

Rongchang Zhao Ph.D.

Contact Information

Associate Professor, Master Supervisor

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Research Interests

Medical image analysis, Pattern recognition, Computer vision

Currently, the **sample imbalance** and **evidence reasoning** are two primary concerns in my research.

Education and Work Experience

- ✓ Dec. 2018 -- Dec.2020 Western University, Visiting Professor, Medical Image Analysis and Artificial Intelligence
- ✓ Nov. 2012 -- Central South University, Computer Science and Engineering, Associate professor, Research area: Medical Image Analysis, Machine Learning, Computer Vision
- ✓ Jan. 2013– Apr.2016 Central South University, Control Science and Engineering, Postdoctoral, Research area: Medical Image Analysis
- ✓ Sept. 2006 – Dec. 2011 Lanzhou University, Radiophysics, PhD, Research area: Computer Vision and Pattern Recognition
- ✓ Sept. 2002 – Jun. 2006 Lanzhou University, Electronic Information Science and Technology, B.Eng

Selected Publications

21. Rongchang Zhao, Xuanlin Chen, Zailiang Chen, Shuo Li. EGDCL: An Adaptive Curriculum Learning Framework for Unbiased Glaucoma Diagnosis. *ECCV*, 2020.

20. Zailiang Chen, Xianxian Zheng, Hailan Shen, Ziyang Zeng, Yukun Zhou, **Rongchang Zhao**. Improving Knowledge Distillation via Category Structure. *ECCV*, 2020.

19. Beiji Zou, Zhiyou He, **Rongchang Zhao***, Chengzhang Zhu, Wangmin Liao, and Shou Li. Non-rigid retinal image registration using an unsupervised structure-driven regression network. *Neurocomputing*, 2020. (Impact Factor: 4.072)

18. Rongchang Zhao, Hong Li, and Xiyao Liu. A Survey of Dictionary Learning in Medical Image

Analysis and Its Application for Glaucoma Diagnosis. *Archives of Computational Methods in Engineering*, 2019. (Impact Factor: 7.242)

17. Beiji Zou, Changlong Chen, **Rongchang Zhao***, Pingbo Ouyang, Chengzhang Zhu, Qilin Chen, and Xuanchu Duan. A Novel Glaucomatous Representation Method based on Radon and Wavelet Transform, *BMC Bioinformatics*, 2019. (Impact Factor: 2.511)

16. **Rongchang Zhao**, Shuo Li. Multi-indices quantification of optic nerve head in fundus image via multitask collaborative learning, *Medical Image Analysis (MedIA)*, 2019. (Top journal on Medical Image Analysis with Impact Factor: 8.88)

15. Wangmin Liao, Beiji Zou, **Rongchang Zhao***, YuanQiong Chen, ZhiYou He, and MengJie Zhou, Clinical Interpretable Deep Learning Model for Glaucoma Diagnosis, *IEEE Journal of Biomedical and Health Informatics (IEEE JBHI)*, 2019. (Top journal on Medical image analysis with Impact Factor: 4.217)

14. **Rongchang Zhao**, Xuanlin Chen, Xiyao Liu, Zailiang Chen, Fan Guo and Shuo Li, Direct Cup-to-Disc Ratio Estimation for Glaucoma Screening via Semi-supervised Learning, *IEEE Journal of Biomedical and Health Informatics (IEEE JBHI)*, 2019. (Top journal on Medical image analysis with Impact Factor: 4.217)

13. **Rongchang Zhao**, Zailiang Chen, Xiyao Liu, Beiji Zou, and Shuo Li, Multi-index Optic Disc Quantification via MultiTask Ensemble Learning, *The 22nd International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI-19)*, Shenzhen, China, 2019.

12. **Rongchang Zhao**, Wangmin Liao, Beiji Zou, Zailiang Chen, and Shuo Li, Weakly-Supervised Simultaneous Evidence Identification and Segmentation for Automated Glaucoma Diagnosis, *The Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-19)*, Honolulu, Hawaii, USA, 2019.

11. **Rongchang Zhao**, Min Wu, Xiyao Liu, Beiji Zou, Fangfang Li. Orientation histogram-based center-surround interaction: an integration approach for contour detection, *Neural Computation*, 2017, 29(1):171-193.

10. **Rongchang Zhao**, Yide Ma, A novel region-based image compression method based on spiking cortical model, *Journal of Systems Engineering and Electronics*, 2015, 26(1): 161-171

9. **Rongchang Zhao**, Yide Ma, A region segmentation method for region-oriented image compression, *Neurocomputing*, 2012, 85(1): 45-52

8. Fangfang Li, Huanting Wang, **Rongchang Zhao***, Xiyao Liu, Yanzhen Wang, Beiji Zou. Chinese

micro-blog sentiment classification through a novel hybrid learning model. *Journal of Central South University*, 2017, 24 (10) :2322-2330

7. Xiyao Liu, Huanting Wang, **Rongchang Zhao**^{*}, Fangfang Li, Shenghui Liao, Yipeng Ding, Beiji Zou. Novel Robust Zero-Watermarking Scheme for Digital Rights Management of 3D Videos, *Signal Processing: Image Communication*, 2017, 54 (C) :140-151

6. **Rongchang Zhao**, Yide Ma, Tri-state cascading pulse coupled neural network and its application in finding shortest path, *Neural Network World*, 2009, 19(6): 711-723

5. **Rongchang Zhao**, Yide Ma, A novel image coding method with visual cortical model, The 2011 *International Conference on Artificial Intelligence and Computational Intelligence (AICI)*, Taiyuan, P.R. China, 2011.9.24-2011.9.25.

4. **Rongchang Zhao**, Zailiang Chen, Xuanchu Duan, Qilin Chen, Ke Liu, Chengzhang Zhu, Automated Glaucoma Detection Based on Multi-channel Features from Color Fundus Images, *Journal of Computer-Aided Design & Computer Graphics*, 2017,29(6): 998-1006

3. **Rongchang Zhao**, Yide Ma, A novel region segmentation algorithm with neural network for segmented image coding, *Acta Electronica Sinica*, 2014, 42(07): 1277-1283

2. **Rongchang Zhao**, Zailiang Chen, Beiji Zou, Xuanchu Duan, Pingbo Ouyang, Supervised learning and its application in detection of retinal microvascular damage, 2015, *The eleventh glaucoma conference of Chinese Medical Association*.

1. Chengzhang Zhu, Beiji Zou, **Rongchang Zhao**, Jinkai Cui, Xuanchu Duan, Zailiang Chen, Yixiong Liang. Retinal vessel segmentation in colour fundus images using Extreme Learning Machine. *Computerized Medical Imaging and Graphics*, 2017, 55:68-77.

China Patent

1. **Rongchang Zhao**, 2016, Object boundary detection via integration of local edges cues, ZL 2016 1 0440406.0

2. **Rongchang Zhao**, 2018, Automated optic disc cup segmentation method for color fundus map, 201811496827.0

3. **Rongchang Zhao**, 2019, Retinal vessel segmentation method based on mid-level patches spatial structure, 201910471171.5

Gants (Principal Investigator)

1. National Natural Science Foundation (61702558), Jan. 2018 – Dec. 2020, RMB 220,000

Project Title: Automatic morphological analysis of optic disc and cup in ophthalmoscopic images for glaucoma screening

2. Hunan Natural Science Foundation(2017JJ3411), Jan. 2017- Dec. 2019, RMB 50,000

Project Title: Optic disc segmentation based on multi-feature fusion in fundus image

3. The Key Research and Development Projects in Hunan(2017WK2074), Jan. 2018 – Dec. 2020, RMB 120,000

Project Title: Computer-aided screening typical eye disease method and health service system based on medical big data analysis

4. The National Key Research and Development Program of China (2017YFC0840104), Jan. 2018 – Dec. 2020, RMB 200,000

Project Title: Early diagnosis of neurodegenerative diseases based on structural features of retina and microscopic imaging

Professional Service

He has been serving as a regular reviewer / PC member for highly selective journals/ conference proceedings, such as MedIA, IEEE TMI, TIP, TBME, JBHI, Neurocomputing, CMIG, ICML 20, MICCAI 19-20, AAAI 19-20, NeurIPS 19, *etc.*

Research Experience

School of Information Science and Engineering, Lanzhou University

PhD student

Supervisor: Prof. Yide Ma

Sept. 2006 – Dec. 2011

- Thesis: Research on some key problems of Segmented Image Coding
- A novel segmentation algorithm based on spiking cortical model is proposed to be used in irregular segmented region coding. The segmentation algorithm partitions an image into irregular regions and tidy contours, the crucial regions corresponding to objects in scene are retained and a lot of tiny parts are merged.
- A model of neural network, named Tri-state cascading pulse coupled neural network, is proposed, which takes the ideas of three-state and pipelining used in circuit designing into neural network. The proposed model transmits signals in parallel way to find the shortest path.

College of Electrical Engineering, Northwest University for Nationalities

Lecturer

Jan. 2012 – Oct. 2012

- An algorithm for image segmentation under complex background is proposed. Using the gradient coupling energy between adjacent pixels in the image, the uniformity of the pixels in the significant region and the smoothness of the region contour are constrained, and the Spiking Neural Network (SNN) is constructed to accurately segment the image significant region.

School of Computer Science and Engineering, Central South University

Postdoctoral Researcher

Supervisor: Prof. Min Wu

Jan. 2013 – Jan. 2015

- Thesis: Object segmentation and contour detection based on human visual system
- A contour detection algorithm based on feature integration is proposed. Based on the idea of feature integration, the algorithm correctly associates the local features of the separated images to form an effective representation of the whole object. Regression analysis method is applied to solve the problem of feature integration, and effectively improve the accuracy of object segmentation and contour detection.

Lecturer & associate professor

Nov. 2012 - Now

- An automatic glaucoma classification approach is proposed, which aggregate multichannel features to represent the glaucomatous characteristics. The approach improves the specificity of the automatic identification of glaucoma by aggregating the features of multi-channel images and based on multiple features and multi-scale techniques to represent the small changes in the shape and structure of the optic disc.
- a direct CDR estimation method is proposed based on the well-designed semi-supervised learning scheme, in which CDR estimation is formulated as a general regression problem while optic disc/cup segmentation is cancelled.
- An innovative weakly-supervised deep learning framework is proposed for accurate evidence identification, optic disc segmentation and automated glaucoma diagnosis. The weakly-supervised framework only uses binary diagnostic labels (normal/glaucoma) for training.

Dept. of Medical Imaging and Medical Biophysics, Schulich School of Medicine and Dentistry, University of Western Ontario

Visiting professor

Nov. 2018.12 - Now

- Multitask ensemble learning framework (DMTFs) is proposed to achieve multi-index OD quantification for clinical assessment of ophthalmic disease.
- Dual-curriculum learning is developed to deal with the biased data distribution problem existing in medical image analysis with two interwoven issues: class imbalance and rate hard examples.
- Evidence reasoning is proposed to boost the prediction performance of image classification, quantification and/or segmentation by inference the visual evidence with graph neural networks.