PRESENTATION

The Algorithm

Assoc Prof Johan Verjans MD PhD FESC FRACP

Lived and worked in

- Maastricht
- Philadelphia
- University of California
- Utrecht
- London
- Israel
- Boston

Cardiometabolic & Imaging Cardiologist
PI Cardiometabolic & AI Clinical Trials
Royal Adelaide Hospital / Jones Radiology

Deputy Director (Medical), Australian Institute for Machine Learning AIML

AUs Largest ML group (200+ people)
#6 in Computer Vision (csrankings)
#7 AI (TIMES higher education)

Leadership

- Federal member, Dutch Medical Association
- National Chair, Dutch Cardiovascular Research (early-mid)
- Partner, National Data Flagship- Australian Cardiovascular Alliance
- Chair - Australian Society for Molecular Imaging
- Board Member - State AI advisory board (AI in Health Hub)
- CareMappr steering committee (Deploying Medicare Dashboard - Digital Health)
- Advisory boards Startups, AI/ML advisor GSK global

- Deputy Director (Health), Australian Institute for Machine Learning (AIML)

Clinical / Research

- 10+ years in Clinical Cardiology
- 10+ years in Clinical Trials
- 3+ years in AI Clinical Trials
- 15+ years in Molecular Biology / Cellular imaging / Molecular Imaging / Imaging / Metabolomics
- 10+ years Photonics Research
- 10+ Worked with state and federal governments
- Editorial Boards -
    - European Heart Journal - Digital Health
    - Frontiers in Cardiology

AI /ML

8+ years in AI/ML

- Building ML pipeline from idea-data-annotation-ML-implementation
- Cross-disciplinary and cross-institutional collaboration
- National AI Centre - AI Digital Capability Centre
- National AI in Health Centre 100M

Methods development

- Vision & Language
- Medical Visual Question Answering
- Causality / Reasoning
- Standardisation / Ethics

Clinical development

- Cardiovascular/GI Imaging
- Oncology
- Genomics/Lipidomics
- Pathology (Breast/Cell imaging)
- Multimodal analytics

Clinical Trials

- AI in Chest pain decision making
- Breath analysis

Google Scholar

Metrics

Top publications

Top cited publications over the last five years Learn more

	Publication	h5-index	h5-median
1.	Nature	414	607
2.	The New England Journal of Medicine	410	704
3.	Science	391	564
4.	IEEE/CVF Conference on Computer Vision and Pattern Recognition	356	583
5.	The Lancet	345	600
6.	Advanced Materials	294	406
7.	Cell	288	459
8.	Nature Communications	287	389

28 papers in 2021

23 papers in 2022

ALGORITHM FACTORY

A FACTORY THAT NEEDS ALGORITHMS

Projects ongoing

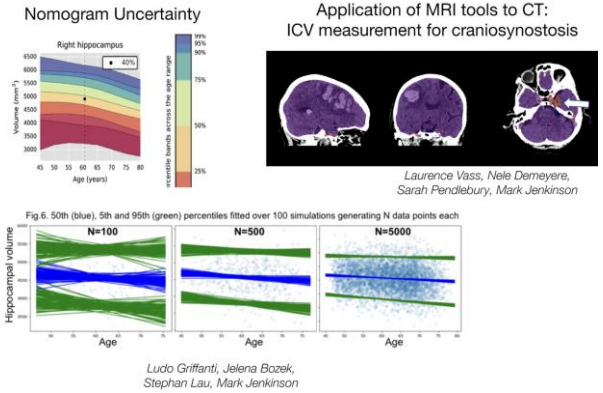
- Imaging
- Cardiovascular Imaging
- GI / Colonoscopy
- Colorectal cancer
- Chest CT / Xray
- Orthopaedics
- Ophthalmology
- Critical Care
- Breast Cancer

- Proteomics, Lipidomics, Metabolomics
- Lipidomics to predict cardiovascular disease and treatment response
- Breath Analysis

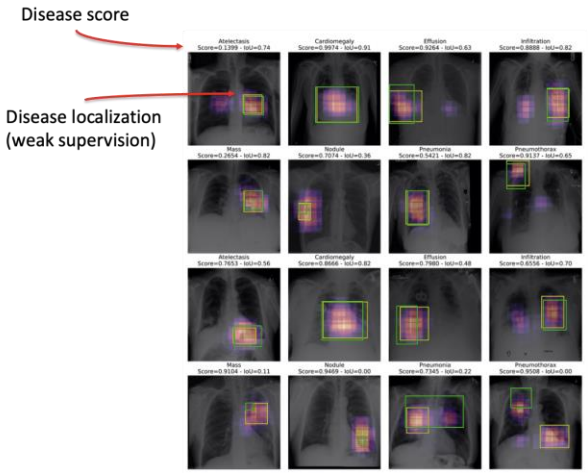
- Genomics / Statewide Genomics Centre

- Clinical Trials / Drug Development / Testing
- Treatment response Leukemia
- Immunotherapy response

Clinical neuroimaging tools / ML tools
(Dr Stephan Lau, Prof Mark Jenkinson)



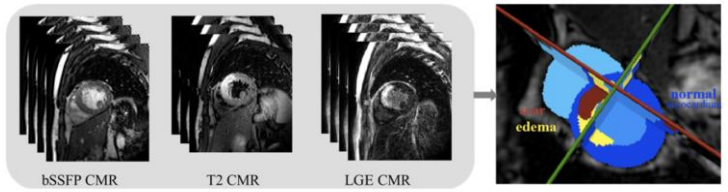
Classification and Explanation of Diseases from Chest X-Ray
Hermoza, Carneiro MICCAI'20]



Few-Shot Anomaly Detection for Polyp Frames from Colonoscopy

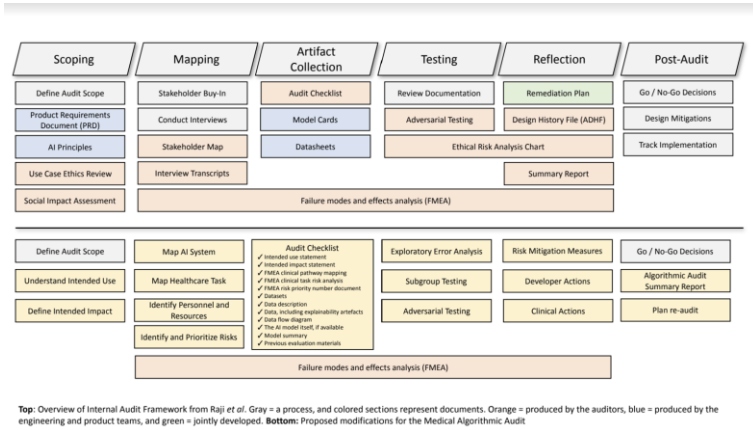
Yu Tian[1,3] Gabriel Maicas[1] Leonardo Zorron Cheng Tao Pu[2,4]
Rajvinder Singh[2] Johan W. Verjans[2,3] Gustavo Carneiro[1]

MyoPS 2020: Myocardial Pathology
Segmentation combining multisequence CMR
(Zhang, Verjans, Xiao - MICCAI 2020 award)



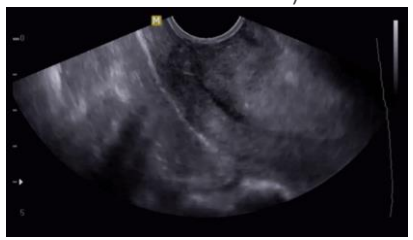
Real-time Polyp Detection and Classification (w/ uncertainty)
Carneiro et al. MedIA'20

Flowchart for algorithmic audit (Oakden-Rayner)



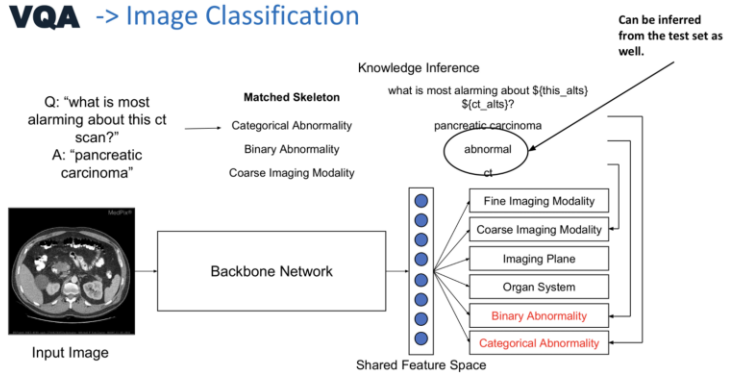
Top: Overview of Internal Audit Framework from Raji *et al.* Gray = a process, and colored sections represent documents. Orange = produced by the auditors, blue = produced by the engineering and product teams, and green = jointly developed. **Bottom:** Proposed modifications for the Medical Algorithmic Audit

AI for Sliding Sign Detection to Diagnose Endometriosis. (G. Maicas, Carneiro, Hull, World Congress on Endometriosis 2021)



Improving Scaphoid Fracture Detection with Human Expert Annotation
(Shen, Liao, Verjans - CHI 2021)

Answering open-ended questions
Winner Medical VQA+VQG ImageCLEF
(Liao, Verjans NIH ImageCLEF 2020)



Government of South Australia

Formal collaborations after government support of AIML
>6M in grants
30+ projects

THE UNIVERSITY of ADELAIDE

Women's and Children's Hospital ADELAIDE

SA Pharmacy

SA PATHOLOGY

2019 2020 2022

Member of Global Alliance of Centres AI in Medicine -

Monthly meetings (ACAIM)

Duke AI HEALTH

NYU Langone Health

AIM

Harvard

Temerty Centre for AI Research and Education in Medicine
UNIVERSITY OF TORONTO

AUSTRALIAN INSTITUTE FOR MACHINE LEARNING

臺北醫學大學 校級人工智慧醫療研究中心
TMU Research Center for Artificial Intelligence in Medicine

u b
UNIVERSITÄT BERN

MAYO CLINIC

Founding Centers

CHOC
THE SHARON DISNEY LUND
Medical Intelligence & Innovation Institute

Stanford AIMI

Cleveland Clinic

Nominated AI Centre in Medicine of the Year

(AIMED 2022)

AUSTRALIAN INSTITUTE FOR MACHINE LEARNING

APAS Petri Dish Reader
First in class FDA approved device

LBT Innovations

Clinical 3D Bladder Scanner
AI enabled

RapidX AI Chest pain
Cluster-randomised Clinical Trial

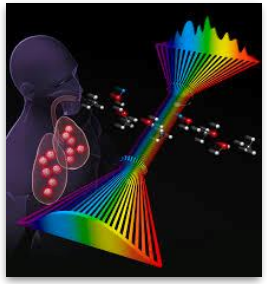
Australian Government
National Health and Medical Research Council

SIEMENS Healthineers

AI enabled
Clinician Insights
using real-time medicare and hospital data

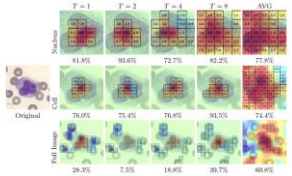
CAREMAPPR

AI Breath Analysis
Clinical trial



OPTICAL FREQUENCY COMB

AI Leukemia detection
Clinical Cell Classification



Interpretable Deep Learning for Chronic Myelomonocytic Leukemia Analysis

One-stop-shop for companies

Leading Methods AI

Computer Scientists
Data Scientists etc

Leading Applied AI

Computer Scientists
Data Scientists, Molecular Scientists, Clinicians

Best Datasets

South Australia Health Network is unique due to its size, connected single health system
stable population
-> Best longitudinal clinical dataset in Australia

Roche

SIEMENS Healthineers

gsk GlaxoSmithKline

CLINICAL AI PIPELINE

Data Collection

Collecting data from medical records, patient surveys, and other sources

Data Cleaning

Organizing and preparing data for analysis

Data Analysis

Using algorithms to identify patterns in the data

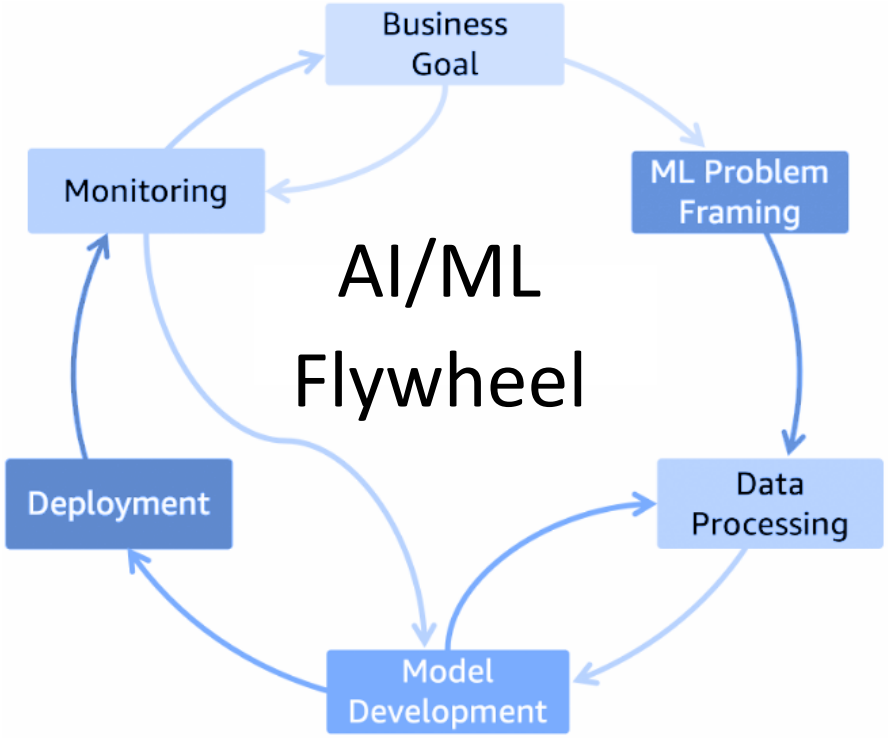
AI Modeling

Building models to predict outcomes and suggest treatments

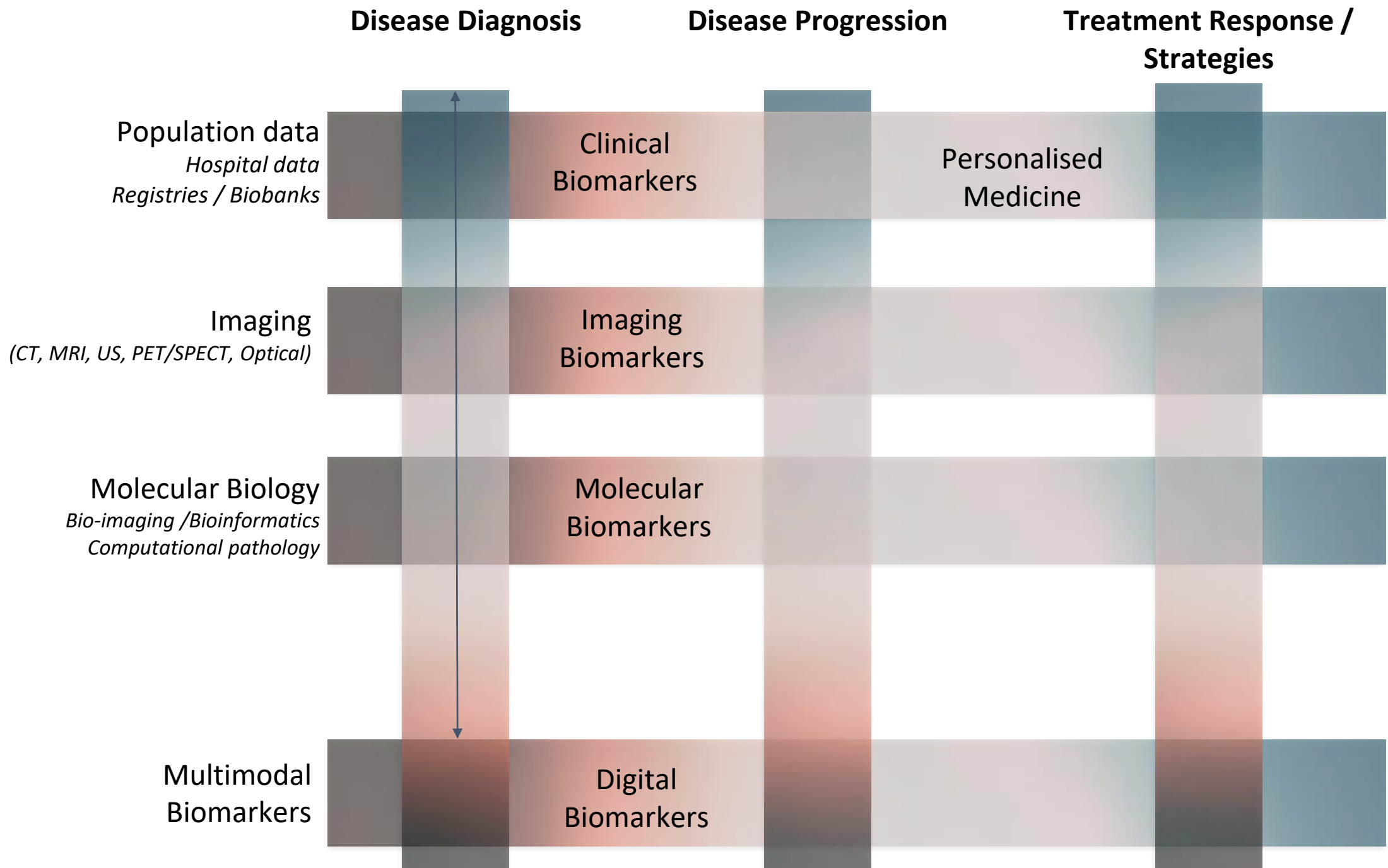
Deployment

Audit

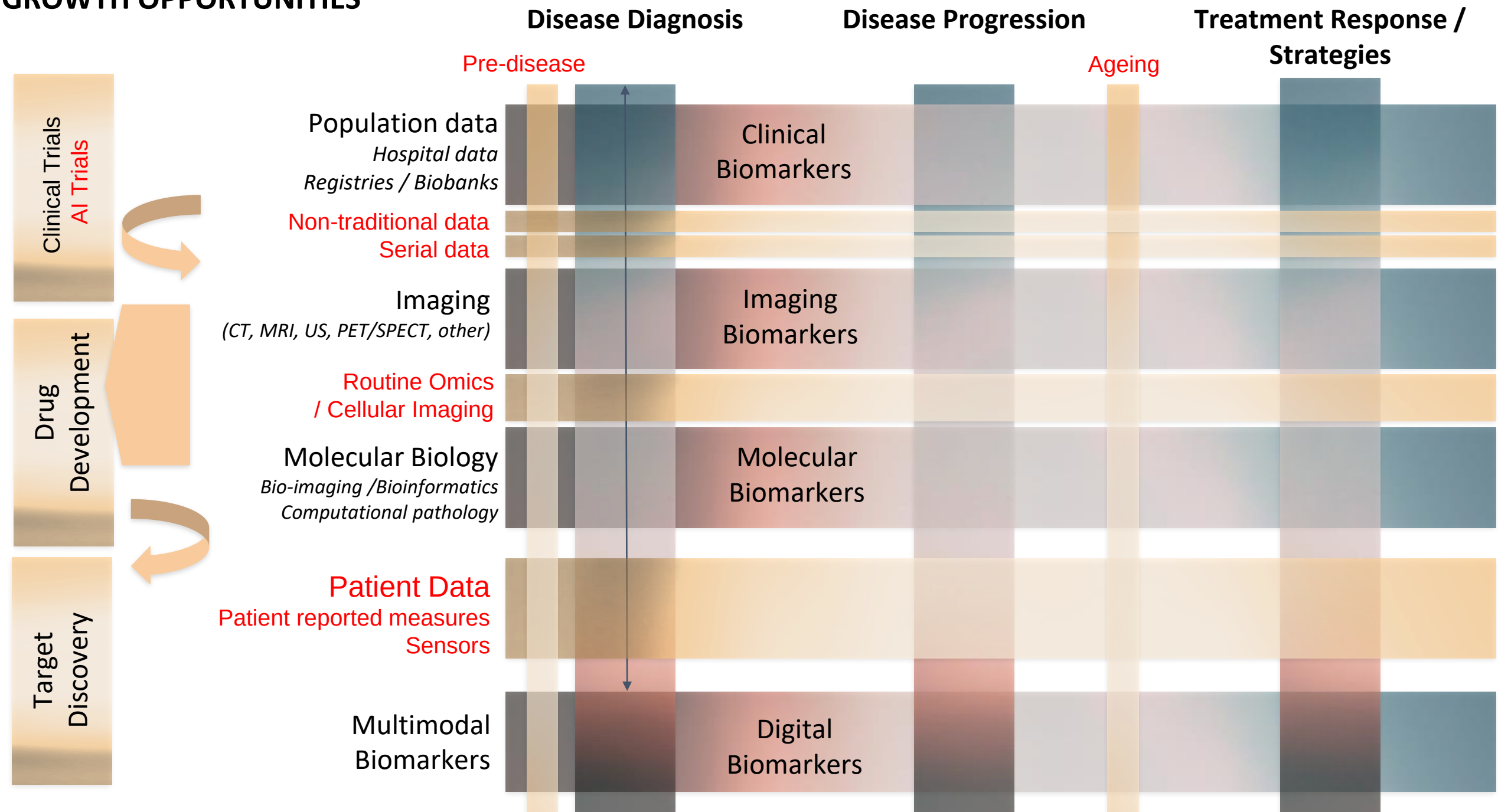
Medical AI requires a variety of technologies to be successful, from data collection to AI modeling.


Business Goal
ML Problem Framing
Data Processing
Model Development
Deployment
Monitoring
AI/ML Flywheel

TRENDS DIGITAL BIOMARKERS



GROWTH OPPORTUNITIES



NAVIGATING **CHALLENGES** IN NEW ERA

- ## Access to Innovation

  Challenges in accessing innovation, which includes the discovery and development of new drugs and treatments.

- ## Innovation by Few

  Small companies, or even one man can build competitive products in AI/ML space.

- ## Personalised Medicine

  There is growing demand for personalized medicine.

- ## Digital therapeutics

  The emergence of digital therapeutics presents new opportunities for pharmaceutical companies, but also poses challenges in developing and commercializing these treatments.

- ## Drug cost

  The cost of developing new drugs is increasing, and pharmaceutical companies will have to find ways to reduce costs while still producing effective treatments.

- ## Drug delivery

  The industry is moving towards non-traditional drug delivery methods, such as gene therapies and RNA-based drugs, which present unique challenges.

- ## Aging population

  As the global population ages, pharmaceutical companies will have to develop treatments for age-related diseases, such as Alzheimer's and Parkinson's and ageing body in general.

- ## Cybersecurity

  GSK will have to keep investing in robust cybersecurity measures to protect sensitive data.

- ## Data privacy

  With the increasing amount of health data being generated, data privacy and security will be a critical concern for pharmaceutical companies.

- ## Regulatory hurdles

  With the continually evolving landscape, GSK will need to remain agile and adaptable to stay compliant.

- ## Environmental concerns

  The industry will have to address environmental concerns, such as the impact of drug manufacturing on the environment, and develop sustainable solutions.

- ## Access to talent

  To get the best talent - GSK.AI must be considered on of the best places to work for Applied AI.

NAVIGATING PHARMA CHALLENGES IN NEW ERA

Making the right choices

Thank you

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