The Faculty of Medicine of Harvard University
Curriculum Vitae

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Place of Birth: China

Education:

09/2006	B.E.	Automation	Shanghai Jiaotong University, China
09/2009	Research Assistant	Data modeling and scientific software platform development	Nankai University, China
06/2016	PhD	Computer Science, Distinguished Prof. Tianming Liu	University of Georgia

Postdoctoral Training:

07/2019	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:

08/2019	Instructor	Radiology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions:

08/2019	Instructor	Radiology	Massachusetts General Hospital

Major Administrative Leadership Positions:

International

2019	Organizer and program chair for the International Workshop on Multiscale Multimodal Medical Imaging	The Medical Image Computing and Computer-Assisted Intervention Society
2021	Organizer and program chair for the International Workshop on Multimodal Learning and Fusion Across Scales for Clinical Decision Support	The Medical Image Computing and Computer-Assisted Intervention Society

Committee Service:

International

2015	Program Committee	MICCAI Workshop on Machine Learning in Medical Imaging (MLMI)
2017	Program Committee	International Conference on Brain Informatics
2018	Program Committee	Machine Learning in Computational Biology
2019	Program Committee	NeurIPS Workshop on Machine Learning in Computational Biology
2019-2022	Program Committee	ACM SIGKDD Workshop on Mining and Learning from Time Series (MILETS)

Professional Societies:

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

Editorial Activities:

- **Ad hoc Reviewer**

Human Brain Mapping

IEEE Transactions on Affective Computing

IEEE Transactions on Biomedical Engineering

IEEE Transactions on Emerging Topics in Computational Intelligence

IEEE Transactions on Fuzzy Systems

IEEE Transactions on Knowledge and Data Engineering

IEEE Transactions on Medical Imaging

IEEE Transactions on Pattern Analysis and Machine Intelligence

JAMA Network Open

Medical Image Analysis

Nature Communications

Neuroimage

Neuroscience

Pattern Recognition

Progress in Neurobiology

- **Other Editorial Roles**

2018-	Editorial Board	Journal of Healthcare Engineering
2019-	Advisory Board	Current Medical Imaging
2021-	Editorial Board	Electronics
2021-	Associate Editor	Frontiers in Computational Neuroscience
2021-	Associate Editor	Frontiers in Oncology
2021-	Associate Editor	Frontiers in Radiology
2021-	Associate Editor	Frontiers in Neuroscience
2022-	Associate Editor	Frontiers in Cardiovascular Medicine
2022-	Associate Editor	Frontiers in Neuroinformatics

Honors and Prizes:

2015	Paul D. Coverdell Neuroimaging Franklin Foundation Scholars Program Travel Award	Department of Psychology, University of Georgia	
2015	Cover and Feature Paper	IEEE Transactions on Biomedical Engineering	"Holistic atlases of functional networks and interactions reveal reciprocal organizational architecture of cortical function"
2016	Outstanding Graduate Dissertation/Thesis	University of Georgia	
2018	Most Cited Articles	Journal of the American College of Radiology	"Artificial Intelligence and Machine Learning in Radiology: Opportunities, Challenges, Pitfalls, and Criteria for Success"
2020	Best Paper Awards	IEEE International Symposium on Biomedical Imaging	"ASCNet: Adaptive-Scale Convolutional Neural Networks for Multi-Scale Feature Learning"

2021	MGH Thrall Innovation Grants Award	Massachusetts General Hospital	
2022	Best Paper Awards	IEEE Transactions on Radiation and Plasma Medical Sciences	"Deep Learning-Based Image Segmentation on Multimodal Medical Imaging"

Report of Funded and Unfunded Projects

Past

08/01/2013-
07/31/2018
"Exploring Functional Interactions between Gyri and Sulci"
National Science Foundation (NSF), Standard Grant #1263524
Graduate student (research assistant) (PI: Tianming Liu)
Investigation of functional architectures of gyri and sulci in human brain, in order to lay down solid foundations for brain disorders studies.

09/01/2013-
05/31/2016
"Assessing Large-scale Brain Connectivities in Mild Cognitive Impairment"
National Institute of Health (NIH), Research Project (R01) #R01AG042599
Graduate student (research assistant) (PI: Tianming Liu)
Establishment of a fine granularity next-generation brain atlas for studying of brain imaging that rely on accurate functional/structural localizations. The atlas is employed to assess large-scale brain network alterations in MCI/AD patients.

11/01/2014-
10/31/2018
"Reciprocal Organizational Architecture of Human Brain Function"
National Science Foundation (NSF), Standard Grant #1439051
Graduate student (research assistant) (PI: Tianming Liu)
Development of novel computational methods to investigate how different brain regions form distinctive networks. The model is used to develop and evaluate a novel theory of reciprocal organizational architecture to explain human brain function.

2016-2018
"Post-Doctoral Scholar in Artificial Intelligence and Image Analysis"
Department of Radiology, Massachusetts General Hospital
Research fellow in training (PI: James Thrall)
Investigation of medical image analysis solutions to address practical challenges in radiology, including overcoming insufficient data samples for deep learning analysis, a fusion of multiple imaging modalities, and developing prescreening protocols to be used in the clinical flow. Training in radiology, especially chest imaging, image analysis, and artificial intelligence.

9/21/2020-
03/01/2021
"Pseudo Chest CT from Chest X-RAY, COVID-19 Workstream"
GE Precision Healthcare, Industrial Grant
Project Leader (PI: Quanzheng Li)
Development of a machine learning model that can generate pseudo-CT from X-rays images to improve diagnosis and management of patients with COVID-19. The model will apply to COVID-19 patients and synthesize chest computed tomography (CT) images from a chest X-ray in COVID-19.

Current

06/01/2021-
11/01/2022
"Aortic Stenosis Clinical Applications"
GE Precision Healthcare, Industrial Grant
Project Leader (PI: Quanzheng Li)
Developing an application for the intelligent management of aortic stenosis (AS) that aims

	to predict relevant clinical outcomes from AS patients undergoing surgeries based on electronic health records (EHR), radiological reports, and imaging data.
07/01/2022-6/30/2024	"Identification of Multi-modal Imaging Biomarkers for Early Prediction of MCI-AD Conversion via Multigraph Representation" Principal Investigator Investigation of the interaction among structural, functional, and proteinopathies networks in MCI and AD patients via a contrastive learning-based, multigraph representation framework on the multi-modal neuroimaging data of MRI, fMRI, and PET modalities. The proposed framework will be used to identify and evaluate a multi-modal image biomarker for the AD conversion in the MCI population from a multi-site dataset.
03/15/2022-02/28/2026	"Deep Learning-Based Phenotyping and Treatment Optimization of Heart Failure with Preserved Ejection Fraction" Senior/Key Person (PI: Quanzheng Li) Development of a multi-modal deep learning model on combined imaging and EHR data, for the purpose of holistic HFpEF patient portrayal, disease phenotyping, as well as treatment optimization.

Projects Submitted for Funding

02/05/2019	"Identification and characterization of Alzheimer's disease subtypes using structural, functional, and neuropathological brain networks" Co-Investigator (PI: Quanzheng Li) Investigation of possible AD subtypes through computational modeling. The model uses a combination of information describing brain atrophy, functional network organization, AD pathology, and neuropsychological assessment as input and employs a graph embedding approach to perform multi-modal data fusion and subtype discovery.
10/05/2019	"A deep learning-based MEG/EEG biomarker integrated with physiological information for early detection and monitoring of Alzheimer's disease." Senior/Key Person (PI: Quanzheng Li) Multimodal, deep learning-based integration of macroscale MEG/EEG brain networks with microscale PET amyloid-β and tau proteinopathy networks for identifying structural-functional AD biomarkers. Percentile: 55
08/06/2021	"Development of a Universal Framework for Video Data Acquisition, Standardization, Validation, and Access" Co-PI (PI: Ozanan Meireles and Quanzheng Li) Development of a multi-modality universal video and metadata generation framework that is ethically sourced, scalable, and sustainable, addressing data structure, standardization, annotation, validation, and sharing, to allow the creation of large and diverse flagship datasets for research, education, and clinical use.

Report of Local Teaching and Training

Teaching of Students in Courses:

2014-2015	CSCI 4850/6850: "Biomedical Image Analysis" Graduate and undergraduate students	University of Georgia 2-hrs session per week for two weeks
2015	CSCI 8850: "Advanced Biomedical Image Analysis" Graduate students	University of Georgia 3-hrs session per week for one week
2016	CSCI 8360: "Data Science Practicum" Graduate students	University of Georgia 3-hrs session per week for one week

Other Mentored Trainees and Faculty:

2018-2019   Xuandong Zhao, undergraduate student, Zhejiang University
Visiting student at MGH. Mentoring role: research advisor. Accomplishments: Development of the Deep Voxel-Graph Convolution Network (DVGCN) model and presented at the 2019 *IEEE International Symposium on Biomedical Imaging*. Graduate student at UC Santa Barbara.

2018-2019   Weichen Wu, undergraduate student, Peking University
Visiting student at MGH. Mentoring role: research advisor. Accomplishments: Participated in the DeepProjection project. Graduate student at Carnegie Mellon University.

2018-2019   Jiaming Guo, undergraduate student, Peking University
Visiting student at MGH. Mentoring role: research advisor. Accomplishments: Development of the graph-based modeling for MCI/AD progression (PETNet) and presented at the 2019 *IEEE International Conference on Big Data*. Graduate student at the University of California, Los Angeles.

2019   Haixing Dai, Ph.D. student, University of Georgia
Graduate research intern at MGH. Mentoring role: research advisor. Mentoring role: Supervising research on developing new models for analyzing brain networks from MEG and PET data.

2020-2021   Shan Lin, Ph.D. student, University of Washington
Research intern at MGH as her curricular practical training (CPT). Mentoring role: research advisor. Supervising the research on surgical image analysis.

2021-2021   Mengjin Dong, Ph.D. student, University of Pennsylvania
Research intern at MGH. Mentoring role: research advisor. Mentoring role: Supervising the research on cardiac image analysis.

2019-2022   Peiting You, Ph.D. student, Peking University
Graduate research intern at MGH. Mentoring role: research advisor. Accomplishments: published two journal papers related to SWI image analysis and cortical parcellation.

2022-   Yongkai Chen, Ph.D. student, University of Georgia
Graduate research intern at MGH. Mentoring role: research advisor. Supervising the research on the echocardiogram image segmentation method development.

2022-   Zhiliang Lyu, MS student, University of Georgia
Graduate research intern at MGH. Mentoring role: research advisor. Supervising the cloud computing projects of deploying models onto Microsoft Azure.

Local Invited Presentations:

☒ *No presentations below were sponsored by 3rd parties/outside entities*

2014   "Interactive and Automatic Cell/Synapse Detection by Exemplar Learning and Propagation"
Allen Institute for Brain Science, Seattle, WA.

2014   "Introduction to Vaa3D: an open-source platform for 3D visualization-assisted analysis on large-scale bioimages."
The Georgia Advanced Computing Resource Center (GACRC), Athens, GA

2014   "Dictionary Learning in Functional Brain Imaging"
Network of Greater Georgia Institutions for Neuroimaging and Statistics (NOGGINS) workshop, Athens, GA.

2015   "Investigation of Alternated Functional Dynamics in Autism fMRI Data"

Department of Biomedical Engineering, Emory University, Atlanta, GA.

2015   "Introduction to Functional Brain Imaging"
Department of Statistics, University of Georgia, Athens, GA

2016   "Brain Imaging and Functional Network Dynamics"
Computational Medicine and Bioinformatics in the Medical School, University of Michigan, Ann Arbor, MI.

2016   "Scalable Fast Rank-1 Dictionary Learning for fMRI Big Data Analysis"
Society for Industrial and Applied Mathematics, Southeastern Atlantic Section Conference (SIAM-SEAS), Athens, GA.

Report of Regional, National and International Invited Teaching and Presentations

☒ *No presentations below were sponsored by 3rd parties/outside entities*

Regional
2015   "Dynamic Functional Connectivity Analysis on 512-Channel LFP long recording data"
Brain and Behavior Discovery Institute, Medical College of Georgia, Augusta, GA.

National
2017   "Towards Practical Problems in Deep Learning for Radiology Image Analysis"
Nvidia GPU Technology Conference, San Jose, CA.

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.

2019   "Personalized Healthcare for Heart Failure with Preserved Ejection Fraction (HFpEF): Diagnosis, Phenotyping and Treatment Optimization with Imaging and EHR Data"
Department of Statistics, The University of Georgia, Athens, GA.

2022   "Novel Methodologies for Combined Image and EMR Modeling"
Department of Computer Science and Engineering, The University of Texas at Arlington, Arlington, TX

International
2011   Brain state change detection via fiber-centered functional connectivity analysis (selected oral full-length paper)
IEEE International Symposium on Biomedical Imaging, Chicago, IL.

2013   Discovering common functional connectomics signatures (selected oral full-length paper)
IEEE International Symposium on Biomedical Imaging, San Francisco, CA.

2014   Dynamic network partition via Bayesian connectivity bi-partition change point model (selected oral full-length paper)
IEEE International Symposium on Biomedical Imaging, Beijing, China.

2016   Big Data Strategies on Neuroimaging Analysis: Challenge in Data Availability and Computation (invited talk)
International Conference on Brain Informatics and Health, Omaha, NE.

2017   "Opportunities, Challenges and Solutions for Artificial Intelligence in Medical Data Processing"

2019	"Towards Holistic Machine Intelligence in Healthcare Research and Clinical Practice" School of biomedical engineering, Shanghai Jiaotong University, Shanghai, China.

Center for Data Science in Health and Medicine, Peking University, Beijing, China.

2019	"Towards Holistic Machine Intelligence in Healthcare Research and Clinical Practice" School of biomedical engineering, Shanghai Jiaotong University, Shanghai, China.
2019	"Large-Scale Spatial-Temporal Modeling" Chinese Center for Disease Control and Prevention, Beijing, 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.
2019	"Holistic Brain Representation for Discovery Science in Neuroimaging" Workshop on Computational Medical Imaging and Artificial Intelligence, Zhejiang University of Technology, China.
2022	"Data Analysis and Clinical Decision Support in Response to COVID-19: Experience from MGH Radiology and ED", Shanghai Tech University, Shanghai, China (Virtual)

Report of Technological and Other Scientific Innovations

Automatic pre-screening method for pneumothorax detection, 2017	Development of a software system for automatically detecting pneumothorax from CT images. The system has been validated internally by multiple radiologists. The innovation was filed as Invention Disclosure to Partners HealthCare in 2017.
Inference of 3D chest CT images from 2D chest radiographs, 2019	Development of an invention to directly infer 3D chest CT images from 2D radiographs. The technique learns the mapping between the 2D image and the 3D spatial structure information of the corresponding CT image from the teaching dataset thus achieving trans-dimensional 2D-3D mapping. The innovation was filed as an Invention Disclosure to Partners HealthCare in 2020. It is currently filing for the patent application.
COVID-19 risk score prediction system and its integration into clinical workflow, 2020	Developing a risk assessment model for COVID-19 based on deep learning-based analysis of EHR and chest radiography data in the Emergency Department and facilitating deployment and integration of the model into the clinical workflow via multiple medical informatics solutions (hospital FHIR infrastructure, Epic Cognitive Computing, Nvidia Clara). The system is currently running online, making >4,000 inferences per day.
Predicting Alzheimer's Disease by Hierarchical Graph Convolution from Positron Emission Tomography Imaging (PETNet), 2021	Lead inventor of the Graph Convolutional Network-based Positron Emission Tomography (PET) image analysis program PETNet. The program can automatically diagnose Alzheimer's Disease (AD) and Mild Cognitive Impairment (MCI) from the input PET imaging data. The program features a hierarchical graph inference algorithm for fine-grained analysis of large-scale voxel-wise data and a Neural Architecture Search (NAS) scheme for identifying the optimal graph representing the brain images. The invention has been filed and approved as an Innovation Disclosure to MGB.
Brain Image Analysis by Graph-based Matched Signal Detection (MSD) Algorithm, 2021	Inventor of the Matched Signal Detection (MSD) algorithm for predicting whether the given signal (e.g., medical images) belongs to a specific graph (e.g., graph of disease / normal population). MSD algorithm identifies the subspace for graph-signal by eigenvectors of the Laplacian matrix of the graph, which provides a concise encoding of the graph structure. Graph Fourier transform (GFT) is applied to project the graph signals onto the identified subspace. Based

on GFT-based processing of graph signals, we can then test signal models on graphs before with hypothesis tests. The invention has been filed and approved as an Innovation Disclosure to MGB.

Report of Scholarship

Peer-Reviewed Scholarship in print or other media:

Research Investigations *indicates co-first authorship, **indicates my mentee

1 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.

2 **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.

3 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.

4 **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.

5 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.

6 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.

7 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.

8 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.

9 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.

10 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.

11 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.

12 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.

13 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.

14 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.

15 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.

16 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.

17 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.

18 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.

19 Ge B, Makkie M, Wang J, Zhao S, Jiang X, **Li X**, Lv J, Zhang S, Zhang W, Han J, Guo L, Liu T. Signal sampling for efficient sparse representation of resting state FMRI data. Brain Imaging and Behavior. 2016;10:1206-22.

20 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.

21 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 Structure and Function. 2017;222(9):4253-70.

22 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.

23 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.

24 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.

25 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.

26 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.

27 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.

28 **Li X**, Guo N, Li Q. Functional Neuroimaging in the New Era of Big Data. Genomics Proteomics and Bioinformatics. 2019; 17(4):393-401.

29 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.

30 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.

31 **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.

32 Jeong S*, **Li X***, Yang J, Li Q, Tarokh V. Sparse Representation-Based Denoising for High-Resolution Brain Activation and Functional Connectivity Modeling: A Task fMRI Study. IEEE Access 2020; 8:36728-36740.

33 Zhang M*, **Li X*** Xu M, Li Q. Automated Semantic Segmentation of Red Blood Cells for Sickle Cell Disease. IEEE Journal of Biomedical and Health Informatics, 2020; 24:3095-3102.

34 Wang P, Jiang X, Chen H, Zhang S, **Li X**, Cao Q, Sun L, Liu L, Yang B, Wang Y. Assessing Fine-Granularity Structural and Functional Connectivity in Children with Attention Deficit Hyperactivity Disorder. Frontiers in Human Neuroscience, 2020; 14:481.

35 Zhong A*, **Li X***, Wu D, Ren H, Kim K, Kim Y, Buch V, Neumark N, Bizzo B, Tak WY, Park SY, Lee YR, Kang MK, Park JG, Kim, BS, Chung WJ, Guo N, Dayan I, Kalra MK, Li Q. Deep metric learning-based image retrieval system for chest radiograph and its clinical applications in COVID-19. Medical Image Analysis, 2021; 70:101993.

36 Xue W, Li J, Hu Z, Kerfoot E, Clough J, Oksuz I, Xu H, Grau V, Guo F, Ng M, **Li X**, Li Q, Liu L, Ma J, Grinias E, Tziritas G, Yan W, Labrador AMA, Garreau M, Jang Y, Debus A, Ferrante E, Yang G, Hua T, Li S. Left Ventricle Quantification Challenge: A Comprehensive Comparison and Evaluation of Segmentation and Regression for Mid-ventricular Short-axis Cardiac MR Data. IEEE Journal of Biomedical and Health Informatics, 2021; 25(9):3541-3553.

37 Dayan I, Roth H R, Zhong A, Harouni A, Gentili A, Abidin A Z, Liu A, Costa A B, Wood B J, Tsai C-S, Wang C-H, Hsu C-N, Lee C K, Ruan P, Xu D, Wu D, Huang E, Kitamura F C, Lacey G, de Antônio Corradi G C, Nino G, Shin H-H, Obinata H, Ren H, Crane J C, Tetreault J, Guan J, Garrett J W, Kaggie J D, Park J G, Dreyer K, Juluru K, Kersten K, Rockenbach M A B C, Linguraru M G, Haider M A, AbdelMaseeh M, Rieke N, Damasceno P F, e Silva P M C, Wang P, Xu S, Kawano S, Sriswasdi S, Park S Y, Grist T M, Buch V, Jantarabenjakul W, Wang W, Tak W Y, **Li X**, Lin X, Kwon Y J, Quraini A, Feng A, Priest A N, Turkbey B, Glicksberg B, Bizzo B, Kim B S, Tor-Díez C, Lee C-C, Hsu C-J, Lin C, Lai C-L, Hess C P, Compas C, Bhatia D, Oermann E K, Leibovitz E, Sasaki H, Mori H, Yang I, Sohn J H, Murthy K N K, Fu L-C, de Mendonça M R F, Fralick M, Kang M K, Adil M, Gangai N, Vateekul P, Elnajjar P, Hickman S, Majumdar S, McLeod S L, Reed S, Gräf S, Harmon S, Kodama T, Puthanakit T, Mazzulli T, de Lavor V L, Rakvongthai Y, Lee Y R, Wen Y, Gilbert F J, Flores M G, Li Q. Federated learning for predicting clinical outcomes in patients with COVID-19. Nature Medicine, 2021; 27:1735–1743.

38 You P**, **Li X***, Wang Z, Wang H, Dong B, Li Q. Characterization of Brain Iron Deposition Pattern and Its Association with Genetic Risk Factor in Alzheimer's Disease Using Susceptibility-Weighted Imaging. Frontiers in Human Neuroscience, 2021; 15.

39 You P**, **Li X***, Zhang F, Li Q. Connectivity-based Cortical Parcellation via Contrastive Learning on Spatial-Graph Convolution. BME Frontiers, 2022; in press.

Other peer-reviewed scholarship: *indicates co-first authorship, **indicates my mentee

Full-length proceedings of meetings which have undergone a formal peer-review process

40 **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.

41 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.

42 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.

43 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.

44 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.

45   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.

46   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.

47   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.

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Thesis:

Title: **Machine Learning Approaches towards Holistic Brain Functional Space Discovery from fMRI Big Data**

by Xiang Li Ph.D., University of Georgia, August 2016

Advisor: Distinguished Prof. Tianming Liu

School: University of Georgia, Department of Computer Science

Source Type: Ph. D.

Subjects: Medical Image Analysis, Machine Learning, Big Data, Neuroimaging

Citation (including journal papers in the thesis):   >1000

Abstracts, Poster Presentations and Exhibits Presented at Professional Meetings:

1   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.

2   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.

3   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.

4   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.

Narrative Report

Area of Excellence – Research Investigation

With more than 10 years of experience in algorithm development/implementation and a doctoral degree in computer science, Dr. Xiang Li has been working on novel frameworks for analyzing multimodal medical images and non-imaging medical data. He is specifically interested in the identification of functional imaging markers and the characterization of the interactions among multiple imaging modalities in patients with Alzheimer's disease (AD) and Mild Cognitive Impairment (MCI).

Dr. Xiang Li's interdisciplinary computer science and neuroimaging expertise have enabled him in conducting novel AI-driven investigations into the human brain and contributing to the Radiology community as an important researcher. He is on the track to establishing his independence with one funded NIH grant application for the multi-modal imaging biomarkers of MCI-AD conversion (1R03AG078625) as Principal Investigator and another one in submission as Co-PI, as well as institutional awards for supporting his research on chest imaging. Dr. Xiang Li has published 39 original research articles in the field of medical image analysis, 20 of which are first-authored or co-first-authored. His H-index is 24 with 2,331 total citations, including 509 in 2021.

Scientific Research

From his Ph.D. study, Dr. Xiang Li has been investigating the modeling of the human brain via neuroimaging, specifically focused on the analysis of the 4-D (3-D spatial plus 1-D temporal) imaging data, He has developed a series of spatial-temporal modeling frameworks, which were recognized for two times as best student paper award nomination by the IEEE International Symposium on Biomedical Imaging conference (ISBI) in 2011 and 2013 (RI #2 and RI #4). Being among the first researchers who utilized mathematic models to characterize abnormities in brain functional dynamics, his works on the diagnosis of post-traumatic stress disorder (PTSD, RI #4) and attention deficit hyperactivity disorder (ADHD, RI #5, #14) were the pioneers in this field and inspired many later research. His neuroimaging-related works after joining Massachusetts General Hospital include more imaging modalities for capturing brain abnormities (RI #38), graph modeling of brain structure and function (RI #22, #38), deep learning-based spatial-temporal modeling (RI #30, OPR #46, #49, #50), and cloud computing architectures for fMRI analysis (RI #24).

By extending his research into more types of imaging modalities, Dr. Xiang Li has developed models for multi-modal image analysis. With his mentee, he developed an integrated multi-modal (CT+MR+PET) image fusion architecture (RI #27) which has been the top-cited article in 2019 of *IEEE Transactions on Radiation and Plasma Medical Sciences* and was awarded the Best Paper Award of the journal. Also extending the modeling technique to multiple scales, Dr. Xiang Li and his mentee have developed a scale-adaptive image feature learning scheme to deal with objects with significant size changes, which are commonly presented in medical images. The work was awarded as the best paper at the 2020 *IEEE International Symposium on Biomedical Imaging* (RI #33).

Technological Innovation

After joining the Massachusetts General Hospital, Dr. Xiang Li has been working with physicians, radiologists, and system engineers to deliver novel solutions for medical imaging. Through close collaboration with thoracic radiologists including Dr. James Thrall and Dr. Mannudeep Kalra, he developed a deep learning-enabled system for pneumothorax prescreening with high sensitivity and very fast running speed after deployment (RI #31). The system is among the four finalists of the 2018 NVIDIA Global Impact Award, for its potential impact on the application of AI in healthcare. With a continuous focus on chest radiology, Dr. Xiang Li has developed risk assessment tools at the Emergency Department for COVID-19 patients based on their chest X-ray images and medical records data (RI #35). He has then worked with the information system team to integrate the tool into the clinical workflow of the hospital. The system is currently under beta testing in a pseudo-online environment, as well as

deployed to over 20 hospitals around the world in a federated learning approach (RI #37). Dr. Xiang Li has submitted 4 Invention Disclosures to the hospital system with 1 of them under patent application.

Service to the Community

Dr. Xiang Li has been serving as a reviewer for multiple top research journals and conferences such as *Nature Communications*, *Pattern Recognition*, *Conference on Neural Information Processing Systems*, and *International Conference on Machine Learning*. He has also served as an editor and program chair for multiple journals and conferences, including *Frontiers in Neuroscience*, *Frontiers in Oncology*, and *ACM SIGKDD Workshop on Mining and Learning from Time Series*, with a specific interest in bridging the communities of medical imaging data science and machine learning. To promote the importance and advancement of multi-modal, multi-scale medical image analysis, and facilitate more interactions between clinical and data science experts, Dr. Xiang Li founded the *International Workshop on Multiscale Multimodal Medical Imaging* in 2019 and chaired the *International Workshop on Multimodal Learning for Clinical Decision Support* in 2021.

Teaching and Educational Activities

During his Ph.D. study at the University of Georgia, Dr. Xiang Li has given guest lectures in medical imaging and data science-related courses, both at undergraduate and graduate levels. He has also been actively teaching and promoting the concept, method, and application of dynamic functional connectome in multiple talks over the university system in Georgia. After joining the Massachusetts General Hospital, Dr. Xiang Li has given multiple lectures on computational modeling and solution development for medical images in the Radiology department. In addition, from 2021, Dr. Xiang Li has been organizing the "AI x Med" bi-weekly seminar, a lecture series on the latest developments of AI applications in medicine, presented by researchers within the hospital as well as invited speakers from external institutions.

As an Instructor at Massachusetts General Hospital, Dr. Xiang Li has supervised and mentored 8 visiting students and graduate research interns. Through mentorship and co-working on research projects, all the graduate students have achieved at least one publication in journals or major conferences. All the undergraduate visiting students he has mentored are now pursuing a graduate degree related to data science and medical imaging in the top colleges in the U.S. He is currently mentoring two graduate students (Dr. Yongkai Chen and Zhiliang Lyu) who are working on medical image segmentation model and cloud computing infrastructure development.

References are cited using the following alphanumeric system and based on the 07/01/2022 version of Dr. Xiang Li's CV.