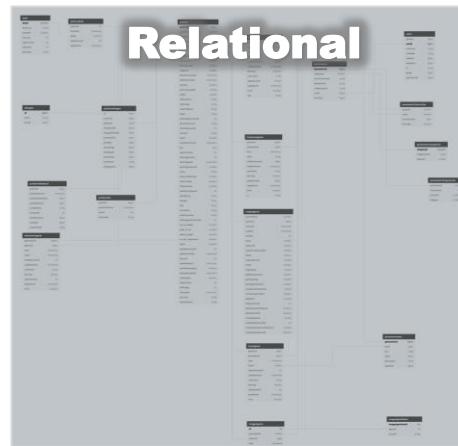


- ▶ A digital and dynamic, yet secure health research and collaboration, cloud-based platform, built to service medical community to translate and scale clinical research on real-world, de-identified data into powerful tools that advance healthcare.
- ▶ Provides the key collaboration tools for in-depth data analysis and development, whilst ensuring that data providers always maintain ultimate control over their data assets.



# Partnership Example Health (Datarwe)

## Datarwe Focus



# **Relational**

**Free Text**

Deidentification Project: Please add labels for any undetected PHI

HPC: \*\*y.o female, Taken to OT for oesophagoscopy secondary to swallowing a snapper fish bone at breakfast. Intubation attempt x 1 - failed - bougie thought to be in trachea but transpired not to be the case attempt x 2 abandoned as cords not visible BVM impossible CICV scenario LMA inserted - difficulty ventilate. Episodes of

**Labels**

- AGE
- CONTACT
- DATE
- ID
- LOCATION
- NAME
- OTHER
- PROFESSION

**Instructions**

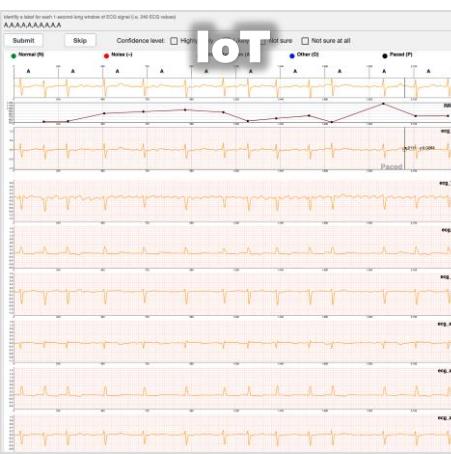
No errors found

Free Text

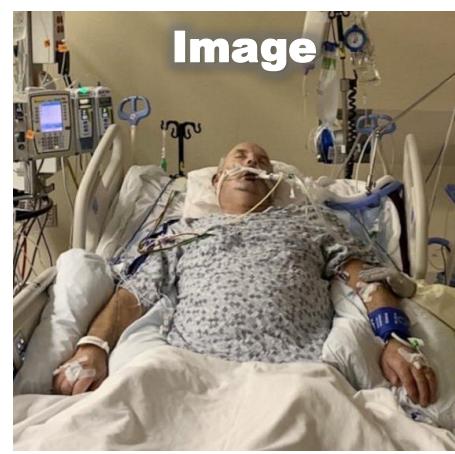


## Video

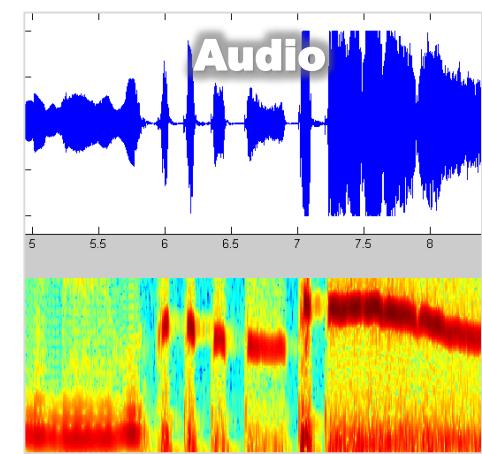
SmartAIConnect & Datarwe Focus



Not sure  Not  
Other (D)



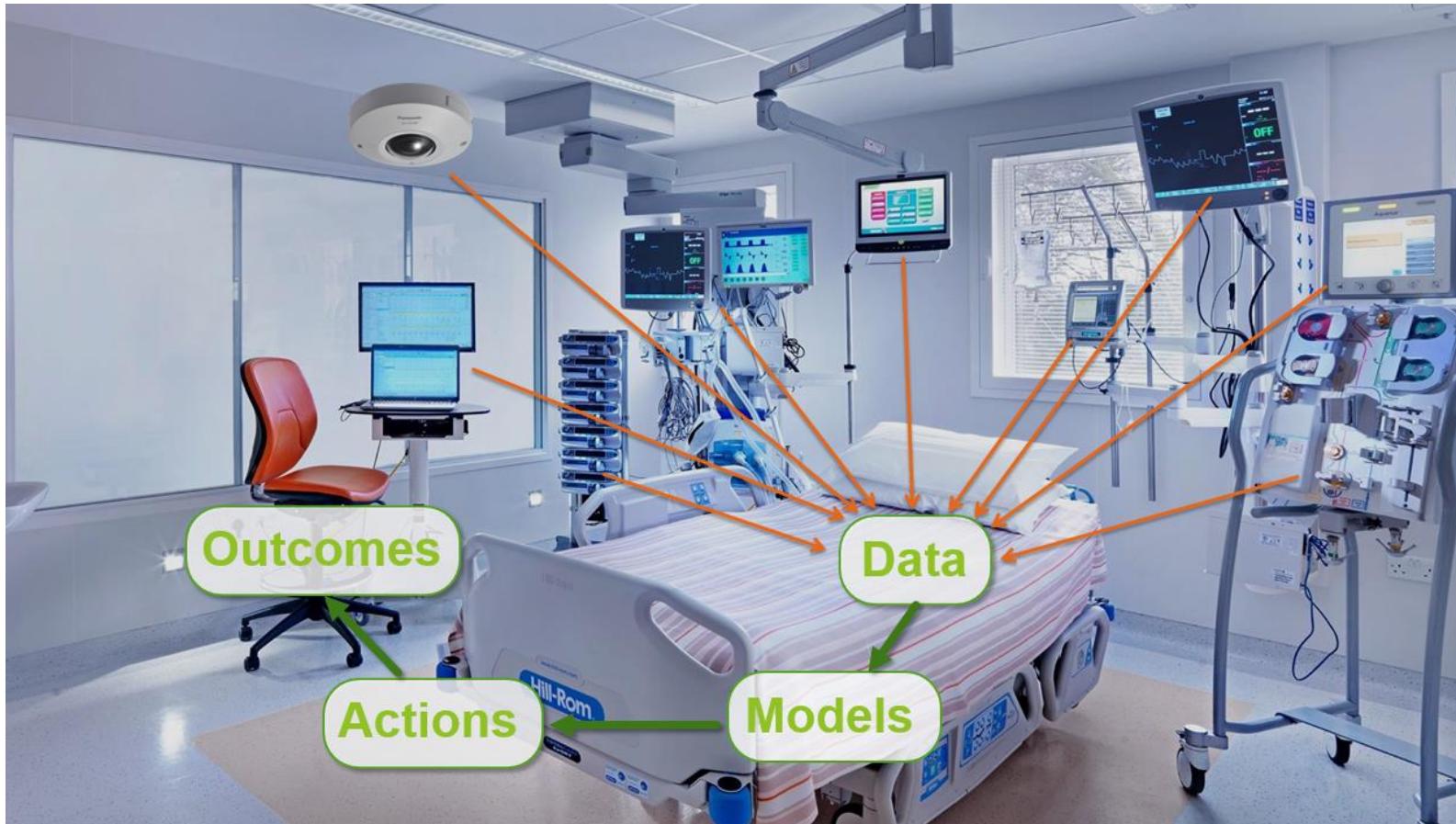
# Image



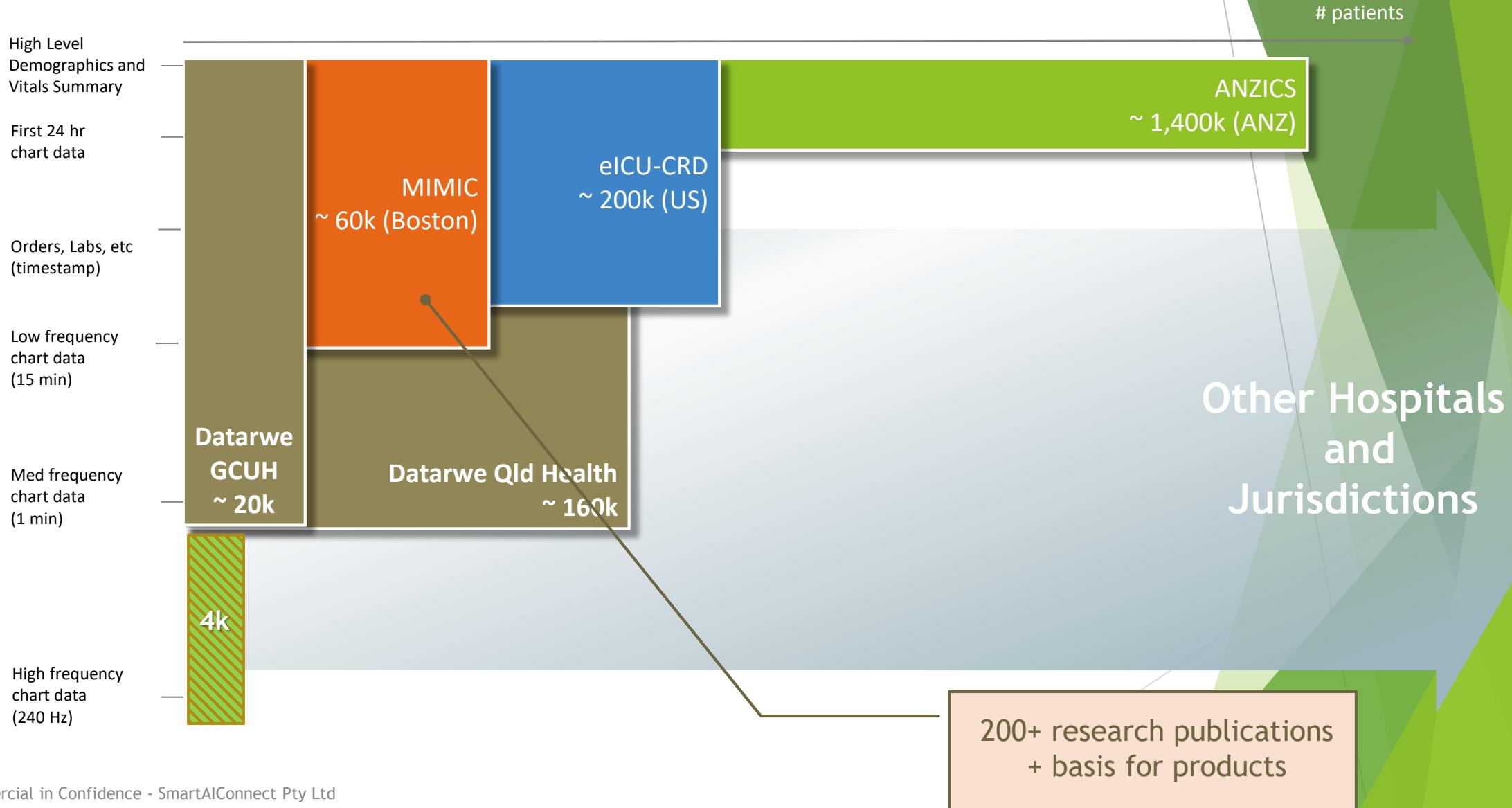
Audio

# ICU - A Data Science Treasure Trove

Comprehensive predictive and prescriptive models of disease and intervention can be realized from deep data sets and AI and machine learning techniques. The Datarwe database encapsulates real-time streaming ICU data such as that measured through electrocardiograms (ECG) as well as ventilatory, cardiovascular, antibiotic, renal, and neurological measurements. Prediction algorithms can be used to determine organ failure in advance, allowing for early intervention. Reinforcement learning can be used to monitor patients and diagnoses. This can augment clinical decision processes to advise on optimal intervention, such as drug dosage.



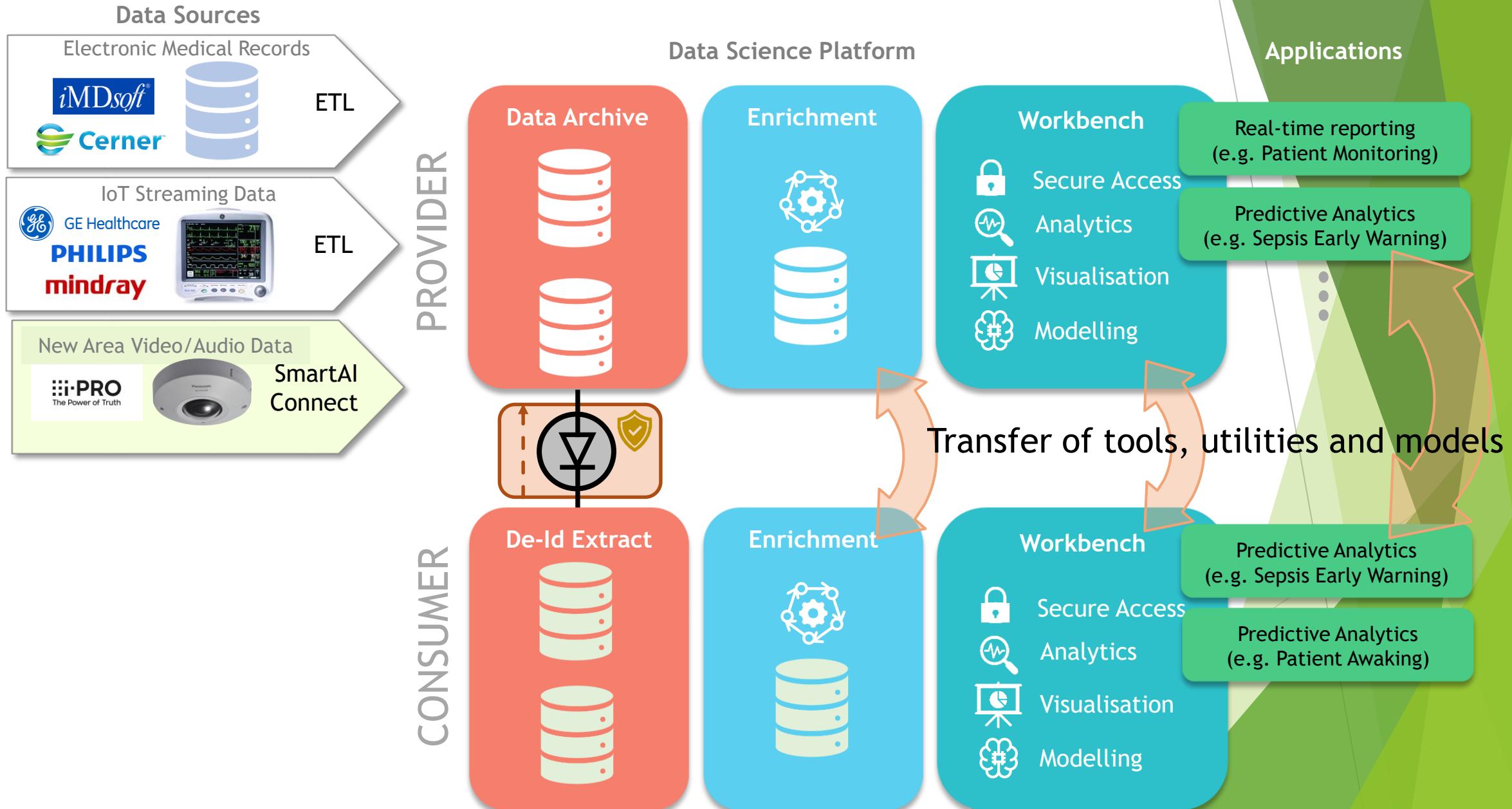
# Global ICU Datasets





Smart AI  
Connect

# Datarwe Platform Architecture





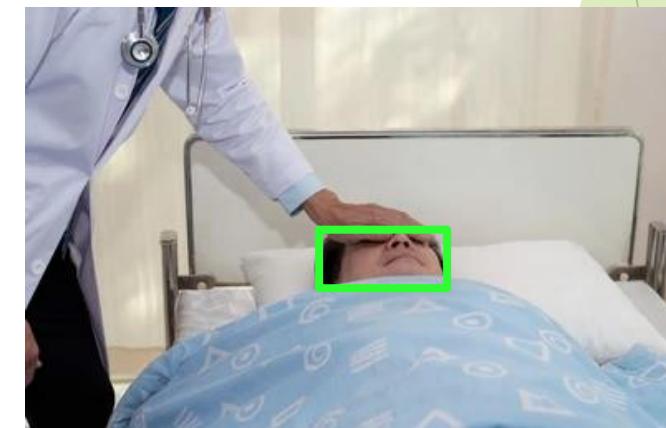
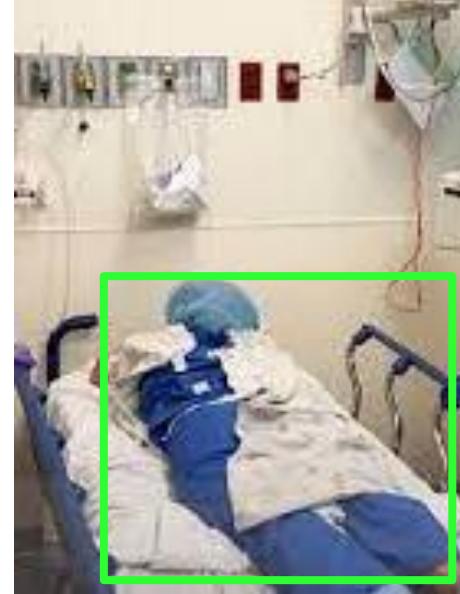
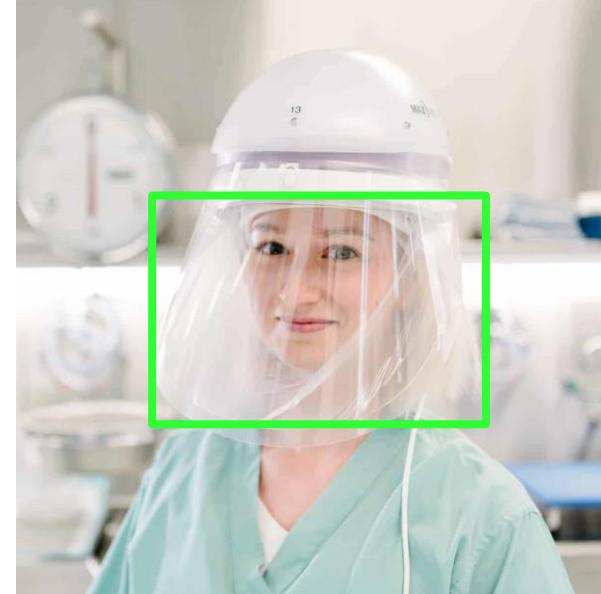
# SmartAIConnect / Datarwe

## Watch My Patient

- Bed occupancy
- Sleep
- Agitation
- Bed position
- Body position
- Accidental catheter removal
- Falls
- Breathing rate (via chest movement)
- Breathing apparatus
- Staff movements
- Interruptions
- Procedure determination
  - Intubation
  - Blood pressure checks
  - Bolus administration



# Challenges of Privacy





Smart AI  
Connect

# Video Demonstration

datarwe



# RMIT, SmartAIConnect and Datarwe Collaboration

- ▶ RMIT University and SmartAIConnect have started their collaboration in research for enhancing AI-based video analysis solutions with applications in healthcare digitalization.
- ▶ Such collaboration is aimed to cover:
  - enhancing surveillance video analysis
  - medical data, and time series analysis
  - medical image analysis



Dr. Azadeh Alavi  
Lecturer,  
RMIT University - City Campus, STEM College,  
School of Computing Technologies  
E: [azadeh.alavi@rmit.edu.au](mailto:azadeh.alavi@rmit.edu.au)



Dr. Pubudu Sanjeeewani  
Machine Learning Engineer,  
SmartAIConnect Pty Ltd, Level 17, Tower 4/727 Collins St,  
Docklands, VIC 3008  
M: 0451607836 | E: [pubudu@smartaiconnect.com](mailto:pubudu@smartaiconnect.com)

**datarwe**

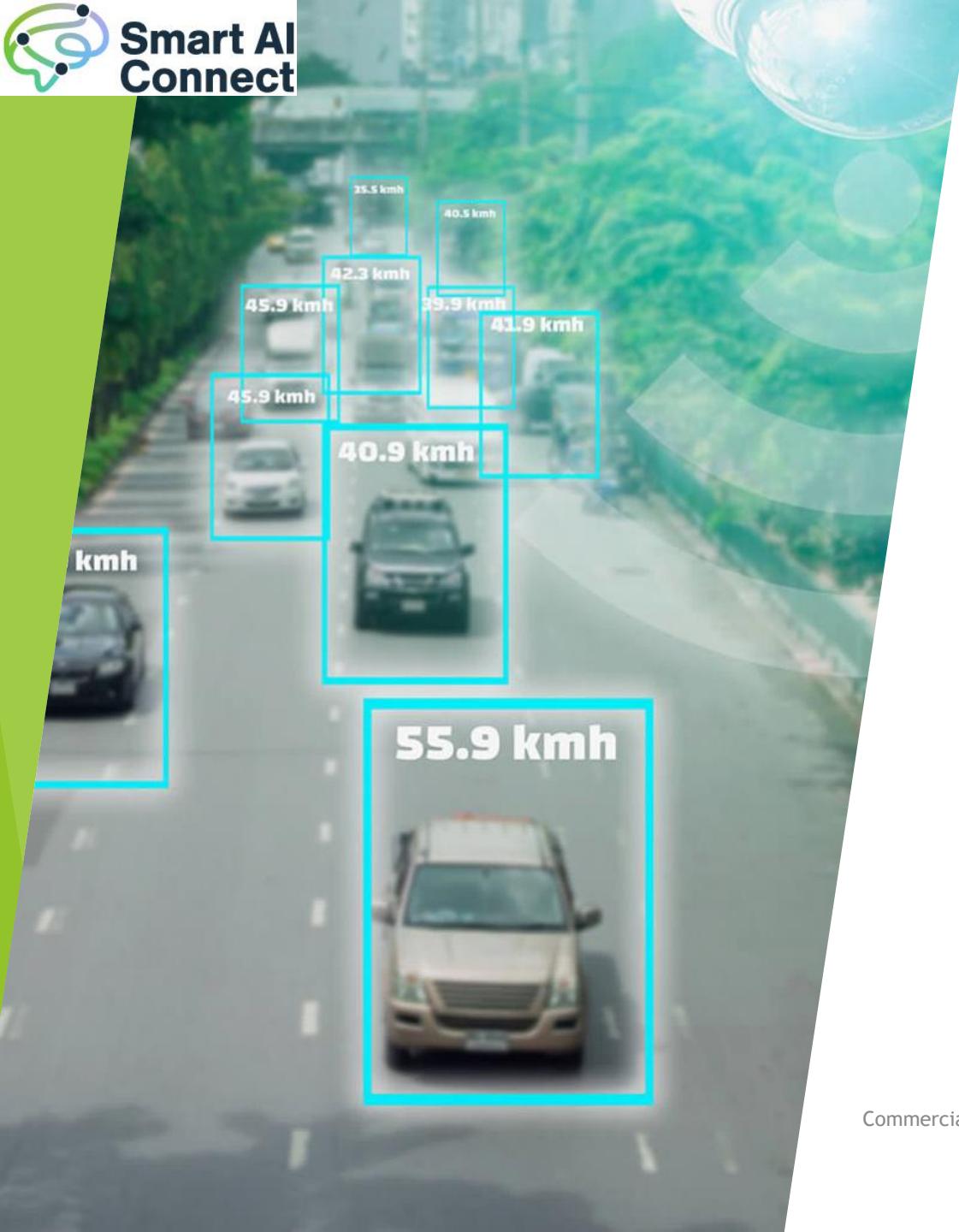


Smart AI  
Connect





Smart AI  
Connect



# Thank You.

Commercial in Confidence - SmartAIConnect Pty Ltd