

Ke XIAO

Curriculum Vitae

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EDUCATION

- 09/19 - CURRENT | MS/PhD Student in COMPUTER SCIENCE
University of Massachusetts Amherst, Amherst, Massachusetts
Research Field: Computer Vision & Deep Learning on Medical Imaging
Advisor: Prof. Madalina FITERAU BROSTEAN
- 12/2016 | Master of Science in MECHANICAL ENGINEERING | GPA: 3.97/4.0
Colorado School of Mines, Golden, Colorado
Research Field: Robotics, Automation, and Design
ACADEMIC ADVISOR: Prof. Douglas VAN BOSSUYT
- 06/2014 | Bachelor's Degree in MECHANICAL ENGINEERING | GPA: 3.43/4.0
Beihang University, Beijing, China
Thesis: "Design and Research of Compliant Mobile Robots in Rough Terrain"
THESIS ADVISOR: Prof. Xu PEI

RESEARCH PROJECTS

- 03/22 - CURRENT | 3D Reconstruction of human heart from 2D cardiac MRI slices
Deep Learning and Computer Vision research on Cardiac MRI data
This project works on training a deep convolutional network in a self-supervised fashion, and using the trained network as the sampler for misalignment correction in reconstructing the 3D heart surface from 2D non-parallel cross-section contours.
- 09/19 - CURRENT | Weakly Supervised Image Segmentation with Cardiac MRI
Deep Learning and Computer Vision research on Cardiac MRI data
Developing a domain structural information constrained neural network model for weakly supervised segmentation. By encoding the structural information in an auto-encoder, and combining the learnt embeddings of the structural information and the constraints extracted with heuristic functions, the model would be able to learn the segmentation with little to no help from the labeled image masks.
The segmentation model is based on a U-Net segmentation model with pre-trained model weights from VGG net trained on ImageNet dataset. The segmentation constraints are encoded in the loss function of the U-Net segmentation model.
The goal of the project is enabling us to utilize the available yet unlabeled large medical imaging datasets. And image segmentation is known for focusing on the area of interest and improving the performance of other tasks such as image classifications.
- 09/19 - CURRENT | Mitral Valve Regurgitation Classification
Deep Learning and Computer Vision research on Cardiac MRI data
Developing a fully automated pipeline consisting of a CNN-LSTM classification model, a U-Net segmentation model and a Random Forest ensemble model for classifying mitral valve regurgitation with long-axis view cardiac MRI datasets from UK Biobank.
In order to improve model performance and utilizing large unlabeled datasets, we are developing multi-view CNN-LSTM classification model and weakly supervised image segmentation model as well.
Ultimately, we are looking for a weakly supervised or an unsupervised solution for extracting, ensembling and utilizing the information from available cardiac MRI datasets.

- 05/21 - 12/21 | Identifying Causal Variants using Bayesian Regression on GWAS Summary Statistics
Learning the true variant effect sizes using Stochastic Variational Inference on GWAS Summary Statistics
Developing a Bayesian regression probabilistic model on the Pyro platform with SVI (Stochastic Variational Inference). Use the annotation embeddings to condition the continuous shrinkage priors on the effect sizes, then use the posterior distributions of the true effect sizes to produce the polygenic risk scores and identify the causal variants for the phenotypes.
- 07/17 - 08/19 | Bicuspid/Tricuspid aortic valve classification project
Machine Learning and Computer Vision application on Cardiac MRI data
Developed a Convolutional Neural Network (CNN) model using pre-trained CNN with customized Fully-connected Neural Network (FNN) top model. Developed a fully automated pipeline for experiments and hyper-parameter tuning.
Applied image pre-processing and augmentations to further boost model performance. Developed multiple other Neural Network model structures for experiments, such as building a un-trained CNN encoder parallel to the pre-trained CNN model then concatenate the outputs together before feeding into the final FNN top model for classification. Introduced Recurrent Neural Network (RNN) component into the Neural Network model to incorporate temporal information in the MRI sequence for improving the model.
- 01/16 - 12/16 | Geobot Project
Four-wheeled ground vehicle operating on ROS
Built a self-driving robot. Used LiDAR and ROS to collect environment data and 3D reconstruct the map of a mine. Also, used the LiDAR point cloud data to avoid obstacle.
Designed a path-planning algorithm and built a communication module between the robot and the Ground Penetrating Radar(GPR) through a Network Interface Controller(NIC).
Given the GPS coordinates of the corners of a selected area, the prototype robot can scan the underground area using attached GPRs and collects the related data. The robot is fully autonomous on its own.
- 12/13 - 06/14 | Undergraduate Research Project
Research on compliant mobile robots in rough terrain
Designed several compliant joints for 6-wheeled robots that are flexible and suitable for rough terrain. Used Mathematica and ANSYS to build the pseudo-rigid model and a finite element analysis model. Used Solidworks to build a prototype.

ABSTRACTS, PRESENTATIONS, AND PUBLICATIONS

- 2022 | **K. Xiao**, M. Fiterau, E. Learned-Miller, J. Priest.
Mitral Regurgitation Detection using Cardiac Imaging Data. Abstract-NECV 2022.
- 2021 | M. Yu, A. R. Harper, M. Aguirre, M. Pittman, C. Tcheandjieu, D. Amgalan, C. Grace, A. Goel, M. Farrall, **K. Xiao**, J. Engreitz, K. Pollard, H. Watkins, J. R. Priest. (2021). *Genetic determinants of interventricular septal anatomy and the risk of ventricular septal defects and hypertrophic cardiomyopathy. medRxiv, doi:10.1101/2021.04.19.21255650*
- 2021 | C. Tcheandjieu, **K. Xiao**, H. Tejada, J. Lynch, S. Ruotsalainen, T. Bellomo, M. Palnati, R. Judy, R. Kember, D. Klarin, S. Verma, A. Palotie, M. Daly, M. Ritchie, D. Rader, M. A Rivas, T. Assimes, P. Tsao, S. Damrauer, J. Priest. (2020). *High heritability of ascending aortic diameter and multi-ethnic prediction of thoracic aortic disease. medRxiv, Nature Genetics. doi:10.1101/2020.05.29.20102335*

- 2020 | M. Yu, C. Tcheandjieu, A. Georges, **K. Xiao**, H. Tejada, C. Dina, T. Le Tourneau, M. Fiterau, R. Judy, N. Tsao, D. Amgalan, C. Munger, J. Engreitz, S. Damrauer, N. Bouatia-Naji, J. Priest (2020). *Computational estimates of mitral annular diameter in systole and diastole cardiac cycle reveal novel genetic determinants of valve function and disease.* medRxiv, doi:10.1101/2020.12.02.20242206
- 2020 | A. Cordova-Palomera, C. Tcheandjieu, J. Fries, P. Varma, V. Chen, M. Fiterau, **K. Xiao**, H. Tejada, B. Keavney, H. Cordell, Y. Tanigawa, G. Venkataraman, M. Rivas, C. Re, E. Ashley, J. R. Priest. (2020). *Cardiac imaging of aortic valve area from 34,287 UK Biobank participants reveals novel genetic associations and shared genetic comorbidity with multiple disease phenotypes.* doi:10.1101/2020.04.09.20060012
- 2019 | F. Sala, P. Varma, J. Fries, D. Fu, S. Sagawa, S. Khattar, A. Ramamoorthy, **K. Xiao**, K. Fatahalian, J. Priest, C. Re. *Multi-Resolution Weak Supervision for Sequential Data.* NIPS 2019
- 2019 | C. Tcheandjieu, **K. Xiao**, H. Tejada, E. Ingelsson, J. Fries, J. Priest. *Polygenic architecture of computationally derived aortic diameter from 20,939 British adults predicts the risk for aortic aneurysm and dissection.* Abstract-ASHG 2019.
- 2018 | J. Fries, P. Varma, V. Chen, **K. Xiao**, H. Tejada, P. Saha, J. Dunnmon, H. Chubb, S. Maskatia, M. Fiterau, S. Delp, E. Ashley, C. Re, J. Priest. *Weakly Supervised Classification of Rare Aortic Valve Malformations Using Unlabeled Cardiac MRI Sequences.* bioRxiv, Nature Communication 2018
- 2018 | A. Córdoba-Palomera, J. Fries, P. Varma, M. Fiterau, **K. Xiao**, H. Tejada, B. Keavney, H. Cordell, E. Ashley, J. Priest. *Deep Learning of Cardiac Morphology from UK Biobank MRI Data Reveals Genome-wide Associations for Bicuspid Aortic Valve.* Abstract-ASHG 2018
- 2017 | **K. Xiao**, H. Tejada, J. Priest, SP. Lee, J. Fries, M. Fiterau. Data Augmentation for Aortic Valve Morphology Classification from Phase-Contrast MRI. ML4H-NIPS 2017
- 2017 | **K. Xiao**, H. Tejada, J. Priest, SP. Lee, J. Fries, M. Fiterau. *Automated Classification of Aortic Valve Morphology from Phase-Contrast Cardiac MRI Using an Augmented CNN.* MED-NIPS 2017

WORK EXPERIENCE

- 05/21 - 12/21 | AI Research Intern at **Invitae Corporation**
AI Research Team Intern (Polygenic Prediction Model)
 Developing a probabilistic polygenic prediction model using GWAS (Genome-wide Association Study) summary statistics and annotation embeddings. Identifying causal variants using the posterior distributions of the true variant effect sizes.
- 09/19 - 05/20 | Research Assistant at **University of Massachusetts Amherst**
Medical Imaging Research at Info Fusion Lab
 Working on Computer Vision & Deep Learning research in the medical imaging field, including Mitral Regurgitation classification, Long-axis view Cardiac MRI segmentation, etc.
- 07/17 - 08/19 | Research Data Analyst at **School of Medicine, Stanford University**
MRI Data Analyst with Machine Learning and Convolutional Neural Network technology.

Working on computer vision projects with MRI image datasets. Applying fully-connected neural network models, convolutional neural network models and recurrent neural network models on image classification and segmentation tasks. Developing MRI image processing platforms. Developing Neural Network model experiments and hyper-parameter tuning pipeline, etc.

SUMMER 2012 | Summer Intern at **NIMAK Welding(Beijing) Ltd, Beijing**
Mechanical Engineer of Control Cabinet Assembly line
Helped develop, manufacture, install mechanical and electronic components of the Control Cabinet of the electrode holder.

SKILLS

LANGUAGES | Python, C/C++, Java, bash, Matlab, Mathematica, \LaTeX , etc

MACHINE LEARNING | PyTorch, Pyro, TensorFlow, Keras, Stochastic Variational Inference, Graphical Model, Bayesian Inference, Convolutional Neural Network, Recurrent Neural Network, Weak Supervision, Sequence Classification, Image Segmentation, etc.

ROBOTICS & SYSTEMS | Robot Operating System (ROS), Velodyne LiDAR, SLAM, Computer Vision, OpenCV, Atmel, TCP/IP, etc.

MECHANICAL | SolidWorks, AutoCAD, ANSYS, Inventor

OPERATING SYSTEMS | Linux, Mac, Android app development using AndroidStudio

TEACHING

09/22 - CURRENT | Teaching Assistant at **University of Massachusetts Amherst**
Course: *COMPSci 661 - Secure Distributed Systems*

01/22 - 05/22 | Teaching Assistant at **University of Massachusetts Amherst**
Course: *COMPSci 690OP - Optimization in Computer Science*

09/21 - 12/21 | Teaching Assistant at **University of Massachusetts Amherst**
Course: *COMPSci 589 - Machine Learning*

02/21 - 05/21 | Teaching Assistant at **University of Massachusetts Amherst**
Course: *COMPSci 688 - Probabilistic Graphical Models*

06/20 - 12/20 | Teaching Assistant at **University of Massachusetts Amherst**
Course: *COMPSci 589 - Machine Learning*

08/16 - 12/16 | Teaching Assistant at **Colorado School of Mines**
Course: *CSCI 507 - Computer Vision*

COURSE PROJECTS

01/16 - 05/16 | Course - Computer Vision

01/16 - 05/16	<p>Top 1% of the class. Learned image processing/filtering, and various computer vision algorithms: edge detection, pose estimation, image matching and patching, SIFT, etc.</p> <p>Developed an algorithm to recognize the chess board and track the movements of all the chess pieces on the board.</p>
01/16 - 05/16	<p>Course - Mechatronics</p> <p>Learned how to use Atmel Studio to program Arduino in performing multiple tasks.</p> <p>Assembled a quad-copter and programmed an Arduino to control the quad-copter based on the feedback from multiple sensors like Gyro, Compass, Accelerometer, and Barometer.</p>
08/16 - 12/16	<p>Course - Computer Networks</p> <p>Learned how to develop video streaming application with RTSP and RTP. Developed communication applications in Android. Developed a system in C++ to simulate the communication and task allocation of a multi-robot system.</p>
08/15 - 12/15	<p>Course - Robot Mechanics</p> <p>Designed and simulated a robotic system for an assumed nuclear power plant. Designed a robot that can transport the nuclear fuel rod from the loading room on the 2nd floor to the reactor room on the 1st floor and back.</p>

AWARDS AND HONORS

JUN 2020	Paul Utgoff Memorial Graduate Scholarship in Machine Learning
MAR 2016	First place in DU (University of Denver) Analytics Challenge (\$2,500)
DEC 2012	Outstanding Volunteer in the 60th Anniversary of Beihang University
DEC 2010	Best Debater in Debate Competition for Freshman in School of Mechanical Engineering and Automation, Beihang University

COURSES

Neural Networks, Probabilistic Graphical Models, Machine Learning, Computer Vision, Advanced Algorithms, Secure Distributed Systems, Engineering Optimization, Non-Linear Optimization, Computer Networks, Advanced Engineering Analysis, Robot Mechanics: *Kinematics, Dynamics, and Control*, Fuel Cell, Mechatronics, Field Robotics System and Control, 3D SLAM Using LiDAR, etc.