

safineai

Intelligent Microscopes that Automate Blood Analysis

Team

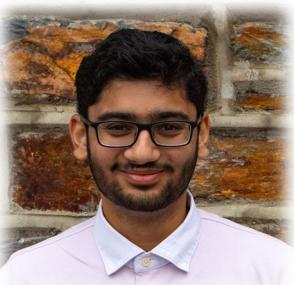
Executive Team



Pratik Bokadia
M.Eng. BME, Duke
University
**Medical Devices, Business
and Optics**



Dr. Roarke Horstmeyer
PhD Caltech
Computational Optics Lab ,
Duke
Co-founder Ramona Optics
Scientific Director



Amey Chaware
M.S. ECE, Duke University
**Machine Learning,
Business and Embedded
Systems**

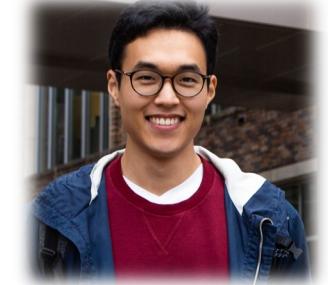
Technical Team



Dr. Pavan Chandra Konda
PhD. Optics, Glasgow
University
**Hardware Development
Lead**



Mahsa Taskindoust
MD Candidate,
Duke University
Clinical Lead



Kanghyun Kim,
M.S. in ECE, Duke
University
**Machine Learning in
Imaging Lead**

Advisory Board



Strategy Advisor

Dr. Joseph Knight
PhD, MBA
CEO, InnAVasc



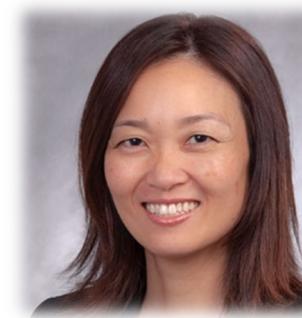
Technical Advisor

Dr. Mark Harfouche
PhD Caltech
CEO, Ramona Optics



Business Advisor

Dr. Inga Deakin
PhD University of Oxford
Mentor in Residence, Duke



Clinical Advisor

Dr. Carolyn Glass
MD PhD
Co-Director, Computational Pathology,
Duke Hospital

Most Common Diagnostic Test

- Complete Blood Cell Count (CBC) & Blood Cell Morphology are the **baseline** blood tests
- 5 Billion+ tests performed globally

Zarella et al. A Practical Guide to Whole Slide Imaging: A White Paper From the Digital Pathology Association

Robboy et al. Pathologist Workforce in the United States: I. Development of a Predictive Model to Examine Factors Influencing Supply

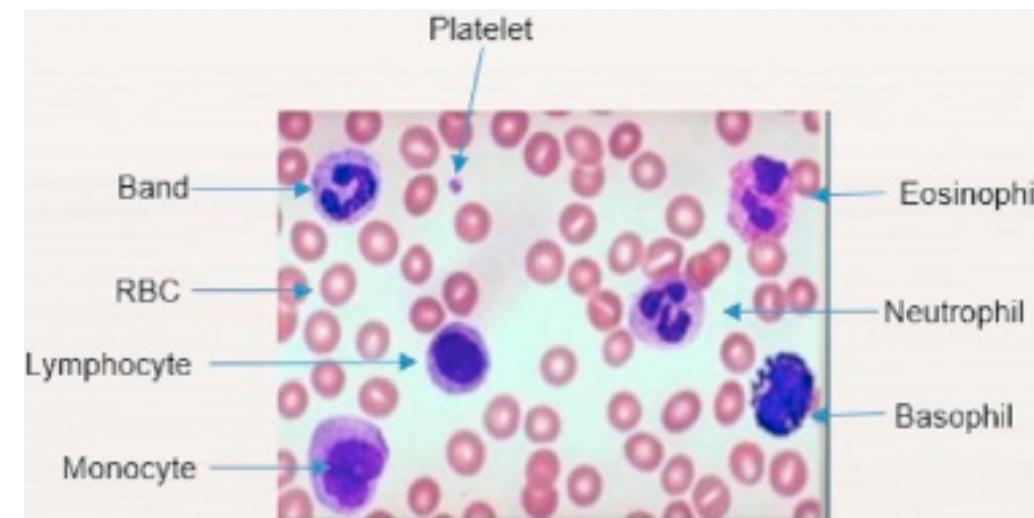
<https://prime.economictimes.indiatimes.com/news/68587067/pharma-and-healthcare/bad-blood-how-indias-uncontrolled-pathology-labs-put-you-at-risk>

CBC – Dated & Many Failure Modes

- Counting 7 types of blood cells
- Coulter Counting – changes shape and structure
- Failure modes
 - Larger platelet clumps may be counted as WBCs
 - Cell fragments may be counted as platelets in specimens from chemotherapy-treated patients
 - And many more.....
- Implication
 - Compromised standard of care



Automated Hematoanalyzer (AHA)



Rodak's Hematology (<https://doctorlib.info/medical/hematology/16.html>)

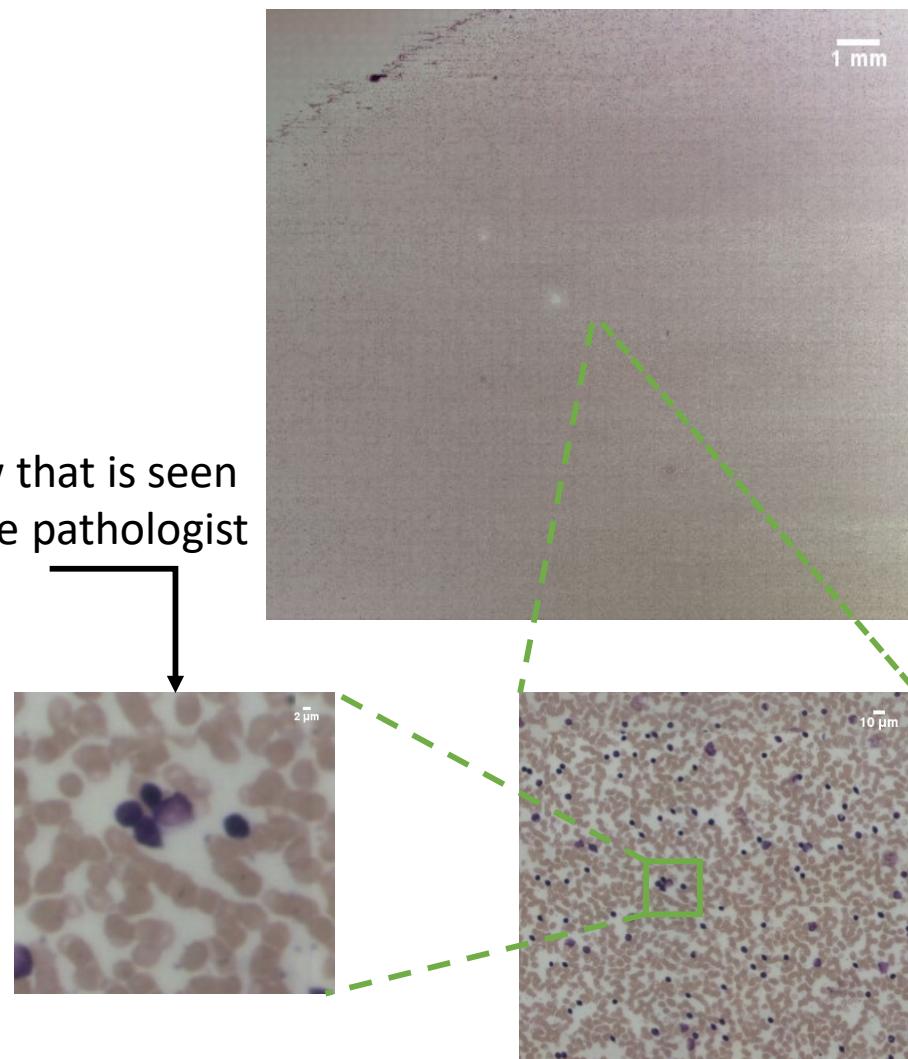
Cell Counter – Related Abnormalities LaboMed Vol.30, 5

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5713789/>

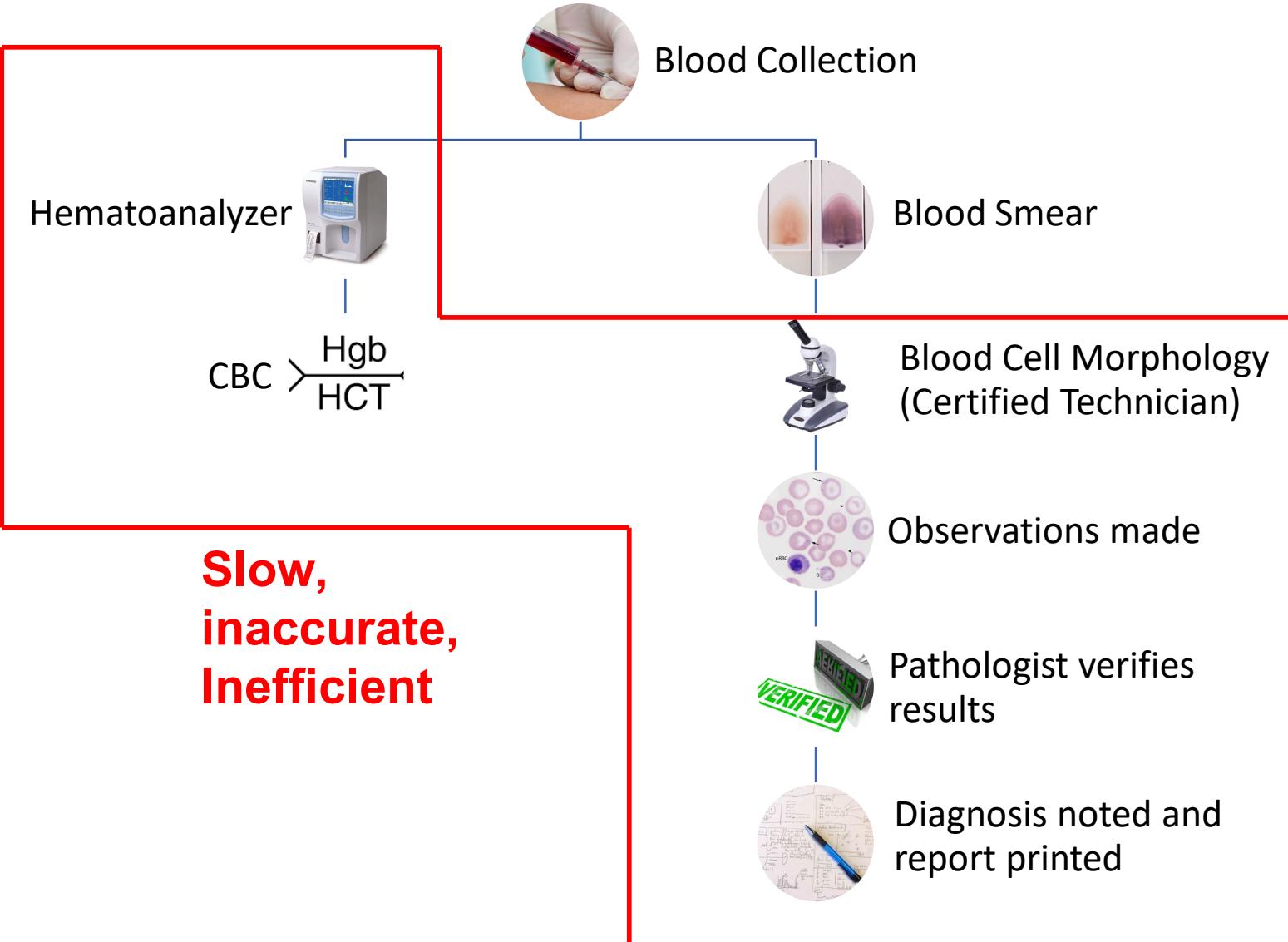
Morphology – Manual Visual Diagnosis/ Screen

- Corroborate results from AHA
- 70+ abnormalities – look at shapes, sizes, color, structure under a microscope
- 15-20 minutes per slide
- Average - 15-20 slides per day
- 6+ hours per day of manual effort

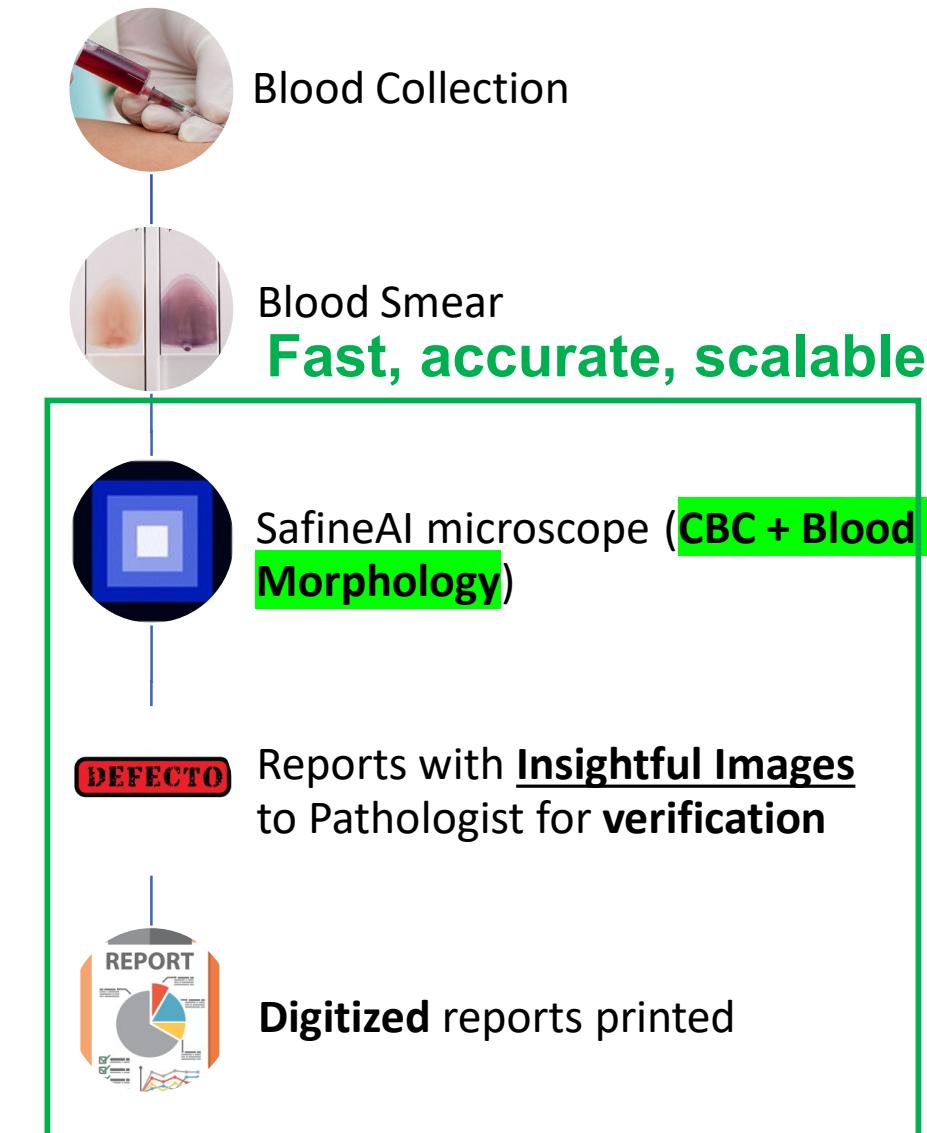
2 Gigapixel image of blood smear



Current Workflow

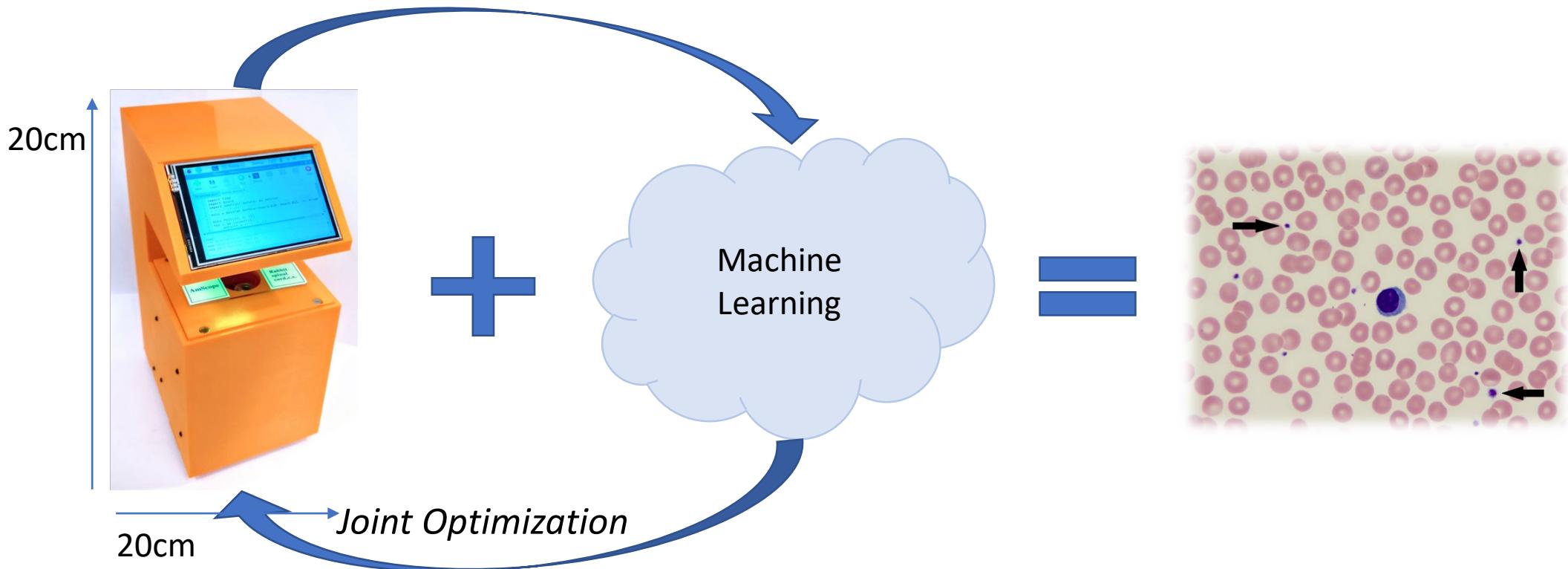


SafineAI Workflow



SafineAI smart microscope: optimized by AI, for AI.

*Our
Imaging
System
(Patent
Pending)*



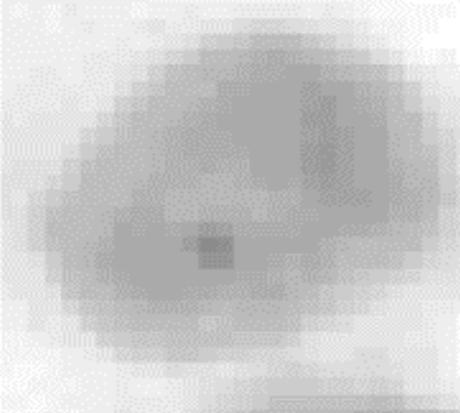
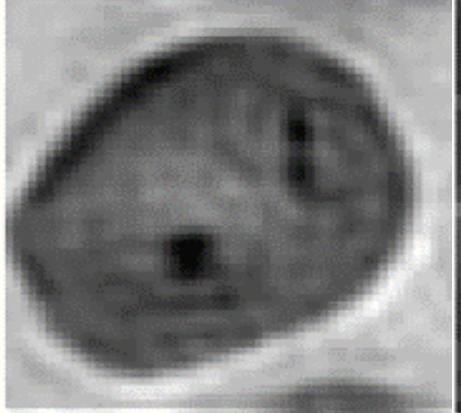
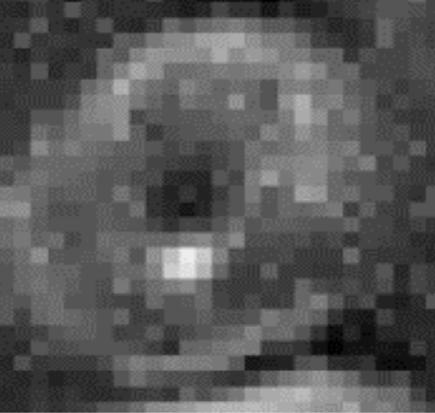
Capture less Data

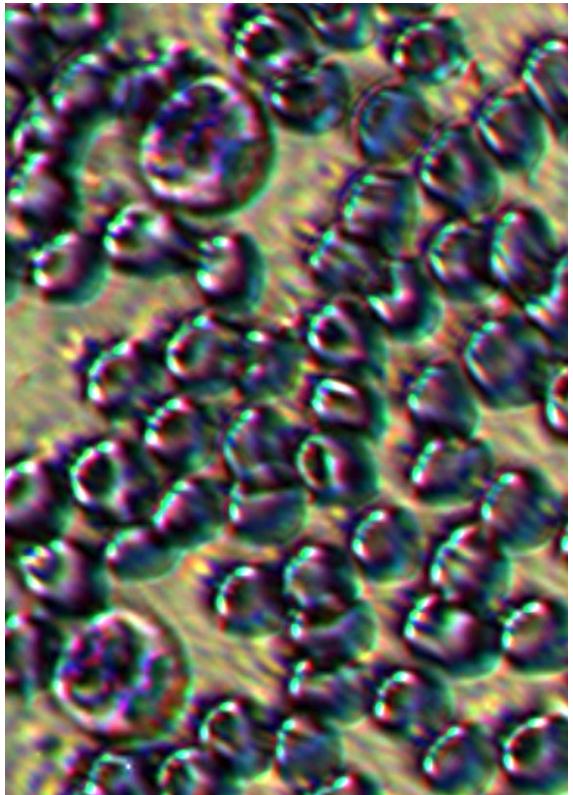
Faster Automated
Diagnosis

Insightful Images

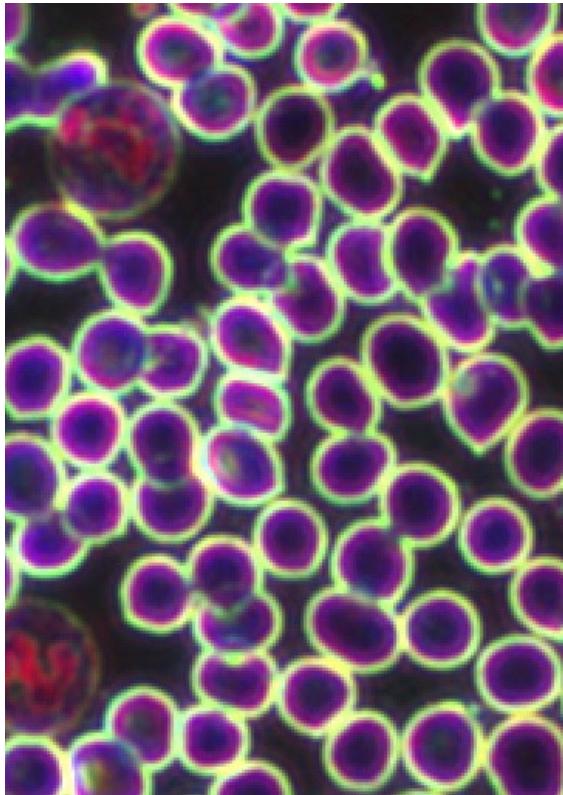
Technology Validation

A malaria infected blood cell imaged under various conditions

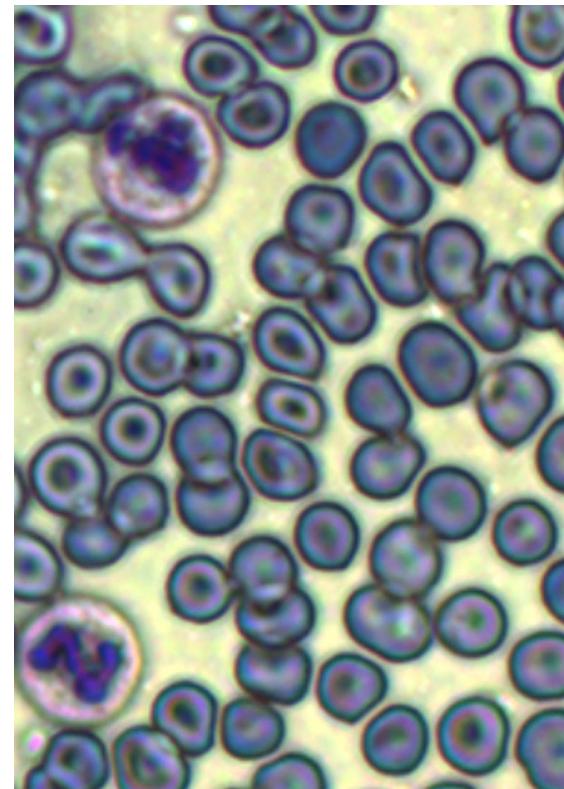
	Traditional Low-Resolution Image	Traditional High-Resolution Image	Low-Resolution image from our microscope
			
Magnification	20X	100X	20X
Data Capture	Low (~0.4 GB)	High (~10 GB)	Low (~0.4 GB)
ML Accuracy	68.9%	96.8%	94.9%
Equipment Cost	~\$1000	~\$100,000	~\$1000



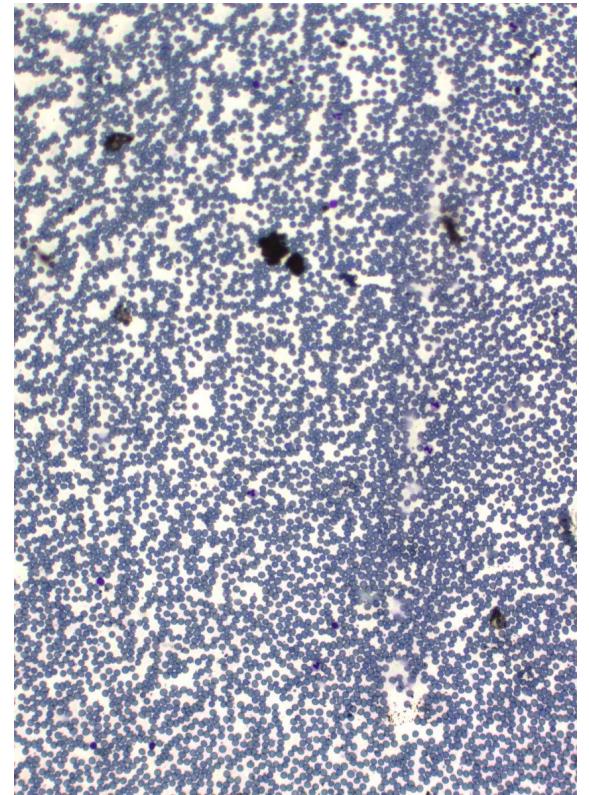
40x Off-axis



40x Dark-field Ring



40x Brightfield



10x Brightfield

Images of the smear obtained under various conditions

Insightful Images



Pathologists look at
only areas that
matter
10x more tests



50% of global blood
market is in rural
regions
Telepathology

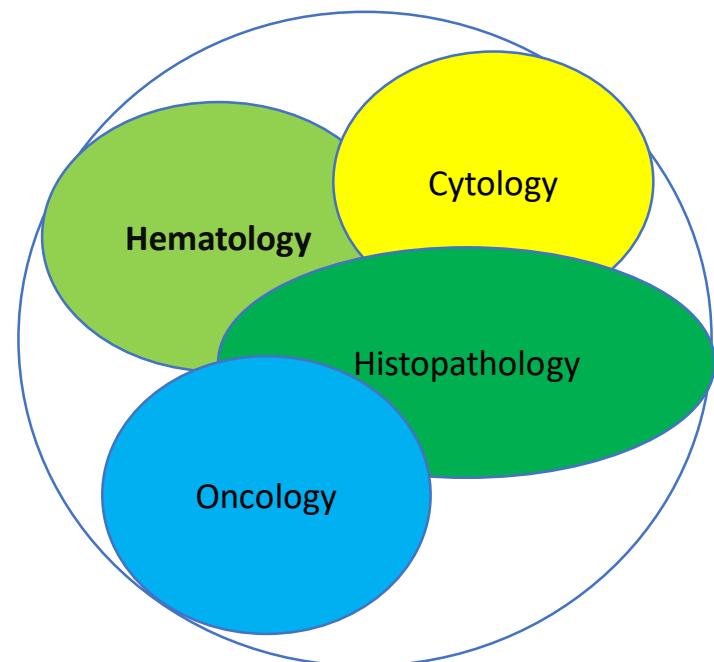


Low data
overhead

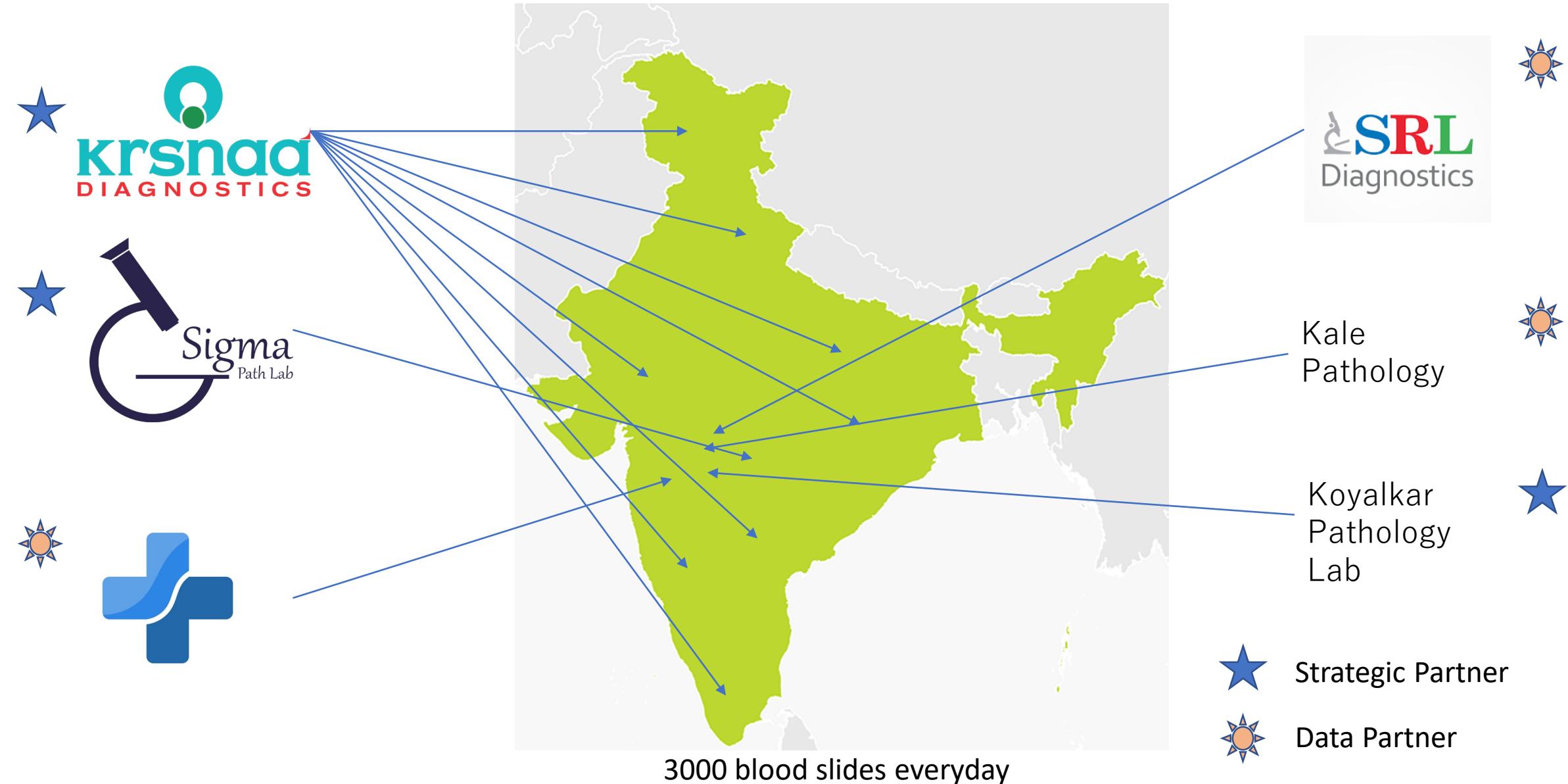


One hardware +
Different Software

Digital Pathology



Partner Labs - India



Partner Labs - US



Microsoft
for Startups

Best Digital Innovation Award
\$125,000 in compute credits



Revenue Model

Razor – razor blade



Service only



Telepathology



SafineAI microscope
(cost price)

+

Analysis per test

SafineAI microscope
(free)

+

Analysis per test at a
premium

+

SafineAI microscope
(free)

+

Analysis per test

Pathologist verification
charge

50

\$0.5

\$8250

Tests/Day

Analysis/Test

Revenue/year

100,000

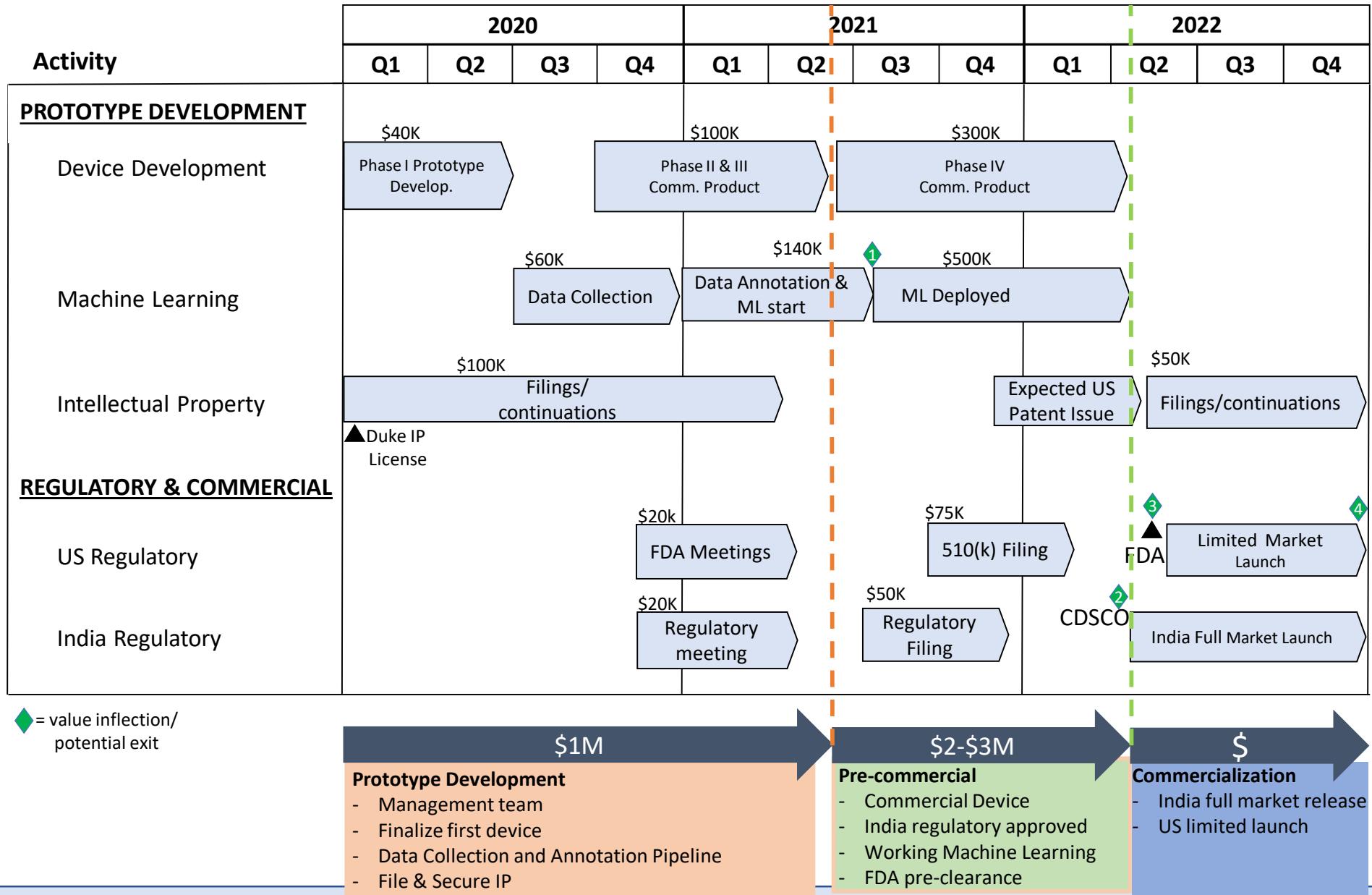
Pathology Labs (India)

\$825 Million

TAM- India

Detailed cost analysis on slide 22, 23 & 24

Roadmap



Regulatory

- US
 - Class 2 (Microscope + Software) with special controls
 - Predicate Athelas Microscope 510(k)
 - OLO (Sight Diagnostics)
 - Class 2 Microscope & Class 2 Software
- India
 - Class B device
 - Predicate Whole Slide Imager (WSI)

Competitive Analysis

	Hematoanalyzer (Current)	SigTuple	Sight Diagnostics	Athelas	Our Device
Blood abnormality analysis	X	Yes	Yes	X	✓
Images of Abnormality	X	Yes	X	X	✓
CBC analysis	Yes	Yes	Yes	Partial	✓
Custom device	Yes	X	Yes	Yes	✓
Cloud based ML platform	X	Yes	X	Yes	✓
Point of Care (POC)	X	X	Yes	Yes	No
Workflow streamlining (Digital Archiving?)	X	Yes	Yes	Yes	✓
Time	<1 minute	Unknown	<10 minutes	10 minutes	10 – 15 minutes
Maintenance	Everyday	Minimal	Minimal	Minimal	Minimal

Summary



Our team is at the frontier of optics and machine learning with previous entrepreneurial experience



We have validated our technology and are patent pending



Existing partnerships with labs in India and US



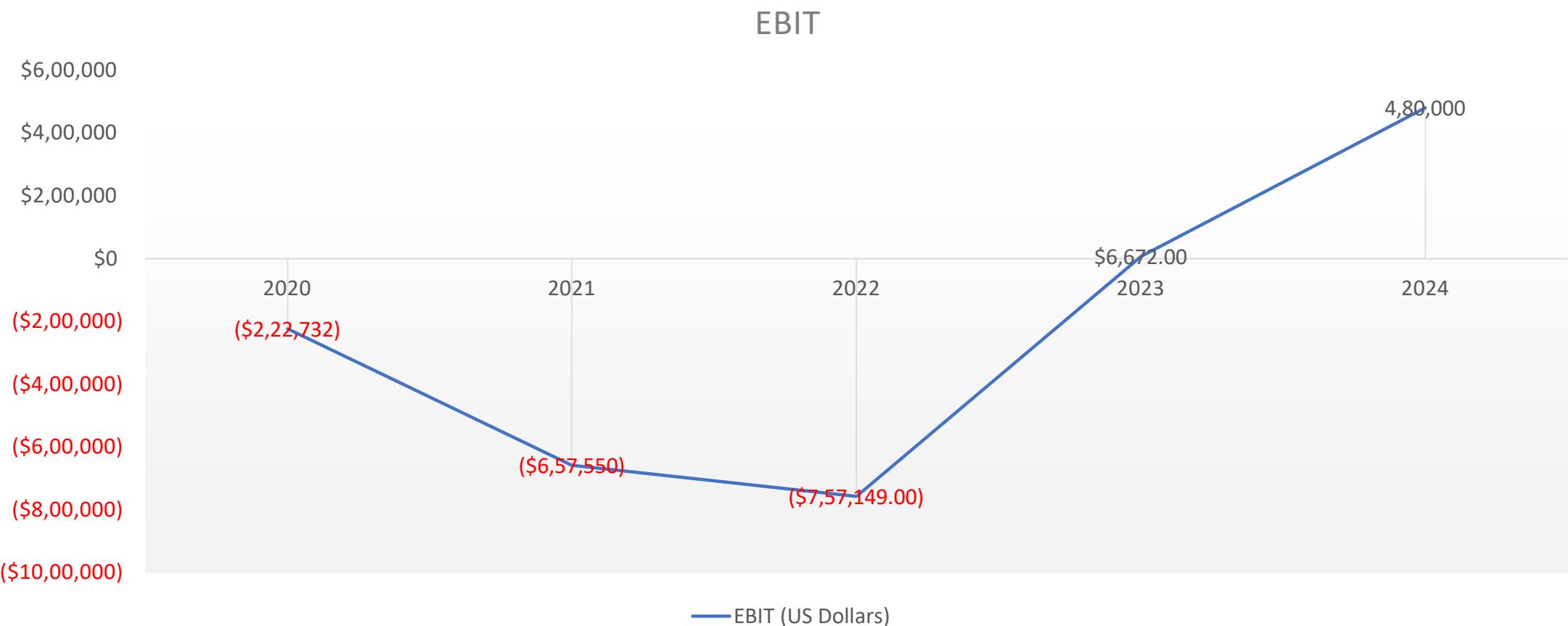
Our device improves the standard of care while saving cost and time



Total addressable market in India is \$1 billion while global addressable market is \$5-10 billion

Appendix

EBIT



High Level Costs to the Lab/ Clinic

<u>Current</u>	Complete Blood Cell Count	Complete Blood Cell Count + Morphology
Cost / test	\$2 - \$3	\$3 - \$5
Time / test	2 – 5 minutes	15 – 20 minutes

<u>SafineAI</u>	Complete Blood Cell Count	Complete Blood Cell Count + Morphology
Cost / test	\$1.5 - \$2	\$1.5 - \$2
Time / test	5 – 10 minutes	10 – 15 minutes

Detailed Cost Analysis

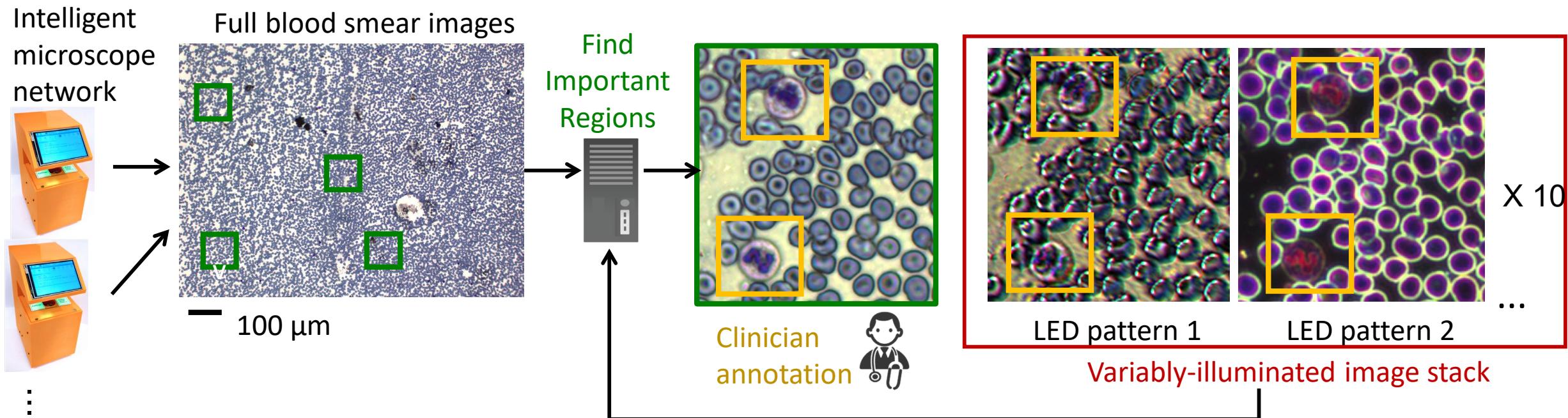
	CBC	CBC + Morphology	SafineAI smart microscope
Blood Collection	\$0.84	\$0.84	\$0.84
Staining and slide preparation	\$0.49	\$0.49	\$0.49
Certified Technician	\$0.35	\$1.25	\$0.1 (Uncertified Technician)
Hematoanalyzer maintenance and chemicals	\$0.42	\$0.42	No chemicals or everyday maintenance
Time (minutes)	~1	20 - 30	~15 (CBC + Morphology)
Total cost to lab (per test)	\$2.10	\$3.00	\$1.43 + \$0.5 (our charge per test) = \$1.93
Cost to patients	\$3.10	\$5.71	Decided by the lab

Value for Labs

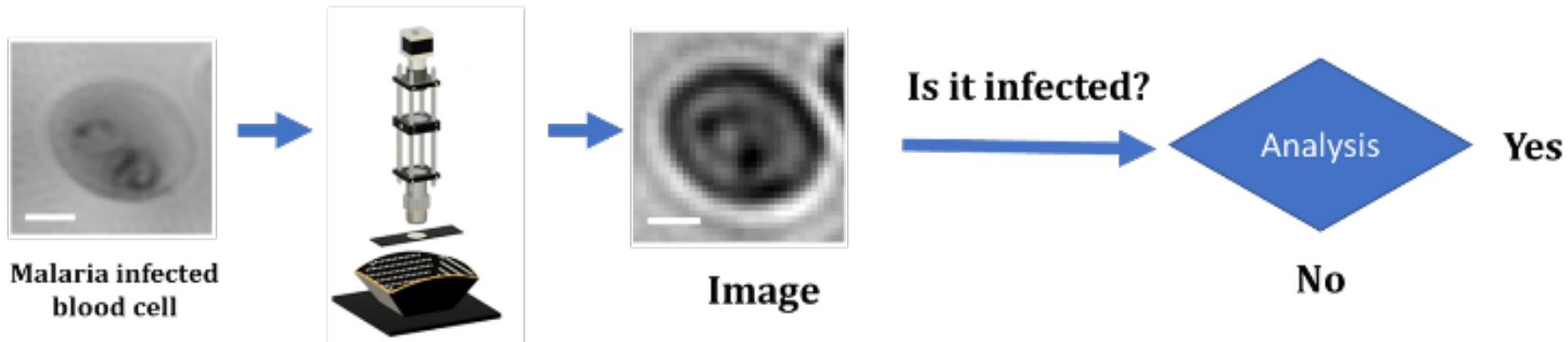
Statistics per Pathology Lab

Avg. Number of Tests	50 / day
SafineAI Charge per Test	\$ 0.5 / test
Operational Days	330
SafineAI Revenue	\$ 8250/ year
Money Saved by Lab after paying SafineAI	~\$ 10,000/ year
Time Saved by Lab through SafineAI	50 days/ year

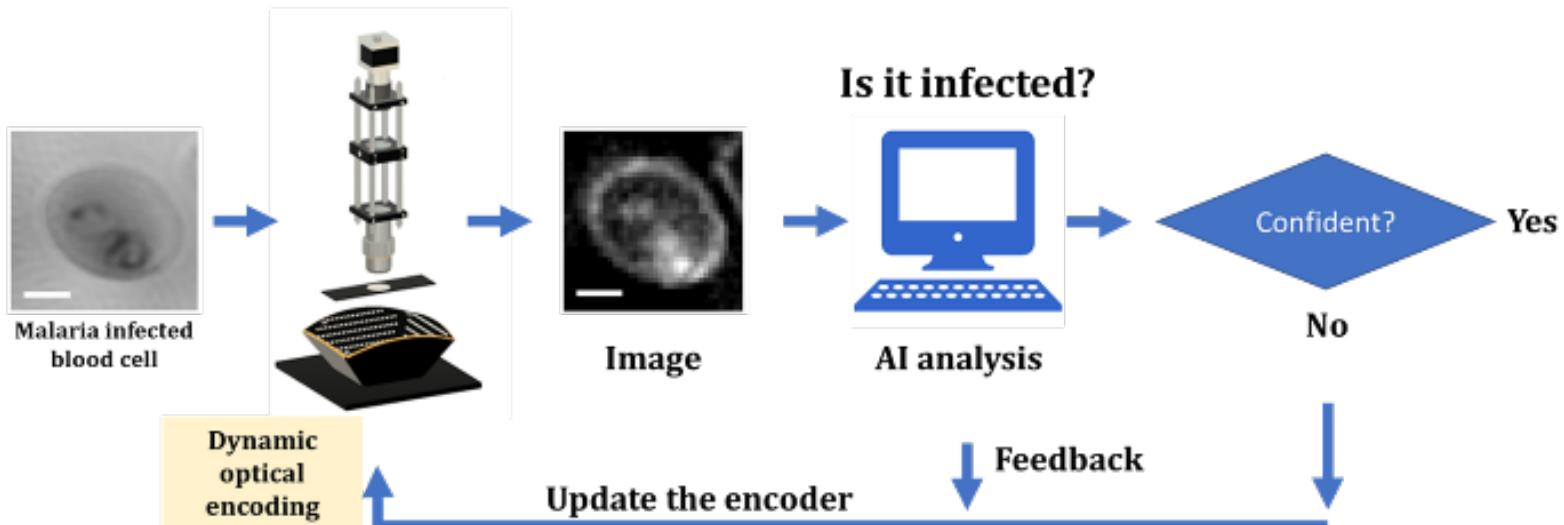
Image cropping figure: show large FOV, and then cropped region, and show the ability to narrow in



Conventional task automation – 89% accuracy

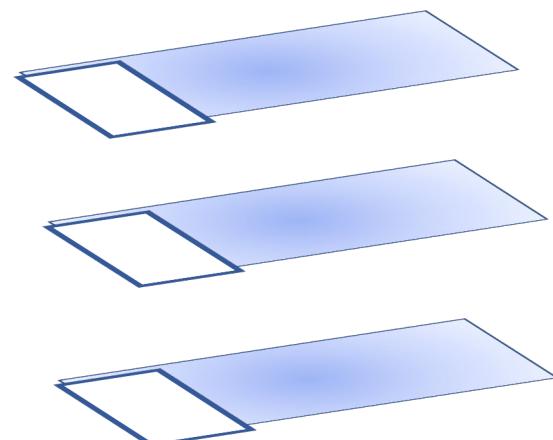


Proposed smart microscopy for task automation – 93.9% accuracy



Pathology and cytology
slides

- Blood
- Sputum
- Tissue



Intelligent microscope scan

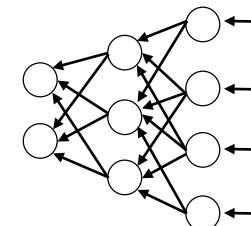


10 x 20 x 30cm

Upload +
Pre-processing

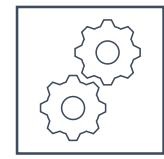


Machine Learning Analysis



Expert annotation,
diagnosis

Value Proposition



Automation



Short and long-term Cost Saving



Images with blood report



Standard
Digitized reports



Remote pathology



Add more diseases on the same device when they are discovered

Partner Labs - India

**MOU includes acquisition of blood slides, annotation of blood slides, bench testing device, clinical inputs*



Krsnaa Diagnostics – India's largest integrated diagnostic chain

**35 Pathology Labs with a team of Pathologists
800 Blood Collection centers
3000 Blood Tests Everyday**



SRL Diagnostics

Dr. Sheikh, MD Path

7+ Years Experience

50 Blood Tests Everyday



Sigma Path Lab

Dr. Khusboo Bardia, MD Path

5+ Years Experience

30 Blood Tests Everyday



Anjali Path Lab

Dr. Chandrashekhar Bhale, MD Path

15+ Years Experience

100 Blood Tests Everyday

Kale
Pathology
Lab



Kale Pathology Lab

Dr. Yogesh Gandhi, MD Path

15+ Years Experience

70 Blood Tests Everyday

Koyalkar
Pathology
Lab



Koyalkar Pathology Lab

Dr. Surendra Koyalkar, MD Path

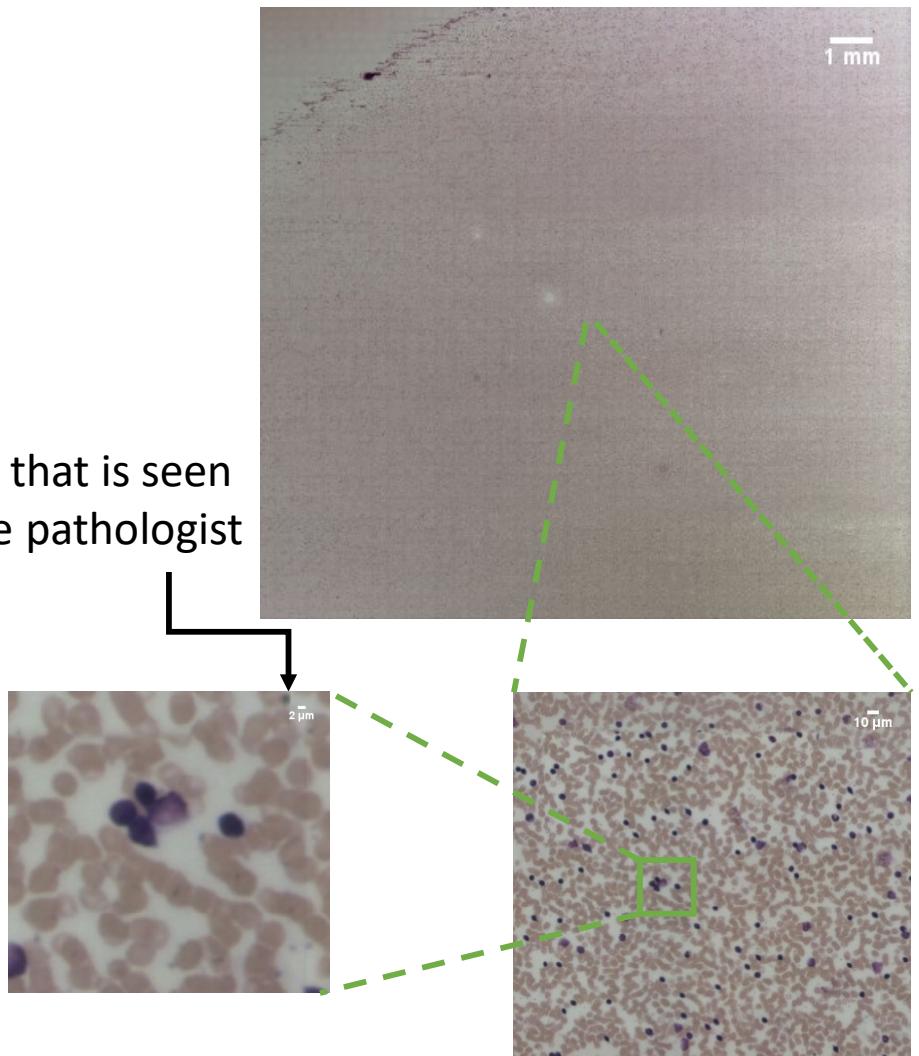
15+ Years Experience

70 Blood Tests Everyday

A pathologist's job is hard, and time-consuming

- Complete Blood Cell Count & Morphology are the **baseline** blood tests
- 15- 20 minutes to analyze every blood slide
- 50 - 100 slides per day per lab
- 1 pathologist per 18,300 people in USA
- 1 pathologist per 236,000 people in India

2 Gigapixel image of blood smear



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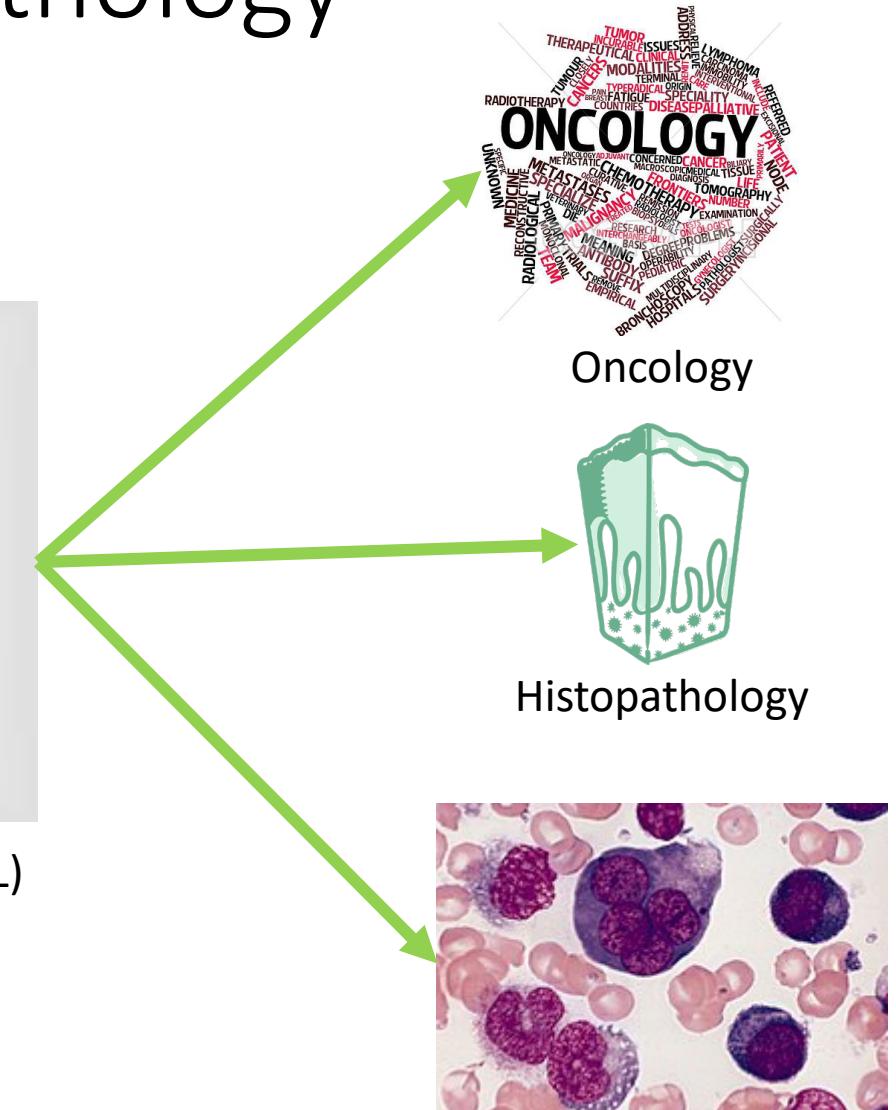
SafineAI will transform Digital Pathology



SafineAI Microscope
(Patent Pending)



Cloud Based Machine Learning (ML)



CBC and Morphology