Breakout Session 7: Track A

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

Ms. Deepa Krishnaswamy
Instructor in Radiology, Brigham and Women's Hospital

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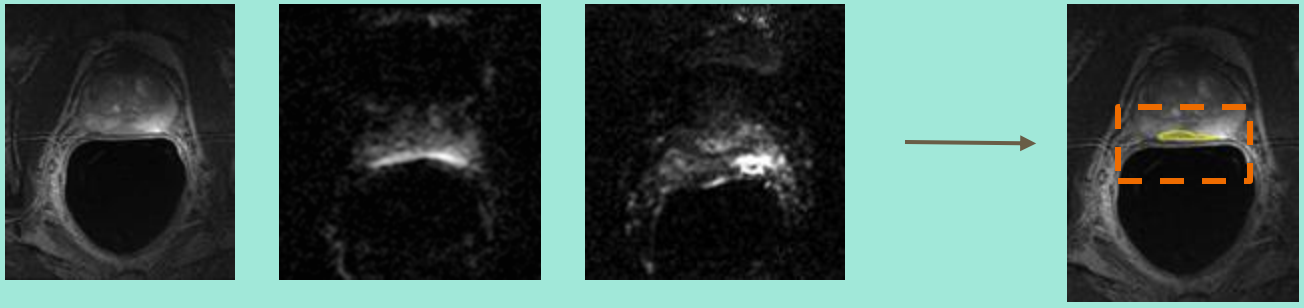
Supervised by: Dr. Andrey Fedorov, Dr. Tina Kapur and Dr. Clare Tempany

Motivation

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



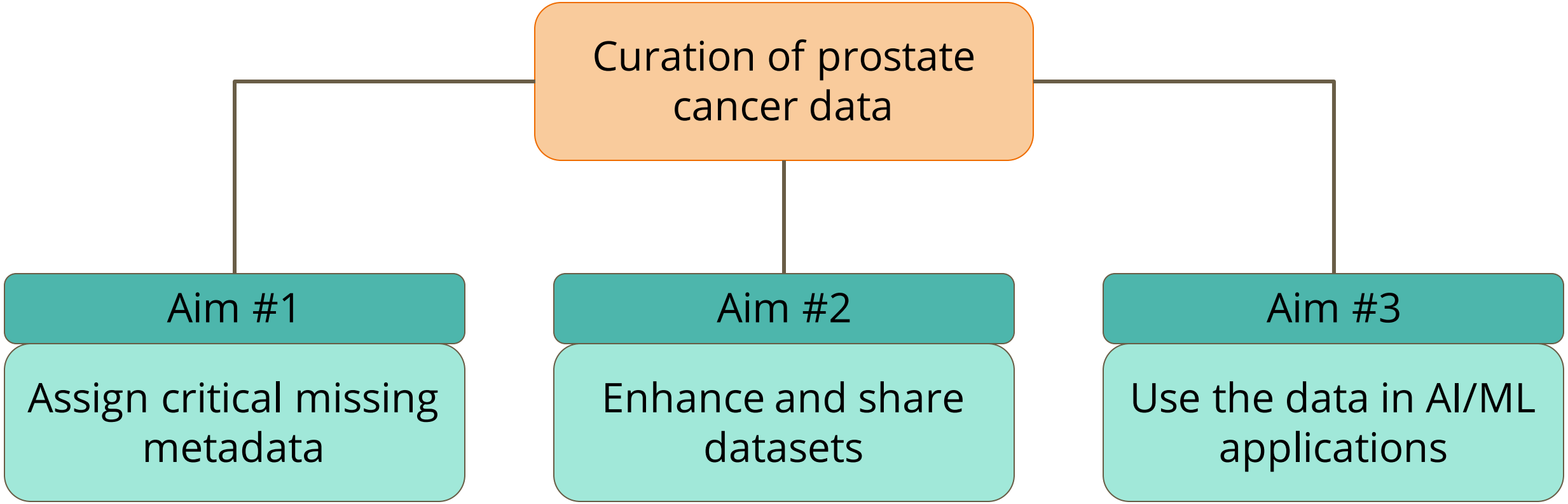
Can we use AI for localization and detection?

Motivation

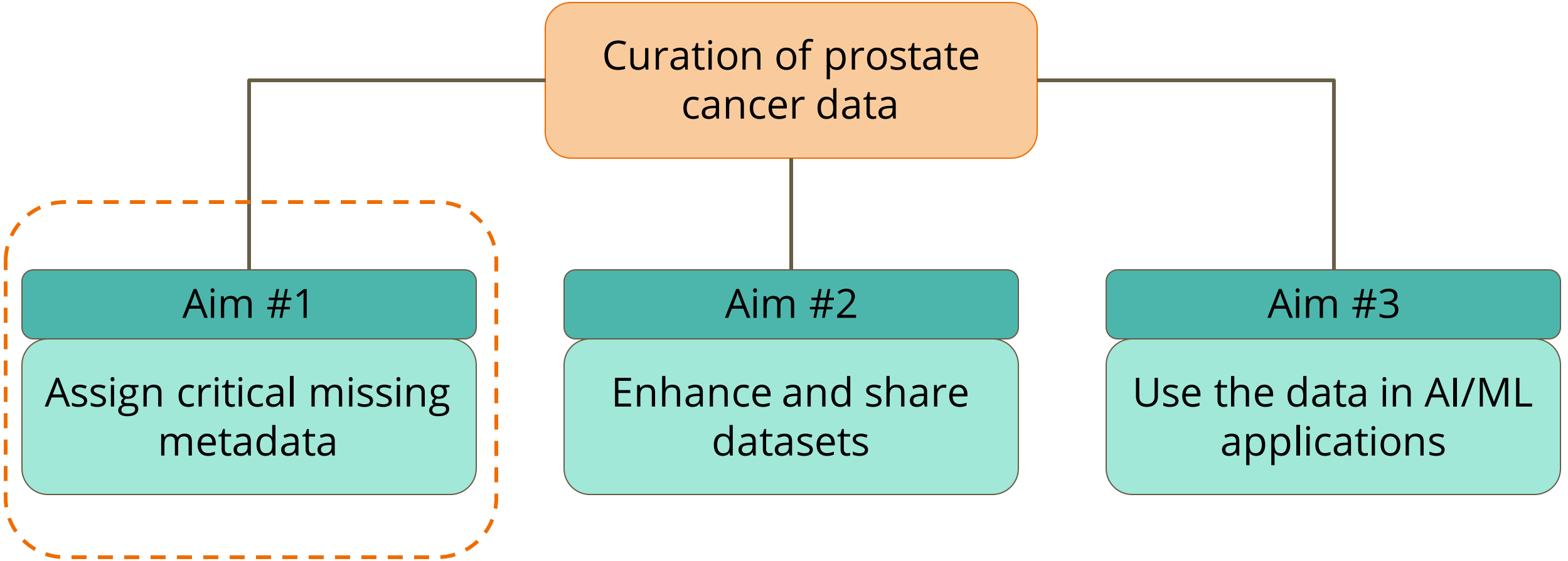
Before using AI... we need highly curated datasets!

- 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


Curation of prostate cancer data
Aim #1
Assign critical missing metadata
Aim #2
Enhance and share datasets
Aim #3
Use the data in AI/ML applications

Plan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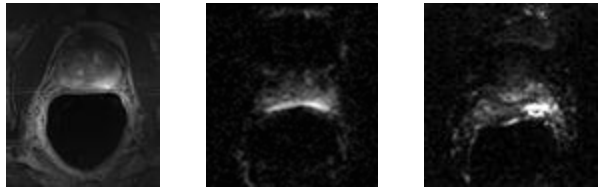
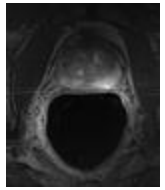
Aim #1 - Assign critical metadata

Assign scan type



T2 ADC DWI

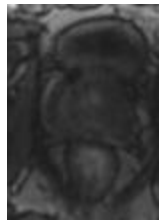
Determine coil presence



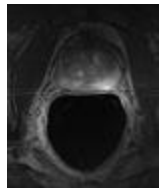
→ Has an endorectal coil

→ 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

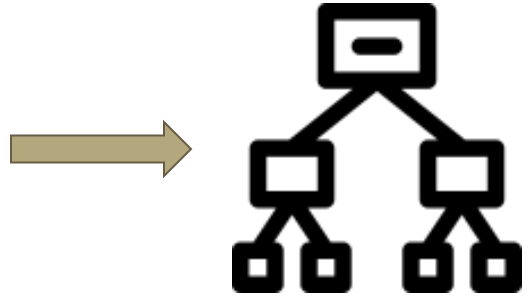
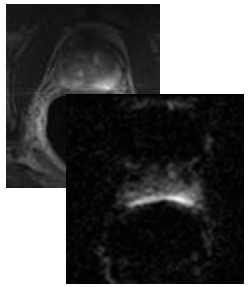


Image data only



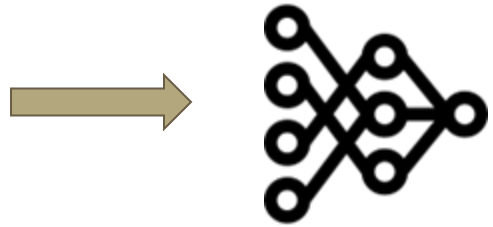
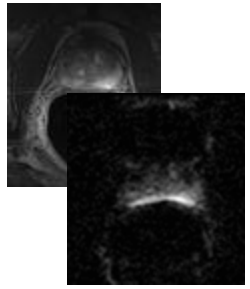
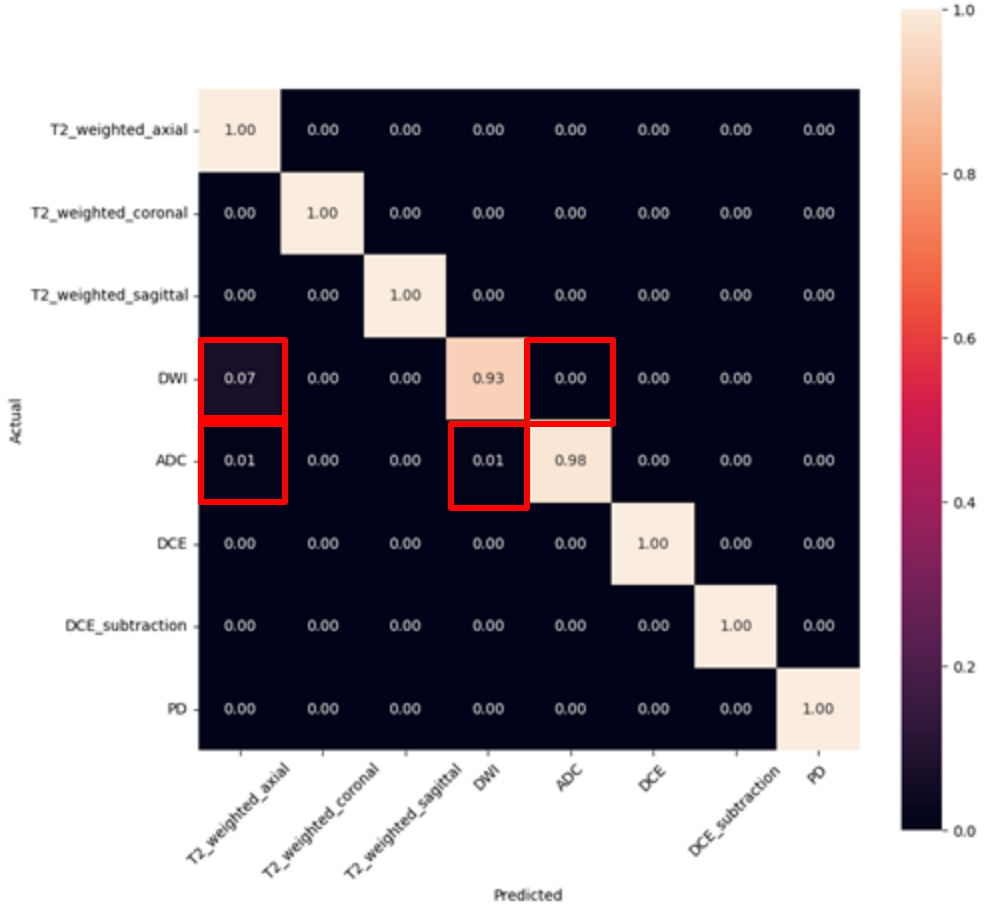


Image data + metadata

Repetition Time
Echo Time
Flip Angle
Contrast



Aim #1 - Assign critical metadata - Assign scan type



Metadata only

94% accuracy

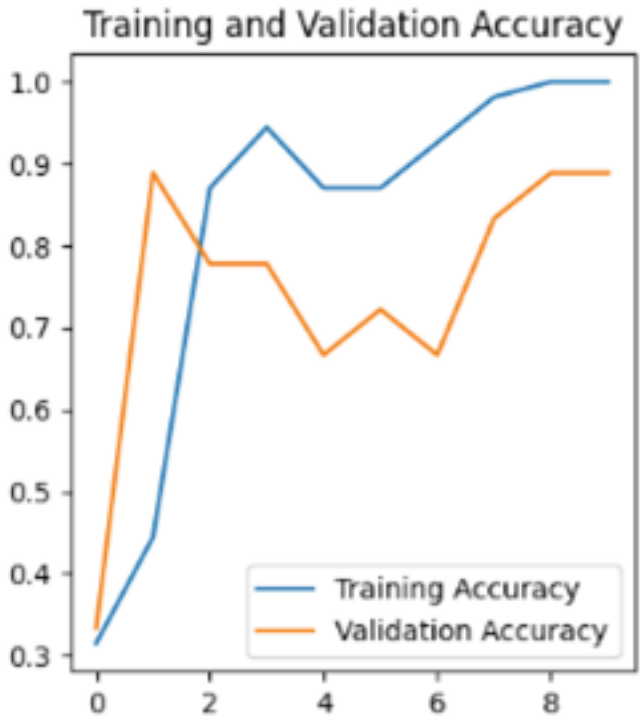
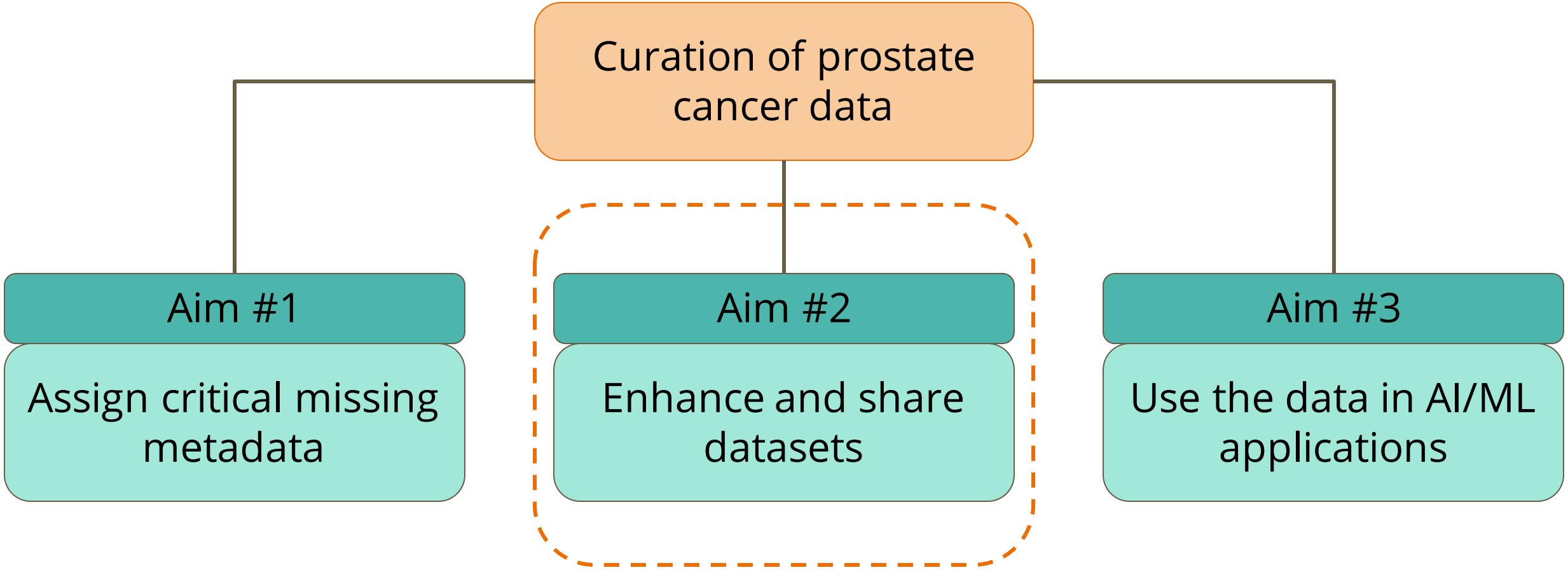


Image data + metadata

Plan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Aim #2: Enhance and share datasets

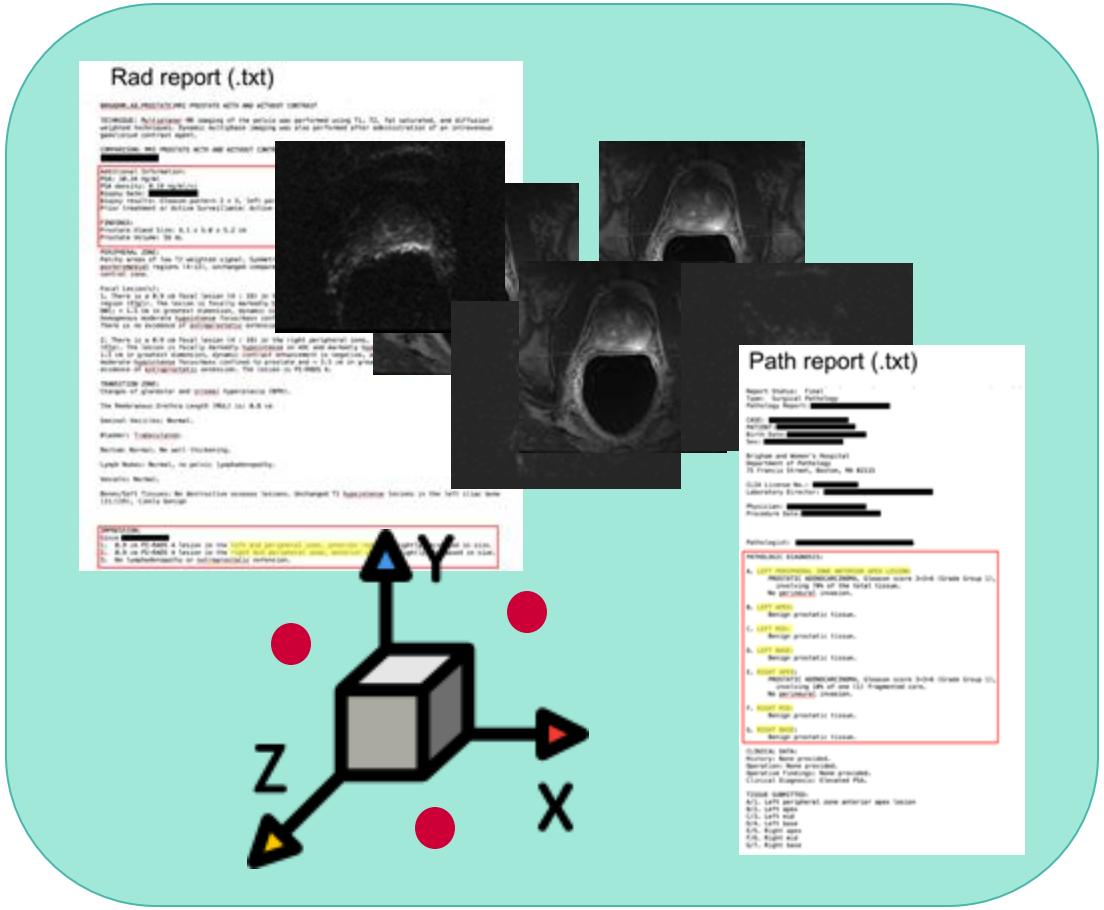
Internal dataset of **800+** in-bore transperineal prostate biopsy procedures

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

Work done in collaboration with Dr. Pedro Moreira, Dr. Quinn Rainier and Patrick Remerscheid

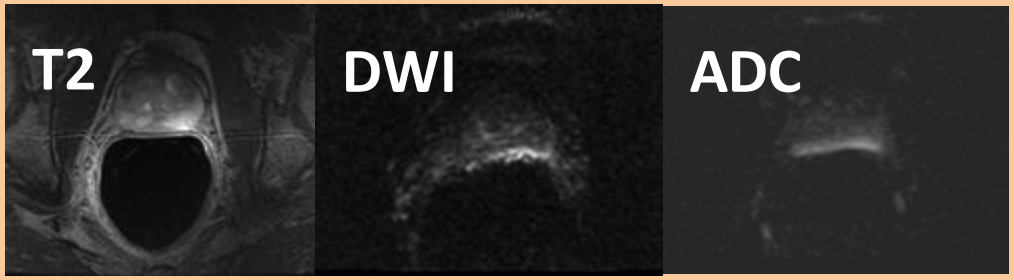
Aim #2: Enhance and share datasets

Before

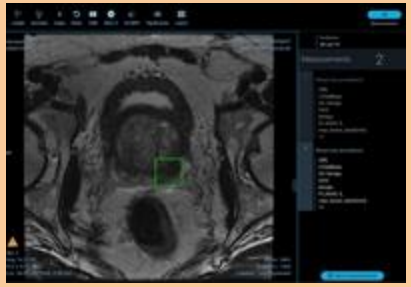


After

Images



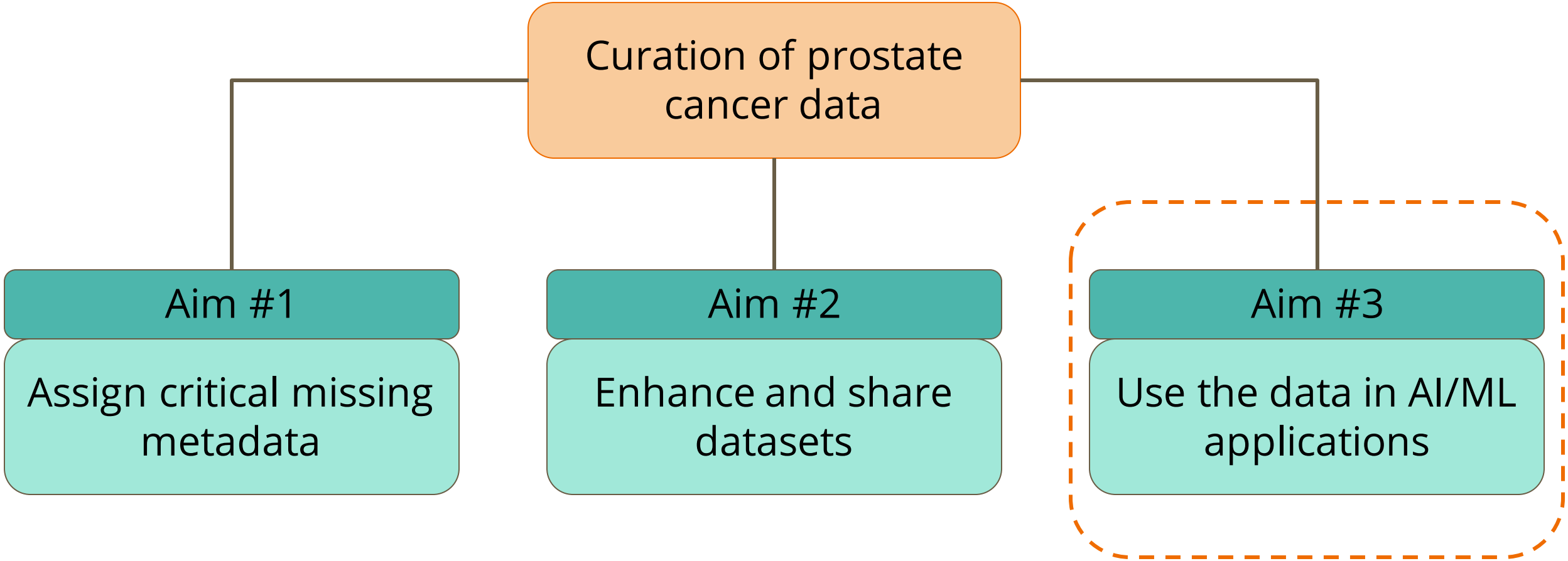
Annotations



Clinical info

Work done in collaboration with Dr. Pedro Moreira, Dr. Quinn Rainier and Patrick Remerscheid

Plan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Use the data in AI/ML applications

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

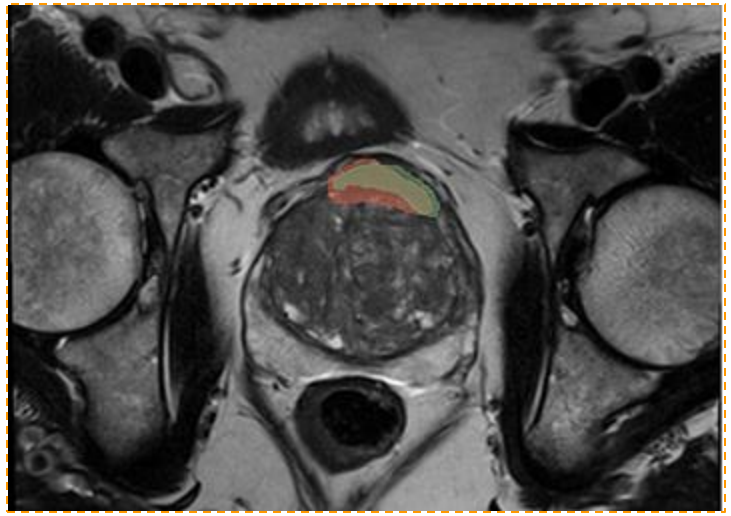
There are a number of methods publicly available for prostate cancer detection and/or segmentation, however, these have not been benchmarked. We have identified 5 publicly available methods, and will evaluate them on prostate cancer datasets from NCI Imaging Data Commons [1], as well as on the internal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

PI-CAI	https://grand-challenge.org/algorithms/pi-cai-baseline-nnu-net-semi-supervised/ https://grand-challenge.org/algorithms/pi-cai-baseline-nndetection-semi-supervised/
MONAI	https://github.com/kbressem/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

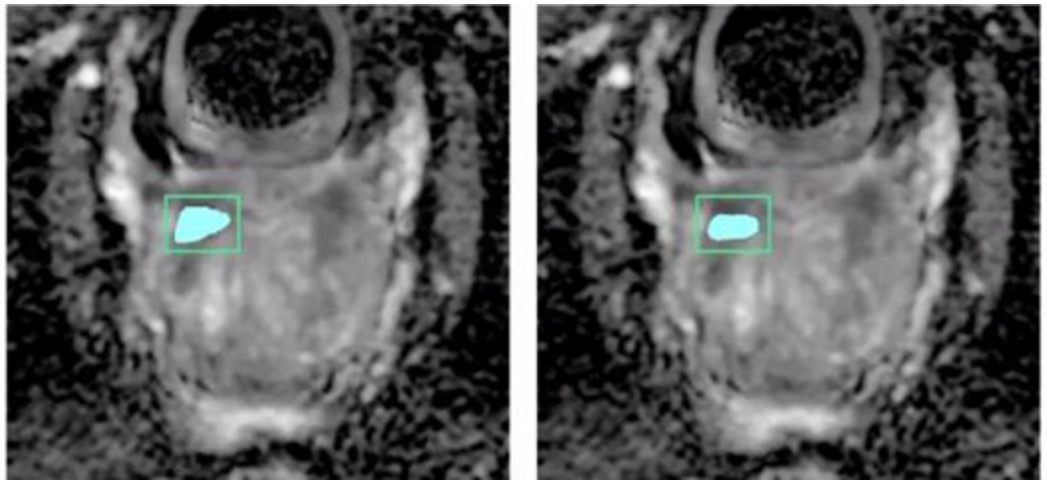
[1] Fedorov A, Longabaugh WJ, Pot D, Clunie DA, Pieper SD, Gibbs DL, Bridge C, Herrmann MD, Homeyer A, Lewis R, Aerts HJ. National Cancer Institute Imaging Data Commons: Toward Transparency, Reproducibility, and Scalability in Imaging Artificial Intelligence. Radiographics. 2023 Nov 24;43(12):e230180.

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



Ground truth in green, prediction in red

MONAI bundle



Ground truth Prediction

Fine tuning MedSAM

Work done in collaboration with Patrick Remerscheid

Thank you!