

#### 1. Problem

Breast Cancer is one of the leading causes of death in the world and the most common cancer among women in many countries. On average, 1 in 11 women will be affected by Breast Cancer in their lifetime, with 1.7 Million women diagnosed in the year 2019 alone. However, early detection has the potential to save lives by significantly enhancing the survival rate, as the chances of recovery drops significantly after stage 2 onwards.

Screening is a critical part of treating breast cancer as it is the very first step before a patient can determine whether or not he/she requires treatment. As such, many countries in the world have set up Breast Cancer Screening Programs to help in early detection and put in place the relevant reimbursement schemes for such programs. There are a number of ways to conduct a mass screen, but 2D Mammographies have been found to be the most accurate way of conducting such programs for a large population.

However, existing mammographies suffer from a number of issues ranging from inefficiencies in the clinical workflow to inaccuracies in the reading interpretation as a result of human errors.

### 3. New Workflow

As such, we have developed a tool based on a number of technologies developed at the NUS Saw Swee Hock School of Public Health's Healthcare Al Lab. These technologies include algorithms developed based on Computer Vision, Deep Learning and Natural Language Processing and aims to enhance the workflow by serving as an Al assistant to a single reader radiologist instead of the need for a double blind reading.

From this, we aim to enhance the efficiency by cutting down the time taken for receiving the report from 2-4 weeks to 3-5 days, 30 minutes to 5 minutes and 2-3 radiologists to just 1. In addition, our algorithm hopes to reduce the false positive results from 9% to 2% and false interval negatives from 10% to 7.5% by replacing the second reader with an Al Assistant. This also has a benefit of enhancing the clinical workflow by easing the burden on breast radiologists and allow them to have a greater capacity to handle patients.

radiologist for

one screen



5. Scientific Validation

We have built our algorithm based on a number of public and private datasets and published our preliminary findings in two major areas. The algorithm was also tested in the US White House DREAM Challenge against 1,100 teams from around the world where we came in as the 4th place in the world and top in Asia. Our algorithm was later refined to achieve one of the highest AUC accuracy levels in the world at 0.96.



US White House DREAM Challenge

7.5%

false interval

negatives

2%

false positives

Zoom in to where it matters: a hierarchical graph based model for mammogram analysis" accepted in AAAI workshop on Deep Learning on Graphs: Methodologies and Applications (DLGMA 20)

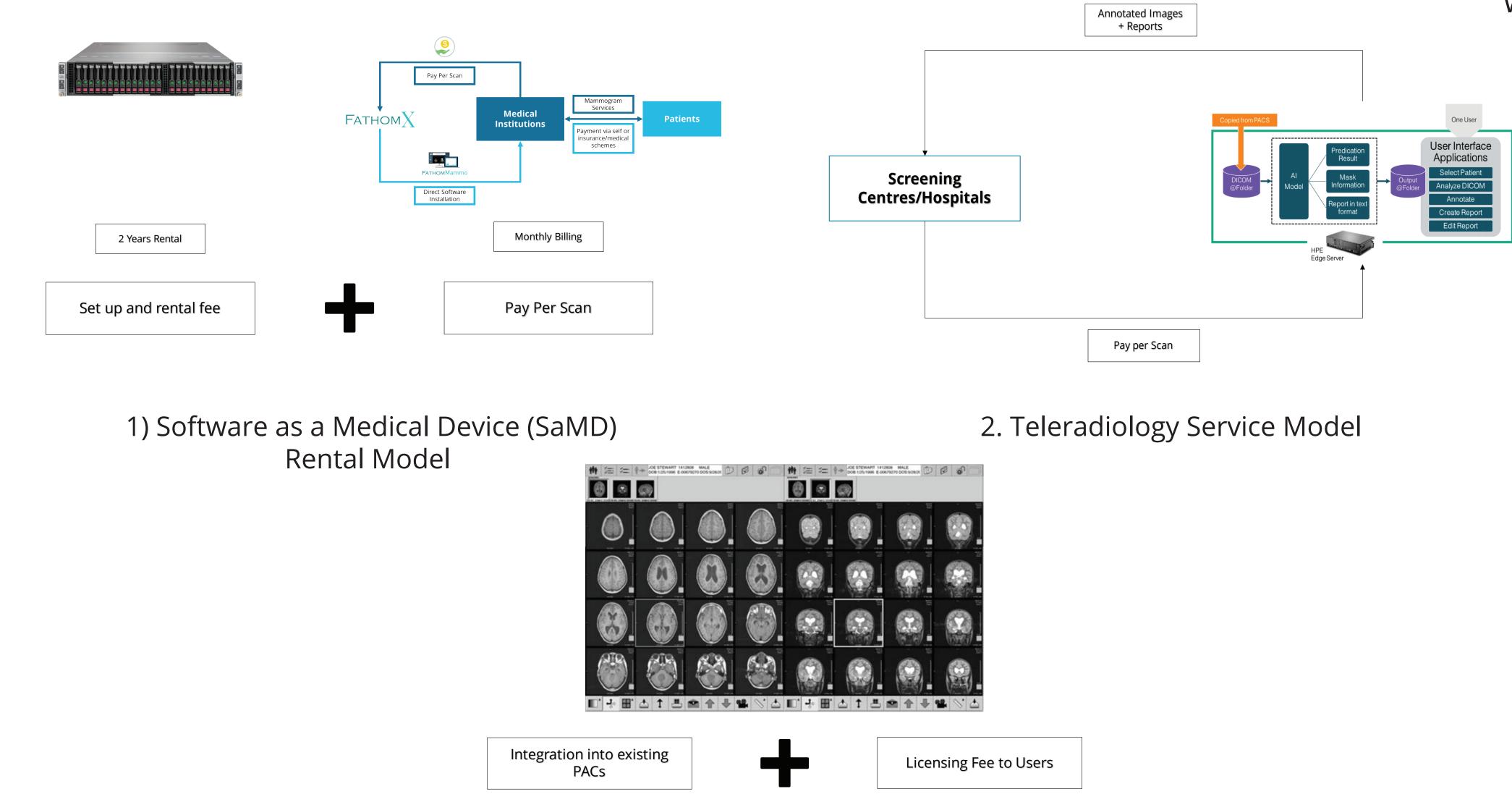


**JAMA** Network<sup>™</sup>

Assessment of Combined Artificial Intelligence and Radiologist Assessment to Interpret Screening Mammograms

## 7. Business Models

We are currently exploring a range of business models, including selling as a Software As a Medical Device (matched with a rental fee for the edge servers) for screening clinics, a servicing model where clinics or programs with capacity issues send us their images to be run through our engine as well as a direct licensing model to hospitals where our Al API is integrated into the Mammogram Machine Picture Archiving and Communication (PAC) System.



3. API and AI Engine Licensing Model

## 2. Existing Workflow

A typical screen for each patient requires 2 radiologists to conduct what is known as a double blind reading where 2 clinicians independently interpret the images, annotate it, write individual diagnosis and compare their results. If the results are negative for breast cancer, they discharge the patient. If the results are positive, the entire procedure is repeated. Only a second positive result would result in the patient being sent for the more invasive biopsy to confirm the diagnosis.

Not only is this inefficient, it is also inaccurate. It takes about 2-4 weeks for each report due to backlog, 30-40 minutes for one whole screen, and multiple radiologists. In addition, 9% of these results are false positive results (because of misreadings) and 10% are false interval results (because of missed lesions).

radiologists for

one screen

minutes per screen

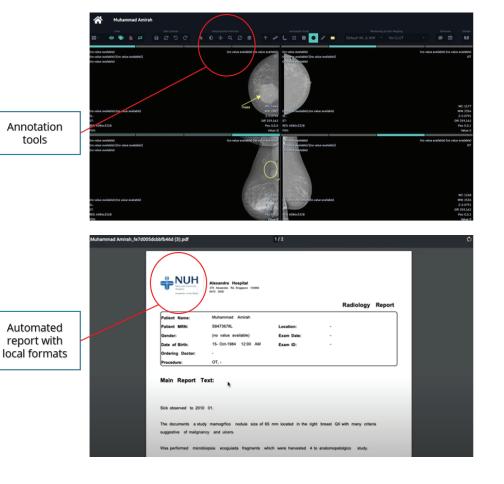
false interval

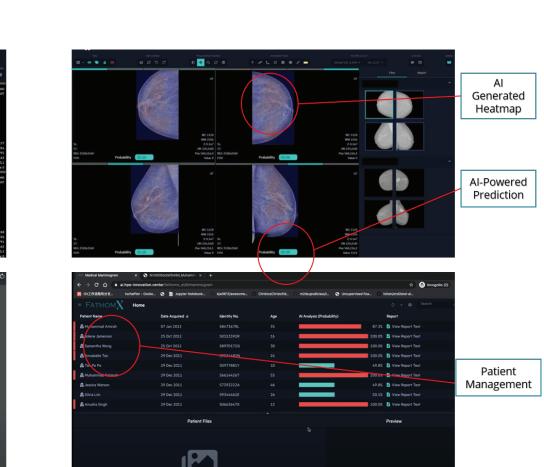
negatives

false positives

4. Technology Solution

We have thus developed a product that incorporates annotation tools, automated Annotation tools reports, Al enabled heat map generation as well as AI powered prediction features to assist clinicians in augmenting their current workflow.





**Cancer Risk Estimation** 

weeks for

each report

**Al Generated Radiology Report** 

**Abnormal Lesion Heatmap** 

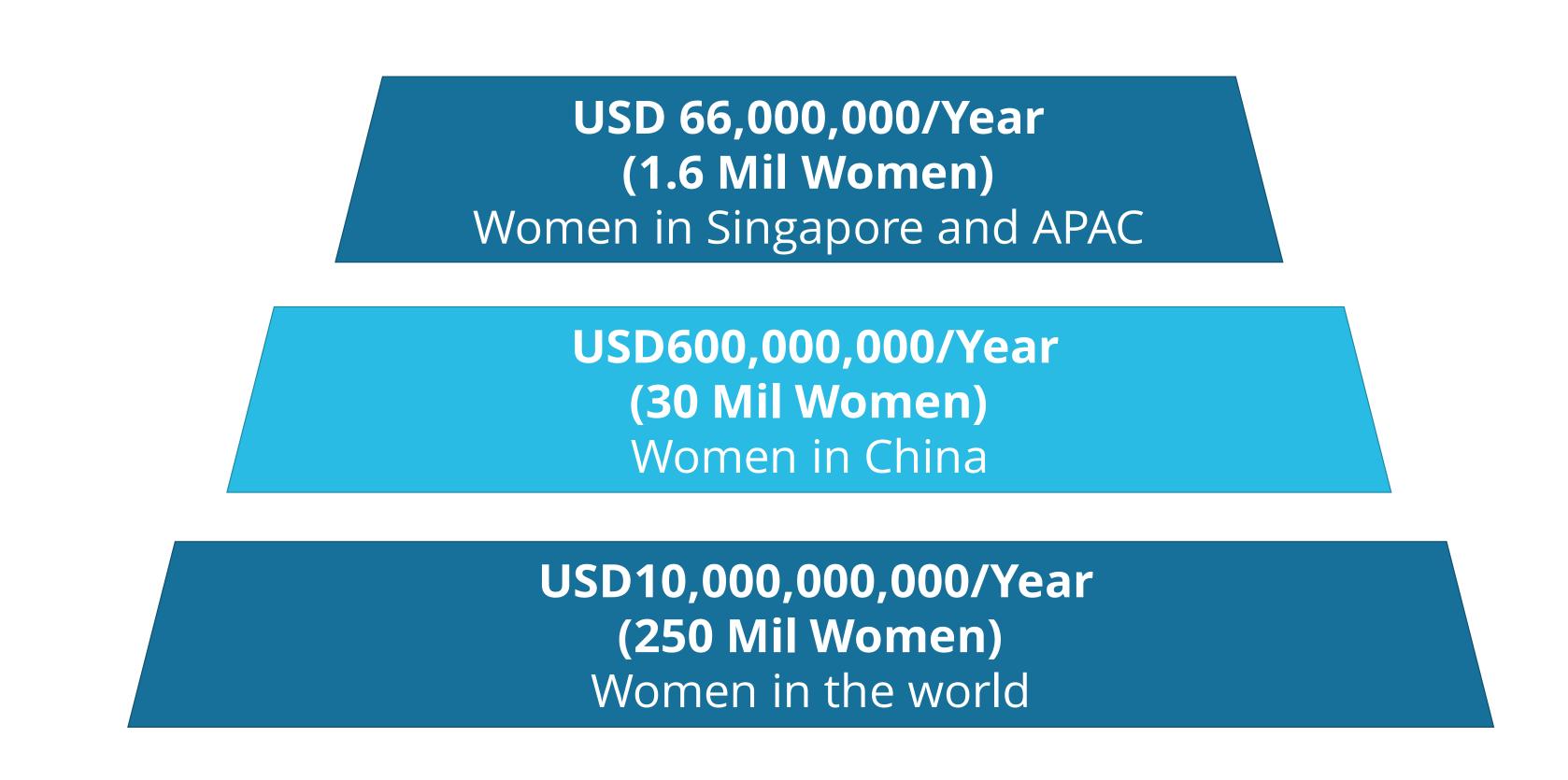
Estimation of the risk of cancer that follows existing guidelines through medical imaging and analysis of medical history records

Al Generated Radiology Report

Heatmap generation of abnormal lesions for analysis

## 6. Market Size

Breast Cancer Screening programs are fairly well established or are about to be set up in various markets in the Asia Pacific region and has a huge potential for market access. The Serviceable Obtainable Market, Serviceable Addresable Market and Total Addressable Market can be seen below.



## 8. Competitive Analysis

FxMMG

(Traditional)

Against existing competitors, we have a small niche in our ability to detect lesions in dense breast datasets which is common in Asia (although the algorithm still works for all kinds of images), one of the highest AUC levels in the world, efficacy tools for the clinical workflow as well as a technical IT infrastructure that is deployable in Asia.

Our technical infrastructure was designed alongside consultation with local IT staff and has been optimised to allow for data security, connectivity and computation speed and complies with local regulations allowing the data to stay within the centre unlike cloud-based solutions.

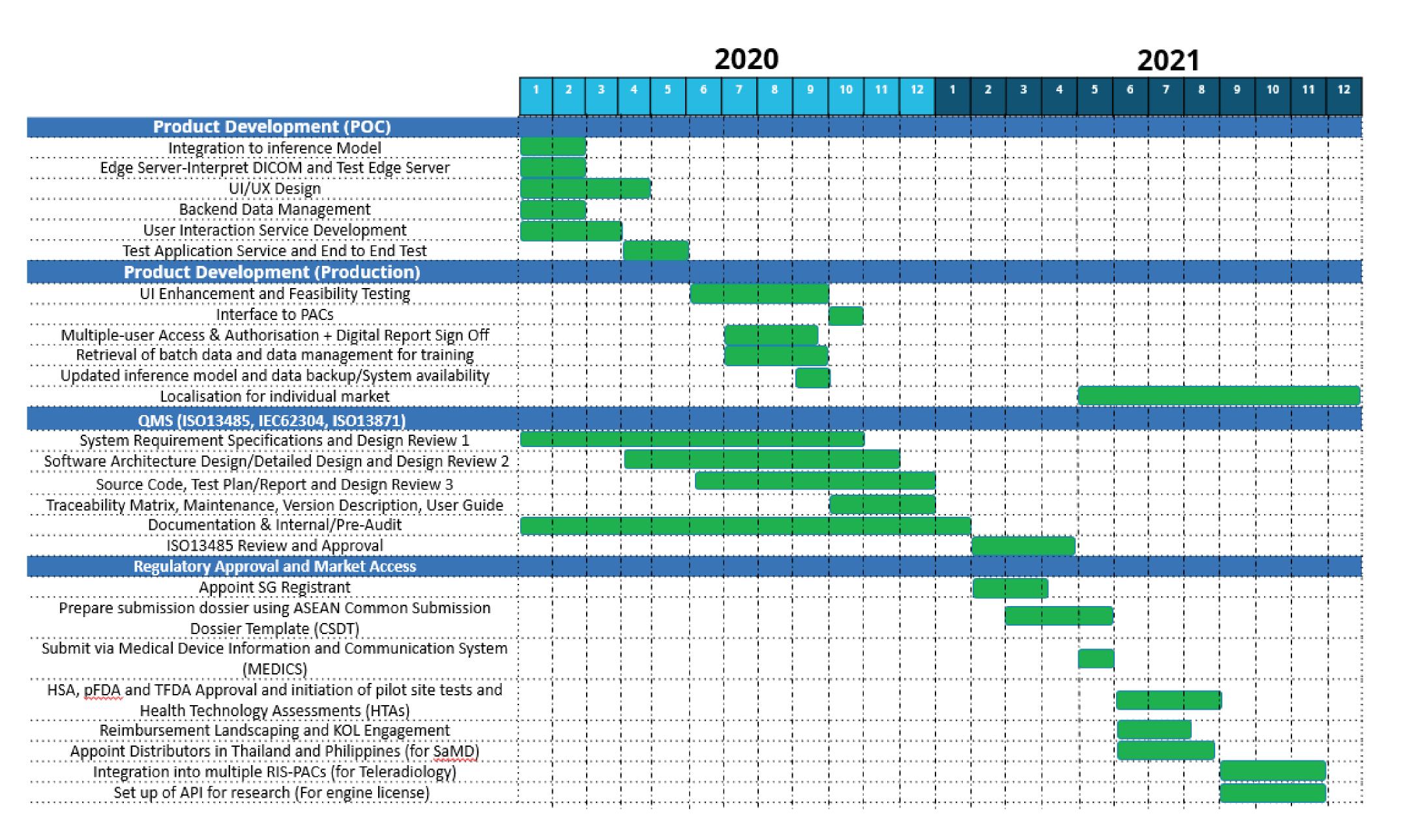
(Startup)

(Asian Competitors)

	 Imagechecker/Care stream/Legacy	iCAD/Screenpoint Transpara/Kheiron	Zebra	Lunit	Miying
Niche in Asian Dense Breast Datasets					
Accuracy Level in AUC					
Efficacy tools for clinical workflow					
Connectivity and Computation Speed					
Technical infrastructure and deployment Structure					
Localised custom data privacy and security					

# 9. Product/Regulatory Roadmap

We aim to get our first certification for our first market in Q4 of 2021 while building up internal capabilities in product development, QA/RA as well as business development.

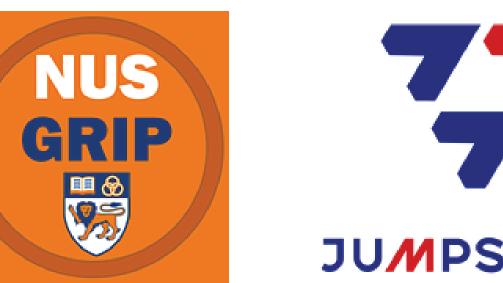


# 11. Partners

We are currently funded by a number of organisations to a value of SGD2.55 Million and supported by several clinical, industry and commercialisation partners.









NUHS

Health System

National University















# 10. Milestones/Achievements

Digital Mammography DREAM Challenge Champions Emerged as the overall winner for the Asian category and Top 5 for the Global category for the Digital Mammography DREAM Challenge organised by Sage Bionetworks

Awarded Healthcare Services Research Grant Awarded Healthcare Research Grant of SGD 1,039,554 by the National Medical Research Council (Under Ministry of Health Singapore)

Secured NUS Graduate Research Innovation Program Funding Awarded the NUS Graduate Research Innnovation Program seed fund of SGD100,000 and incorporated a company

Award Winners in Hubei Innovate/Qingdao Innovate

3rd out of 100 teams in Qingdao Innovate and Top 9 out of 140 teams in Hubei Innovate Publication on AAAI/Jama Open Network

Journal publications accepted on AAAI Workshop and JAMA Open Network and also featured on news outlet Physicsworld

Signed Research Collaboration Agreement with NUH, KKH, Lifepool Australia and Taipei Medical University Co-Development with HP Enterprise APAC

Research Collaboration Agreement

technical and deployment feasibility

Signed an MoU to co-develop and co-deploy solution across multiple clinics in the APAC region Completed Product Development Concluded product development for POC and tested for

Secured SGD1.25 Million in I2Start Funding Awarded SGD1.25 Million in commercialisation funding comprising of funding from SMART, NHIC and Enterprise Singapore

# 12. Team

# Management Team



Dr Mikael Hartman Chief Medical Officer Execution/Development Team

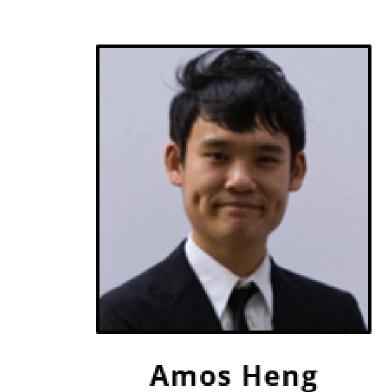


Dr Feng Mengling Chief Scientific

Officer



Chief Technology Officer



Chief Operating

Officer

**Sep 2017** 

Nov 2017

**July 2019** 

Nov 2019

Feb 2020

Mar 2020

Mar 2020

**July 2020** 

**July 2020** 



Infrastructure Lead

(Seconded by HPE)





Francis Lo

Engineering Lead

(Seconded by HPE)