A new 2.5 D representation for lymph node detection in CT (CT Lymph Nodes)

Summary

Redirection Notice

This page will redirect to https://www.cancerimagingarchive.net/collection/ct-lymph-nodes/ in about 5 seconds.

This collection consists of Computed Tomography (CT) images of the mediastinum and abdomen in which lymph node positions are marked by radiologists at the National Institutes of Health, Clinical Center. Radiologists at the ***Imaging Biomarkers and Computer-Aided Diagnosis Laboratory*** labeled a total of 388 mediastinal lymph nodes in CT images of 90 patients and a total of 595 abdominal lymph nodes in 86 patients.

The collection is aimed at the medical image computing community for developing and assessing computer-aided detection methods. Automated detection of lymph nodes can be an important clinical diagnostic tool but is very challenging due to the low contrast of surrounding structures in CT and to their varying sizes, poses, shapes and sparsely distributed locations. This data set is made available to make direct comparison to other detection methods in order to advance the state of the art.

Acknowledgements

- We would like to acknowledge the individuals and institutions that have provided data for this collection: National Institutes of Health, Bethesda MD. Special thanks to Dr. **Holger R. Roth** and Dr. **Ronald Summers**, ***Imaging Biomarkers and Computer-Aided Diagnosis Laboratory*** , Grant Magnuson Clinical Center.
- Conversion of the segmentations into DICOM SEG representation was completed by Cosmin Ciausu using dcmqi (https://github.com/QIICR/dcmqi), assisted by Andrey Fedorov, David Clunie, and other members of the NCI Imaging Data Commons team. NCI Imaging Data Commons consortium is supported by the contract number 19X037Q from Leidos Biomedical Research under Task Order HHSN26100071 under Contract Number HHSN261201500003l from NCI.

Data Access

Data Access

Data Type	Download all or Query/Filter	License
Images, Segmentations (DICOM, 58.4 GB)	*Download* *Search* (Download requires the NBIA Data Retriever)	CC BY 3.0
Med ABD Lymph Annotations (txt, mps, ZIP, 704 files, 307 kB)	*Download*	CC BY 3.0
Med Lymph Candidate Nodes (ZIP, 1056 files, 604 kB)	*Download*	CC BY 3.0
Med ABD Lymph Masks (ZIP, 1.20 MB)	*Download*	CC BY 3.0

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	
Modalities	CT, SEG
Number of Participants	176
Number of Studies	176
Number of Series	352
Number of Images	110,179
Images Size (GB)	58.4

The DICOM files were created from volumetric images (Analyze and NifTI) using this from ITK: ***http://www.itk.org/Doxygen/html/Examples_2IO_2ImageReadDicomSeriesWrite_8cxx-example.html*.**

Annotation files

MED_ABD_LYMPH_ANNOTATIONS.zip (new 6/24/2015). The annotations include a folder for each case with text files of voxel indices, physical coordinates, size measurements and a MITK point set file (.mps), which can be visualized using the MITK workbench (Note: only release 2014.10.0 and later supports visualization of point set files using the "point set interaction plugin"). Abdominal size measurements include the longest and shortest axis in axial view of a lymph node. The shortest axis is used for the RECIST criteria. The mediastinal set only includes the shortest axis.

Mediastinal and abdominal lymph nodes

Computer-generated candidate detections for mediastinal and abdominal lymph nodes (produced by methods in [K. Cherry et al., SPIE Med. Img. 2014] and [J. Liu et al., SPIE Med. Img. 2014]]). See attached: MED_ABD_LYMPH_CANDIDATES.zip (new 9/14/2015).

MED_ABD_LYMPH_MASKS.zip (new 12/8/2015): These files contain a compressed NifTI image (*.nii.gz) for each patient with manually traced lymph node segmentations. Note: these segmentation masks were produced independently to the centroid annotations in MED_ABD_LYMPH_ANNOTATIONS.zip. There is an overlapping set of lymph nodes marked in both files but the indexing does not align. On 3/31/2023 (version 5) a DICOM-SEG version of these data were added to the collection.

Please cite the following paper when using the segmentation masks:

> A Seff, L Lu, A Barbu, H Roth, HC Shin, RM Summers. **Leveraging Mid-Level Semantic Boundary Cues for Automated Lymph Node Detection**. Medical Image Computing and Computer-Assisted Intervention–MICCAI 2015, 53-61 (http://link.springer.com/chapter/10.1007/978-3-319-24571-3_7)

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

Roth, H., Lu, L., Seff, A., Cherry, K. M., Hoffman, J., Wang, S., Liu, J., Turkbey, E., & Summers, R. M. (2015). **A new 2.5 D representation for lymph node detection in CT [Data set]**. The Cancer Imaging Archive. https://doi.org/10.7937/K9/TCIA.2015.AQIIDCNM

Publication Citation

Roth, H. R., Lu, L., Seff, A., Cherry, K. M., Hoffman, J., Wang, S., Liu, J., Turkbey, E., & Summers, R. M. (2014). **A New 2.5D Representation for Lymph Node Detection Using Random Sets of Deep Convolutional Neural Network Observations**. In Medical Image Computing and Computer-Assisted Intervention – MICCAI 2014 (pp. 520–527). Springer International Publishing. https://doi.org/10.1007/978-3-319-10404-1_65

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. (2013). **The Cancer Imaging Archive (TCIA): Maintaining and Operating a Public Information Repository**. Journal of Digital Imaging, 26(6), 1045–1057. https://doi.org/10.1007/s10278-013-9622-7

Additional Publication Resources:

The Collection *authors* suggest the below will give context to this dataset, please cite if you use them in your work:

- Seff, A., Lu, L., Cherry, K.M., Roth, H.R., Liu, J., Wang, S., Hoffman, J., Turkbey, E.B., & Summers, R.M. **2D view aggregation for lymph node detection using a shallow hierarchy of linear classifiers**. Medical Image Computing and Computer-Assisted Intervention--MICCAI 2014, p544-552, 2014. (http://arxiv.org/abs/1408.3337)
- Please cite the following paper when using the segmentation masks: Seff, A., Lu, L., Barbu, A., Roth, H., Shin, H.-C., & Summers, R. M. (2015). **Leveraging Mid-Level Semantic Boundary Cues for Automated Lymph Node Detection.** In Lecture Notes in Computer Science Medical Image Computing and Computer-Assisted Intervention–MICCAI 2015 (pp. 53–61). Springer International Publishing. https://doi.org/10.1007/978-3-319-24571-3_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.

- Bier, B., Goldmann, F., Zaech, J. N., Fotouhi, J., Hegeman, R., Grupp, R., . . . Unberath, M. (2019). Learning to detect anatomical landmarks of the pelvis in X-rays from arbitrary views. Int J Comput Assist Radiol Surg. doi: https://doi.org/10.1007/s11548-019-01975-5
- Esteban, J., Grimm, M., Unberath, M., Zahnd, G., & Navab, N. (2019). Towards Fully Automatic X-Ray to CT Registration. 11769, 631-639. doi: https://doi.org/10.1007/978-3-030-32226-7_70
- Felsner, L., Roser, P., Maier, A., & Riess, C. (2021). Comparison of methods for sensitivity correction in Talbot-Lau computed tomography. Int J Comput Assist Radiol Surg, 16(12), 2099-2106. doi: https://doi.org/10.1007/s11548-021-02487-x
- Goerres, J., Uneri, A., Jacobson, M., Ramsay, B., De Silva, T., Ketcha, M., . . . Siewerdsen, J. H. (2017). Planning, guidance, and quality assurance of pelvic screw placement using deformable image registration. Phys Med Biol, 62(23), 9018-9038. doi: https://doi.org/10.1088/1361-6560/aa954f
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- Iuga, A. I., Carolus, H., Hoink, A. J., Brosch, T., Klinder, T., Maintz, D., . . . Pusken, M. (2021). Automated detection and segmentation of thoracic lymph nodes from CT using 3D foveal fully convolutional neural networks. BMC Med Imaging, 21(1), 69. doi: https://doi.org/10.1186/s12880-021-00599-z
- Krishna, P., Robinson, D. L., Bucknill, A., & Lee, P. V. S. (2022). Generation of hemipelvis surface geometry based on statistical shape modelling and contralateral mirroring. Biomechanics and Modeling in Mechanobiology. doi: https://doi.org/10.1007/s10237-022-01594-1
- Liu, F., Feng, J., Su, W., Lv, Z., Xiao, F., & Qiu, S. (2017). Normalized Euclidean Super-Pixels for Medical Image Segmentation. Paper presented at the International Conference on Intelligent Computing.
- Moshfeghifar, F., Gholamalizadeh, T., Ferguson, Z., Schneider, T., Nielsen, M. B., Panozzo, D., . . . Erleben, K. (2022). LibHip: An open-access hip joint model repository suitable for finite element method simulation. Computer Methods and Programs in Biomedicine, 226, 107140. doi: https://doi.org/10.1016/j.cmpb.2022.107140
- Reis, C., Little, B., Lee MacDonald, R., Syme, A., Thomas, C. G., & Robar, J. L. (2021). SBRT of ventricular tachycardia using 4pi optimized trajectories. J Appl Clin Med Phys. doi: https://doi.org/10.1002/acm2.13454
- Roth, H. R., Lu, L., Seff, A., Cherry, K. M., Hoffman, J., Wang, S., . . . Summers, R. M. (2014). A new 2.5 D representation for lymph node detection using random sets of deep convolutional neural network observations. Paper presented at the Med Image Comput Comput Assist Interv.
- Sengupta, D. (2019). Deep Learning Architectures for Automated Image Segmentation. (MS). University of California, Los Angeles, Retrieved from https://escholarship.org/uc/item/6gb3k51s
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- Shen, K., Quan, H., Han, J., & Wu, M. (2022). URO-GAN: An untrustworthy region optimization approach for adipose tissue segmentation based on adversarial learning. Applied Intelligence. doi: https://doi.org/10.1007/s10489-021-02976-1
- Simmons-Ehrhardt, T. (2021). Open osteology: Medical imaging databases as skeletal collections. Forensic Imaging, 26. doi: https://doi.org/10.1016/j.fri.2021.200462

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- Wang, Q., Xue, W., Zhang, X., Jin, F., & Hahn, J. (2021). Pixel-wise body composition prediction with a multi-task conditional generative adversarial network. J Biomed Inform, 120, 103866. doi: https://doi.org/10.1016/j.jbi.2021.103866
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Versions

Version 5 (Current): Updated 2023/03/31

Data Type	Download all or Query/Filter
Image, Segmentations (DICOM, 58.4 GB)	*Download* *Search* (Download requires the NBIA Data Retriever)
Med ABD Lymph Annotations (ZIP)	*Download*
Med Lymph Candidate Nodes (ZIP)	*Download*
Med ABD Lymph Masks (ZIP)	*Download*

Added DICOM version of MED_ABD_LYMPH_MASKS.zip segmentations that were previously available

Version 4 : Updated 2015/12/14

MED_ABD_LYMPH_MASKS.zip added via the wiki.

Data Type	Download all or Query/Filter
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Med ABD Lymph Annotations (ZIP)	*Download*
Med Lymph Candidate Nodes (ZIP)	*Download*
Med ABD Lymph Masks (ZIP)	*Download*

Version 3: Updated 2015/09/14

MED_ABD_LYMPH_CANDIDATES.zip added via the wiki.

Data Type	Download all or Query/Filter
Images (DICOM, 57.8GB)	*Download* (Download requires the NBIA Data Retriever)

Med ABD Lymph Annotations (ZIP)	*Download*
Med Lymph Candidate Nodes (ZIP)	*Download*

Version 2: Updated 2015/06/24

MED_ABD_LYMPH_ANNOTATIONS.zip added via the wiki.

Data Type	Download all or Query/Filter
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Med ABD Lymph Annotations (ZIP)	*Download*

Version 1: Updated 2015/03/16

Image data set uploaded

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