ROUTINE USE OF AN ARTIFICIAL INTELLIGENCE SOLUTION FOR PRIMARY DIAGNOSIS OF PROSTATE BIOPSIES IN CLINICAL PRACTICE

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BACKGROUND

- Due to global increase in the cancer prevalence and the complex pathologic diagnostics landscape, personalized medicine with the support of AI has gained more interest in the recent years
- Artificial-intelligence (AI)-based diagnostic solutions can support pathologists and improve pathologists' accuracy and efficiency during cancer diagnosis

OBJECTIVE

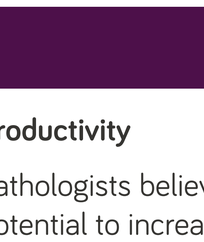
To assess a clinically deployed artificial intelligence (AI) decision support solution for prostate biopsies, which was previously validated at UPMC[1], in primary diagnosis employed in a digital pathology workflow

METHODOLOGY

4 pathologists underwent training and used the Galen™ Prostate solution for prospective primary diagnosis of consecutive prostate core needle biopsies

144 cases were reported (641 parts, 940 H&E slides)

113 (78.5%) **CANCER**



2 | (1.4%) **ASAP**

29 | (20.1%) **BENIGN**

All the slides were digitized and blindly processed by the AI solution.

AI results were compared to pathologist's sign-out report and AUC, NPV and PPV were calculated accordingly

RESULTS

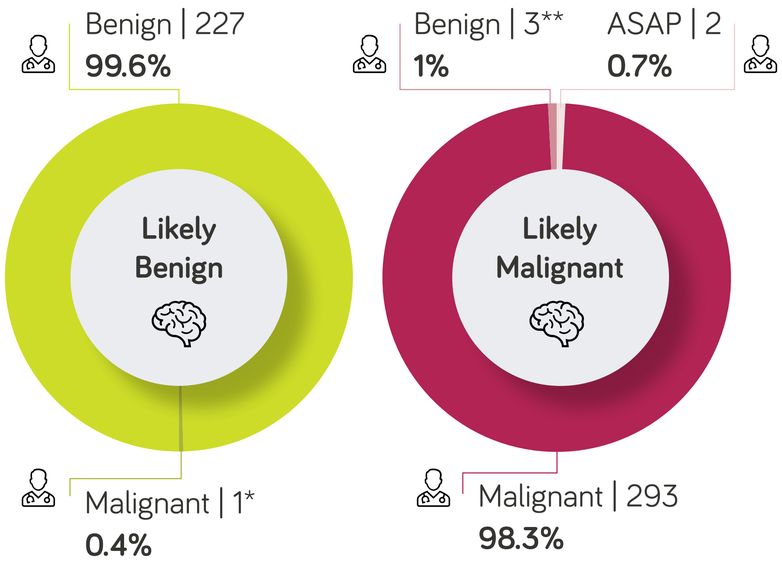
Galen Prostate Performance

The analysis displays the comparison between:

AI results and pathologist report

NPV = 0.99 (**Negative** Predictive Value)

PPV = 0.99 (**Positive** Predictive Value)



The AI determined 298 parts as malignant, 228 parts as benign and 115 parts as suspicious. The suspicious parts were reported by pathologists as 89 benign (77.4%) and 26 parts as malignant (22.6%)

Figure 1 | Performance of the Galen Prostate algorithm
*The points of interest (POI) highlighted malignant areas to the pathologist
**has florid atrophy-related changes; with post-atrophic hyperplasia

Cancer detection

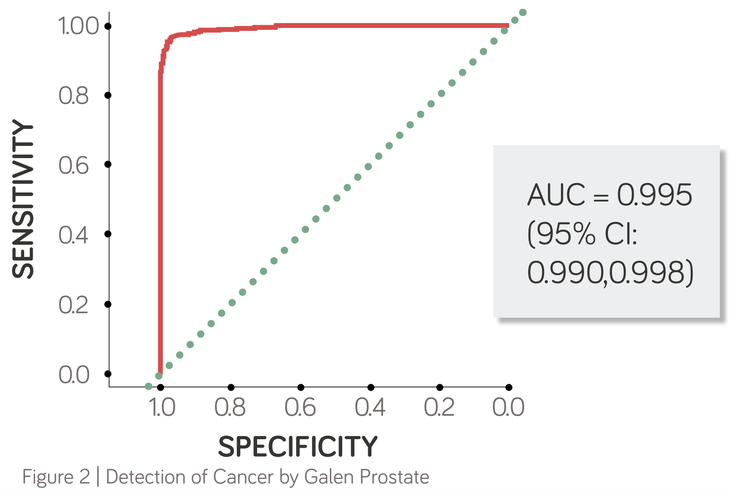


Figure 2 | Detection of Cancer by Galen Prostate

Gleason Grade Group detection

Rate of agreement		AI vs. lab report
Full	Same Grade Group	63.9%
Partial	Difference of 1 Grade Group	28%
No	Difference of 2 or more Grade Groups	8.1%

Quadratic Kappa – 0.761
ICC - 0.762, 95% CI [0.683, 0.82]

Table 1 | Detection of Gleason Grade Group by Galen Prostate on High likelihood parts (N=283)

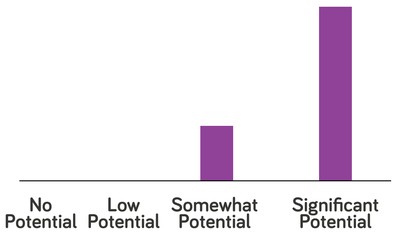
User Feedback Survey

Accuracy & Confidence

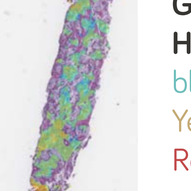
of pathologists feel confident in providing accurate diagnosis when reporting slides with Galen Prostate as with reporting on the microscope

Productivity

Pathologists believe there is potential to increase diagnostic efficiency with the use of Galen Prostate



User satisfaction

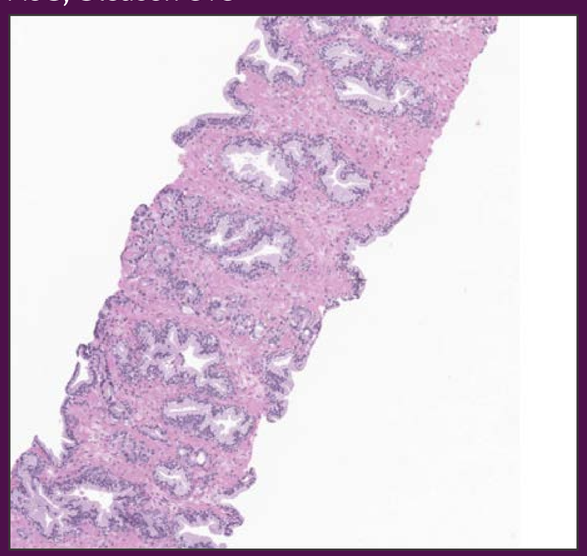


of pathologists were satisfied with using Galen Prostate, specifically mentioning the useful features for reporting, such as Gleason scoring, PNI detection and automated measurements

Figure 3 | User feedback survey completed by 4 pathologists.

EXAMPLES OF DIAGNOSES WITH THE GALEN PROSTATE

AdC, Gleason 3+3

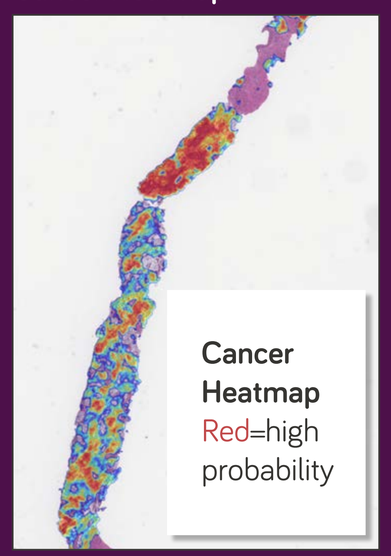


Cancer Heatmap

Figure 4 | Adenocarcinoma with Gleason 3+3 (A). Adenocarcinoma detected by Cancer heatmap (B).

AdC, Gleason 4+4

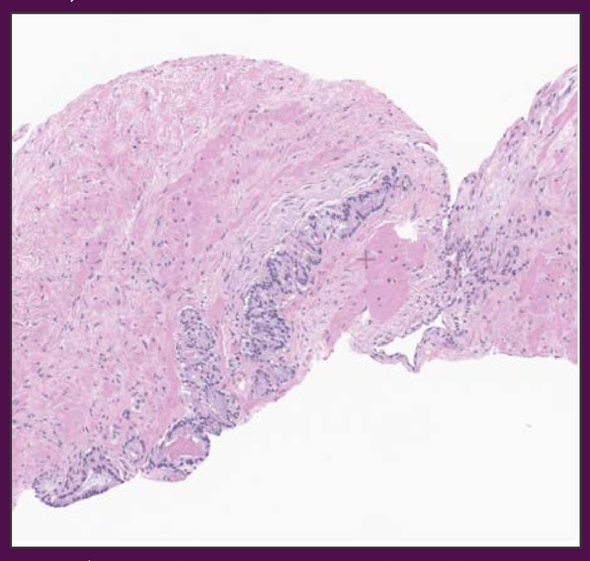
Cancer Heatmap



Gleason Heatmap

Figure 5 | Adenocarcinoma with Gleason 4+4 (A). Adenocarcinoma detected by Cancer heatmap (B). Gleason heatmap (C).

AdC, Gleason 3+4



Perineural Invasion Heatmap

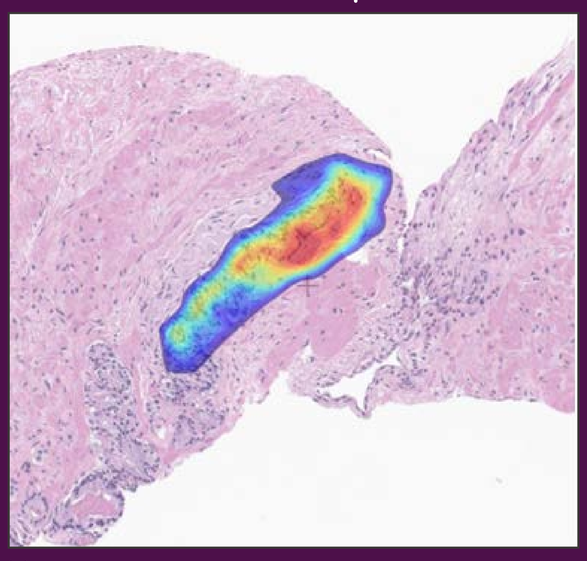


Figure 6 | Perineural invasion (PNI) (A). PNI detected by PNI heatmap (B).

Conclusions

- Successful implementation of a multi-feature AI solution that automatically imparts clinically relevant diagnostic parameters regarding prostate cancer, grading, measurements, and other pathologic features at UPMC
- The solution demonstrated high accuracy for prostate cancer detection and improved diagnostic quality
- All pathologists feel confident in providing accurate diagnoses when reporting slides supported by Galen Prostate
- In the near future, AI and Digital Pathology will enable UPMC to implement a Centralized Laboratory approach

Reference: Pantanowitz et al, Lancet Digital Health 2(8): e407-e416, 2020. PMID: 33328045
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