

Artificial Intelligence Resource

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Artificial Intelligence Resource (AIR)

- Mission: To develop translational AI tools that enhance advanced image analysis and computer vision, empowering researchers both within and outside NIH to effectively integrate AI into their research.

Projects/data:

- Clinical and preclinical
- **Radiology** (CT, MRI, ultrasonography, PET/CT, x-ray), **digital pathology** (H&E, IHC), **endoscopy** (GI, GU, robotic surgery), **EHR**

AI for Prostate Cancer Diagnosis

Problem: Inconsistent diagnostic performance of prostate MRI for localized prostate cancer diagnosis

Can a fully automated AI model solve this problem?

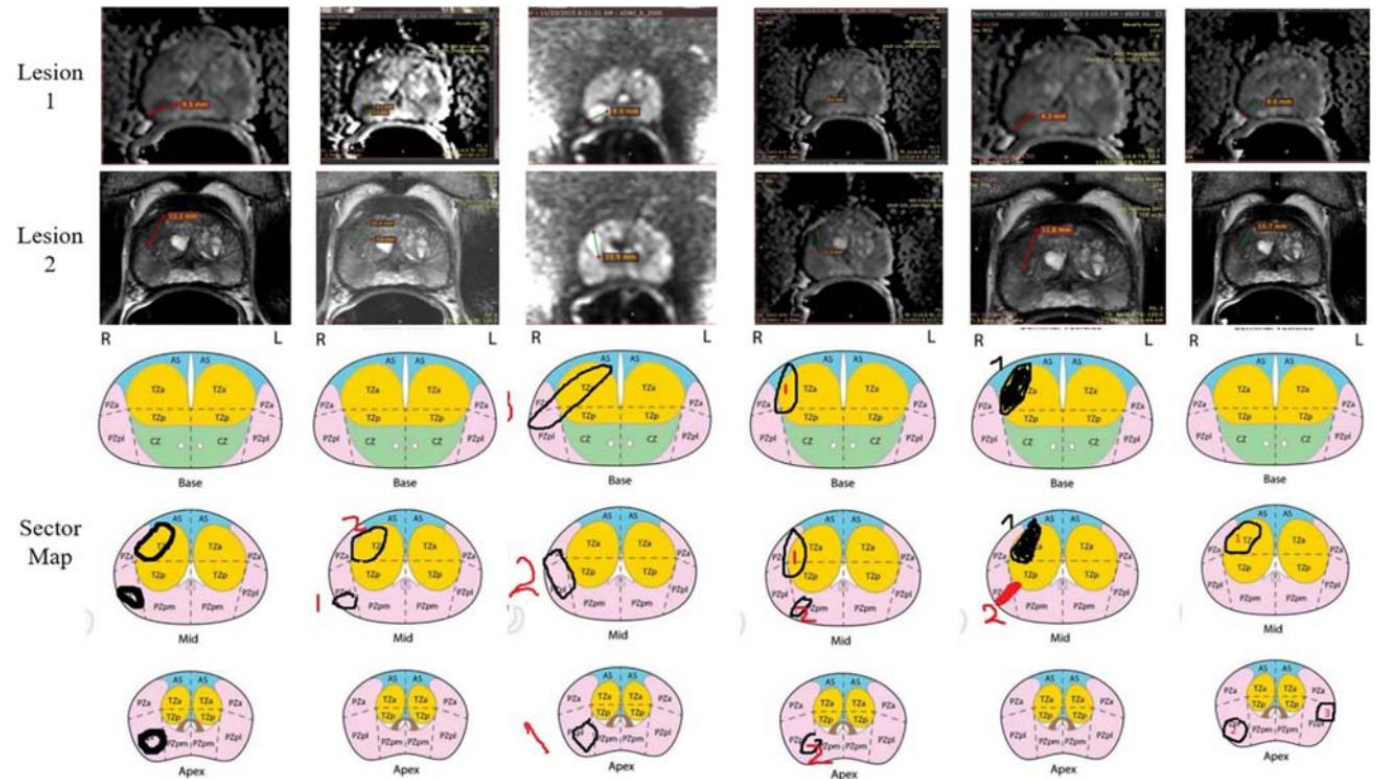


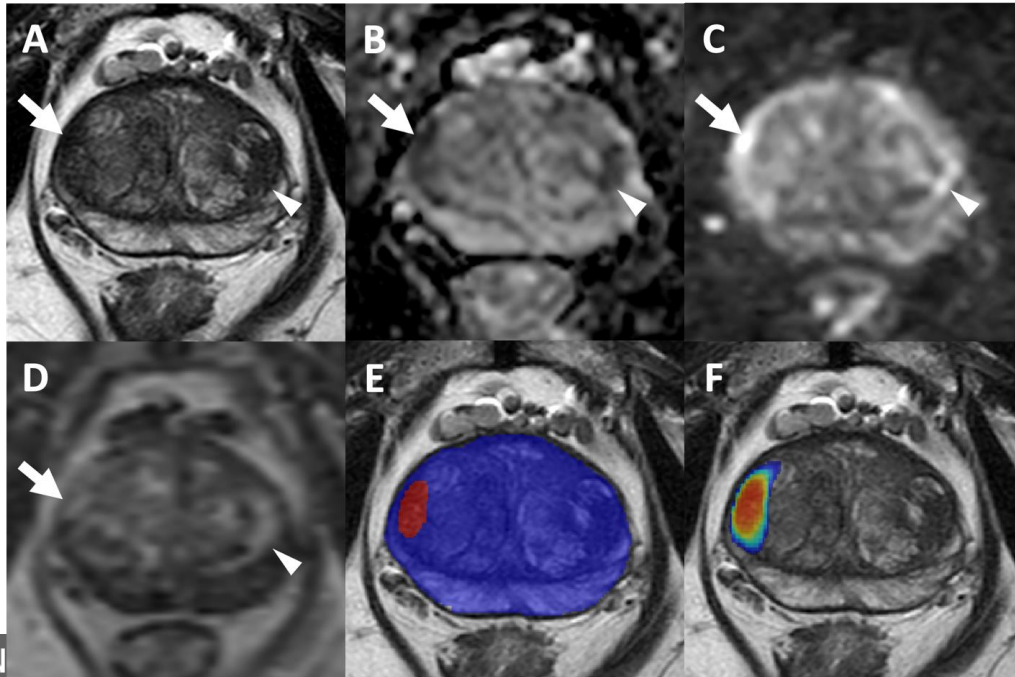
FIGURE 4: Example of interreader variability on sector map. On the top row are the screen shots of DWI images for six readers detecting the same lesion in the right mid-peripheral zone; this was the index lesion. On the second row are screen shots for all six readers detecting a lesion in the right mid-transition zone. The sector maps demonstrate the variability in how these two lesions were mapped. Both lesions were Gleason = 3+4 at prostatectomy.

Greer, Turkbey JMRI, 2018

A Cascaded Deep Learning–Based Artificial Intelligence Algorithm for Automated Lesion Detection and Classification on Biparametric Prostate Magnetic Resonance Imaging

Sherif Mehralivand, MD, Dong Yang, PhD, Stephanie A. Hamon, PhD, Daguang Xu, PD, Ziyue Xu, PhD, Holger Roth, PhD, Samira Masoudi, PhD, Thomas H. Sanford, MD, Deepak Kesani, DO, Nathan S. Lay, PhD, Maria J. Merino, MD, Bradford J. Wood, MD, Peter A. Pinto, MD, Peter L. Choyke, MD, Baris Turkbey, MD

- 1390 patients (n=350 outside NIH)
 - train/test (89%/11%)
- Lesions were contoured + assigned PI-RADS category
- 3D U-Net: lesion detection and segmentation
- Two 3D residual neural network: PI-RADS categorization

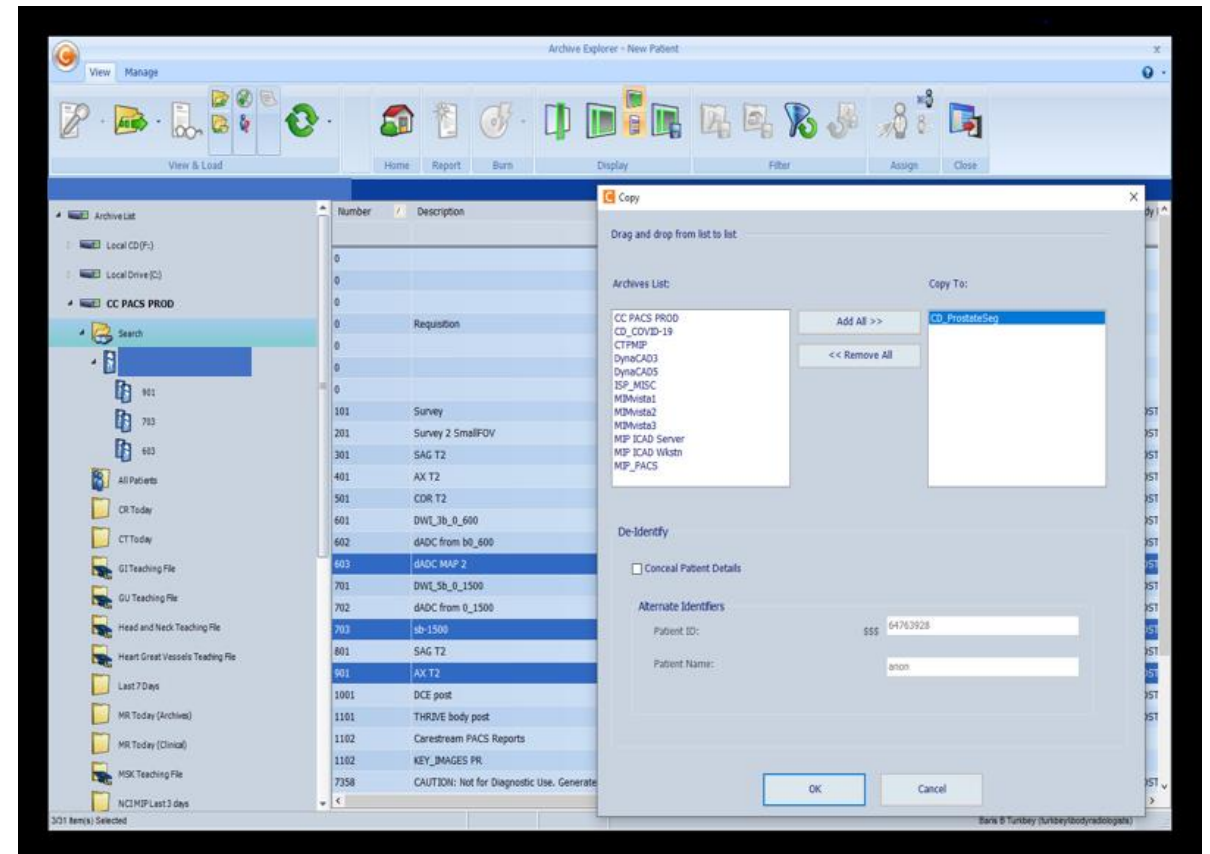
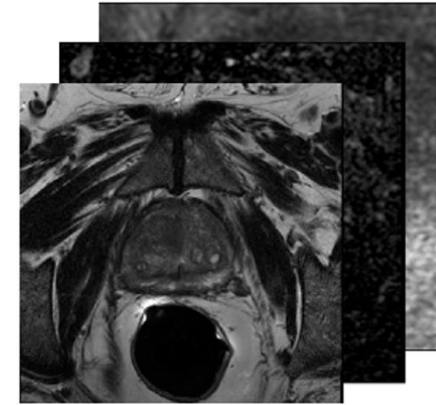


- PPV (CDR) = 63%
- False positives/patient = 0.44 lesion/patient
 - TP= 82% were cancer
 - FP=51% were benign
- Lesion segmentation (DSC) = 0.36
- PI-RADS classification accuracy=58%

Workflow

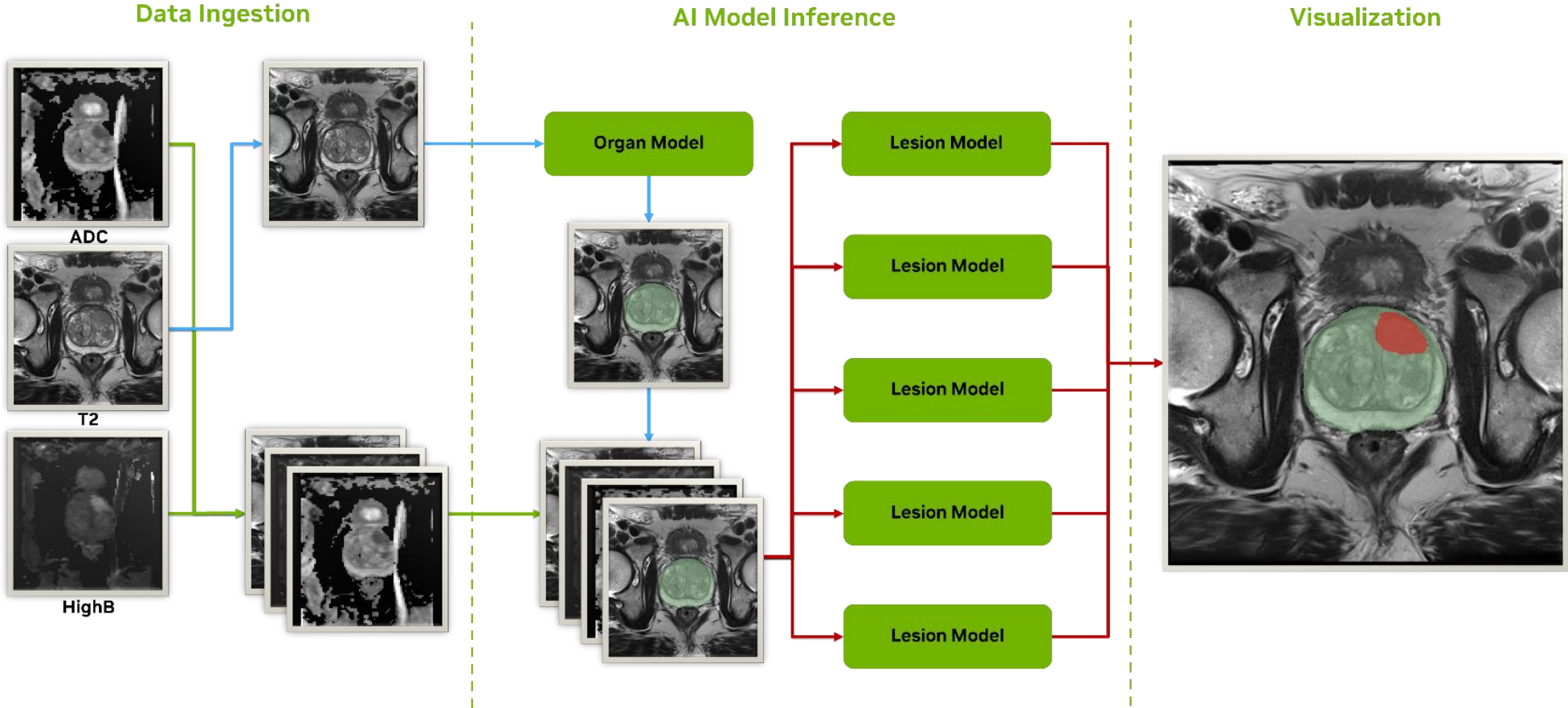
- DICOM images pushed from PACS under Application Entity Titles specifically associated to each inference pipeline
- Patient selection and pipeline execution are controlled by the PACS user (radiologist)

user-controlled
series selection

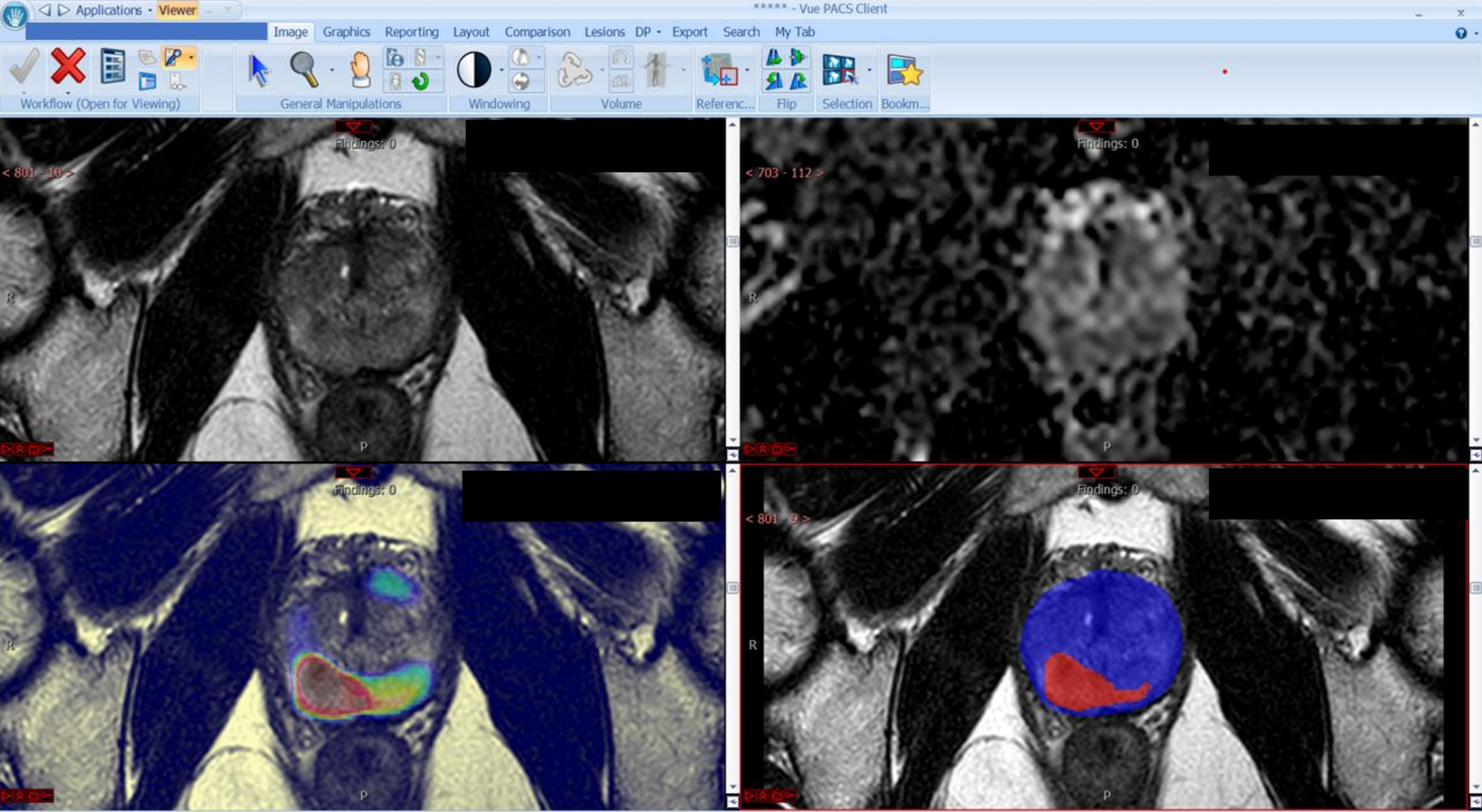


AI Pipeline

MONAI Deploy Express



PACS Display

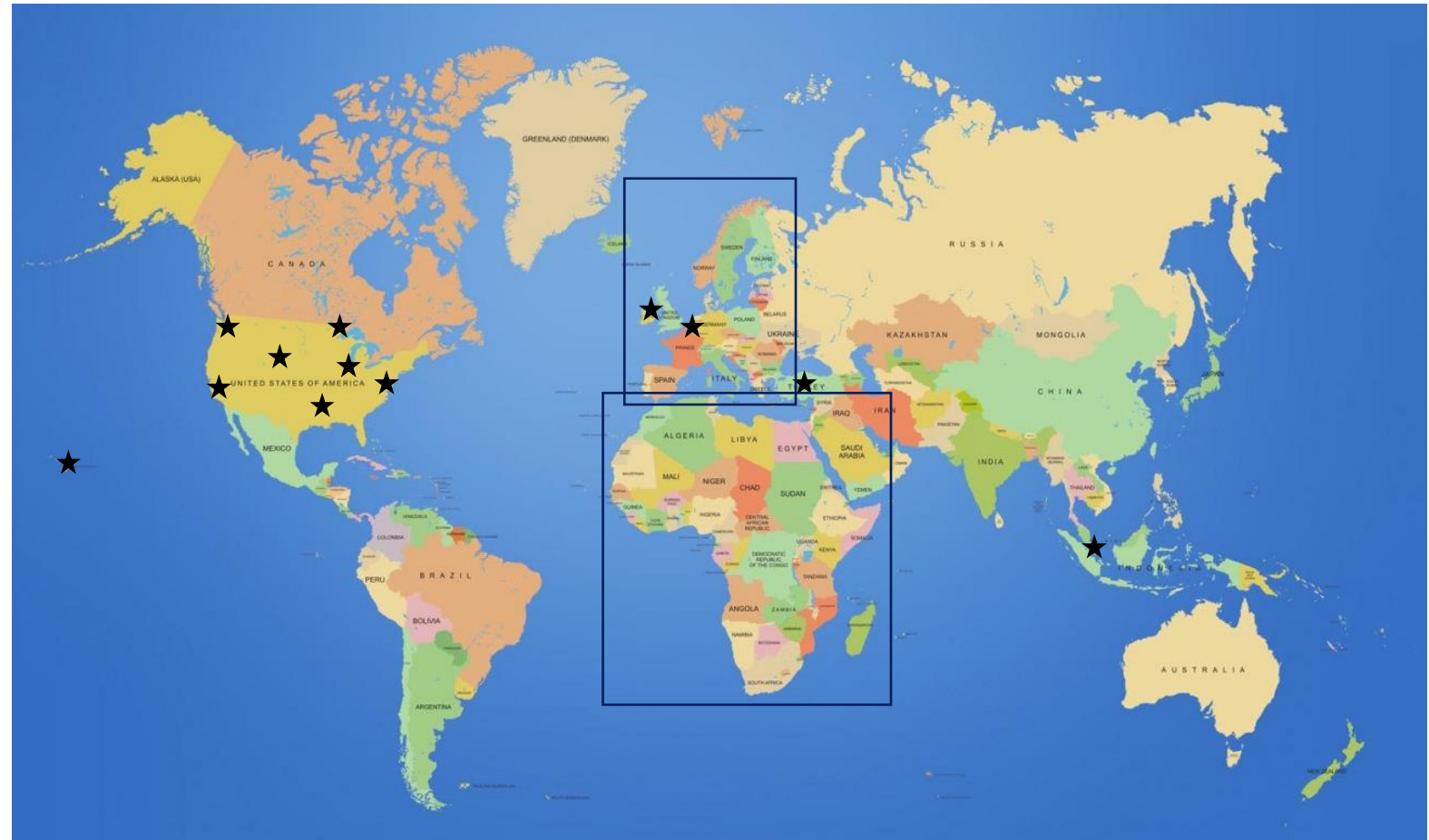




NCI Prostate MRI AI model

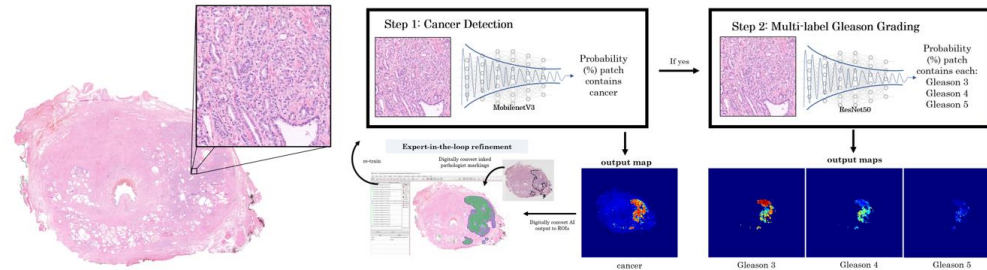
NCI CCR:

- Guiding prostate biopsies (UOB)
- Radiotherapy planning (ROB)
- Focal therapy planning (UOB)
- Prostatectomy specimen processing (UOB, LP)

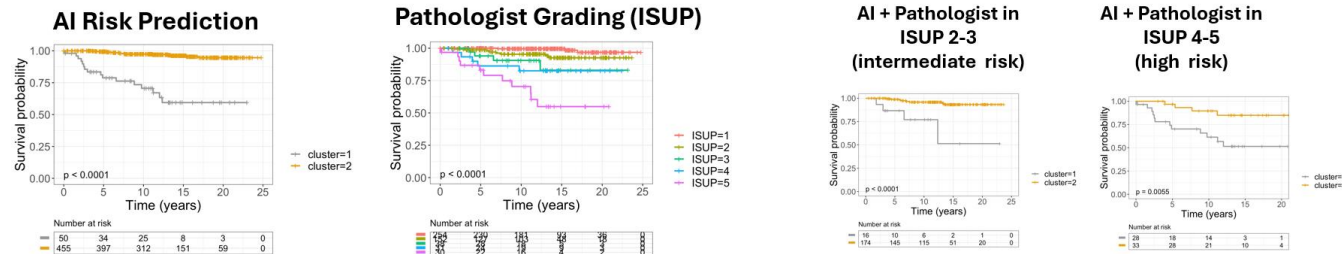


Artificial Intelligence Resource (AIR)

AI-derived quantitative scoring improves prognostication of Metastasis-Free Survival within Gleason Grade groups

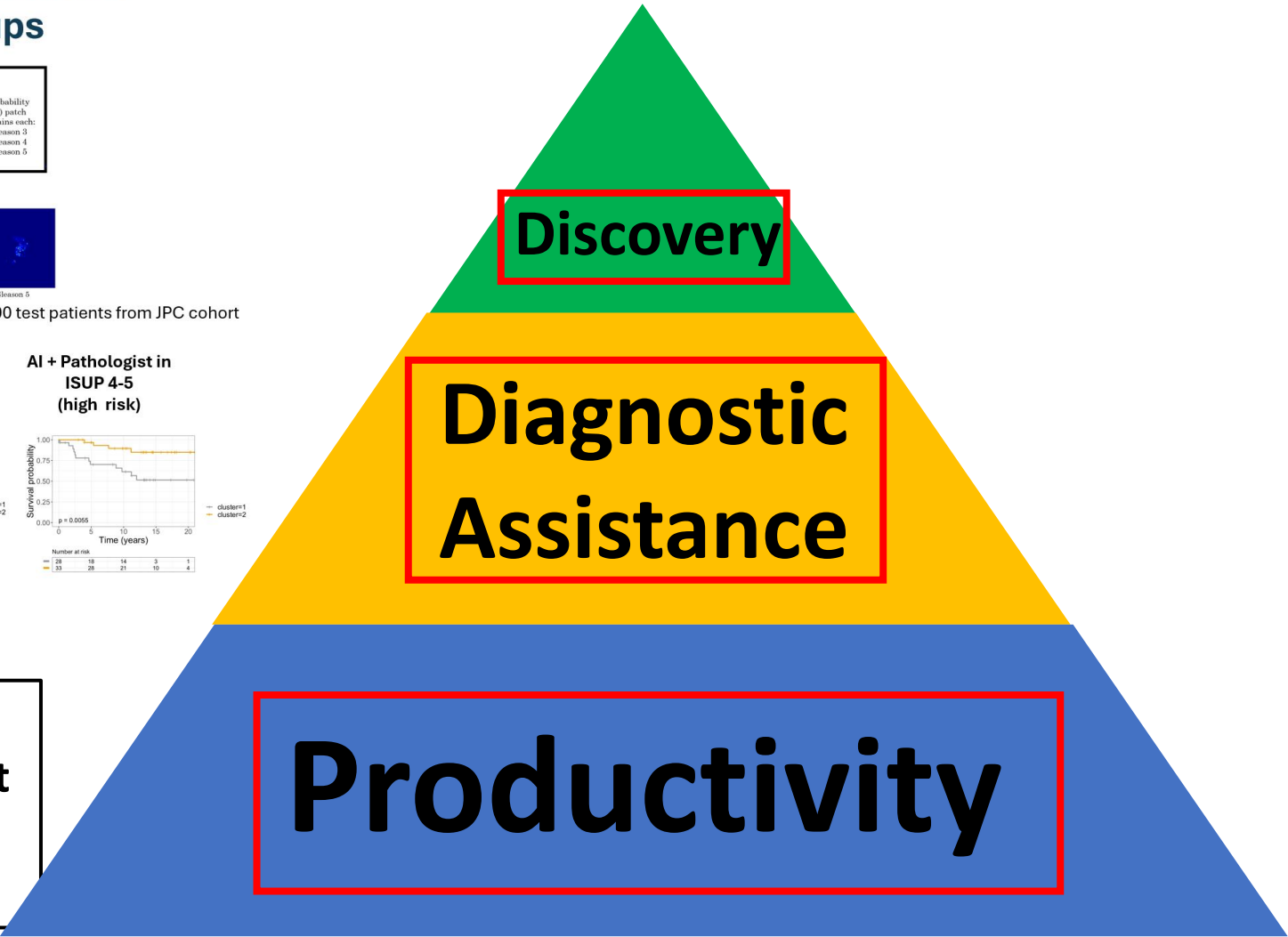


Model developed from diverse set of biopsy and surgical specimens (Patkar, Harmon, et al JPI 2024) and evaluated in 500 test patients from JPC cohort



NCI-JPC-CPDR-WRNMMC Collaboration

- Deployment (PACS-HALO-HPC/Biowulf)
- Future use in clinical-preclinical environment
- Trainings to fellows and researchers in NCI, NIH





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Thank you

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