

CONTACT  
INFORMATION

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RESEARCH  
INTERESTS

Artificial intelligence, biomedical data analysis, and computer vision and image processing

## EDUCATION

**Utah State University (USU)**, Logan, Utah, 2020  
**Ph.D.**, Department of Computer Science. **GPA: 4.0/4.0.**

**Harbin Institute of Technology (HIT)**, Harbin, China, 2011  
**M.S.**, Computer Science. **GPA: Top 10%.**

**Northeast Normal University**, China, 2009  
**B.S.**, Computer Science and technology. **GPA: 3.91/4.0.**

WORK  
EXPERIENCE

**Grand View University, now**  
*Assistant Professor of Department Math & Computer Science*

**China Mobile (*Forbes Global 2000, 2018: 25th*), Shenzhen, China, 2011 - 2014**  
*Software Engineer*

Worked as a project lead to design and evaluate a new automatic test system which improved the test efficiency significantly; worked as a major member of the Business Integration Test Project; and worked as a major member of the functional test of the online Mobile Mall.

**Tencent (*Forbes Global 2000, 2018: 105th*), Shenzhen, China, Summer 2010**  
*R&D engineer in the Sorting Analysis Group, summer internship*

Improved the efficiency of the previous sorting algorithm; built a benchmark to evaluate the performance of clustering methods; and proposed an efficient method to remove the duplicate web pages in the Sougou browser.

HONORS,  
CERTIFICATES, AND  
AWARDS

**Doctoral Student Researcher Award**, Computer Science, Utah State University, 2019

**Teaching Assistant Certificate**, Utah State University, 2014

**Best Employee**, China Mobile, China, 2013

**Project Model**, China Mobile, China, 2013

**Certificate ISTQB Certified Tester**, China Mobile, China, 2013

**Certificate Project Management Training**, China Mobile, China, 2013

**Qualification Certificate of Computer and Software Technology Proficiency**, China Mo-

bile, China, 2013

**People Fellowship**, Top Grade, Harbin Institute of Technology, China, 2011

**People Fellowship**, Second Grade, Harbin Institute of Technology, China, 2010

**National Scholarship**, Northeast Normal University, China, 2009

**People Fellowship** (three times), Northeast Normal University China, 2005 - 2009

RESEARCH  
EXPERIENCE

**Computer Vision, Pattern Recognition, and Image Processing (CVPRIP) Lab**

Utah State University, Logan, Utah

*Ph.D. Student/Teaching and Research Assistant*

**2014 - 2020**

Focus on AI applications in computer vision and biomedical image analysis. Specially, my Ph.D. research consists of three main parts: (1) human visual attention modeling; (2) theory and algorithms for data topology modeling; and (3) biomedical image analysis:

(1) **Human visual attention modeling**

Model human visual attention process as a quadratic programming (QP) problem with robust constraints to detect the objects in the natural images. The proposed adaptive center-based constraint is more robust than the traditional image center-based constraint to handle the image with the objects near the borders. The new smoothness term is more robust than commonly used region-based smooth term when the image has a complicated background or low contrast. The proposed method outperformed 10 state-of-the-art methods on three public benchmark datasets.

(2) **Theory and algorithms for data topology modeling**

- Built the generalized Neutro-Connectedness (NC) based on local similarity and inhomogeneity, which enabled the NC to be independent of top-down prior from the task domain and to have wide potential applications like data analysis, image segmentation, saliency estimation, object detection, etc.
- Implemented NC computation algorithm that takes polynomial time to output NC values and NC forest simultaneously. The NC forest explored the topological structure of datasets.

(3) **Biomedical image analysis**

Designed, implemented and evaluated a suite of approaches for breast tumor saliency estimation in breast ultrasound (BUS) images.

- **A hybrid approach for breast tumor saliency estimation.** The Decision tree based on the extracted image features is utilized to determine the tumor existence. A optimization framework integrating three popular human vision attention hypotheses from biological priors and low-level BUS image information is employed to localize the tumor. The proposed model achieved the best performance on 610 images among the state-of-the-art methods.
- **A unified framework integrating the topological properties for tumor saliency estimation.** In the framework, we utilized a new topological properties to generate the non-semantic breast anatomy, and analyzed the structure high-level knowledge of the BUS image, and designed a new objective function for the optimization process. The proposed model outperformed 8 state-of-the-art methods on a public dataset with 562 images.
- **Breast anatomy enriched tumor saliency estimation in BUS images.** It utilized the U-Net to generate the initial breast anatomy layers. High-level semantic priors and low-level BUS image information are modeled in a Quadratic Programming(QP) framework with equality and inequality constraints to localize the tumor. The proposed model outperformed four state-of-the-art methods on a public dataset with 562 images.

**Harbin Institute of Technology**, Harbin, Heilongjiang China

*Research Assistant*

**September, 2009 - June, 2011**

**Image retrieval and sorting by using random projection.** Proposed a new method to transfer variable-length vectors into vectors with a constant number of low dimensions by using random projection. The proposed approach was applied to image retrieval and sorting.

TEACHING  
EXPERIENCE

**Instructor**, Grand View University

- Computer Science I(CPSC/BSAD 241), **Fall 2020**
- Data Structures and Algorithms(CPSC 330), **Fall 2020**
- Databases(CPSC/BSAD 421), **Fall 2020**

**Teaching Assistant**, Utah State University

Collaborated on class development, tutored students during office hour or upon requests and graded all assignments and projects for:

- Python Introduce(CS1440), **Fall 2018 - Spring 2020**
- Operating Systems and Concurrency(CS3100), **Spring 2018**
- Computer Vision: Foundations and Applications (CS5680), **Fall 2017**
- Computer Systems, Organization and Architecture(CS 3810), **Spring 2015-2017, Fall 2015**
- Foundations of Computer Science Lecture(CS 1030), **Fall 2016**
- C++ Programming (CS1410), **Fall 2014**

**Instructor**, Utah State University

**Fall 2014**

Worked as lab instructor for C++ Programming(CS1410) and given 3 lectures about sorting technology.

**Lab Instructor**, Harbin Institute of Technology

**Spring 2011**

Lab instructor for undergraduate C++ programming course. Lectured and tutored for the weekly lab session. Developed course projects and graded assignments, exams and projects.

PROGRAMMING  
SKILLS

- Proficient: C++, C, Matlab
- Familiar: Python

PROFESSIONAL  
SERVICE

Reviewed manuscripts for

- Pattern Recognition
- IEEE Transactions on Image Processing
- Neurocomputing

PUBLICATIONS

**Under Review**

1. [J] F. Xu, Y. Zhang, H. Cheng, B. Zhang, J. Ding, C. Ning, and Y. Wang. "Tumor Saliency Estimation for Breast Ultrasound Images via Breast Anatomy Modeling," submitted to *Information Sciences*, 2020.
2. [J] Y. Zhang, H. Cheng, M. Xian, F. Xu, K. Huang, B. Zhang, J. Ding, C. Ning, and Y. Wang, "A Benchmark for Breast Ultrasound Image Segmentation (BUSIS)," under review of *IEEE Transaction on Medical Imaging*, 2020.

**Published Publication**

3. [C] F. Xu, Y. Zhang, H. D. Cheng, B. Zhang, J. Ding, C. Ning, and Y. Wang. "Breast Anatomy Enriched Tumor Saliency Estimation," submitted to IEEE International Conference on Pattern Recognition (ICPR), 2020(Accepted).

4. [C] F. Wei, J. Ding, C. Ning, F. Xu, M. Xian, and Y. Zhang, "Texture analysis and imbalanced data processing for papillary thyroid microcarcinoma detection," in BIBE 2018; International Conference on Biological Information and Biomedical Engineering, 2018, pp. 1-4.
5. [C] F. Xu, M. Xian, Y. Zhang, K. Huang, H. D. Cheng, B. Zhang, A Novel Hybrid Framework for Tumor Saliency Estimation, in: IEEE International Conference on Pattern Recognition (ICPR), 2018.
6. [J] M. Xian, Y. Zhang, H. D. Cheng, F. Xu, B. Zhang, and J. Ding, "Automatic breast ultrasound image segmentation: A survey," *Pattern Recognition*, vol. 79, pp. 340-355, 2018.
7. [C] M. Xian, F. Xu, H. D. Cheng, Y. Zhang, and J. Ding, "EISeg: Effective interactive segmentation," in IEEE International Conference on Pattern Recognition (ICPR), 2016, pp. 1982-1987.
8. [J] M. Xian, Y. Zhang, H. D. Cheng, F. Xu, J. Ding, Neutro-Connectedness Cut, *IEEE Transactions on Image Processing*, vol. 25, no. 10, pp. 4691-4703, 2016
9. [C] F. Xu, M. Xian, H. D. Cheng, Unsupervised saliency estimation based on robust hypotheses, in IEEE Winter Conference on Applications of Computer Vision (WACV), 2016, pp. 1-6.
10. [J] J. Ding, H. Cheng, M. Xian, Y. Zhang, and F. Xu, "Local-weighted Citation-kNN algorithm for breast ultrasound image classification," *Optik-International Journal for Light and Electron Optics*, vol. 126, no. 24, pp. 5188-5193, 2015.
11. [C] J. Ding, M. Xian, H. D. Cheng, Y. Zhang, and F. Xu, "An algorithm based on LBPV and MIL for left atrial thrombi detection using transesophageal echocardiography," in Proceedings - International Conference on Image Processing(ICIP), 2015, vol. 2015-December, pp. 4224-4227.
12. [C] H. Shao, Y. Zhang, M. Xian, H. D. Cheng, F. Xu, J. Ding, A saliency model for automated tumor detection in breast ultrasound images, in IEEE International Conference Image Processing(ICIP), 2015, pp. 1424-1428.
13. [J] F. Xu, J. F. Liu, and B.Y. Zhang and R .Wu and W. Wei. "Research on clustering of natural scene images with texts based on random projection", *Application Research of Computers*, Vol. 28, No. 12, pp. 4730-4733, 2011.
14. F. Xu, "Research on Clustering of Natural Scene Images with Texts Based on Random Projection," Thesis, 2011.