

# Fused Radiology-Pathology Prostate Dataset (Prostate Fused-MRI-Pathology)

## Summary

This collection comprises a total of 28 3 Tesla T1-weighted, T2-weighted, Diffusion weighted and Dynamic Contrast Enhanced prostate MRI along with accompanying digitized histopathology (H&E stained) images of corresponding radical prostatectomy specimens. The MRI scans also have a mapping of extent of prostate cancer on them [[10.1002/jmri.24975](https://doi.org/10.1002/jmri.24975)]. Each surgically excised prostate specimen was originally sectioned and quartered resulting in 4 slides for each section. Each of these individual slides was digitized at 20x magnification using an Aperio slide scanner resulting in a set of 4 .svs images. Each of the 4 .svs images were then digitally stitched together to constitute a pseudo-whole mount section (.tiff) using the program in [PMCID: [PMC4023035](https://pubmed.ncbi.nlm.nih.gov/PMC4023035/)]. Annotations of cancer presence on the pseudo-whole mount sections were made by an expert pathologist. Slice correspondences were established between the individual T2w MRI and stitched pseudo-whole mount sections by the program in [[10.1016/j.comppmedimag.2010.12.003](https://doi.org/10.1016/j.comppmedimag.2010.12.003)] and checked for accuracy by an expert pathologist and radiologist. Deformable co-registration [[PMC3078156](https://pubmed.ncbi.nlm.nih.gov/PMC3078156/)] was employed to spatially co-registered the corresponding radiologic and histopathologic tissue sections to map disease extent onto the corresponding MRI scans.

## Acknowledgement

- Data collection and analysis was provided by Anant Madabhushi, PhD, Case Western Reserve University and Michael D. Feldman, MD, PhD, Hospital at the University of Pennsylvania.
- This work was supported by NIH R01CA136535.

### Data Access

#### Data Access

Data Type	Download all or Query/Filter	License
Images (DICOM, 4.4 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download requires the <a href="#">NBIA Data Retriever</a> )	<a href="#">CC BY 3.0</a>
Annotated Whole Slide Pathology Images & Annotations (Tiff, XML 76.8 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download and apply the <a href="#">IBM-Aspera-Connect plugin</a> to your browser to retrieve this faspex package)	<a href="#">CC BY 3.0</a>
Fused Rad-Path Matlab Files (zip, 65 kB)	<a href="#">Download</a>	<a href="#">CC BY 3.0</a>
Correspondence tables (XLSX, 22 kB)	<a href="#">Download</a>	<a href="#">CC BY 3.0</a>

Click the Versions tab for more info about data releases.

## Additional Resources for this Dataset

The NCI Cancer Research Data Commons (CRDC) provides access to additional data and a cloud-based data science infrastructure that connects data sets with analytics tools to allow users to share, integrate, analyze, and visualize cancer research data.

- [Imaging Data Commons \(IDC\)](#) (Imaging Data)

## Detailed Description

### Detailed Description

Collection Statistics	Radiology Image Statistics	Pathology Image Statistics
Modalities	MRI	Pathology, Matlab
Number of Participants	28	16
Number of Studies	28	N/A
Number of Series	324	N/A
Number of Images	32,508	114
Image Size (GB)	4.4	76.8

### Supporting Documentation

The data set is fully described in the following publications:

1. Singanamalli, A. , Rusu, M. , Sparks, R. E., Shih, N. N., Ziober, A. , Wang, L. , Tomaszewski, J. , Rosen, M. , Feldman, M. and Madabhushi, A. (2016), **Identifying in vivo DCE MRI markers associated with microvessel architecture and gleason grades of prostate cancer.** *J. Magn. Reson. Imaging*, 43: 149-158. doi: <https://doi.org/10.1002/jmri.24975> (PMID:26110513).
2. Toth, R, Feldman, M, Yu, D, Tomaszewski, J, Madabhushi, A, **“Histostitcher™: An Informatics Software Platform for Reconstructing Whole-Mount Prostate Histology using the Extensible Imaging Platform (XIP™) Framework,”** *Journal of Pathology Informatics*, vol. 5, pg. 8, 2014 (PMID: 24843820, PMCID: PMC4023035). <https://doi.org/10.4103/2153-3539.129441>
3. Xiao, G, Bloch, N, Chappelow, J, Genega, E, Rofsky, N, Lenkinsky, R, Tomaszewski, J, Feldman, M, Rosen, M, Madabhushi, A, **“Determining Histology-MRI Slice Correspondences for Defining MRI-based Disease Signatures of Prostate Cancer,”** *Special Issue of Computerized Medical Imaging and Graphics on Whole Slide Microscopic Image Processing*, vol. 35[7-8], pp. 568-78, 2011 (PMID: 21255974). <https://doi.org/10.1016/j.compmedimag.2010.12.003>
4. Chappelow, J, Bloch, N., Rofsky, N, Genega, E, Lenkinski, R, DeWolf, W, Madabhushi, A, **“Elastic Registration of Multimodal Prostate MRI and Histology via Multi-Attribute Combined Mutual Information,”** *Medical Physics*, vol. 38[4], pp. 2005-2018, 2011 (PMID: 21626933). <https://doi.org/10.1118/1.3560879>

## Citations & Data Usage Policy

### Citations & Data Usage Policy

Users must abide by the [TCIA Data Usage Policy and Restrictions](#). Attribution should include references to the following citations:

#### Data Citation

Madabhushi, A., & Feldman, M. (2016). **Fused Radiology-Pathology Prostate Dataset (Prostate Fused-MRI-Pathology)** . The Cancer Imaging Archive. doi: [10.7937/k9/TCIA.2016.tlpmr1am](https://doi.org/10.7937/k9/TCIA.2016.tlpmr1am)

**i** Publication Citation

Singanamalli, A. , Rusu, M. , Sparks, R. E., Shih, N. N., Ziober, A. , Wang, L. , Tomaszewski, J. , Rosen, M. , Feldman, M. and Madabhushi, A. (2016), **Identifying in vivo DCE MRI markers associated with microvessel architecture and gleason grades of prostate cancer.** *J. Magn. Reson. Imaging*, 43: 149-158. doi: [10.1002/jmri.24975](https://doi.org/10.1002/jmri.24975) (PMID:26110513).

**i** Publication Citation

Toth, R, Feldman, M, Yu, D, Tomaszewski, J, Madabhushi, A, “**Histostitcher™: An Informatics Software Platform for Reconstructing Whole-Mount Prostate Histology using the Extensible Imaging Platform (XIP™) Framework,**” *Journal of Pathology Informatics*, vol. 5, pg. 8, 2014 (PMID: 24843820, PMCID: PMC4023035). <https://doi.org/10.4103/2153-3539.129441>

**i** Publication Citation

Xiao, G, Bloch, N, Chappelow, J, Genega, E, Rofsky, N, Lenkinsky, R, Tomaszewski, J, Feldman, M, Rosen, M, Madabhushi, A, “**Determining Histology-MRI Slice Correspondences for Defining MRI-based Disease Signatures of Prostate Cancer,**” Special Issue of Computerized Medical Imaging and Graphics on Whole Slide Microscopic Image Processing, vol. 35[7-8], pp. 568-78, 2011 (PMID: 21255974). <https://doi.org/10.1016/j.compmedimag.2010.12.003>

**i** Publication Citation

Chappelow, J, Bloch, N., Rofsky, N, Genega, E, Lenkinski, R, DeWolf, W, Madabhushi, A, “**Elastic Registration of Multimodal Prostate MRI and Histology via Multi-Attribute Combined Mutual Information,**” *Medical Physics*, vol. 38[4], pp. 2005-2018, 2011 (PMID: 21626933). <https://doi.org/10.1118/1.3560879>

**i** TCIA Citation

Clark K, Vendt B, Smith K, Freymann J, Kirby J, Koppel P, Moore S, Phillips S, Maffitt D, Pringle M, Tarbox L, Prior F. **The Cancer Imaging Archive (TCIA): Maintaining and Operating a Public Information Repository,** *Journal of Digital Imaging*, Volume 26, Number 6, December, 2013, pp 1045-1057. DOI: <https://doi.org/10.1007/s10278-013-9622-7>

## Other Publications Using This Data

TCIA maintains [a list of publications](#) which leverage our data. If you have a publication you'd like to add, please [contact TCIA's Helpdesk](#).

1. Brunese, L., Mercaldo, F., Reginelli, A., & Santone, A. (2020). Formal methods for prostate cancer gleason score and treatment prediction using radiomic biomarkers. *Magnetic resonance imaging*, 66, 165-175. doi:<https://doi.org/10.1016/j.mri.2019.08.030>
2. Chatzoudis, P. (2018). MRI prostate cancer radiomics: Assessment of effectiveness and perspectives. (Master of Biomedical Engineering). Delft University of Technology, Delft, Netherlands. Retrieved from <http://resolver.tudelft.nl/uuid:b8459bdb-1761-4f17-8807-e3b1cf7da629>

3. Duran, A., Dussert, G., Rouviere, O., Jaouen, T., Jodoin, P. M., & Lartizien, C. (2022). ProstAttention-Net: A deep attention model for prostate cancer segmentation by aggressiveness in MRI scans. *Medical image analysis*, 77, 102347. doi:<https://doi.org/10.1016/j.media.2021.102347>

### Versions

#### **Version 2 (Current): Updated 2023/04/10**

Data Type	Download all or Query/Filter	License
Images (DICOM, 4.4 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download requires the <a href="#">NBIA Data Retriever</a> )	CC BY 3.0
Annotated Whole Slide Pathology Images & Annotations (Tiff, XML 76.8 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download and apply the <a href="#">IBM-Aspera-Connect plugin</a> to your browser to retrieve this faspex package)	CC BY 3.0
Fused Rad-Path Matlab Files	<a href="#">Download</a>	CC BY 3.0
Correspondence tables (XLSX)	<a href="#">Download</a>	CC BY 3.0

Added a correspondence xlsx between MR and Pathology slides, imaging data are unchanged.

#### **Version 1: Updated 2016/11/30**

Data Type	Download all or Query/Filter
Images (DICOM, 4.4 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download requires the <a href="#">NBIA Data Retriever</a> )
Annotated Whole Slide Pathology Images & Annotations (Tiff, XML 76.8 GB)	<a href="#">Download</a> <a href="#">Search</a> (Download and apply the <a href="#">IBM-Aspera-Connect plugin</a> to your browser to retrieve this faspex package)
Fused Rad-Path MATLAB Files	<a href="#">Download</a>