

BII CONFERENCE COMPUTATIONAL DIGITAL PATHOLOGY LAB

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Principle Investigator

Group leader of Computational Digital Pathology Lab

Bioinformatics Institute

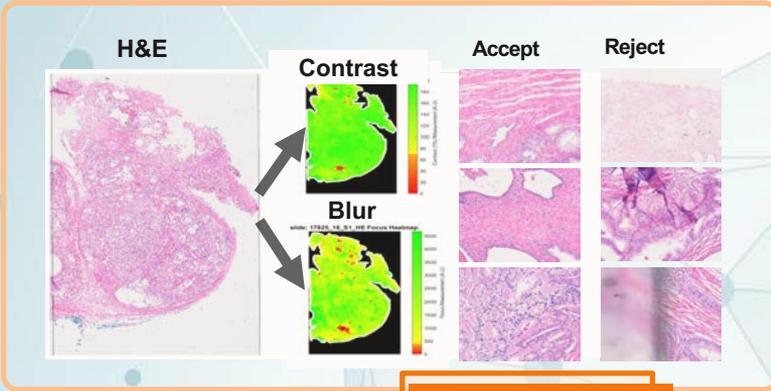
A*STAR

29. March, 2022



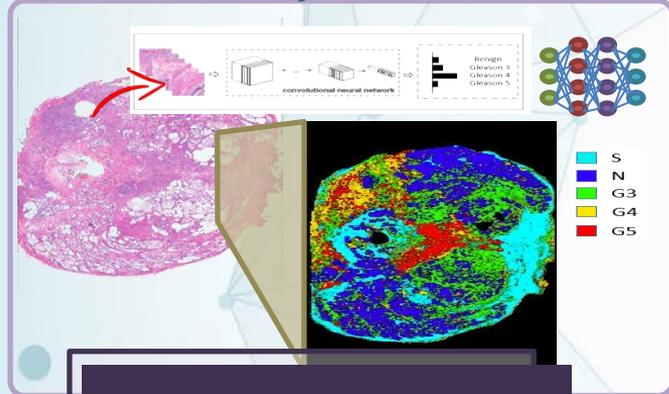
AI-based Digital Pathology (AIDP)

Unique AI solution for DP image quality control



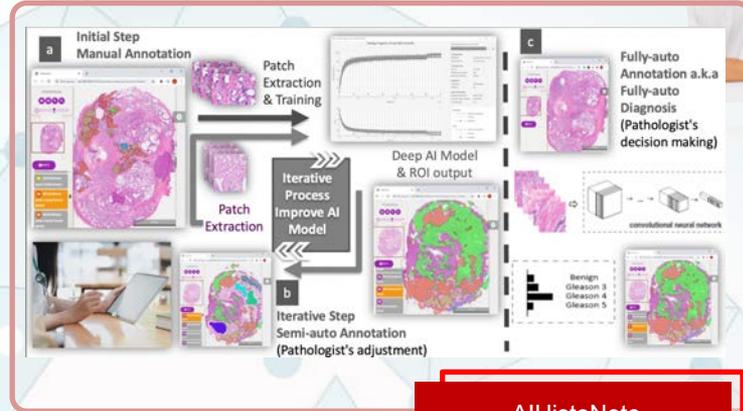
AIMagQC

AI Powered H&E Analysis for Prostate Cancer



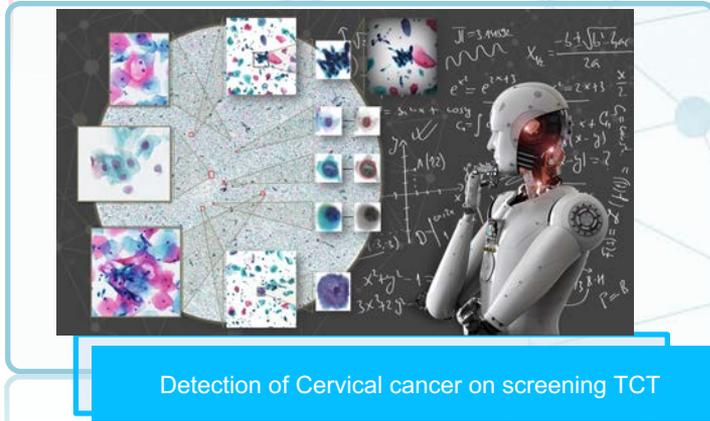
Prostate Cancer Staging

Cloud Based Structural DP image annotation



AIHistoNote

Clinical class TCT diagnostic solution based on TBS standard



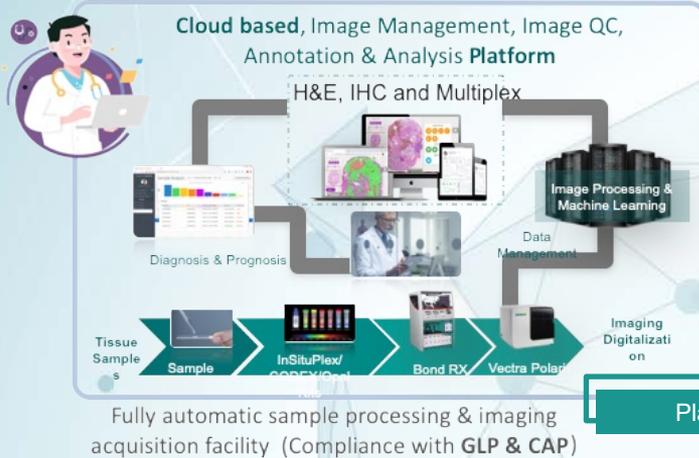
Published in Nature Communication



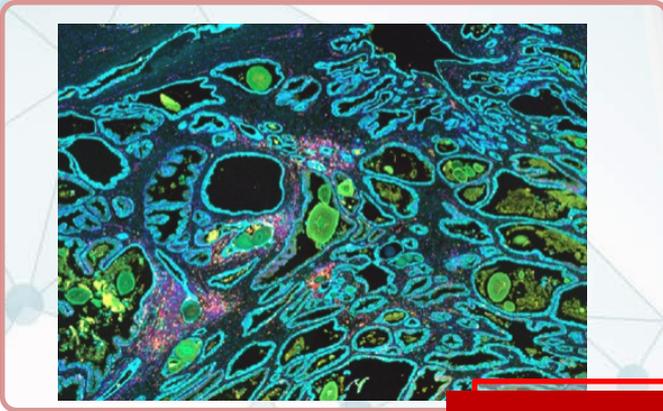


Multiplex ImmunoFluorescence (MIF) Image analysis

Comprehensive platform for H&E, IHC and MIF imaging The challenges in MIF image analysis



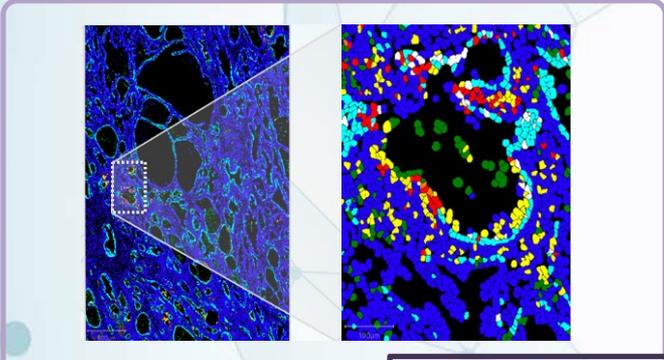
Platform



MIF image

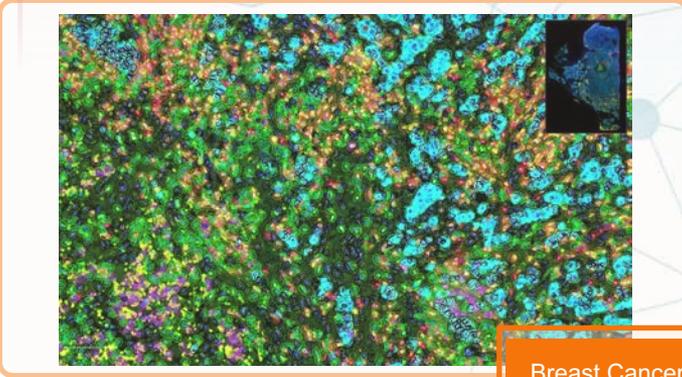


Cell-by-cell information in prostate tissue



Prostate Cancer Staging

Prediction of HER+ breast cancer patient response



Breast Cancer Prediction



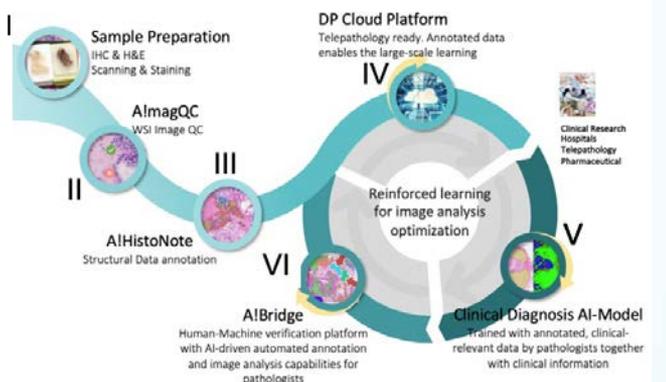
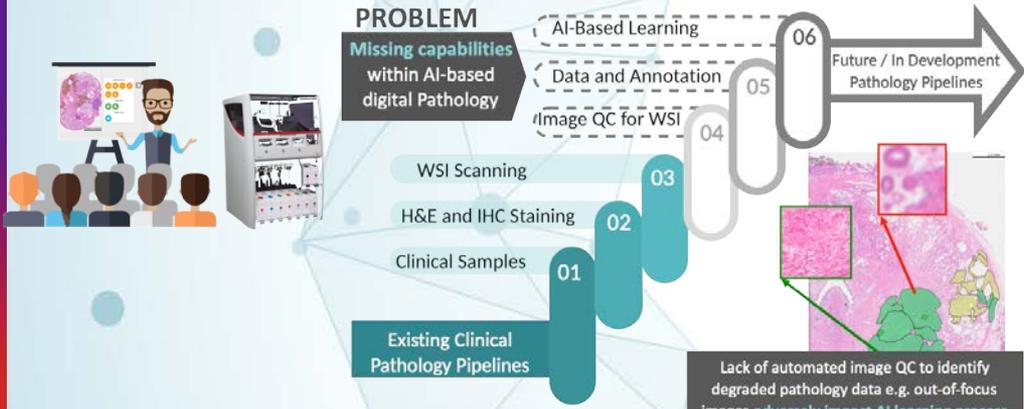
Developed technical tools and closed loop



Developed Tools Library	
Image Management <ul style="list-style-type: none"> Archiving Compression Image Stitching Image Overlap 	Image Analysis <ul style="list-style-type: none"> Annotation Segmentation Feature extraction Profiling
Apps Library – Disease Oriented Solutions	
H&E Mitosis detection Cancer Gleason Grade Prostate cancer TMN Stage Breast cancer	IHC PD-1 & PDL-1 analysis Prostate cancer Prognosis Subtype

Partnership	
	Equipment Suppliers <ul style="list-style-type: none"> Perkin Elmer Leica Phillips
	Reagent Suppliers <ul style="list-style-type: none"> Ultivue Akoya Leica Perkin Elmer
	Pathology Labs <ul style="list-style-type: none"> NUH & SGH Parkway Fosun

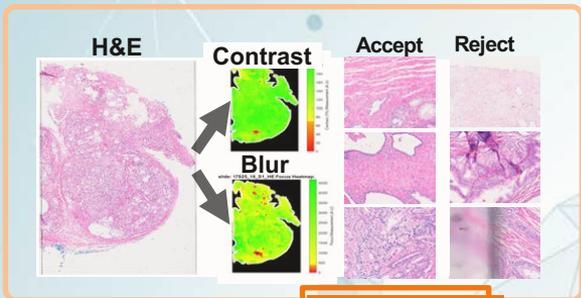
Target Market
Research Academic & Pharma
Clinical Confirmation Diagnostics Prognosis Treatment Selection Prediction of Response
Commercial Instrument Companies AI Biotech Companies Cloud Providers



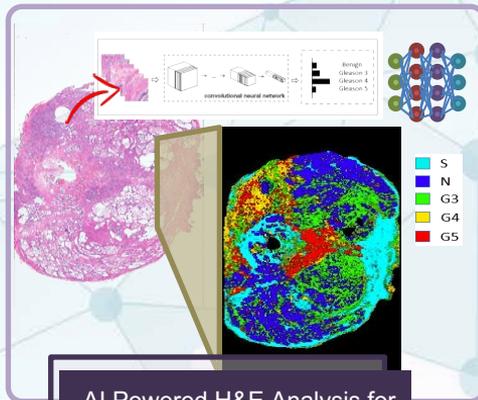
Overview of AIDP development technical pipeline



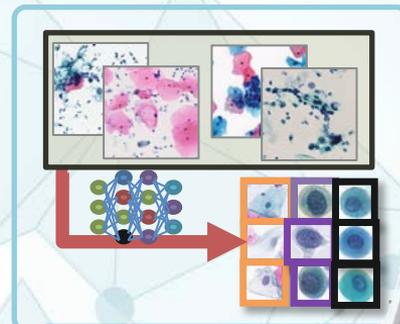
CREATING GROWTH, ENHANCING LIVES



AIMagQC



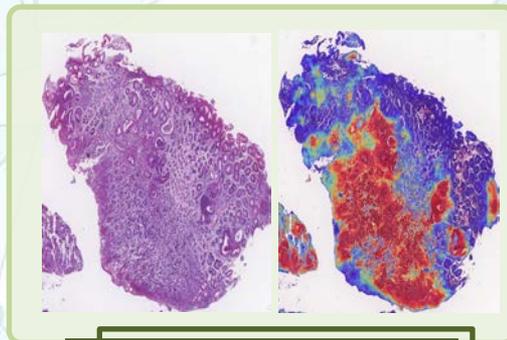
AI Powered H&E Analysis for Prostate Cancer Staging



Detection of Cervical cancer on screening TCT



AIHistoNote



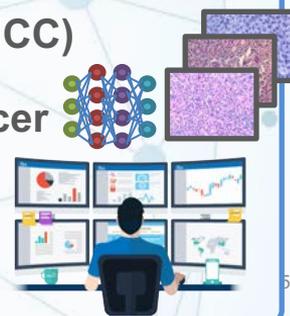
Gastric cancer diagnosis

Liver cancer (HCC)

Colorectal cancer

Lymphoma

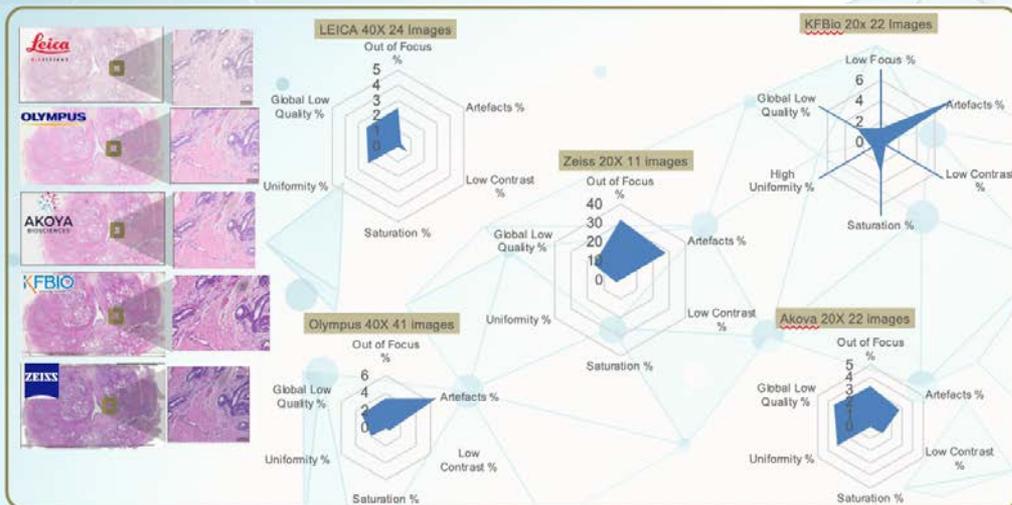
and many more!



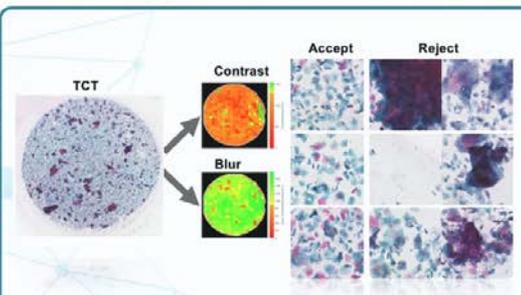
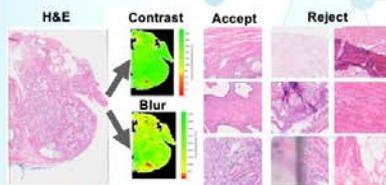
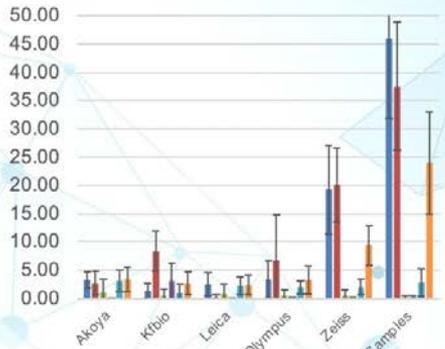
DP image quality control - A!magQC



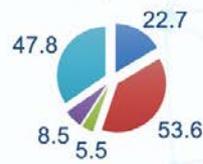
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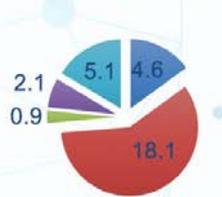
- Out of Focus %
- Artefacts %
- Low Contrast %
- Saturation %
- Uniformity %
- Global Low Quality %



TCT 20x Rejected & expected Bad (85/130) Average Value



TCT 20x All Valid & expected good (107/130)



- Out of Focus %
- Artefacts %
- Low Contrast %
- Saturation %
- Uniformity %

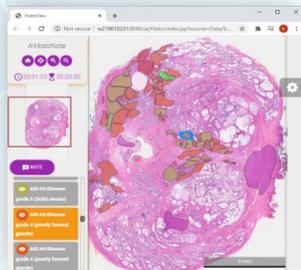
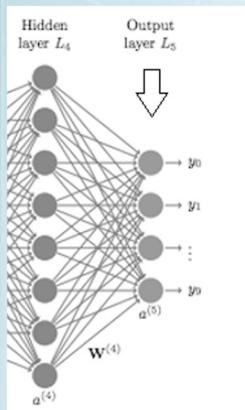


Structural DP image annotation platform - A!HistoNotes

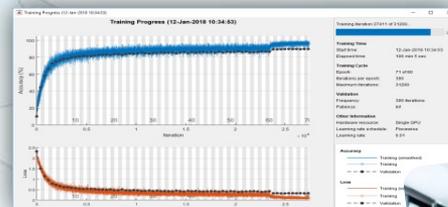


CREATING GROWTH, ENHANCING LIVES

1 Initial Step Manual Annotation



Patch Extraction & Training



Patch Extraction



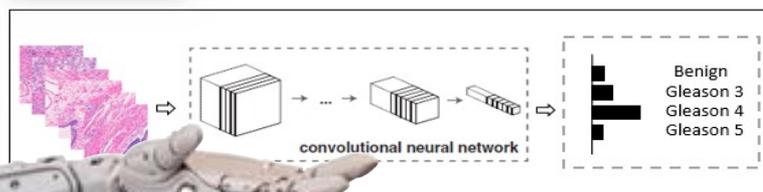
Iterative Process Improve AI Model

2 Iterative Step Semi-auto Annotation (Pathologist's adjustment)

Deep AI Model & ROI output



3 Fully-auto Annotation a.k.a Fully-auto Diagnosis (Pathologist's decision making)



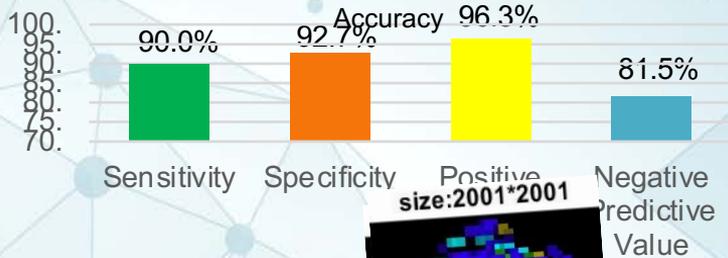
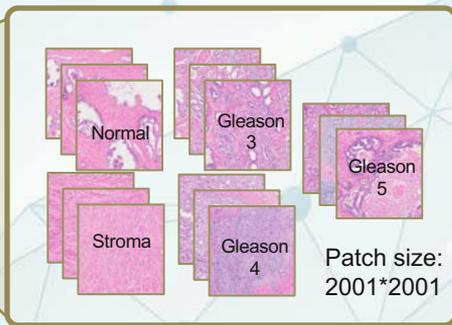
AI-based prostate diagnosis



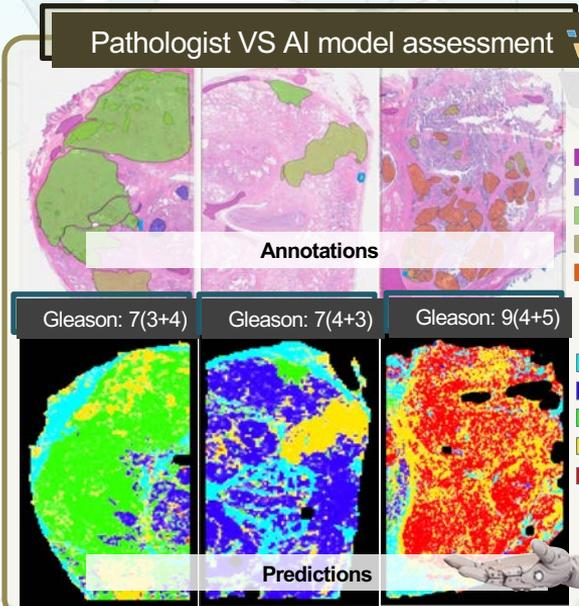
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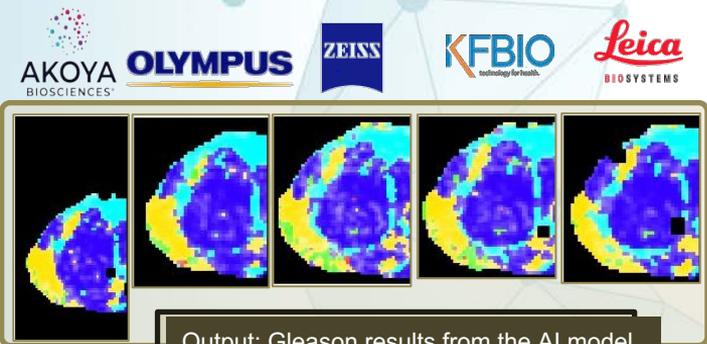
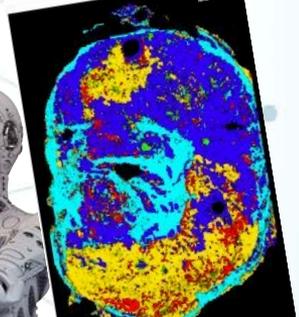
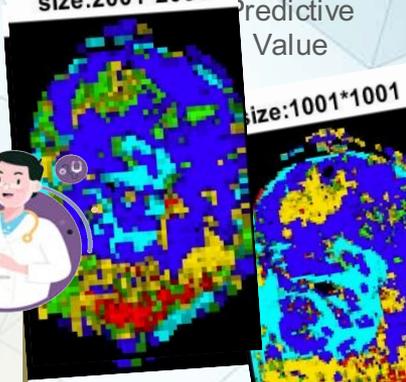
Pathologist training AI model



Input: original image from various acquisition system



Pathologist VS AI model assessment



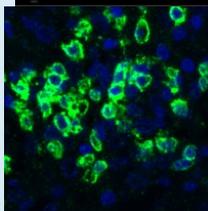
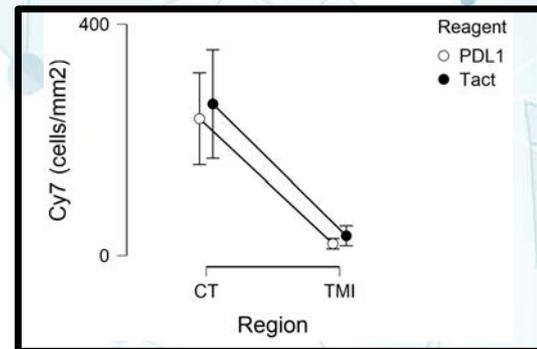
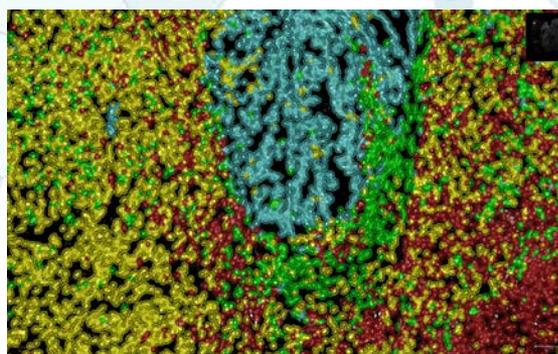
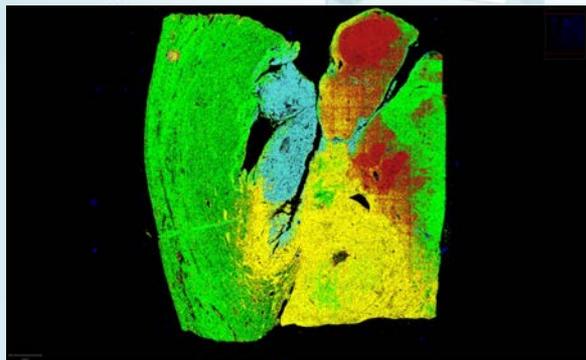
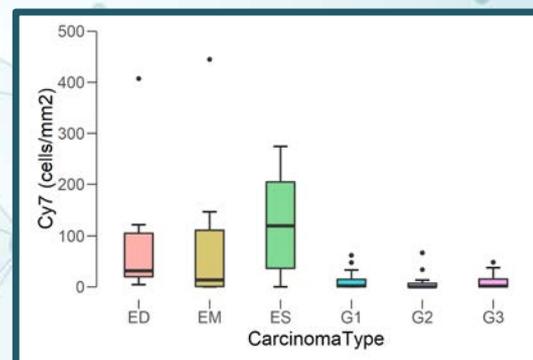
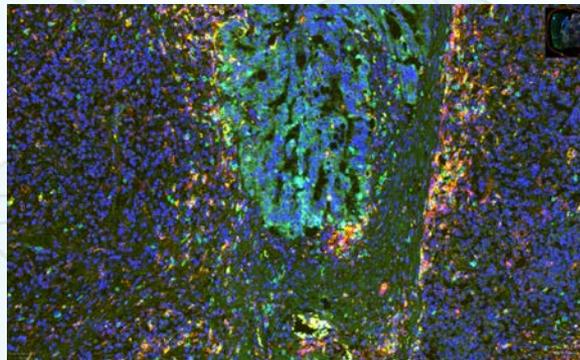
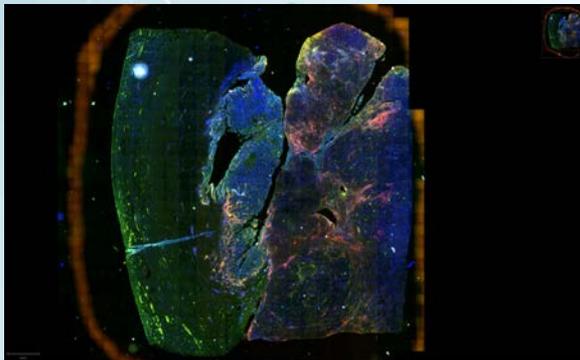
Output: Gleason results from the AI model

Gleason: 7(3+4) Gleason: 7(4+3) Gleason: 9(4+5)

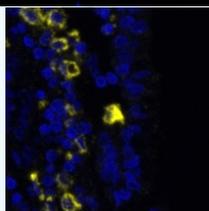
Analysis of Endometrial MIF images



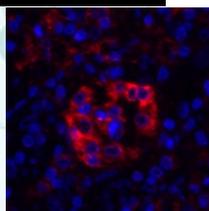
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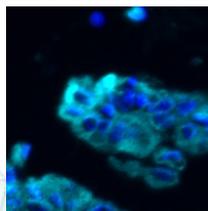
CD8+



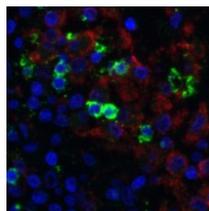
CD68+



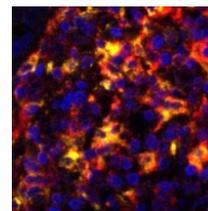
PDL1+



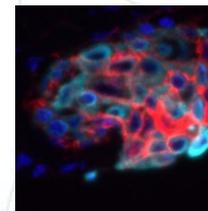
CK+



CD8+PDL1+



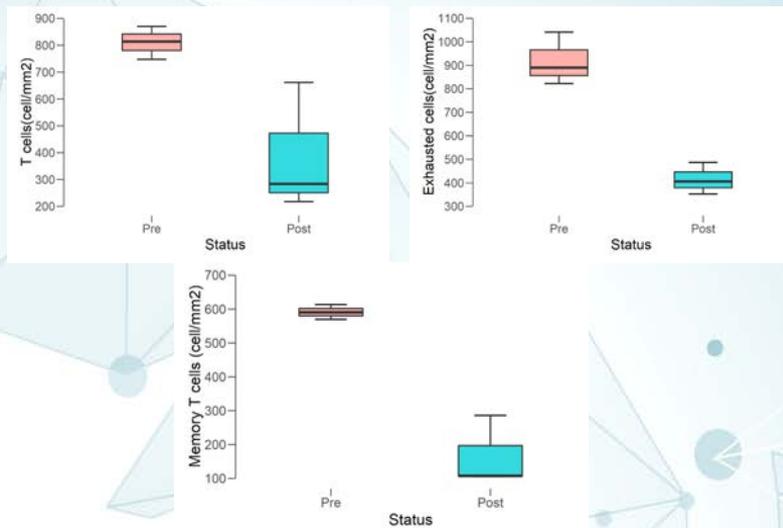
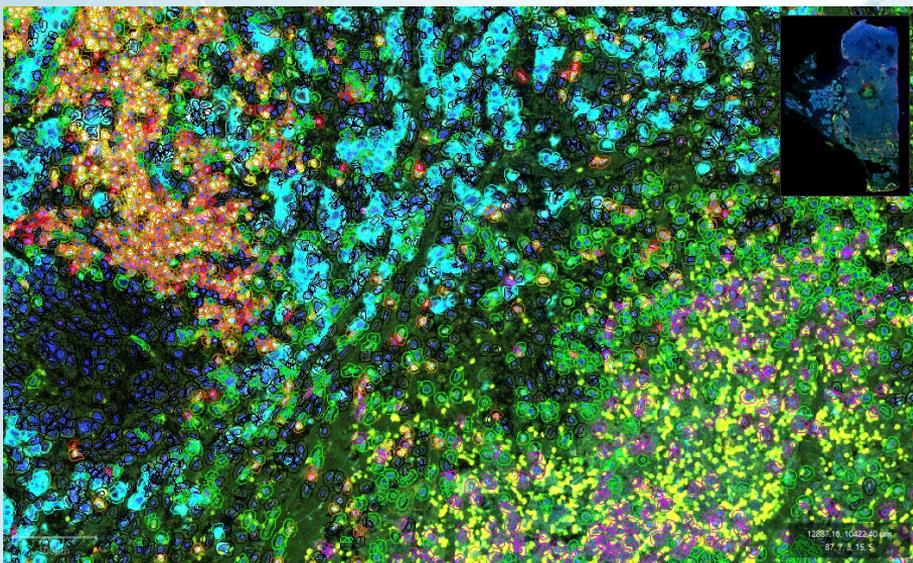
CD68+PDL1+



CK+PDL1+



Prediction of HER+ breast cancer patient response



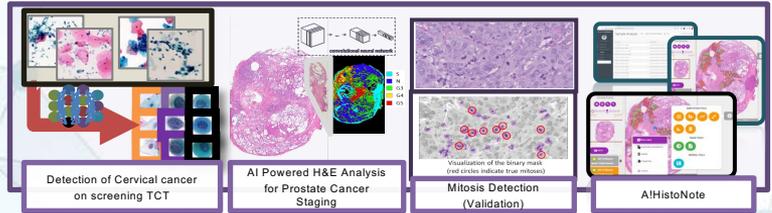
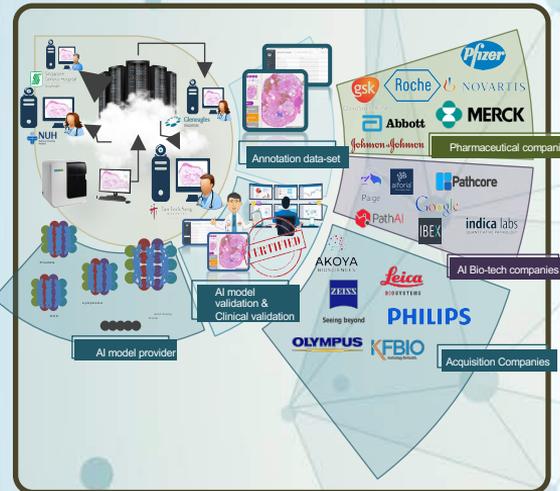
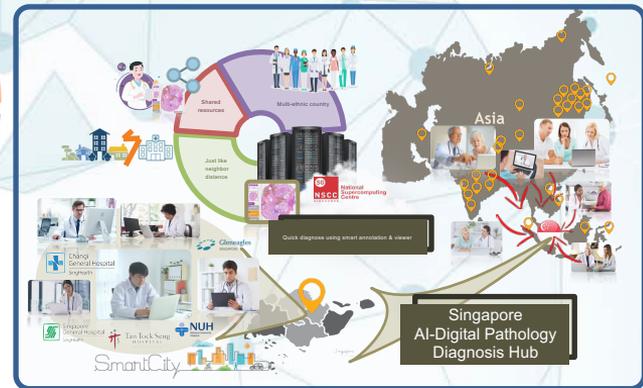
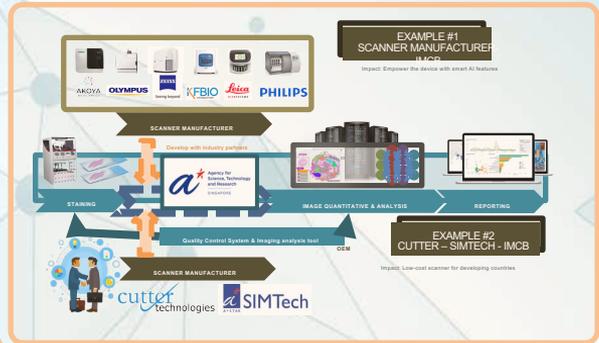
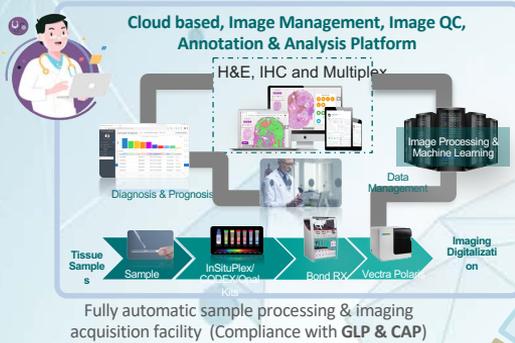
Descriptive Statistics

■ FITC	Memory cells
■ CY3	Exhausted cells
■ CY5	T cells
■ Cy7	Carcinoma (panCK) or Melanoma (SOX10)
■ FITCCY5	Memory T cells
■ FITCCY3	Exhausted memory cells
■ CY3CY5	Exhausted T cells
■ FITCCY3CY5	Exhausted memory T cells

	T cells(cell/mm2)		Exhausted cells(cell/mm2)		Memory T cells (cell/mm2)	
	Pre	Post	Pre	Post	Pre	Post
Valid	3	3	3	3	3	3
Missing	0	0	0	0	0	0
Mean	810.6	387.6	917.923	415.0	591.1	166.4
Std. Deviation	23	35	87	67.74	50	62
Minimum	61.50	239.5	111.974	3	21.92	103.6
Maximum	0	41	3	67.74	2	26
	747.5	217.6	822.456	352.4	569.6	105.5
	55	57	34	12	62	62
	870.4	661.5	1041.17	486.9	613.4	286.1
	25	96	3	73	37	13

Collaborations: Industrial development

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Collaborations: Academic Research



Singapore General Hospital
SingHealth



Tan Tock Seng HOSPITAL
National Healthcare Group



National Cancer Centre Singapore
SingHealth

We are working on different disease



- Prostate cancer
- Endometrial cancer
- Sarcoma
- Breast cancer
- Liver cancer
- Colon Cancer
- Thyroid cancer
- Melanoma
- Sarcoma
- Lymphoma



A*STAR RIs



Existing Collaborators



Potential Collaborators



- Established close collaboration with locale and oversea hospital and medical centers to ensure the smooth data flow and clinically relevant questions.
- Closely work with different institutes in A*STAR for multidisciplinary studies.
- Co-development with the MNC and locale SMEs to achieve the economic impacts and realize the social values of different projects.



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THANK YOU

www.a-star.edu.sg

Acknowledgement

