

Breakout Session 7: Track A

Generation and Dissemination of Enhanced AI/ML-ready Prostate Cancer Imaging Datasets for Public Use

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Instructor in Radiology, Brigham and Women's Hospital

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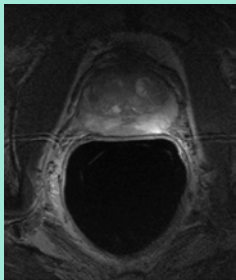
Instructor in Radiology, Brigham and Women's Hospital and Harvard Medical School

March 27-28, 2024

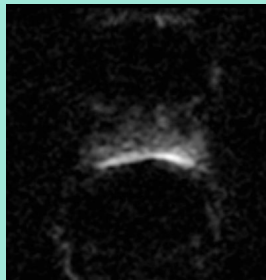
Supervised by: Dr. Andrey Fedorov, Dr. Tina Kapur and Dr. Clare Tempany

Motivation

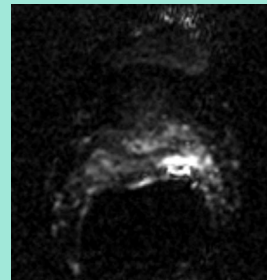
Prostate cancer is difficult to assess and diagnose because of heterogeneity in the data



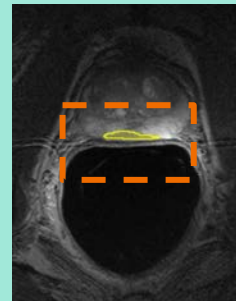
T2



ADC



DWI



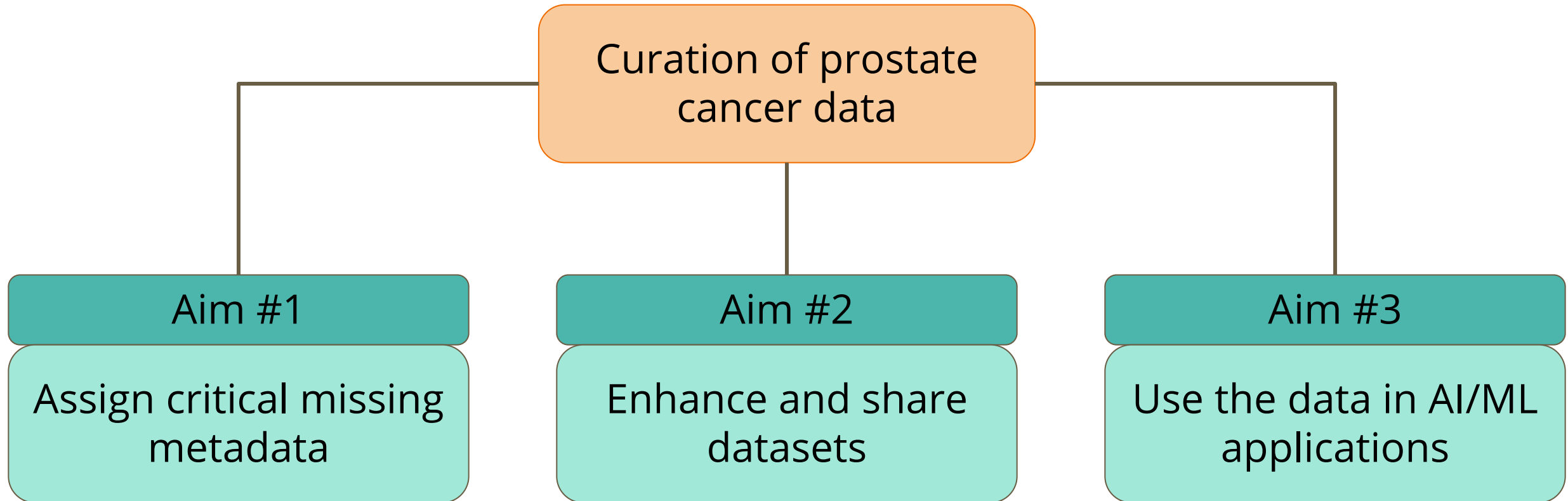
Can we use AI for localization and detection?

Motivation

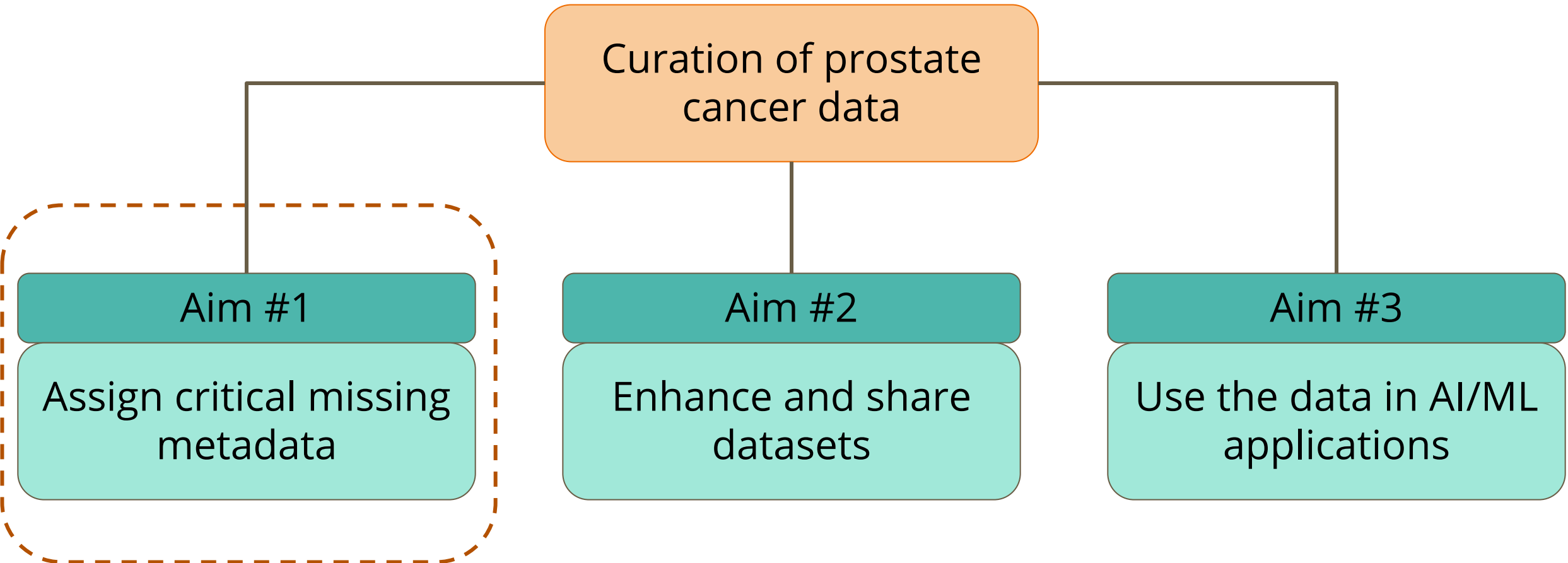
Before using AI... we need highly curated datasets!

- Many types of MRI scans are produced
- Metadata describing these scans could be incorrect, missing, or partially given
- Enough data for AI method development

Plan

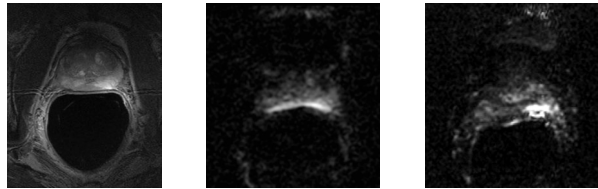


Plan



Aim #1 - Assign critical metadata

Assign scan type

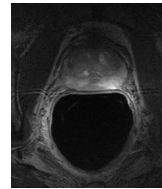


T2

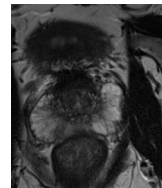
ADC

DWI

Determine coil presence

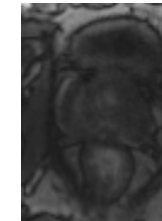


Has an
endorectal
coil

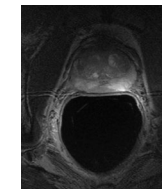


Does not
have an
endorectal
coil

Determine contrast



Has
contrast



Does not
have
contrast

Aim #1 - Assign critical metadata - Assign scan type

Metadata
only

Repetition Time
Echo Time
Flip Angle
Contrast

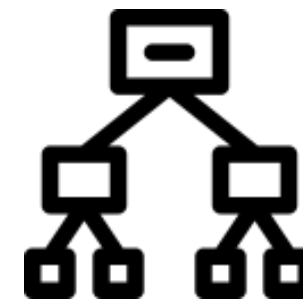


Image data
only

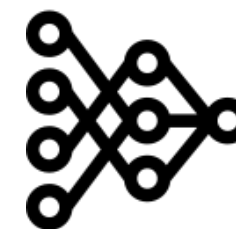
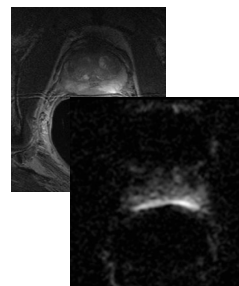
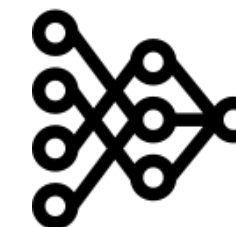
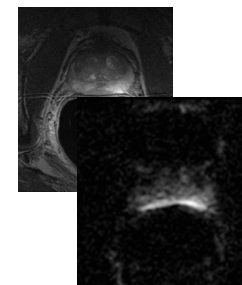
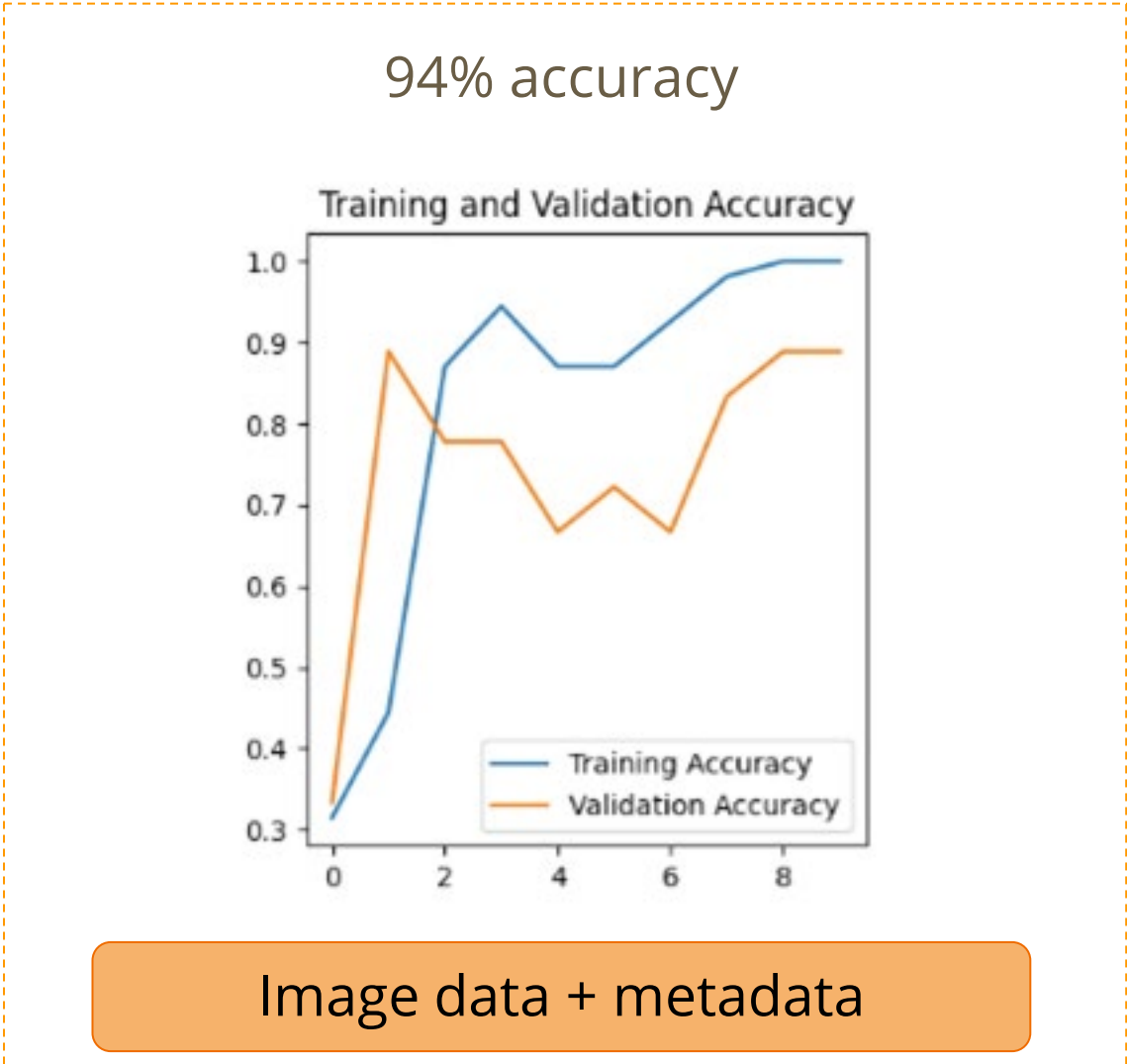
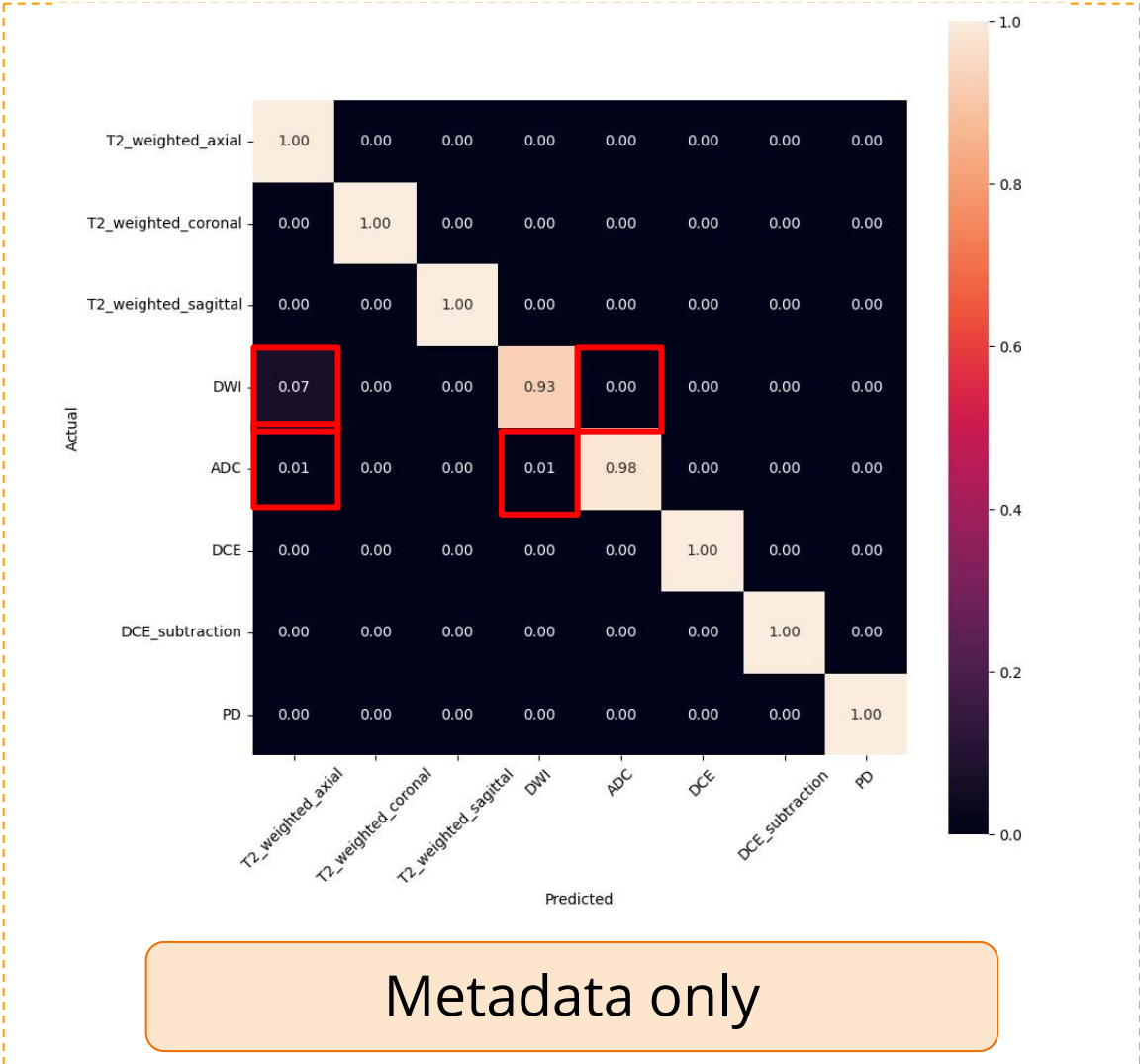


Image data
+
metadata

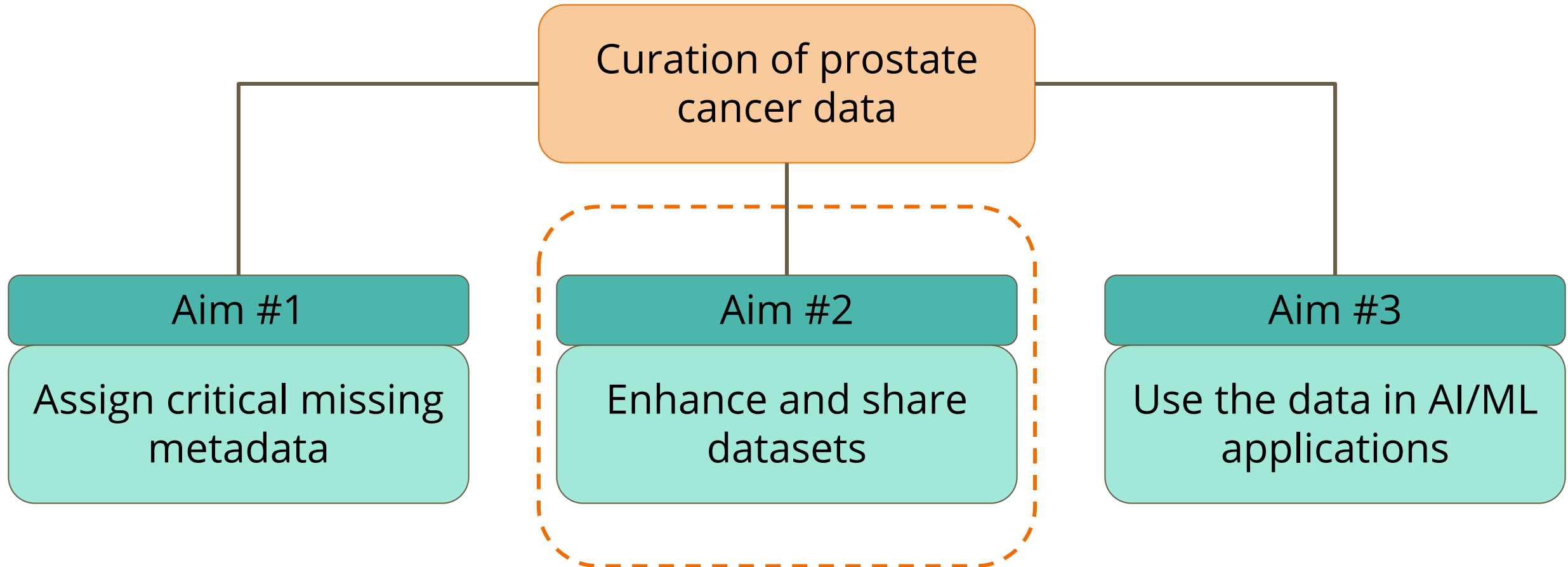
Repetition Time
Echo Time
Flip Angle
Contrast



Aim #1 - Assign critical metadata - Assign scan type



Plan



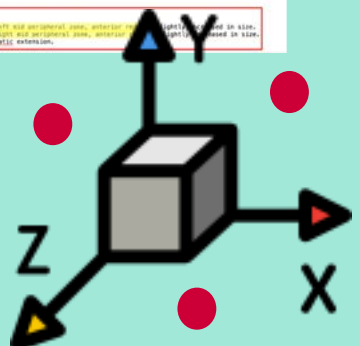
Aim #2: Enhance and share datasets

Internal dataset of **800+** in-bore transperineal prostate biopsy procedures

- Imaging data (T2 weighted, DWI, ADC, etc)
- Radiology reports
- Pathology reports
- Target biopsy coordinates

Aim #2: Enhance and share datasets

Before



Rad report (.txt)

TECHNIQUE: Multiphase MR imaging of the pelvis was performed using T2, T2, fat saturated, and diffusion weighted techniques. Dynamic Multiphase imaging was also performed after administration of an intravenous gadolinium contrast agent.

COMPARISON: MR1 PROSTATE WITH AND WITHOUT CONTRAST

TECHNIQUE: Multiphase MR imaging of the pelvis was performed using T2, T2, fat saturated, and diffusion weighted techniques. Dynamic Multiphase imaging was also performed after administration of an intravenous gadolinium contrast agent.

COMPARISON: MR1 PROSTATE WITH AND WITHOUT CONTRAST

ADDITIONAL INFORMATION:
PSA: 10.34 ng/mL
PSA density: 0.18 ng/mL/cc
Biopsy date: [REDACTED]
Biopsy results: Gleason pattern 3 + 3, left on prior treatment or Active Surveillance: Active

FINDINGS:
Prostate gland size: 4.1 x 5.8 x 5.2 cm
Prostate volume: 58 mL

POSTERIOR ZONE:
Patchy areas of low T2 weighted signal, symmetric posterolateral regions (4,12), unchanged compared to central zone.

PERIPHERAL ZONE:
1. There is a 0.8 cm focal lesion (4 : 10) in the right peripheral zone. The lesion is focally markedly hypointense on ADC and markedly hypointense on DWI. The lesion is 0.5 cm in greatest dimension, dynamic contrast enhancement is negative, moderate hypointense foci/nests confined to prostate and < 1.5 cm in greatest dimension of extracapsular extension. The lesion is PI-RADS 4.

TRANSITION ZONE:
Changes of glandular and stromal hyperplasia (BNI).
The Membranous Urethra Length (MUL) is: 0.8 cm
Seminal Vesicles: Normal.
Bladder: Trabeculated.
Rectum: Normal. No wall thickening.
Lymph Nodes: Normal. No pelvic lymphadenopathy.
Remarks: Normal.
Biopsy/Soft Tissue: No destructive lesions. Unchanged T1 hypointense lesions in the left transition zone (11,12). Likely benign.

IMPRESSION:
1. 0.8 cm PI-RADS 4 lesion in the right peripheral zone, anterior to the urethra, with moderate hypointense foci/nests confined to prostate and < 1.5 cm in greatest dimension of extracapsular extension.
2. 0.8 cm PI-RADS 4 lesion in the left peripheral zone, anterior to the urethra, with moderate hypointense foci/nests confined to prostate and < 1.5 cm in greatest dimension of extracapsular extension.
3. No lymphadenopathy of extracapsular extension.

Path report (.txt)

Report Status: Final
Type: Surgical Pathology
Pathology Report:
[REDACTED]
CASE: [REDACTED]
REF: [REDACTED]
DATE: [REDACTED]
Brigham and Women's Hospital
Department of Pathology
75 Francis Street, Boston, MA 02135
CLIA License No.: [REDACTED]
Laboratory Director: [REDACTED]
Physician: [REDACTED]
Procedure Date: [REDACTED]

Pathologist:
[REDACTED]

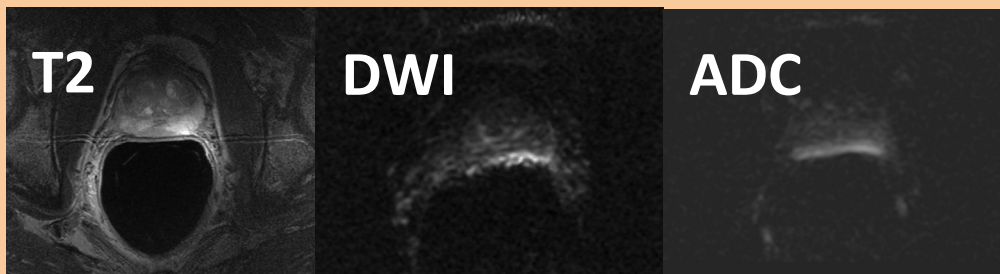
PATHOLOGIC STANDARDS:
A. LEFT PERIPHERAL ZONE ANTERIOR APPEX LESION
PROSTATIC ADENOCARCINOMA, Gleason score 3+3=6 (Grade Group 1), involving 10% of the urethral tissue.
B. LEFT ZONE
Benign prostatic tissue.
C. LEFT ZONE
Benign prostatic tissue.
D. LEFT ZONE
Benign prostatic tissue.
E. RIGHT APPEX
PROSTATIC ADENOCARCINOMA, Gleason score 3+3=6 (Grade Group 1), involving 10% of urethral tissue. Fragmented core. No perineural invasion.
F. RIGHT ZONE
Benign prostatic tissue.
G. RIGHT ZONE
Benign prostatic tissue.

CLINICAL DATA:
History: None provided.
Operation: None provided.
Operative Findings: None provided.
Clinical Significance: Elevated PSA.

TISSUE SUBMITTED:
A/U, Left peripheral zone anterior apex lesion
S/U, Left zone
S/U, Left mid
S/U, Left base
R/U, Right apex
R/U, Right mid
R/U, Right base

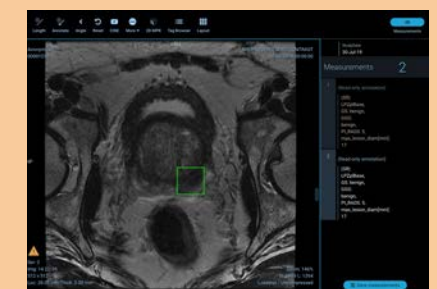
After

Images




T2 DWI ADC

Annotations



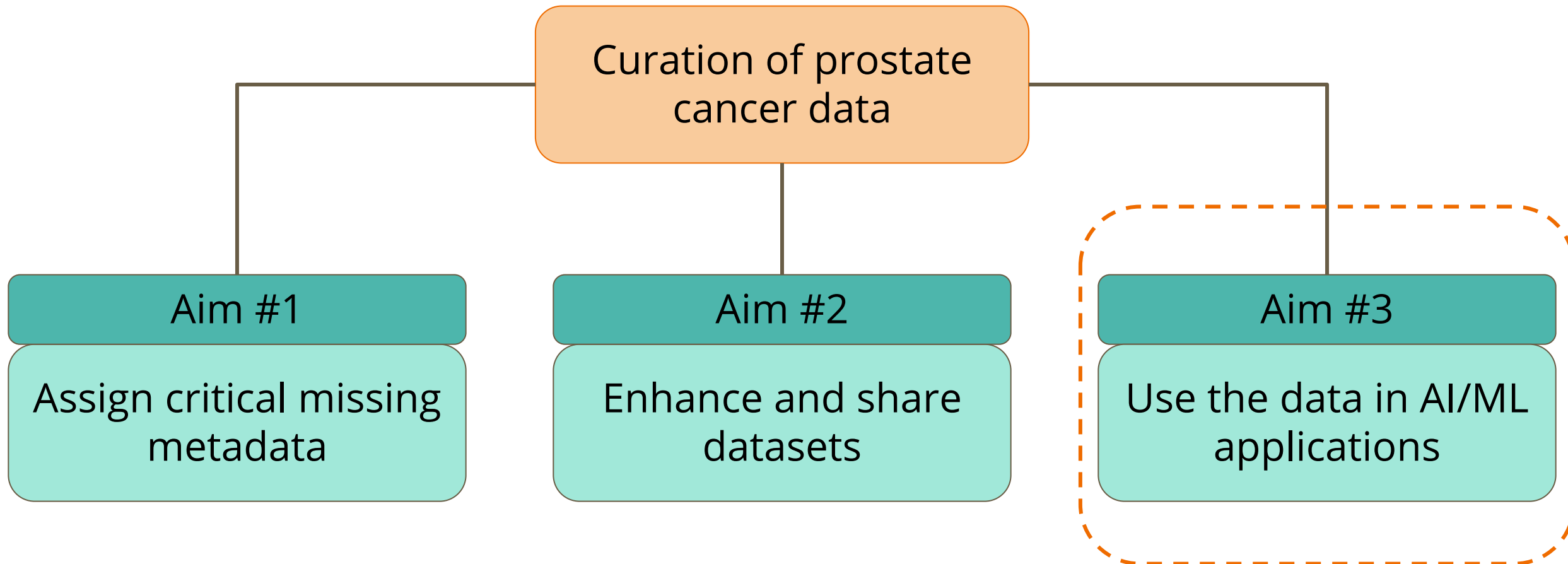
Clinical info



CSV



Plan



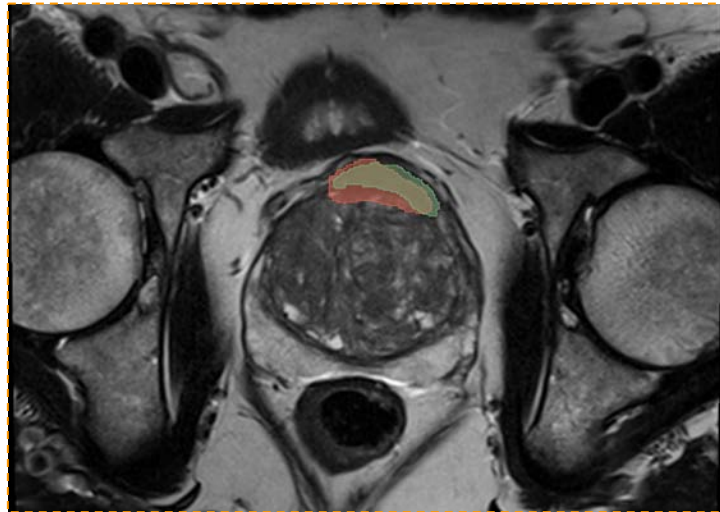
Aim #3: Use of data in AI/ML applications

There are a number of methods publicly available for prostate cancer detection and/or segmentation, however, these have not been benchmarked. We have identified 5 publicly available methods, and will evaluate them on prostate cancer datasets from NCI Imaging Data Commons [1], as well as on the internal dataset:

PI-CAI	https://grand-challenge.org/algorithms/pi-cai-baseline-nnu-net-semi-supervised/ https://grand-challenge.org/algorithms/pi-cai-baseline-ndetection-semi-supervised/
MONAI	https://github.com/kbresse/prostate158 https://github.com/Project-MONAI/research-contributions/tree/main/prostate-mri-lesion-seg
MedSAM	https://github.com/bowang-lab/MedSAM

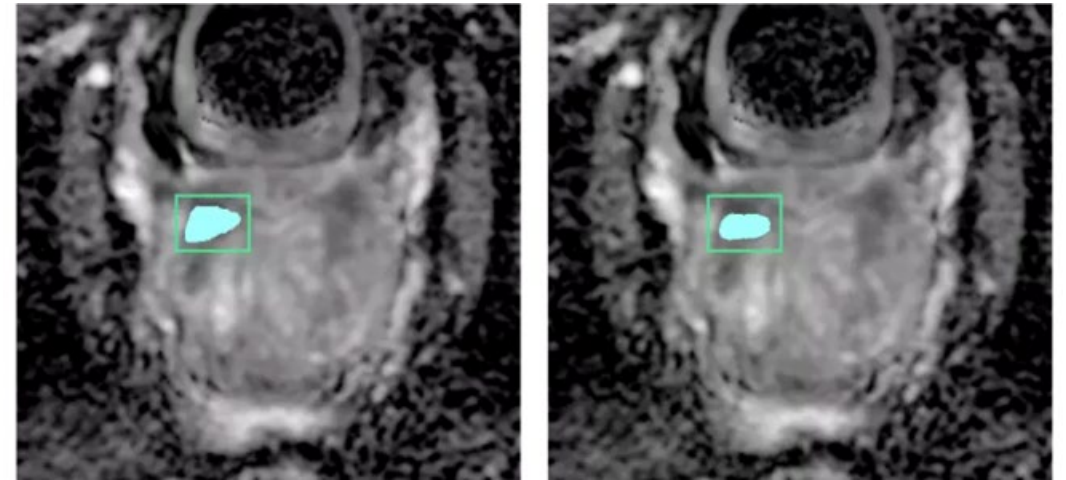
Work done in collaboration with Patrick Remerscheid

Aim #3: Use of data in AI/ML applications



Ground truth in green,
prediction in red

MONAI bundle



Ground truth

Prediction

Fine tuning MedSAM

Thank you!