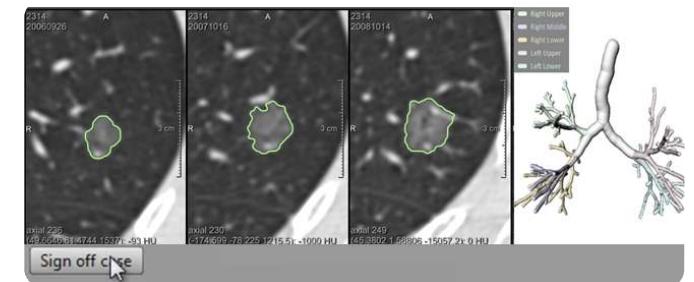


Long CT Screening

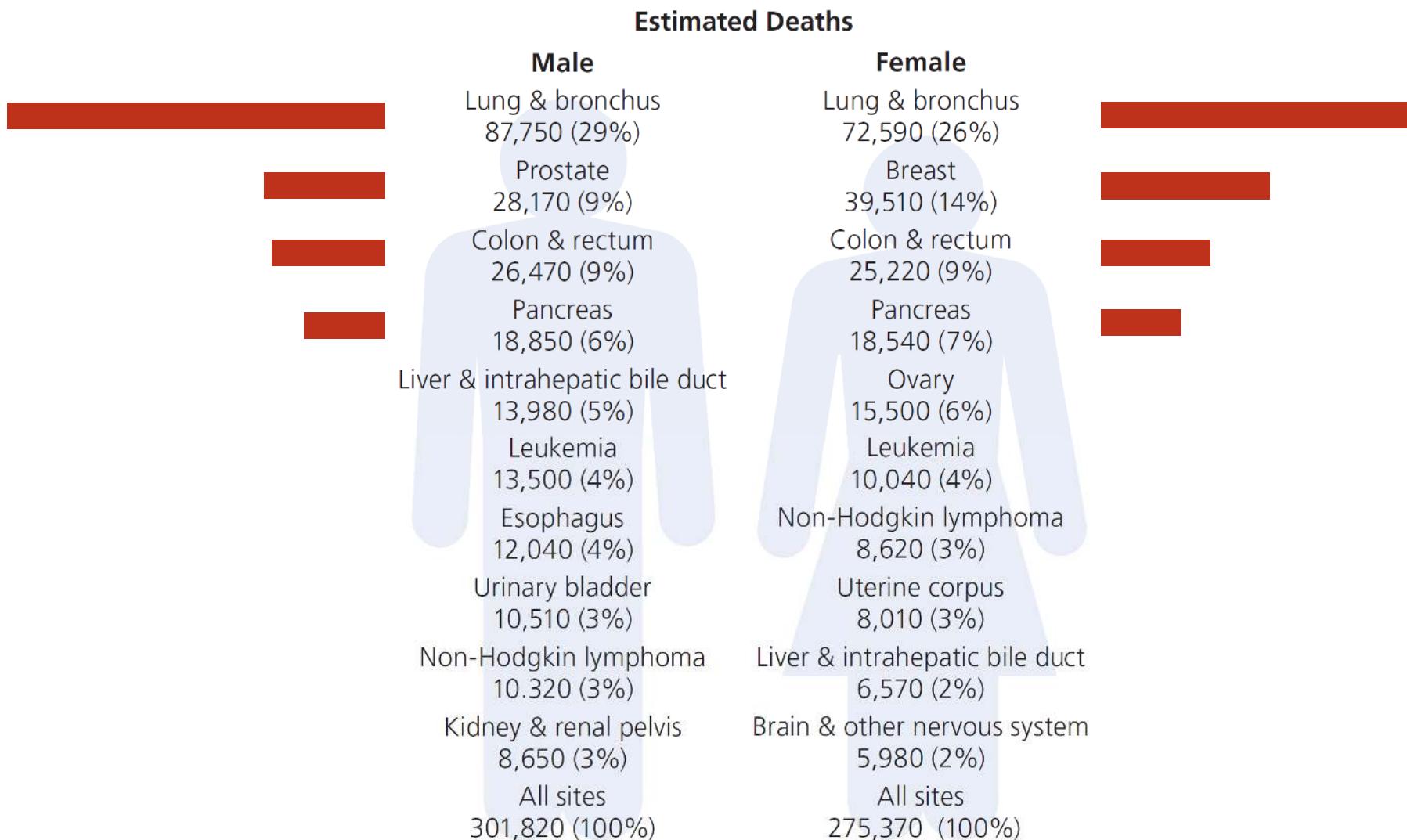


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Lung cancer



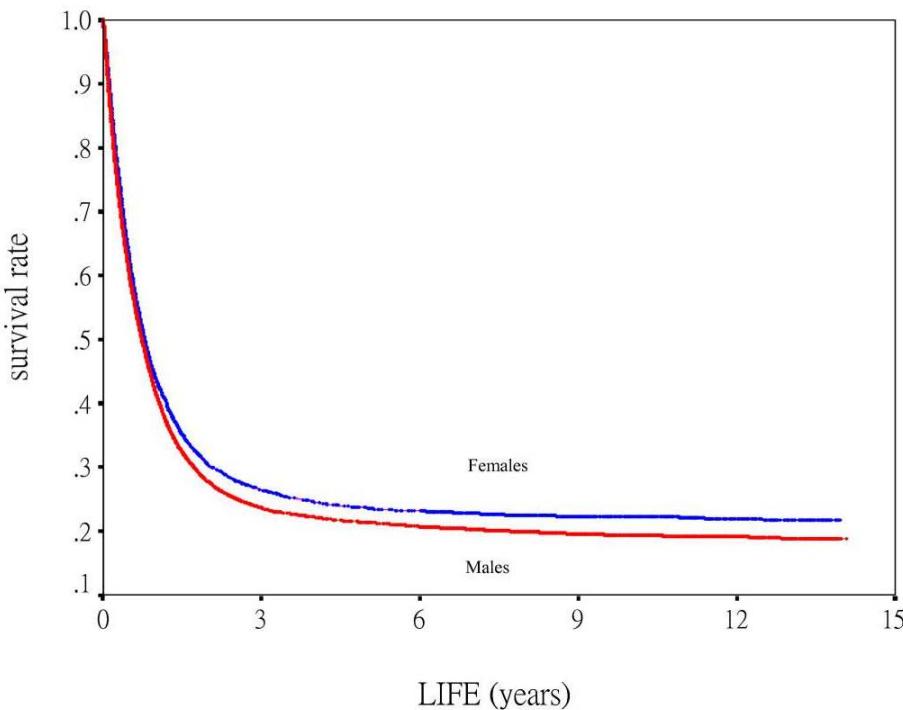
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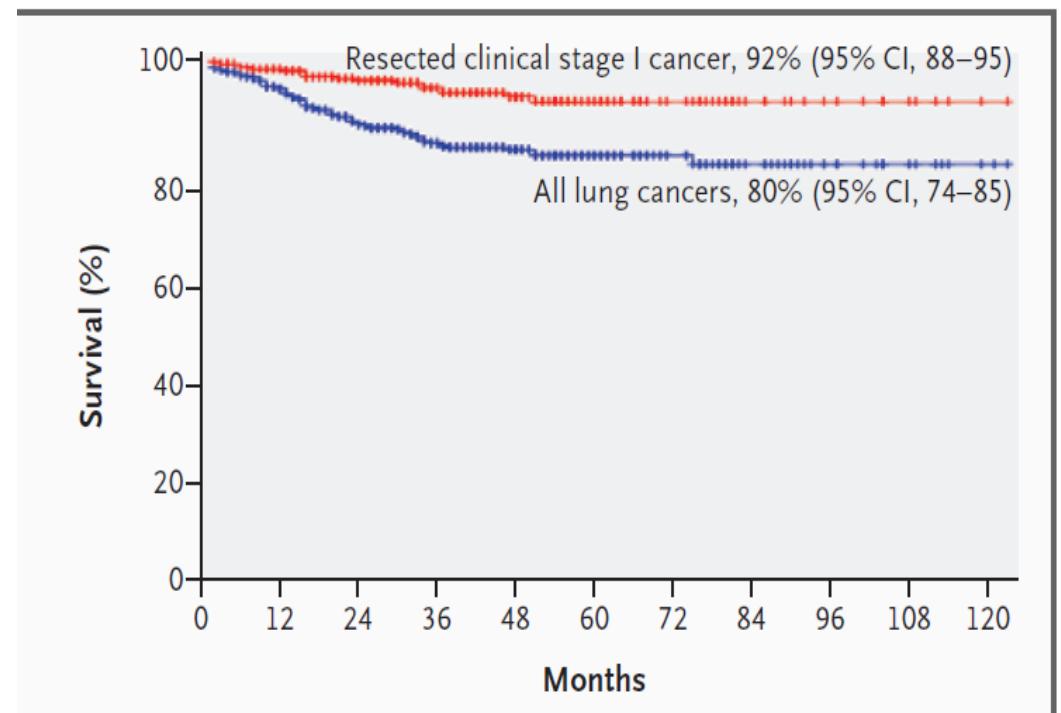


Lung cancer survival

Symptoms



Early detection

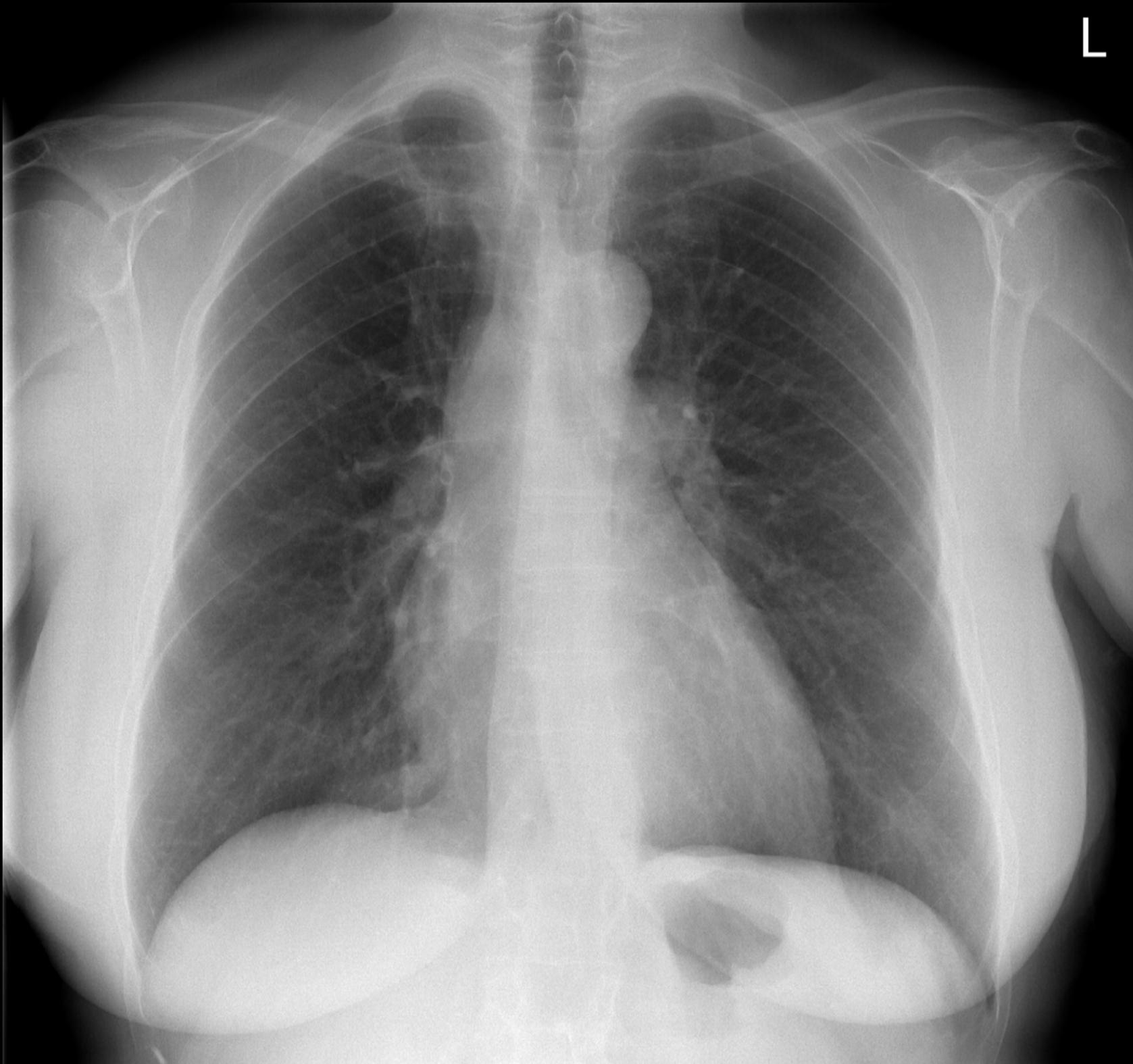


Screening with chest radiography

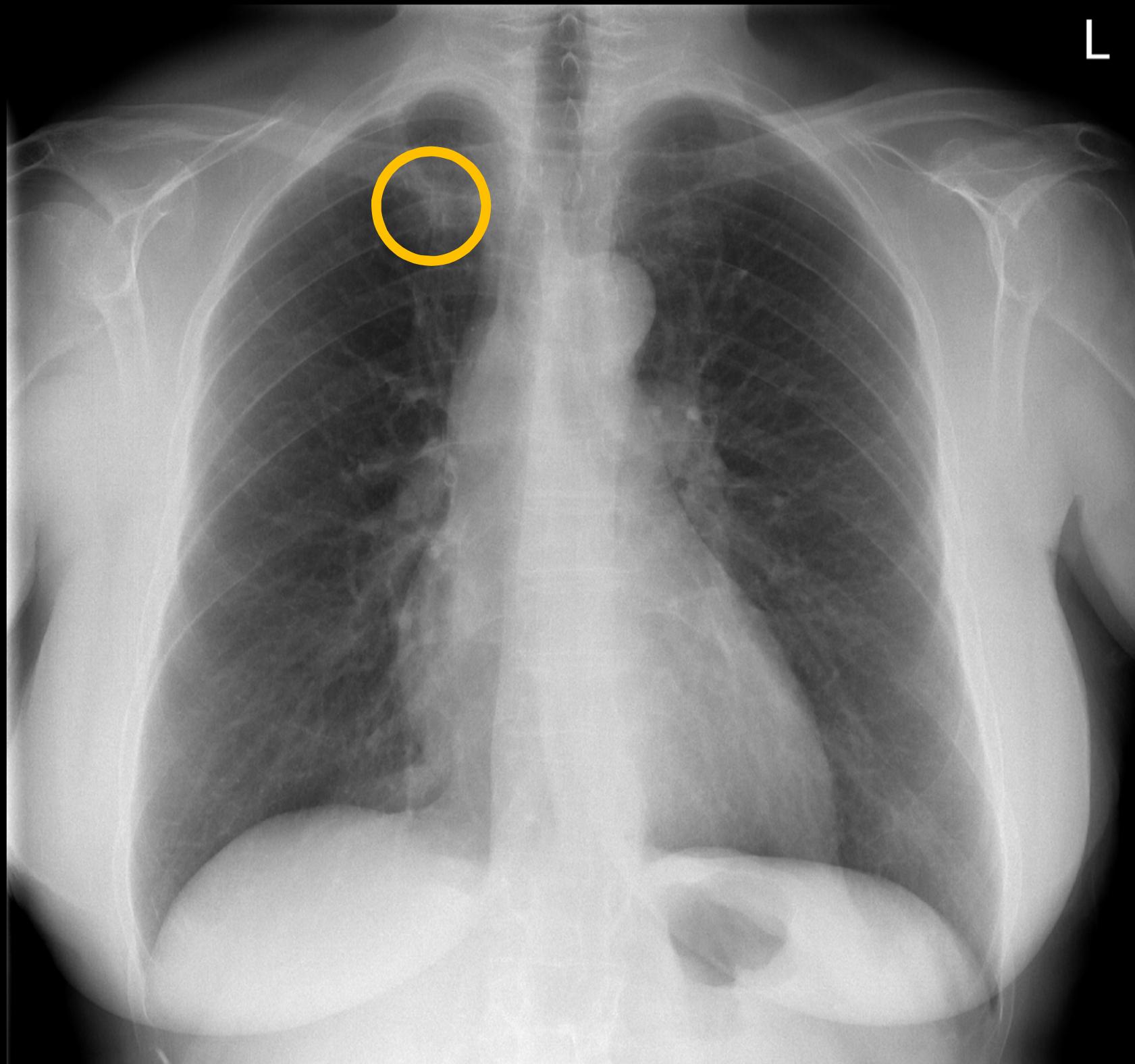
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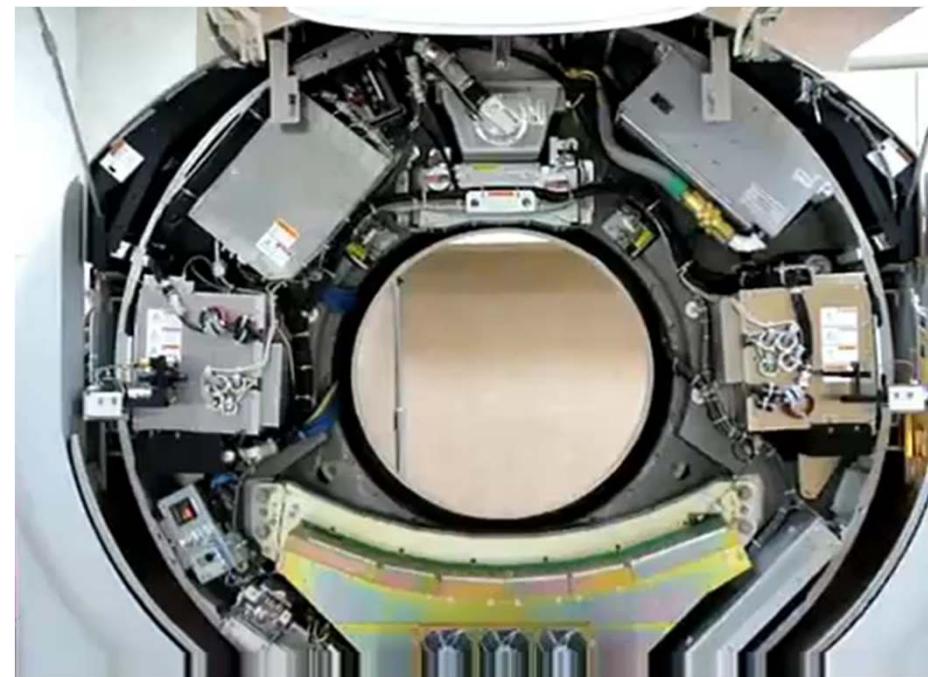
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CT versus CXR



Simulated
X-ray

CT versus CXR



105
mm

CT versus CXR



70
mm

CT versus CXR



35
mm

CT versus CXR



Key points thoracic CT acquisition and viewing

- CT is an isotropic modality: similar resolution in all directions (this was not always the case; many hospitals use outdated strategies for acquisition and data storage)
- You can view the images in any direction (tradition: axial only)
- Adjust the window level depending on what you are looking for (Q: Why not a more effective color lookup table? A: tradition)
- Adjust the section width (slice thickness, slab thickness) to reduce noise or help yourself for your detection task
- Use slab MIP, MinIP, averaging

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Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

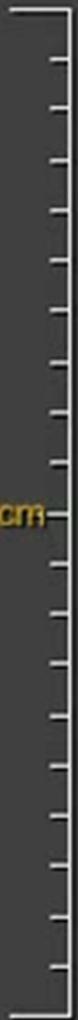
The National Lung Screening Trial Research Team*

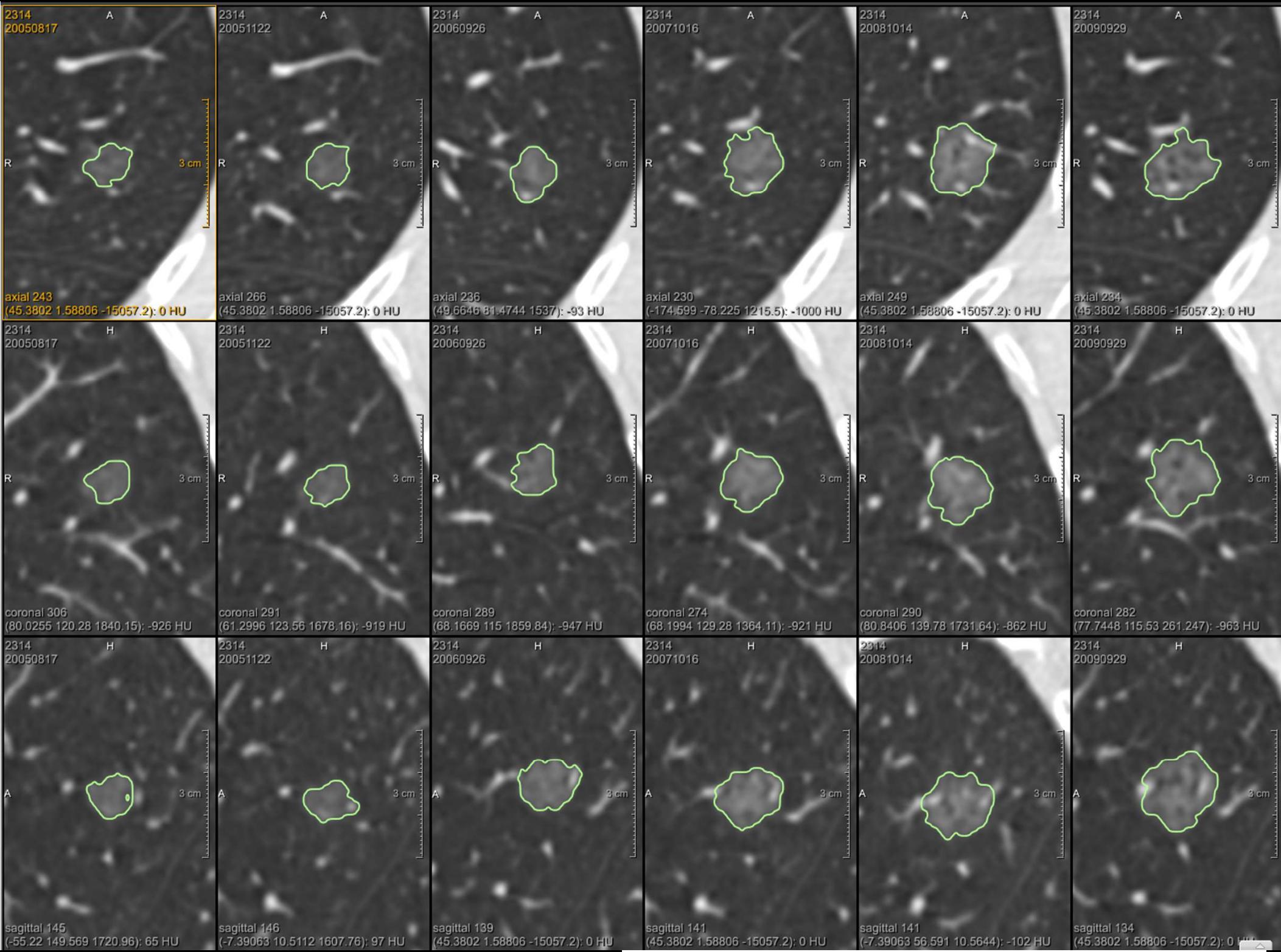
Radboud University Nijmegen



R

20 cm







A large-scale evaluation of automatic pulmonary nodule detection in chest CT using local image features and k-nearest-neighbour classification

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ABSTRACT

A scheme for the automatic detection of nodules in thoracic computed tomography scans is presented and extensively evaluated. The algorithm uses the local image features of shape index and curvedness in order to detect candidate structures in the lung volume and applies two successive k-nearest-neighbour classifiers in the reduction of false-positives.

The nodule detection system is trained and tested on three databases extracted from a large-scale experimental screening study. The databases are constructed in order to evaluate the algorithm on both randomly chosen screening data as well as data containing higher proportions of nodules requiring follow-up. The system results are extensively evaluated including performance measurements on specific nodule types and sizes within the databases and on lesions which later proved to be malignant. In a random selection of 813 scans from the screening study a sensitivity of 80% with an average 4.2 false-positives per scan is achieved. The detection results presented are a realistic measure of a CAD system performance in a low-dose screening study which includes a diverse array of nodules of many varying sizes, types and textures.

www.grand-challenge.org

The image shows a desktop with multiple browser windows open, each displaying a different medical image segmentation challenge from the website www.grand-challenge.org. The challenges include:

- Grand Challenges in Medical Image Analysis:** Home page.
- All Challenges:** Overview of all challenges, subdivided into Upcoming, Active, and Past categories.
- Active Challenges:** A grid of 15 challenges:
 - MICCAI 2012 Grand Challenge: Website: http://www.grand-challenge.org/index.php/All_Challenges, Event: MICCAI, Number of submissions: 13.
 - Prostate MR Image Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/MICCAI_2012_Grand_Challenge, Event: MICCAI, Latest result: June 2012.
 - NIBAD'12: Atropine challenge to assess segmentation of the brain: Website: http://www.grand-challenge.org/index.php/Active_Challenges/NIBAD_12, Event: MICCAI, Number of submissions: 10.
 - RV Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/RV_Segmentation, Event: MICCAI, Latest result: June 2012.
 - EXACT09: Evaluation of segmentation methods for cardiac CT angiography: Website: http://www.grand-challenge.org/index.php/Active_Challenges/EXACT09, Event: MICCAI, Number of submissions: 10.
 - SK10: Segmentation of the brain and spinal cord: Website: http://www.grand-challenge.org/index.php/Active_Challenges/SK10, Event: MICCAI, Number of submissions: 10.
 - Vessel Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/Vessel_Segmentation, Event: ISBI, Number of submissions: 10.
 - Coronary Artery Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/Coronary_Artery_Segmentation, Event: MICCAI, Number of submissions: 10.
 - Cardiac Data Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/Cardiac_Data_Segmentation, Event: ISBI, Number of submissions: 10.
 - The Carotid Artery Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/The_Carotid_Artery_Segmentation, Event: MICCAI, Number of submissions: 10.
 - Empire10: Evaluation of segmentation methods for abdominal CT angiography: Website: http://www.grand-challenge.org/index.php/Active_Challenges/EMPIRE10, Event: MICCAI, Number of submissions: 10.
 - MS Lesion Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/MS_Lesion_Segmentation, Event: MICCAI, Number of submissions: 10.
 - Cardiac Deformation Segmentation: Website: http://www.grand-challenge.org/index.php/Active_Challenges/Cardiac_Deformation_Segmentation, Event: ISBI, Number of submissions: 10.
- Past Challenges:** A grid of 15 challenges:
 - STACOM 2011 – Motion Tracking: Website: http://www.grand-challenge.org/index.php/Past_Challenges/STACOM_2011_Motion_Tracking, Event: MICCAI 2011, Number of submissions: 6.
 - STACOM 2011 – EP Simulation: Website: http://www.grand-challenge.org/index.php/Past_Challenges/STACOM_2011_EP_Simulation, Event: MICCAI 2011, Number of submissions: 6.
 - The STACOM 2011 – 4D LV: Website: http://www.grand-challenge.org/index.php/Past_Challenges/The_STACOM_2011_4D_LV, Event: MICCAI 2011, Number of submissions: 6.
 - DTI Tractography Challenge: Website: http://www.grand-challenge.org/index.php/Past_Challenges/DTI_Tractography_Challenge, Event: MICCAI 2011, Number of submissions: 9.
 - VOLCANO'09: Vessel Segmentation: Website: http://www.grand-challenge.org/index.php/Past_Challenges/VOLCANO_09, Event: MICCAI 2011, Number of submissions: 9.
 - Head & Neck Auto-segmentation of the Parotid Glands: Website: http://www.grand-challenge.org/index.php/Past_Challenges/Head_Neck_Auto-segmentation_Parotid_Glands, Event: MICCAI 2010, Overview article: <http://www.dgijnmegen.nl/volcano/>, Number of submissions: 6.
 - Head & Neck Auto-segmentation Challenge 2010: Segmentation of the Mandible and Brainstem: Website: http://www.grand-challenge.org/index.php/Past_Challenges/Head_Neck_Auto-segmentation_Challenge_2010, Event: MICCAI 2009, Overview article: <http://www.insight-journal.org/browse/journal/>, Number of submissions: 4.
 - Cardiac MR Left Ventricle Segmentation Challenge: Website: http://www.grand-challenge.org/index.php/Past_Challenges/Cardiac_MR_Left_Ventricle_Segmentation_Challenge, Event: MICCAI 2008, Number of submissions: 10.
 - CAUSE07: Caudate Segmentation: Website: http://www.grand-challenge.org/index.php/Past_Challenges/CAUSE07, Event: MICCAI 2007, Number of submissions: 23, Latest result: June 2007.
 - ROC: Retinopathy of prematurity Segmentation: Website: http://www.grand-challenge.org/index.php/Past_Challenges/ROC, Event: SPIE Medical Imaging 2009, Overview article: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2734826/>, Number of submissions: 10.
 - 3D Liver Tumor Segmentation Challenge 2008: Website: http://www.grand-challenge.org/index.php/Past_Challenges/3D_Liver_Tumor_Segmentation_Challenge_2008, Event: MICCAI 2008, Number of submissions: 10.
 - 2009 Prostate Segmentation: Website: http://www.grand-challenge.org/index.php/Past_Challenges/2009_Prostate_Segmentation, Event: MICCAI 2009, Number of submissions: 23, Latest result: June 2009.

anode09.isi.uu.nl

All Challenges - Grand Ch All Challenges - Grand Ch

Home Why Challenges? All Challenges Contr

ANODE09

Home Details Results Register Download Submit

Automatic Nodule Detection 2009

Computer-aided detection (CAD) of nodules in chest computed tomography (CT) scans has attracted massive interest in the last eight years. There are now multiple commercial systems on the market and a large number of papers have been published that describe systems developed in academia. ANODE09 is an initiative to compare systems that perform automatic detection of pulmonary nodules in chest CT scans on a single common database, with a single evaluation protocol. Data is provided by the **Nelson study**, the largest CT lung cancer screening trial in Europe. Any team, whether from academia or industry, can join.

How does it work?

On this website, teams can **register** to participate in the study. After registration, they can **download** an example dataset of 5 annotated scans and a test set of 50 scans without annotations. Results of CAD systems on those test scans, consisting of a list of locations in the scans and a degree of suspicion that this location is a nodule, can be **submitted**. The submitted results will be processed and immediately published on-line on the **results** page.

A special session devoted to the ANODE09 study was held at the 2009 CAD Conference of **SPIE Medical Imaging** and a joint paper with the first results of the study has been accepted by **Medical Image Analysis**:

B. van Ginneken, S.G. Armato, B. de Hoop, S. van de Vorst, T. Duindam, M. Niemeijer, K. Murphy, A.M.R. Schilham, A. Retico, M.E. Fantacci, N. Camarlinghi, F. Bagagli, I. Gori, T. Hara, H. Fujita, G. Gargano, R. Bellotti, F.D. Carlo, R. Megna, S. Tangaro, L. Bolanos, P. Cerello, S.C. Cheran, E.L. Torres and M. Prokop. "Comparing and combining algorithms for computer-aided detection of pulmonary nodules in computed tomography scans: the ANODE09 study", *Medical Image Analysis* 2010.

The paper can be downloaded on the Medical Image Analysis web site by **following this link**. If you have no access to this journal, you can request a reprint by **following this link**.

ANODE09 is currently open for new submissions. To read more about ANODE09, go to the page that has all the **details**.

Head & Neck Airway Segmentation Challenge and Brainstem Event: MICCAI 2011 Overview article http://www.insight-journal.org/browsing Number of submissions: 6

2011 - Motion Trajectory lab2.upf.edu/stac...om_content&#39;ICCIAI 2011

2011 - EP Simulation lab2.upf.edu/stac...om_content&#39;ICCIAI 2011

COM 2011 - 4D LV www.cardiacatlas.o...ICCIAI 2011

tography Challenge http://www.na...Niki/index.php/Eve...ICCIAI 2011 Number of submissions: 9

VOLCANO'09: V Website: http://smail.sri...Event: MICCAI Overview article journal.org/Wiki/Number of submissions: 9

Leek Auto-segmentation of Glands lab2.upf.edu/stac...om_content&#39;ICCIAI 2010 Number of submissions: 6

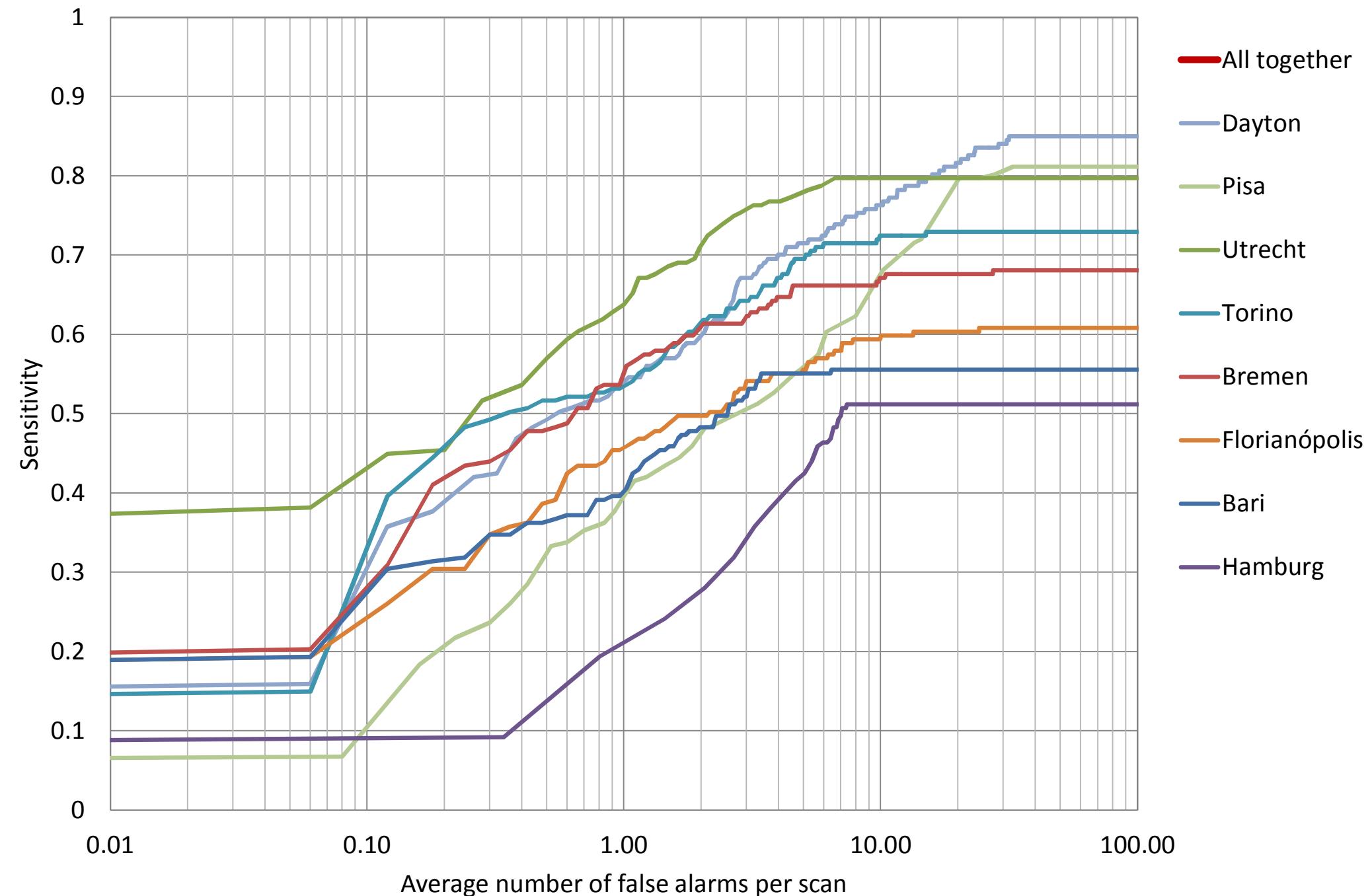
Leek Auto-segmentation of the Mandibular Gland lab2.upf.edu/stac...om_content&#39;ICCIAI 2009 Number of submissions: 4

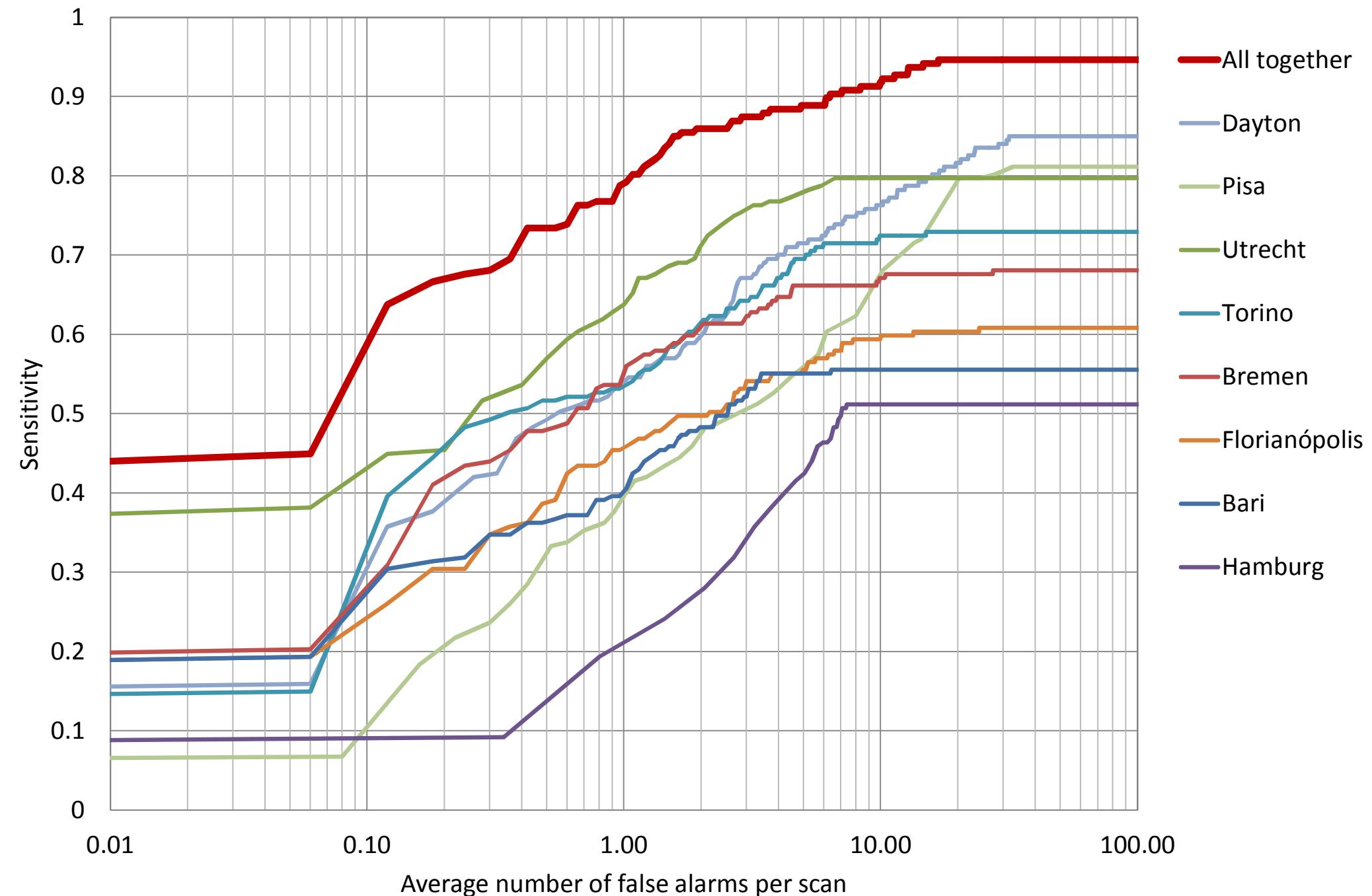
MR Left Ventricle Segmentation nial.sri.utoronto.ca/ICCIAI 2009 Number of submissions: 10

CAUSE07: Caudate Segmentation 2007 Event: MICCAI 2007 Number of submissions: 23, Latest

Luidspeakers: 83%

2:00 PM 1/6/2013





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