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
06/2016	PhD	Computer Science, Distinguished Prof. Tianming Liu	University of Georgia

Postdoctoral Training:

08/2016-07/2019	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:

08/2019-05/2023	Instructor	Radiology	Harvard Medical School
06/2023-	Assistant Professor	Radiology	Harvard Medical School
09/2023-	Affiliate Faculty Member	Kempner Institute for Natural and Artificial Intelligence	Harvard University

Appointments at Hospitals/Affiliated Institutions:

01/2007-06/2009	Research Assistant	The College of Environmental Science and Engineering	Nankai University, China
08/2019-	Research Staff	Radiology	Massachusetts General Hospital

Major Administrative Leadership Positions:

International

2019, 2022-2024	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)
2017,2023	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)
2023	Program Committee	International Workshop on Medical Image Learning with Noisy and Limited Data (MILLanD)
2023-2024	Area Chair	International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)
2024	Program Committee	International Workshop on Embodied AI and Robotics for HealTHcare (EARTH)
2024	Program Committee	The SAGES Critical View of Safety Challenge

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 (MICCAI), International	Member
2017-	American Roentgen Ray Society (ARRS), Regional	Member
2023-	American Medical Informatics Association (AMIA), 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 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

Nature Medicine

Neuroimage

Neuroscience

Pattern Recognition

Progress in Neurobiology

- **Other Editorial Roles**

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
2023-	Associate Editor	Meta-Radiology
2023-	Associate Editor	BMC Biomedical Engineering
2023-	Associate Editor	IEEE Transactions on Artificial Intelligence
2024-	Associate Editor	Data Intelligence

Honors and Prizes:

2011	Best Student Paper Award	IEEE International Symposium on Biomedical Imaging	"Brain State Change Detection via Fiber-centered Functional Connectivity Analysis"
2013	Best Student Paper Award	IEEE International Symposium on Biomedical Imaging	"Discovering Common Functional Connectomics Signatures"
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	"Chest Radiographs-based Lung Cancer Screening by the DeepProjection Technique"
2022	Best Paper Awards	IEEE Transactions on Radiation and Plasma Medical Sciences	"Deep Learning-Based Image Segmentation on Multimodal Medical Imaging"
2024	Research Scholar Program	Google Inc.	"Tailoring Large Language Models for the Diagnosis and Management of Late-life Depression Patients with Limited Access to Healthcare Resources"

Report of Funded and Unfunded Projects

Past

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, "DeepProjection," that can generate pseudo-CT from X-rays images to improve the 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.
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.

Current

03/15/2022-02/28/2026	"Deep Learning-Based Phenotyping and Treatment Optimization of Heart Failure with Preserved Ejection Fraction" NIH R01, 1R01HL159183 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.
07/01/2022-6/30/2024	"Identification of Multi-modal Imaging Biomarkers for Early Prediction of MCI-AD Conversion via Multigraph Representation" NIH R03, 1R03AG078625-01, Direct cost: $200,000/2 years

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 AD conversion in the MCI population from a multi-site dataset.

Projects Submitted for Funding

"iBRAIN: Individualized Brain Representation, Analysis, and INtegration"
NIH U24
Subcontract PI (PI: Gang Li at UNC)

08/22/2022
Integrate, refine, enrich, standardize, and disseminate our previously developed cortical surface-based software, toolbox, and computational model libraries, which have been validated and widely used for years, into a unified and comprehensive neuroimaging software suite: the Individualized Brain Representation, Analysis, and Integration (iBRAIN).

"Generation of Near-real Computed Tomography (CT) Images from Wrist Radiographs via Deep Image Projection"

02/18/2023
NIH R21
Principle Investigator

Developing an AI model that can generate near-real wrist CTs from a single X-ray image to better characterize patients' wrist bone condition with 3D imaging information.

"Development of Expert-enhanced Large Language Models for Oncology"
NIH R01

10/04/2023
Principle Investigator

Developing an oncology domain-specific Large Language Model (LLM) using techniques including Supervised Fine-Tuning, Retrieval Augmented Generation (RAG), and Knowledge Graph (KG)-guided prompt design.

"PharmacyGPT: Developing large language models to improve access to optimized drug therapy"

09/19/2023
NIH R01
Subcontract PI (PI: Andrea Sikora at UGA)

Developing a pharmacy domain-specific Large Language Model (LLM) to improve medication decision-making and prevent adverse drug events (ADE).

"Knowledge-based Explainability for Large Language Models in Oncology"
NIH R21

11/15/2023
Principle Investigator

Developing software attached to a Large Language Model (LLM) to improve its effectiveness and explainability for oncology use.

"Discover Amyloid-β/Tau Causal Relationship on Personalized Multi-Modal Brain Network"
NIH R01

03/14/2024
Principle Investigator

Identification of regional-specific causal relationships between amyloid-β and tau in Alzheimer's disease patients by PET imaging using advanced machine learning approaches.

03/20/2024
"Advanced Multi-modal Foundational AI Models for Healthcare"
NIH R21
Principle Investigator

Developing a general-purpose AI algorithm that can serve as the foundation for various tasks in medicine, the so-called "multi-modal foundational model."

Report of Local Teaching and Training

Research Supervisory and Training Responsibilities:

2018-	Supervised visiting students, graduate research interns, and research fellows (average 2-3 per year).	Massachusetts General Hospital. Two hours of lab meetings per week; One hour per week per student and research fellow for 1:1 discussion and supervision.
2021-	Administration and coordination of the CAMCA AIxMedicine Biweekly Seminar, the public lab meeting on AI research in medicine of the Center for Advanced Medical Computing and Analysis in MGH.	Massachusetts General Hospital. One hour of meetings per two weeks.

Other Mentored Trainees and Faculty:

2019-2023	Hui Ren, Research Fellow at MGH. **Mentoring role**: Advising research on cardiac image analysis and Electronic Health Record (EHR) modeling. **Accomplishment:** Research presented at the 2019 *Annual Meeting of American Heart Association*, 2019 *IEEE International Symposium on Biomedical Imaging*, 2022 *International Workshop on Advances in Simplifying Medical Ultrasound*, and 2023 *AMIA Clinical Informatics Conference*.
2019-2020	Haixing Dai, Ph.D. student at the University of Georgia Graduate research intern at MGH. **Mentoring role**: Advising research on graph-based deep learning models for brain network modeling from MEG and PET images.
2019-2020	Mo Zhang, Ph.D. student at Peking University Graduate research intern at MGH. **Mentoring role:** Advising research on image segmentation methodologies. **Accomplishment:** Research published in *IEEE JBHI* and presented at the 2018 *International Conference on Medical Image Computing and Computer-Assisted Intervention,* and the 2020 *IEEE International Symposium on Biomedical Imaging* (Best Paper Award).
2020-2020	Qinglin Dong, Research Fellow at MGH. **Mentoring role**: Advising research on neuroimage, especially functional MRI analysis and modeling. **Accomplishment:** Research presented at the 2020 *International Conference on Medical Image Computing and Computer-Assisted Intervention* and 2020 *International Workshop on Machine Learning in Medical Imaging*.
2019-2022	Peiting You, Ph.D. student at Peking University Graduate research intern at MGH. **Mentoring role:** Advising research on brain surface parcellation and image analysis for AD diagnosis. **Accomplishment:** Research published in *BME Frontiers* and *Frontiers in Human Neuroscience*.
2021-2023	Jerome Charton, Research Fellow at MGH. **Mentoring role**: Advising research on the computational modeling of ultrasound, especially echocardiogram images. **Accomplishment:** Research presented at the 2022 *International Workshop on Advances in Simplifying Medical Ultrasound.*
2022-2023	Zhengliang Liu, Ph.D. student at the University of Georgia Graduate research intern at MGH. **Mentoring role:** Advising research on natural language processing (NLP) in healthcare. **Accomplishment:** Research presented at the 2022 *International Workshop on Machine Learning in Medical Imaging*.

2022-	Zhennong Chen, Research Fellow at MGH. **Mentoring role:** Advising research on the image analysis of cardiac MRI.
2022-	Sekeun Kim, Research Fellow at MGH. **Mentoring role:** Advising research on the differential diagnosis for cardiac conditions and image modeling for echocardiography.
2023-	Siyeop Yoon, Research Fellow at MGH. **Mentoring role:** Advising research on the generative modeling for medical images utilizing diffusion models.

Local Invited Presentations:

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

2024	"Interactive and Automatic Cell/Synapse Detection by Exemplar Learning and Propagation" Allen Institute for Brain Science, Seattle, WA.

Report of Regional, National and International Invited Teaching and Presentations

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

Regional

2024	"Utilizing Large Language Models for Effective Management and Analysis of Nuclear Medicine Radiology Reports" (Invited Talk) Hampton Symposium 2024, Boston, MA

National

2017	"Towards Practical Problems in Deep Learning for Radiology Image Analysis" (Invited Talk) 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" (Invited Talk) Department of Statistics, The University of Georgia, Athens, GA.
2022	"Novel Methodologies for Combined Image and EMR Modeling" (Invited Talk) Department of Computer Science and Engineering, The University of Texas at Arlington, Arlington, TX
2022	"Data Governance of the SAGES CVS Challenge" (Invited Talk) Society of American Gastrointestinal and Endoscopic Surgeons, Houston, TX (Virtual)
2023	"Application and Development of Foundational Models in Healthcare" (Invited Talk) Department of Electrical and Computer Engineering, University of Rochester, Rochester, NY (Virtual)
2023	"Application and Development of Foundation Models in Healthcare" (Invited Talk) AIM Seminar Series, Department of Radiation Oncology, UT Southwestern Medical Center, Dallas, TX.
2023	"A New Perspective of Human-Computer Interaction in the Era of Large Pre-trained Models" (Keynote Speech) Workshop on the Intersection of Artificial Intelligence and Human Intelligence (IAIHI), Hoboken, NJ.

2023	"Application and Development of Foundation Models in Healthcare" (Invited Talk) Neuro Image Research and Analysis Laboratories (NIRAL), Department of Psychiatry, University of North Carolina at Chapel Hill, Chapel Hill, NC.
2024	"Development of Specialized Large Language Models for Radiology Report Processing" (Invited Talk) 31st Annual Council on Ionizing Radiation Measurements & Standards Meeting, Rockville, MD.
2024	"Understanding Neurodegenerative Diseases via Multi-modal Data Analytics, Generative Modeling, and Counterfactual Causal Inference" (Invited Talk) The New Investigators in Alzheimer's Disease Meeting, Bethesda, MA

International

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" School of Biomedical Engineering, Shanghai Tech University, Shanghai, China (Virtual)
2023	"Impact of ChatGPT on Medical Image Analysis" Medical Imaging Computing Seminar, Shanghai, China (Virtual)
2023	"Foundation Models in Medical Research and Clinical Application" Intelligent Medicine Forum, Beijing, China (Virtual)
2023	"Application and Development of Foundational Models in Healthcare" IEEE EMBS Webinar Series, "Frontiers of Biomedical Imaging and Analysis" (Virtual)
2023	"Identification of Causal Relationship between Amyloid-beta Accumulation and Alzheimer's Disease Progression via Counterfactual Inference" Optica Imaging Congress, Boston, MA (selected oral abstract)
2023	"Recent Advances in Sparse and Ultra-Sparse Reconstruction and Generative Modeling for Medical Imaging" Optica Imaging Congress, Boston, MA (invited talk)

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 an 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.
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	Developing a 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	Developing a 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.
Predicting Patient Outcomes of In-hospital Stay and Readmission for Managing Aortic Stenosis with Valve Replacement, 2022	Developing an Aortic Stenosis Ensemble Risk Prediction (AS-ERP) Model. AS-ERP performs Aortic Stenosis patient outcome (length of stay and readmission) prediction based on the input Electronic Medical Records (EMR) data. The model utilizes an ensemble learning scheme consisting of three machine learning classifiers for patient outcome prediction. Internal validation performance meets the clinical acceptance criteria and is superior to the current risk score system developed by the Society of Thoracic Surgeons. The invention is currently pending for patent.
Machine Learning Model for the Prediction of Early Discharge of Patient Underwent Transcatheter Aortic Valve Replacement (TAVR) Using Electronic Medical Record, 2023	Developing a machine learning algorithm to predict the early discharge (<36h) of patients who underwent transcatheter aortic valve replacement, given in-house electronic medical record (EMR) information. The prediction is based on data extracted from EMR during a patient's hospital stay, including demographics, vital signs, medical history, related laboratory results, and medications. The invention has been filed for an Innovation Disclosure to MGB.
System and Method for Synthesizing 3D Volumetric Medical Images Using a Diffusion-Based	Developing an AI system that synthesizes 3D volumetric images, e.g. computed tomography (CT), given the patient's 2D radiographs. The model is based on the diffusion model, a state-of-the-art machine-learning technique for image synthesis. The input is one or more radiographs of the distal radius, and the output is a synthesized 3D volumetric medical image. The 3D volumetric medical image can be rendered or resliced to provide 3D geometric information.

Machine Learning Model, 2023 — A prototype has been internally evaluated. The model performance on the validation dataset was 16.78 dB in PSNR compared to the original 3D CT images. The synthesized 3D CT using our invention showed superior SSIM compared to 36-view FBP reconstructed 3D CT (0.42 ± 0.03 vs. 0.29 ± 0.03, p<0.01).

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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.
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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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

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.

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*. 2019:12(3):451.

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.

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.

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.

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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:

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Narrative Report

I am an Assistant Professor at the Massachusetts General Hospital and Harvard Medical School, Department of Radiology, and an Affiliate Faculty Member at the Kempner Institute for Natural and Artificial Intelligence of Harvard University. I have led multiple medical imaging, text analysis, and multi-modal fusion projects, especially on developing artificial intelligence (AI) in healthcare. I am specifically experienced in leveraging the latest advancements of Artificial General Intelligence (AGI) to develop general-purposed solutions to tackle the practical challenges of applying AI in a complex clinical context, including the heterogeneity in multi-institutional data, scalability, and computational constraints of AI, and the system integration into the clinical workflow. I have authored over 100 articles with an H-index of 37 on topics including medical imaging/text analysis methodology development, the application of AI for diagnosing and detecting diseases, and the computational architecture design for big data strategies in healthcare.

Research Investigation

My research focuses on developing generalized, robust, and explainable solutions for multi-modal data analytics in healthcare. With the advancement of AGI, my recent works are mainly on the foundation models in medicine. By combining clinical domain priors with novel algorithm designs, I have developed and published a series of works for modeling large-scale, domain-specific text/image/multi-modal data, including RadiologyGPT, RadOncGPT, and BiomedGPT. We have also experimented with leveraging large pre-trained models for medical tasks, including cohort establishment, text de-identification, and general-purposed image segmentation. My research into the large language model is awarded by Google for its Research Scholar Program. My previous works in methodology development for medical image analysis have been awarded by the IEEE International Symposium on Biomedical Imaging (ISBI) as the Best Student Paper award for 3 times (2011, 2013, and 2020 by my mentee), the Best Paper Award of IEEE Transactions on Radiation and Plasma Medical Sciences in 2022. I have received grant support from both NIH and MGH Thrall Innovation Grants Award for my research.

Technological Innovation

At MGH, I have worked 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, I developed a deep learning-enabled system for pneumothorax prescreening. The work was among the four 2018 NVIDIA Global Impact Award finalists. I have also developed risk assessment tools at the Emergency Department for COVID-19 patients based on their chest X-ray images and tabular medical records data.

Service to the Community

I have been serving as a reviewer for multiple top research journals and conferences, as well as editor and program chair for multiple journals and conferences, with a focused 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, I founded and chaired the International Workshop on Multiscale Multimodal Medical Imaging in 2019, 2022, 2023, and 2024.

Teaching and Educational Activities

I have supervised and mentored 6 research fellows and many visiting students at MGH. Through mentorship and co-working on research projects, most research fellows and students have accomplished more than one publication in scientific journals or conferences. In addition, I have given multiple lectures on computational modeling and solution development in Radiology. Since 2021, I have 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 and invited speakers from external institutions.