Xiang Li

Date Prepared: September 20th, 2019

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Place of Birth: China

Education:

09/02-09/06	B.E.	Automation	Shanghai Jiaotong University
09/09-06/16	PhD	Computer Science, Distinguished Prof. Tianming Liu	University of Georgia

Working as Research Assistant at Nankai University, China from 09/06 to 09/09.

Postdoctoral Training:

09/16-07/19	Research Fellow	Medical Image Analysis, Assoc. Prof. Quanzheng Li and Distinguished Prof. James H. Thrall	Harvard Medical School and Massachusetts General Hospital

Faculty Academic Appointments:

08/19-	Instructor	Radiology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions:

08/19-	Instructor	Radiology	Massachusetts General Hospital

Committee Service:

International:

2019-	Program Chair	MICCAI Workshop on Multiscale Multimodal Medical Imaging (MMMI)
2019-	Program Committee	NeurIPS Workshop on Machine Learning in Computational Biology
2019-	Program Committee	ACM SIGKDD Workshop on Mining and Learning from Time Series (MILETS)
2015	Program Committee	MICCAI Workshop on Machine Learning in Medical Imaging (MLMI)

Professional Societies:

2017-	American Roentgen Ray Society (ARRS)	Member
2011-	Institute of Electrical and Electronics Engineers (IEEE)	Member
2011-	Engineering in Medicine and Biology Society (EMBS)	Member
2011-	The Medical Image Computing and Computer Assisted Intervention Society	Member

Updated March 2019

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(MICCAI)

Editorial Activities:

Ad hoc Reviewer
Array
BMC Bioinformatics
Computer Methods and Programs in Biomedicine
Computer Methods in Biomechanics and Biomedical Engineering
Frontiers in Computational Neuroscience
Frontiers in Genetics
Frontiers in Human Neuroscience
Frontiers in Neural Circuits
Frontiers in Neuroscience
Human Molecular Genetics
IEEE/ACM Transactions on Computational Biology and Bioinformatics
IEEE Access
IEEE Transactions on Affective Computing
IEEE Transactions on Biomedical Engineering
IEEE Transactions on Cognitive and Developmental Systems
IEEE Transactions on Fuzzy Systems
IEEE Transactions on Medical Imaging
International Conference on Machine Learning
Neurocomputing
Neuroimage
Pattern Recognition
Physical Communication
Progress in Neurobiology

Other Editorial Roles

2018-	Editorial Board	Journal of Healthcare Engineering

Honors and Prizes:

2016	Outstanding Graduate Dissertation/Thesis	University of Georgia	Thesis

Report of Regional, National and International Invited Teaching and Presentations

National

2018	Deep Learning Algorithm for rapid automatic detection of pneumothorax on chest CT (selected oral abstract) Annual Meeting of American Roentgen Ray Society, Washington, D.C.

International

2019	Holistic Brain Representation for Discovery Science in Neuroimaging (invited talk) Workshop on Computational Medical Imaging and Artificial Intelligence, Hangzhou, China
2019	Automated Segmentation of Cervical Nuclei in Pap Smear Images using Deformable Multi-path Ensemble Model (selected oral full-length paper) IEEE International Symposium on Biomedical Imaging, Venice, Italy
2016	Big Data Strategies on Neuroimaging Analysis: Challenge in Data Availability and Computation (invited talk) International Conference on Brain Informatics and Health, Omaha, NE
2014	Dynamic network partition via Bayesian connectivity bi-partition change point model (selected oral full-length paper)

2013   Discovering common functional connectomics signatures (selected oral full-length paper)
         IEEE International Symposium on Biomedical Imaging, San Francisco, CA
2011   Brain state change detection via fiber-centered functional connectivity analysis (selected oral full-length paper)
         IEEE International Symposium on Biomedical Imaging, Chicago, IL

Report of Technological and Other Scientific Innovations

Automatic pre-screening method for pneumothorax detection	At MGH, I developed a software system for the automatic detection of pneumothorax from CT images. The system has been validated internally by multiple radiologists. The innovation is filed as Invention Disclosure to Partners HealthCare in 2017.

Report of Scholarship

Peer-Reviewed Scholarship in print or other media:

1. **Li X**, Thrall JH, Digumarthy SR, Kalra MK, Pandharipande PV, Zhang B, Nitiwarangkul C, Singh R, Khera RD, Li Q. Deep learning-enabled system for rapid pneumothorax screening on chest CT. European Journal of Radiology 2019;120:108692.
2. Zhao Y*, **Li X***, Huang H, Zhang W, Zhao S, Makkie M, Zhang M, Li Q, Liu T. 4D Modeling of fMRI Data via Spatio-Temporal Convolutional Neural Networks (ST-CNN). IEEE Transactions on Cognitive and Developmental Systems. 2019:1-1.
3. Wang H, Xie K, Xie L, **Li X**, Li M, Lyu C, Chen H, Chen Y, Liu X, Tsien J, Liu T. Functional Brain Connectivity Revealed by Sparse Coding of Large-Scale Local Field Potential Dynamics. Brain Topography. 2019;32(2):255-70.
4. **Li X**, Guo N, Li Q. Functional Neuroimaging in the New Era of Big Data. Genomics Proteomics and Bioinformatics. 2019 in press.
5. Guo Z*, **Li X***, Huang H, Guo N, Li Q. Deep Learning-based Image Segmentation on Multi-modal Medical Imaging. IEEE Transactions on Radiation and Plasma Medical Sciences. 2019;3(2):162-69.
6. Zhang W, Lv J, **Li X**, Zhu D, Jiang X, Zhang S, Zhao Y, Guo L, Ye J, Hu D, Liu T. Experimental Comparisons of Sparse Dictionary Learning and Independent Component Analysis for Brain Network Inference from fMRI Data. IEEE Transactions on Biomedical Engineering. 2018;66(1):289-99.
7. Thrall JH, **Li X**, Li Q, Cruz C, Do S, Dreyer K, Brink J. Artificial Intelligence and Machine Learning in Radiology: Opportunities, Challenges, Pitfalls, and Criteria for Success. Journal of the American College of Radiology. 2018;15(3):504-8.
8. Makkie M*, **Li X***, Quinn S, Lin B, Ye J, Mon G, Liu T. A Distributed Computing Platform for fMRI Big Data Analytics. IEEE Transactions on Big Data. 2018;5(2):109-119.
9. Ge B, **Li X**, Jiang X, Sun Y, Liu T. A Dictionary Learning Approach for Signal Sampling in Task-based fMRI for Reduction of Big Data. Frontiers in Neuroinformatics. 2018;12:17.
10. Yuan J, **Li X**, Zhang J, Luo L, Dong Q, Lv J, Zhao Y, Jiang X, Zhang S, Zhang W, Liu T. Spatio-temporal modeling of connectome-scale brain network interactions via time-evolving graphs. NeuroImage. 2017;180:350-369.
11. Li Y, Chen H, Jiang X, **Li X**, Lv J, Peng H, Tsien JZ, Liu T. Discover mouse gene coexpression landscapes using dictionary learning and sparse coding. Brain Struct Funct. 2017;222(9):4253-70.
12. Li Y, Chen H, Jiang X, **Li X**, Lv J, Li M, Peng H, Tsien JZ, Liu T. Transcriptome Architecture of Adult Mouse Brain Revealed by Sparse Coding of Genome-Wide In Situ Hybridization Images. Neuroinformatics. 2017;15(3):285-95.
13. Jiang X, **Li X**, Lv J, Zhao S, Zhang S, Zhang W, Zhang T, Han J, Guo L, Liu T. Temporal dynamics assessment of spatial overlap pattern of functional brain networks reveals novel functional architecture of cerebral cortex. IEEE Transactions on Biomedical Engineering. 2016;65(6):1183-92.
14. Zhang S*, **Li X***, Lv J, Jiang X, Guo L, Liu T. Characterizing and differentiating task-based and

resting state fMRI signals via two-stage sparse representations. Brain Imaging and Behavior. 2016;10(1):21-32.

15. Hou Y, Xiao T, Zhang S, Jiang X, **Li X**, Hu X, Han J, Guo L, Miller LS, Neupert R, Liu T. Predicting Movie Trailer Viewer's "Like/Dislike" via Learned Shot Editing Patterns. IEEE Transactions on Affective Computing. 2016;7(1):29-44.

16. Ou J, Xie L, **Li X**, Zhu D, Terry DP, Puente AN, Jiang R, Chen Y, Wang L, Shen D, Zhang J, Miller LS, Liu T. Atomic connectomics signatures for characterization and differentiation of mild cognitive impairment. Brain Imaging and Behavior. 2015;9(4):663-77.

17. Ou J, Xie L, Jin C, **Li X**, Zhu D, Jiang R, Chen Y, Zhang J, Li L, Liu T. Characterizing and differentiating brain state dynamics via hidden Markov models. Brain Topography. 2015;28(5):666-79.

18. Makkie M, Zhao S, Jiang X, Lv J, Zhao Y, Ge B, **Li X**, Han J, Liu T. HAFNI-enabled largescale platform for neuroimaging informatics (HELPNI). Brain Informatics. 2015;2(4):225-38.

19. Lv J, Jiang X, **Li X**, Zhu D, Zhao S, Zhang T, Hu X, Han J, Guo L, Li Z. Coles C, Hu X, Liu T. Assessing effects of prenatal alcohol exposure using group-wise sparse representation of fMRI data. Psychiatry Research: Neuroimaging. 2015;233(2):254-68.

20. Lv J*, Jiang X*, **Li X***, Zhu D, Zhang S, Zhao S, Chen H, Zhang T, Hu X, Han J. Ye J, Guo L, Liu T. Holistic atlases of functional networks and interactions reveal reciprocal organizational architecture of cortical function. IEEE Transactions on Biomedical Engineering. 2015;62(4):1120-31.

21. Lv J*, Jiang X*, **Li X***, Zhu D, Chen H, Zhang T, Zhang S, Hu X, Han J, Huang H, Zhang J, Guo L, Liu T. Sparse representation of whole-brain fMRI signals for identification of functional networks. Medical image analysis. 2015;20(1):112-34.

22. Jiang X, **Li X**, Lv J, Zhang T, Zhang S, Guo L, Liu T. Sparse representation of HCP grayordinate data reveals novel functional architecture of cerebral cortex. Human brain mapping. 2015;36(12):5301-19.

23. Zhang X*, **Li X***, Jin C, Chen H, Li K, Zhu D, Jiang X, Zhang T, Lv J, Hu X, Han J, Zhao Q, Guo L, Liu T. Identifying and characterizing resting state networks in temporally dynamic functional connectomes. Brain Topography. 2014;27(6):747-65.

24. Zhang J*, **Li X***, Li C, Lian Z, Huang X, Zhong G, Zhu D, Li K, Jin C, Hu X, Han J, Guo L, Hu X, Li L, Liu T. Inferring functional interaction and transition patterns via dynamic bayesian variable partition models. Human brain mapping. 2014;35(7):3314-31.

25. Sabatinelli D, Frank D, Wanger T, Dhamala M, Adhikari B, **Li X**. The timing and directional connectivity of human frontoparietal and ventral visual attention networks in emotional scene perception. Neuroscience. 2014;277:229-38.

26. Ou J, Lian Z, Xie L, **Li X**, Wang P, Hao Y, Zhu D, Jiang R, Wang Y, Chen Y, Zhang J, Liu T. Atomic dynamic functional interaction patterns for characterization of ADHD. Human brain mapping. 2014;35(10):5262-78.

27. **Li X**, Zhu D, Jiang X, Jin C, Zhang X, Guo L, Zhang J, Hu X, Li L, Liu T. Dynamic functional connectomics signatures for characterization and differentiation of PTSD patients. Human brain mapping. 2014;35(4):1761-78.

28. Zhang X, Guo L, **Li X**, Zhang T, Zhu D, Li K, Chen H, Lv J, Jin C, Zhao Q, Li L, Liu T. Characterization of task-free and task-performance brain states via functional connectome patterns. Medical image analysis. 2013;17(8):1106-22.

29. **Li X**, Lim C, Li K, Guo L, Liu T. Detecting brain state changes via fiber-centered functional connectivity analysis. Neuroinformatics. 2013;11(2):193-210.

30. Sun J, Hu X, Huang X, Liu Y, Li K, **Li X**, Han J, Guo L, Liu T, Zhang J. Inferring consistent functional interaction patterns from natural stimulus FMRI data. NeuroImage. 2012;61(4):987-99.

Other peer-reviewed scholarship

31. Qiu W*, Guo J*, **Li X***, Xu M, Zhang M, Guo N, Li Q. Multi-label Detection and Classification of Red Blood Cells in Microscopic Images. Machine Learning in Computational Biology (MLCB) 2019.

32. Guo J*, Qiu W*, **Li X***, Zhao X, Guo N, Li Q. Predicting Alzheimer's Disease by Hierarchical Graph Convolution from Positron Emission Tomography Imaging. IEEE BigData Workshop of Deep Graph Learning (DGLMA) 2019.

33. Wu D, Gong K, Kim K, **Li X**, Li Q. Consensus Neural Network for Medical Image Denoising with Only Noisy Training Samples. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2019.
34. Zhao J, Li Q, **Li X**, Li H, Zhang L. Automated Segmentation of Cervical Nuclei in Pap Smear Images using Deformable Multi-path Ensemble Model. IEEE International Symposium on Biomedical Imaging (ISBI) 2019.
35. Zhao X*, **Li X***, Guo N, Zhou Z, Meng X, Li Q. Multi-Size Computer-Aided Diagnosis of Positron Emission Tomography Images Using Graph Convolutional Networks. IEEE International Symposium on Biomedical Imaging (ISBI) 2019.
36. Bao H*, Ren H*, Zhou Z*, **Li X***, Guo N, Li Q. 3D Regional Shape Analysis of Left Ventricle Using MR Images: Abnormal Myocardium Detection and Classification. IEEE International Symposium on Biomedical Imaging (ISBI) 2019.
37. Zhou Z, Guo N, Cui J, Meng X, Hu Y, Bao H, **Li X**, Li Q. Novel Radiomic Features Based on Graph Theory for Pet Image Analysis. IEEE International Symposium on Biomedical Imaging (ISBI) 2019.
38. Ren H, Yu S, **Li X**, Qiu W, Zhong A, Guo N, Li Q. Personalized Treatment for Heart Failure With Preserved Ejection Fraction Using Deep Reinforcement Learning. Annual Meeting of American Heart Association (AHA) 2019.
39. Ren H, Qiu W, Zhong A, Yu S, **Li X**, Guo N, Li Q. Recurrent Neural Network Enhance Phenotyping in Heart Failure With Preserved Ejection Fraction Using Electronic Health Record. Annual Meeting of American Heart Association (AHA) 2019.
40. Wang X*, **Li X***, Chen Q, Wu N, Li Q. Transition Patterns between N1 and N2 Stations Discovered from Data-driven Lymphatic Metastasis Study in Non-Small Cell Lung Cancer. World Conference on Lung Cancer (WCLC) 2019.
41. Zhang M*, **Li X***, Xu M, Li Q. Image Segmentation and Classification for Sickle Cell Disease using Deformable U-Net. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2018.
42. Zhao Y*, **Li X***, Zhang W, Zhao S, Makkie M, Zhang M, Li Q, Liu T. Modeling 4D fMRI Data via Spatio-Temporal Convolutional Neural Networks (ST-CNN). International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2018.
43. Liu J*, **Li X***, Ren H*, Li Q. Multi-Estimator Full Left Ventricle Quantification through Ensemble Learning. Workshop on Statistical Atlases and Computational Modelling of the Heart (STACOM) 2018.
44. Guo Z*, **Li X***, Huang H, Quo N, Li Q, Medical image segmentation based on multi-modal convolutional neural network: Study on image fusion schemes. IEEE International Symposium on Biomedical Imaging (ISBI) 2018.
45. Zhao Y*, **Li X***, Makkie M, Quinn S, Lin B, Ye J, Liu T, Template-guided Functional Network Identification via Supervised Dictionary Learning. IEEE International Symposium on Biomedical Imaging (ISBI) 2017.
46. Zhang S*, **Li X***, Guo L, Liu T, Exploring human brain activation via nested sparse coding and functional operators. IEEE International Symposium on Biomedical Imaging (ISBI) 2017.
47. Farhadi H, Xiang Y, Jeong S, **Li X**, Guo N, Sepulcre J, Tarokh V, Li Q. Inferring the causality network of Abeta and Tau accumulation in the aging brain: a statistical inference approach. Annual Meeting of Society of Nuclear Medicine and Molecular Imaging (SNMMI) 2017.
48. **Li X**, Zhong A, Lin M, Guo N, Sun M, Sitek A, Ye J, Thrall J, Li Q, Self-paced Convolutional Neural Network for Computer Aided Detection in Medical Imaging Analysis. International Workshop on Machine Learning in Medical Imaging (MLMI) 2017.
49. Jeong S*, **Li X***, Yang J, Li Q, Tarokh V. Dictionary Learning and Sparse Coding-based Denoising for High-Resolution Task Functional Connectivity MRI Analysis. (MLMI) 2017.
50. Makkie M*, **Li X***, Liu T, Quinn S, Lin B, Ye J. Distributed rank-1 dictionary learning: Towards fast and scalable solutions for fMRI big data analytics. IEEE International Conference on Big Data (Big Data) 2016.
51. Mon G, Makkie M, **Li X**, Liu T, Quinn S. Implementing dictionary learning in Apache Flink. IEEE International Conference on Big Data (Big Data) 2016.
52. **Li X**, Makkie M, Lin B, Fazli MS, Davidson I, Ye J, Liu T, Quinn S. Scalable Fast Rank-1 Dictionary

Learning for fMRI Big Data Analysis. ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) 2016.

53. **Li X**, Lin B, Lv J, Ye J, Liu T. Modeling functional network dynamics via multi-scale dictionary learning and network continuums. IEEE International Symposium on Biomedical Imaging (ISBI) 2016.
54. **Li X**, Dong Q, Jiang X, Lv J, Liu T. Multple-demand system identification and characterization via sparse representations of fMRI data. IEEE International Symposium on Biomedical Imaging (ISBI) 2016.
55. Lyu C, **Li X**, Lv J, Hu X, Han J, Quo L, Liu T. Identifying group-wise consistent sub-networks via spatial sparse representation of natural stimulus FMRI data. IEEE International Symposium on Biomedical Imaging (ISBI) 2016.
56. Jiang X, **Li X**, Lv J, Zhao S, Zhang S, Zhang W, Zhang T, Liu T. Modeling Functional Dynamics of Cortical Gyri and Sulci. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2016.
57. Lian Z, **Li X**, Pan Y, Guo X, Chen L, Chen G, Wei Z, Liu T, Zhang J. Dynamic Bayesian brain network partition and connectivity change point detection. IEEE Computational Advances in Bio and Medical Sciences (ICCABS) 2015.
58. **Li X**, Zhou Z, Keller P, Zeng H, Liu T, Peng H. Interactive exemplar-based segmentation toolkit for biomedical image analysis. IEEE International Symposium on Biomedical Imaging (ISBI) 2015.
59. Ge B, Wang J, Lv J, Zhang S, Zhao S, Zhang W, Zhao Q, **Li X**, Jiang X, Han J, Guo L, Liu T. Signal sampling for efficient sparse representation of resting state FMRI data. IEEE International Symposium on Biomedical Imaging (ISBI) 2015.
60. Zhu D, **Li X**, Liu T. Sparse representation of working memory processes based on fMRI data. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
61. Zhang S, Hu X, Lv J, Zhang T, **Li X**, Jiang X, Guo L, Liu T. Learning fMRI-guided predictor of video shot changes. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
62. Lyu C, Hu X, Han J, Cheng G, **Li X**, Guo L, Liu T. Exploring consistent functional brain networks during free viewing of videos via sparse representation. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
63. Lian Z, Lv J, Xing J, **Li X**, Jiang X, Zhu D, Xu J, Potenza MN, Liu T, Zhang J. Generalized fMRI activation detection via Bayesian magnitude change point model. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
64. Lian Z*, **Li X***, Zhang H, Kuang H, Xie K, Xing J, Zhu D, Tsien JZ, Liu T, Zhang J. Detecting cell assembly interaction patterns via Bayesian based change-point detection and graph inference model. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
65. Lian Z*, **Li X***, Young T, Hao Y, Xing J, Lv J, Jiang X, Zhu D, Liu T, Zhang J. Dynamic network partition via Bayesian connectivity bi-partition change point model. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
66. Lian Z*, **Li X***, Xing J, Lv J, Jiang X, Zhu D, Zhang S, Xu J, Potenza MN, Liu T. Exploring functional brain dynamics via a Bayesian connectivity change point model. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
67. Jiang X, Lv J, Zhu D, Zhang T, **Li X**, Hu X, Guo L, Liu T. Discovering network-level functional interactions from working memory fMRI data. IEEE International Symposium on Biomedical Imaging (ISBI) 2014.
68. Zhu D*, **Li X***, Jiang X*, Chen H, Shen D, Liu T. Exploring high-order functional interactions via structurally-weighted LASSO models. International Conference on Information Processing in Medical Imaging (IPMI) 2013.
69. Xing J, Lv J, Lian Z, **Li X**, Zhu D, Liu T, Zhang J. Group-wise change point detection in task FMRI data by Bayesian methods. International IEEE/EMBS Conference on Neural Engineering (NER) 2013.
70. Ou J, Xie L, Wang P, **Li X**, Zhu D, Jiang R, Wang Y, Chen Y, Zhang J, Liu T. Modeling brain functional dynamics via hidden Markov models. International IEEE/EMBS Conference on Neural Engineering (NER) 2013.
71. Lv J, Jiang X, **Li X**, Zhu D, Chen H, Zhang T, Zhang S, Hu X, Han J, Huang H, Zhang J, Guo L, Liu

T. Identifying functional networks via sparse coding of whole brain FMRI signals. International IEEE/EMBS Conference on Neural Engineering (NER) 2013.

72. **Li X**, Zhu D, Jiang X, Jin C, Guo L, Li L, Liu T. Discovering common functional connectomics signatures. IEEE International Symposium on Biomedical Imaging (ISBI) 2013.

73. Wang P, Zhu D, **Li X**, Chen H, Jiang X, Sun L, Cao Q, An L, Liu T, Wang Y. Identifying functional connectomics abnormality in attention deficit hyperactivity disorder. IEEE International Symposium on Biomedical Imaging (ISBI) 2013.

74. Zhang S, Lv J, **Li X**, Jiang X, Guo L, Liu T. Activated cliques: Network-based activation detection in task-based FMRI. IEEE International Symposium on Biomedical Imaging (ISBI) 2013.

75. Lv P, Guo L, Hu X, **Li X**, Jin C, Han J, Li L, Liu T. Modeling dynamic functional information flows on large-scale brain networks. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2013.

76. Lv J, **Li X**, Zhu D, Jiang X, Zhang X, Hu X, Zhang T, Guo L, Liu T. Sparse representation of group-wise fMRI signals. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2013.

77. Zhang S, **Li X**, Lv J, Jiang X, Zhu D, Chen H, Zhang T, Guo L, Liu T. Sparse representation of higher-order functional interaction patterns in task-based FMRI data. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2013.

78. Zhang X, Guo L, **Li X**, Zhu D, Li K, Sun Z, Jin C, Hu X, Han J, Zhao Q. Characterization of task-free/task-performance brain states. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2012.

79. Lim C*, **Li X***, Li K, Guo L, Liu T. Brain state change detection via fiber-centered functional connectivity analysis. IEEE International Symposium on Biomedical Imaging (ISBI) 2011.

80. **Li X**, Li K, Guo L, Lim C, Liu T. Fiber-centered granger causality analysis. International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI) 2011.

PhD Thesis:

"Machine Learning Approaches towards Holistic Brain Functional Space Discovery from fMRI Big Data"

Narrative Report

As an instructor at MGH/HMS, my research includes on two main fields which are interlinked: 1) development of new machine learning and artificial intelligence methodologies, mainly for the purpose of medical image analysis, and 2) applying these methods for solving practical clinical/scientific problems. With more than 10 years of experience in algorithm development/implementation and a doctoral degree in computer science, I have been working on new tools to support efficient large-scale data analytics, including matrix decomposition under different regularizations, new network architectures for deep learning models and distributed computing platforms. My work presented in 2016 ACM SIGKDD conference, "Scalable Fast Rank-1 Dictionary Learning for fMRI Big Data Analysis", is the first system that performs computation of terabytes-level neuroimaging data without relying on supercomputers. My current work on methodology development focuses on building a unified framework to integrate the analysis across multi-modal, multi-scale and multi-view images, as well as co-analysis of those images in a single model. This framework is particularly useful for medical image analysis, as usually there exists multiple scans of the same patient under different protocols (e.g. modalities, scanning parameters, etc.) and it is often desired for analyzing them together.

From the application perspective, I have been working on the processing and analysis of medical images in two main categories: lung CT and brain MR. By collecting and analyzing CT images >300 patients within the institution, I have developed a deep learning-enabled system for pneumothorax detection (i.e. screening) with high sensitivity and very fast running speed. The system is among the four finalists of the 2018 NVIDIA Global Impact Award, for its potential impact on application of AI in healthcare. Currently I'm working on the alpha testing for the system's integration into the clinical workflow of MGH, as well as extending its applicability to other critical conditions such as pulmonary embolism. On the other hand, analysis of brain MR images especially functional MRI data is a continuation of my PhD research. Being among the first researchers who utilized mathematic models to

characterize brain functional dynamics in both normal and abnormal populations (since 2011), my works on diagnosis of post-traumatic stress disorder (PTSD), attention deficit hyperactivity disorder (ADHD), and mild cognitive impairment (MCI) are the pioneers in this field and inspired many later works. My current project on functional brain modeling involves using dynamic graph representation combined with geometric deep learning to achieve holistic and efficient characterization of functional brain states.