Xiaosong Wang, PhD

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EMPLOYMENT

Jul. 2015 – present	**Visiting Fellow** *CAD Lab, National Institutes of Health Clinical Center, Bethesda, USA* - Build large-scale medical image dataset via data mining and NLP - Develop deep learning based algorithms for medical image analysis and CAD
Dec. 2013 – Jun. 2015	**Product Manager Post-processing Workstations** *HSW BU, Shanghai United Imaging Healthcare, Shanghai, CHINA* - Lead a product definition and upstream marketing team (product managers/owners) for mutli-modality post-processing workstations - Plan road-maps of advanced post-processing workstations for medical images. Analyze and prototype clinical requirements from clients - Lead clinical collaboration with radiology departments in top-grade hospitals - Manage product, project and human resource (CT/MR/PET/Mammo advanced workstations, group of product managers/specialists) - Design and practice validation and clinical trial of advanced applications to obtain CFDA approval
Sep. 2011 – Nov. 2013	**CAD Dept. Manager / Tech Lead / Algorithm Engineer** *HSW BU, Shanghai United Imaging Healthcare, Shanghai, CHINA* - Lead algorithm R&D in CADe / CADx and many other post-processing applications in medical images (more details in R&D PROJECTS section). - Manage project and human resource (group of algorithm engineers) - Design and practice validation and evaluation of advanced applications in clinical settings

EDUCATION

Oct. 2006 – Sep. 2011	UNIVERSITY OF BRISTOL, Bristol UK	Ph.D in Computer Vision
Oct. 2005 – Sep. 2006	UNIVERSITY OF BRISTL, Bristol UK	M.Sc in Computer Science
Sep. 2001 – Jun. 2005	HARBIN INSTITUTE OF TECHNOLOGY, Harbin CHINA	B.Sc in Computational Mathematics

R&D PROJECTS

- **Weakly-Supervised Classification and Localization of Common Thorax Diseases (2016-2017)**
  Construct a new chest X-ray database, namely ''ChestX-ray8'', which comprises 108,948 frontal-view X-ray images of 32,717 unique patients with the text-mined eight disease image labels (where each image can have multi-labels), from the associated radiological reports using natural language processing. Demonstrate that these commonly occurring thoracic diseases can be detected and even spatially-located via a unified weakly-supervised multi-label image classification and disease localization framework.
- **Lymph Node Segmentation (2016)** Develop a novel approach to segment lymph nodes by combining holistically nested neural networks and structured optimization (i.e. dense CRF, graph cuts, and a newly proposed matrix global optimization).
- **Unsupervised Image Category Discovery (2015-2016)** Develop a generic method using looped image representation learning and clustering to enable auto-annotation and category discovery from a large-scale image database.
- **Clinical Validation of post-processing applications (2012 - 2015)** Design and develop methods for validating the post-processing workstation produced in HSW BU, e.g. blinded validation in clinical studies, internal quantitative evaluation of the accuracy of algorithms. Workstations cross all modality are certificated by CFDA.

- **MR Breast CAD (2012-2013)** Develop a CADx module for MR breast Mass, including an interactive mass segmentation tool and mass kinetic analysis tools.
- **CT Lung Nodule CAD (2012-2013)** Develop a CADe module for automatic CT lung Nodule detection, involving nodule enhancement, nodule segmentation, feature calculation / selection, LDA based nodule classification, for both solid and GGO nodules.
- **CT Colonoscopy (2012-2013)** Develop a tool for processing CT colonoscopy images, involving colon segmentation, cleansing, central line extraction, polyp segmentation, feature calculation/extraction, SVM based polyp classification
- **FFDM Mass/Calcification CAD (2013)** Develop a tool for automatic detection of mass and calcification in FFDM, involving breast segmentation, pectoralis removal, background suppression, mass/calcification segmentation, feature calculation/selection, LDA based mass/calcification classification
- **MI Cardiac Perfusion (2013)** Develop a tool for processing PET/SPECT Cardiac Perfusion images, involving SA view reconstruction, LV segmentation, Bull's eye polar map calculation.
- **Resting-state fMRI (2013)** Develop a tool for processing resting-state fMRI data with ICA and seeded region based analysis methods. Collaboration with Shanghai Xuhui District Hospital in a clinical migraine study (data mining the relationship between migraine and fMRI resting-state components)
- **DBT / CBCT / Synthesis 2D Image Reconstruction (2013)** Develop FBP and iterative algorithms for DBT/CBCT tomography reconstruction from projection data, including FBP, BPF, MLEM, etc.
- **CT Liver Perfusion (2012)** Develop a method for processing CT liver perfusion data, involving artery localization, bone removal, dual-input single-compartment modeling (kinetic analysis), computing functional maps.
- **MR BOLD (2012)** C++ implementation of SPM and an inline version for real-time scan controlling.
- **MR Auto-Windowing (2011)** Develop an automatic windowing method for MR images, involving feature calculation, SOM/adaptive k-means classification, RBF windowing training, online training.
- **Automatic Archive Film Restoration (2006-2011)** Develop a unified framework for automatic archive film restoration, which is composed of three parts, i.e. defect detection, false alarm elimination and defect removal. First, we propose a novel probabilistic approach to detect defects in digitized archive film, by combining temporal and spatial information across a number of frames. A two-stage false alarm elimination process is then applied on the resulting defect maps, comprising MRF modelling and localized feature tracking. Given the resulting defect maps, restoration is performed for defects and missing regions in archive films. The proposed statistical framework is based on random walks to examine the spatiotemporal path of a degraded pixel, and uses texture features in addition to intensity and motion information traditionally used in previous restoration works.
- **A SIFT Tool (2006)** The aim of this project is to produce a fully comprehensive software library which implements previous work by David G. Lowe on the subject of the Scale Invariant Feature Transform (SIFT). The SIFT library is critically evaluated and demonstrated by using images under different transformations and an object recognition system.

DISTINCTIONS

Nov. 2016	RSNA 2016 Fellow Research Award
Aug. 2016	NIH Fellows Award for Research Excellence (FARE)
Sep. 2010	ECCV Student Travel Award
Sep. 2009	Best Industrial Paper Prize, BMVC 2009
Oct. 2006 – Sep. 2009	Great Western Research PhD scholarship, UK
Sep. 2006	Msc thesis with Distinction (top 5%)
Jul. 2005	Bsc thesis with Distinction (100 among over 5600 graduates)

SERVICES

Reviewer	Pattern Recognition, Medial Image Analysis, IEEE Transactions on Biomedical Engineering, Journal of Biomedical Informatics, IET Computer Vision, IEEE Transactions on Medical Imaging, Neurocomputing, Knowledge-Based Systems, Pattern Analysis and Application
Chief Judge	Informatics / Computational Biology section, NIH Fellows Award for Research Excellence Competition 2018
Lead Judge	Poster competition for NIH Postbac Poster Day 2017, 13th Annual Graduate Student Research Symposium

PEER-REVIEWED PUBLICATIONS

[9] **X. Wang**, Y. Peng, L. Lu, Z. Lu, M. Bagheri, R. Summers. ChestX-ray8: Hospital-scale Chest X-ray Database and Benchmarks on Weakly-Supervised Classification and Localization of Common Thorax Diseases. IEEE CVPR, 2017 (spotlight)

[8] Y. Tsehay, N. Lay, **X. Wang**, B. Turkbey, J. T. Kwak, P. Choyke, P. Pinto, B. Wood, R. Summers. Biopsy-guided Learning with Deep Convolutional Neural Networks for Prostate Cancer Detection on Multiparametric MRI. IEEE ISBI, 2017

[7] **X. Wang**, L. Lu, H. Shin, L. Kim, M. Bagheri, I. Nogues, J. Yao, R. M. Summers. Unsupervised Joint Mining of Deep Features and Image Labels for Large-scale Radiology Image Annotation and Scene Recognition. IEEE WACV, 2017

[6] Y. Tsehay, N. Lay, H. Roth, **X. Wang**, J. T. Kwak, B. Turkbey, P. Pinto, B. Wood, R. Summers. Convolutional neural network based deep-learning architecture for prostate cancer detection on multiparametric magnetic resonance images. SPIE Medical Imaging, 2017

[5] I. Nogues, L. Lu, **X. Wang**, H. Roth, G. Bertasius, N. Lay, J. Shi, Y. Tsehay, R. M. Summers. Automatic Lymph Node Cluster Segmentation using Holistically-Nested Networks and Structured Optimization. MICCAI, 2016

[4] **X. Wang** and M. Mirmehdi. Archive Film Defect Detection and Removal: an Automatic Restoration Framework. IEEE Transactions on Imaging Processing (T-IP 2012), 21(8):3757-3769, March 2012.

[3] **X. Wang** and M. Mirmehdi. Archive Film Restoration based on Spatiotemporal Random Walks. In Proceedings of the 11th European Conference on Computer Vision (ECCV 2010), September 2010.

[2] **X. Wang** and M. Mirmehdi. HMM based Archive Film Defect Detection with Spatial and Temporal constraints. In Proceedings of the 20th British Machine Vision Conference (BMVC 2009), **Winner of the Best Industrial Paper Prize**, September 2009.

[1] **X. Wang** and M. Mirmehdi. Archive Film Defect Detection based on a Hidden Markov Model. In Proceedings of the 10th International Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS 2009), May 2009.

ABSTRACTS

[4] Xiaosong Wang, Ke Yan, Le Lu, Ronald Summers, "DETECTION OF RADIOLOGY IMAGE FINDINGS USING LARGE-SCALE CLINICAL LESION ANNOTATIONS", RSNA 2017.

[3] Y. Peng, **X. Wang**, L. Lu, M. Bagheri, R.Summers, Z. Lu: DeepText Mining Radiology Reports for Deep Learning Radiology Images. American Medical Informatics Association (AMIA) Annual Symposium (Oral), Nov. 2017

[2] I. Nogues, L. Lu, **X. Wang**, H. Roth, G. Bertasius, N. Lay, J. Shi, Y. Tsehay, R. M. Summers: Automatic Lymph Node Cluster Segmentation Using Holistically-Nested Deep Convolutional Neural Networks and Structured Optimization in CT Images. RSNA 2016

[1] **X. Wang**, L. Lu, H. Shin, L. Kim, I. Nogues, J. Yao, R. M. Summers: Automated Annotation of a Large Scale Radiology Image Database Using Deep Learning. RSNA 2016, **Winner of RSNA Fellow Research Award**, **Best paper in Imaging Informatics section**

PATENTS

[11] **X. Wang**, K. Yan, L. Lu, R. M. Summers: Detection of Radiology Image Findings Using Large-scale Clinical Lesion Annotations. U.S. Patent Application No. 62/514,223, 2017

[10] **X. Wang**, Y. Peng, L. Lu, Z. Lu, R. M. Summers: ChestX-ray8: Hospital-scale Chest X-ray Database and Benchmarks on Weakly-Supervised Classification and Localization of Common Thorax Diseases. U.S. Patent Application No. 62/476,029, 2017

[9] L. Lu, **X. Wang**, R. M. Summers: Category Discovery and Image Auto-annotation via looped Deep Pseudo-task Optimization. US Patent Application, 62/302,096, 2016

[8] L. Lu, H. Roth, I. Nogues, R. M. Summers, **X. Wang**: Integrating Deep Boundary and Appearance Convolutional Neural Networks for Bottom-up Organ Segmentation. US Patent Application, 62/345,606, 2016

[7] L. Wang, **X. Wang**: Heart model building method, heart model registration and heart multi-plane reconstruction method. CN103839249A, 2014

[6] H. Li, H. Shi, **X. Wang**: Pectoralis segmentation method in breast image. CN104182965B, 2014

[5] H. Li, **X. Wang**: Region real-time segmentation method for medical image. CN104299217A, 2013

[4] Z. Chen, **X. Wang**, C. Qiu: Image processing method and image processing device. CN104462149A, 2013

[3] **X. Wang**: Simulation method and quantitative test method of liver perfusion. CN103902801A, 2012

[2] **X. Wang**: CT liver-perfusion image post-processing method and CT liver-perfusion method. CN103839249B, 2012

[1] Y. Fei, **X. Wang**, C. Li: Automatic window width and window level extraction method based on neural network. CN103310227A, 2012