

Jinzheng Cai

Senior Research Scientist @ PAII Inc.
6720B Rockledge Drive, Suite 410, Bethesda, MD 20817, US

RESEARCH INTEREST

Medical Image Analysis, Machine Learning, Biomedical Imaging Informatics, Big Healthcare Data

QUALIFICATIONS

- Highly motivated researcher with solid knowledge and professional training in biomedical engineering.
- Experienced in medical image analysis, computer vision, and deep machine learning.
- Intensively involved in algorithm design, implementation, and coding under Linux and Windows.
- Skilled in programming languages and tools: C/C++, Python, Pytorch, Tensorflow, Caffe, Matlab, and Mitk.
- Native Chinese, fluent English.

EDUCATION

University of Florida Gainesville, FL, US
Ph.D. in Biomedical Engineering Jan. 2015 – May 2019
Supervisor: Prof. Lin Yang

Tsinghua University Beijing, China
Ph.D. Student in School of Aerospace Engineering Jul. 2013 – Dec. 2014
Supervisor: Prof. Youzheng Wang

Fudan University Shanghai, China
B.E. in Biomedical Engineering Sep. 2009 – Jul. 2013
Supervisor: Prof. Yu Ma

WORK & RESEARCH EXPERIENCE

Senior Research Scientist May 2019 – Present
PAII Inc. Bethesda, MD, US

- Research on advancing 3D/4D medical imaging related clinical applications. Develop solutions to analysis general lesions in whole body computed tomography (CT) images at big data scale and detect liver tumors in dynamic-contrast CT.
- Build software to bridge communications between doctors and machine. Implement cross-platform graphical user interface to present machine outputs to radiologists and collect their edits and feedbacks for further method improvements.

Research Intern May 2018 – Aug. 2018
NVIDIA Crop. Bethesda, MD, US

- Abdominal organ segmentation in CT images with shape priors. This model was patented by NVIDIA Crop. and was accepted as an oral presentation at the international workshop on machine learning in medical imaging in 2019.
- Developed segmentation algorithms for participating medical segmentation decathlon 2018. Won the 3rd place in this challenge.

Predoctoral Fellowship Jun. 2017 – Jan. 2018
National Institute of Health Bethesda, MD, US
Studies on a large-scaled cancer CT database – DeepLesion:

- Developed a weakly supervised method to perform accurate lesion segmentation in CT images. It enables training of deep learning algorithms with measurements that recorded from the daily workflow of radiologists and requires no explicit manual annotations.
- Conducted CT image enhancement using stacked generative adversarial networks and transfer learning for lesion segmentation improvement.

Graduate Research Assistant

Department of Biomedical Engineering, University of Florida

Jan. 2015 – May 2019

Gainesville, FL, US

Algorithm design & implementation for:

- Solutions for pancreas segmentation in MRI and CT imaging: 1) proposed graph-based decision fusion to combine outputs of different models, 2) proposed recurrent neural contextual learning to improve consistency of 2D-based segmentation results, 3) proposed direct loss function to efficiently train deep learning models.
- Approaches of automatic disease classification and weakly supervised localization for thoracic diseases in chest X-Rays and muscular dystrophy in MRI.
- A medical image augmentation framework using cycle generative adversarial networks with organ shape consistency. It significantly improved pancreas segmentation in CT and MRI, cardiac segmentation in MRI, and mass segmentation in mammography X-rays.

PUBLICATIONS

Book Chapter

1. Jin, Dakai, Adam P. Harrison, Ling Zhang, Ke Yan, Yirui Wang, **Jinzheng Cai**, Shun Miao, and Le Lu. “Artificial intelligence in radiology.” In *Artificial Intelligence in Medicine*, pp. 265-289. Academic Press, 2020.
2. **Cai, Jinzheng**, Le Lu, Fuyong Xing, and Lin Yang. “Pancreas Segmentation in CT and MRI via Task-Specific Network Design and Recurrent Neural Contextual Learning.” In *Deep Learning and Convolutional Neural Networks for Medical Imaging and Clinical Informatics*, pp. 3-21. Springer, Cham, 2019.

Peer-Reviewed Journal Papers

1. **Cai, Jinzheng**, Adam P. Harrison, Youjing Zheng, Ke Yan, Yuankai Huo, Jing Xiao, Lin Yang, and Le Lu. “Lesion-Harvester: Iteratively Mining Unlabeled Lesions and Hard-Negative Examples at Scale,” in *IEEE Transactions on Medical Imaging*, doi: 10.1109/TMI.2020.3022034, 2020. (**Impact factor=9.710**)
2. Xia, Yingda, Dong Yang, Zhiding Yu, Fengze Liu, **Jinzheng Cai**, Lequan Yu, Zhuotun Zhu, Daguang Xu, Alan Yuille, and Holger Roth. “Uncertainty-aware multi-view co-training for semi-supervised medical image segmentation and domain adaptation.” *Medical Image Analysis* 65 (2020): 101766. (**Impact factor=11.148**)
3. **Cai, Jinzheng**, Zizhao Zhang, Lei Cui, Yefeng Zheng, and Lin Yang. “Towards cross-modal organ translation and segmentation: a cycle-and shape-consistent generative adversarial network.” *Medical image analysis* 52 (2019): 174-184. (**Impact factor=8.880**)
4. **Cai, Jinzheng**, Fuyong Xing, Abhinandan Batra, Fujun Liu, Glenn A. Walter, Krista Vandenborne, and Lin Yang. “Texture analysis for muscular dystrophy classification in MRI with improved class activation mapping.” *Pattern recognition* 86 (2019): 368-375. (**Impact factor=5.898**)
5. Shi, Xiaoshuang, Zhenhua Guo, Fuyong Xing, **Jinzheng Cai**, and Lin Yang. “Self-learning for face clustering.” *Pattern Recognition* 79 (2018): 279-289. (**Impact factor=5.898**)
6. Zizhao Zhang, Pingjun Chen, Mason McGough, Fuyong Xing, Chunbao Wang, Marilyn Bui, Yuanpu Xie, Manish Sapkota, Lei Cui, Jasreman Dhillon, Nazeel Ahmad, Farah K. Khalil, Shohreh I. Dickinson, Xiaoshuang Shi, Fujun Liu, Hai Su, **Jinzheng Cai**, and Lin Yang. “Pathologist-level interpretable whole-slide cancer diagnosis with deep learning.” *Nature Machine Intelligence* 1, no. 5 (2019): 236-245.

Peer-Reviewed Conference Papers

1. **Cai, Jinzheng**, Ke Yan, Chi-Tung Cheng, Jing Xiao, Chien-Hung Liao, Le Lu, and Adam P. Harrison. “Deep Volumetric Universal Lesion Detection Using Light-Weight Pseudo 3D Convolution and Surface Point Regression.” In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pp. 3-13. Springer, Cham, 2020.

2. Ashwin Raju, Chi-Tung Cheng, Yunakai Huo, **Jinzheng Cai**, Junzhou Huang, Jing Xiao, Le Lu, ChienHuang Liao, Adam P Harrison. "Co-heterogeneous and Adaptive Segmentation from Multi-source and Multi-phase CT Imaging Data: A Study on Pathological Liver and Lesion Segmentation." In: Vedaldi A., Bischof H., Brox T., Frahm JM. (eds) Computer Vision – ECCV 2020. ECCV 2020. Lecture Notes in Computer Science, vol 12368. Springer, Cham.
3. Fengze Liu, **Jinzheng Cai**, Yuankai Huo, Chi-Tung Cheng, Ashwin Raju, Dakai Jin, Jing Xiao, Alan Yuille, Le Lu, ChienHung Liao, Adam P. Harrison. "JSSR: A Joint Synthesis, Segmentation, and Registration System for 3D Multi-modal Image Alignment of Large-Scale Pathological CT Scans." In: Vedaldi A., Bischof H., Brox T., Frahm JM. (eds) Computer Vision – ECCV 2020. ECCV 2020. Lecture Notes in Computer Science, vol 12358. Springer, Cham.
4. Chao, Chun-Hung, Zhuotun Zhu, Dazhou Guo, Ke Yan, Tsung-Ying Ho, **Jinzheng Cai**, Adam P. Harrison et al. "Lymph Node Gross Tumor Volume Detection in Oncology Imaging via Relationship Learning Using Graph Neural Network." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 772-782. Springer, Cham, 2020.
5. Raju, Ashwin, Zhanghexuan Ji, Chi Tung Cheng, **Jinzheng Cai**, Junzhou Huang, Jing Xiao, Le Lu, ChienHung Liao, and Adam P. Harrison. "User-Guided Domain Adaptation for Rapid Annotation from User Interactions: A Study on Pathological Liver Segmentation." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 457-467. Springer, Cham, 2020.
6. Xia, Yingda, Fengze Liu, Dong Yang, **Jinzheng Cai**, Lequan Yu, Zhuotun Zhu, Daguang Xu, Alan Yuille, and Holger Roth. "3D semi-supervised learning with uncertainty-aware multi-view co-training." In The IEEE Winter Conference on Applications of Computer Vision, pp. 3646-3655. 2020.
7. Yao, Jiawen, **Jinzheng Cai**, Dong Yang, Daguang Xu, and Junzhou Huang. "Integrating 3D Geometry of Organ for Improving Medical Image Segmentation." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 318-326. Springer, Cham, 2019.
8. Su, Hai, Xiaoshuang Shi, **Jinzheng Cai**, and Lin Yang. "Local and Global Consistency Regularized Mean Teacher for Semi-supervised Nuclei Classification." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 559-567. Springer, Cham, 2019.
9. **Cai, Jinzheng**, Yingda Xia, Dong Yang, Daguang Xu, Lin Yang, and Holger Roth. "End-to-End Adversarial Shape Learning for Abdomen Organ Deep Segmentation." In International Workshop on Machine Learning in Medical Imaging, pp. 124-132. Springer, Cham, 2019.
10. **Cai, Jinzheng**, Le Lu, Adam P. Harrison, Xiaoshuang Shi, Pingjun Chen, and Lin Yang. "Iterative attention mining for weakly supervised thoracic disease pattern localization in chest x-rays." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 589-598. Springer, Cham, 2018.
11. **Cai, Jinzheng**, Youbao Tang, Le Lu, Adam P. Harrison, Ke Yan, Jing Xiao, Lin Yang, and Ronald M. Summers. "Accurate weakly-supervised deep lesion segmentation using large-scale clinical annotations: Slice-propagated 3d mask generation from 2d RECIST." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 396-404. Springer, Cham, 2018.
12. Tang, Youbao, **Jinzheng Cai**, Le Lu, Adam P. Harrison, Ke Yan, Jing Xiao, Lin Yang, and Ronald M. Summers. "CT image enhancement using stacked generative adversarial networks and transfer learning for lesion segmentation improvement." In International Workshop on Machine Learning in Medical Imaging, pp. 46-54. Springer, Cham, 2018.
13. Liu, Jiamin, **Jinzheng Cai**, Karthik Chellamuthu, Mohammadhadi Bagheri, Le Lu, and Ronald M. Summers. "Cascaded coarse-to-fine convolutional neural networks for pericardial effusion localization and segmentation on CT scans." In 2018 IEEE 15th international symposium on biomedical imaging (ISBI 2018), pp. 1092-1095. IEEE, 2018.
14. **Cai, Jinzheng**, Le Lu, Yuanpu Xie, Fuyong Xing, and Lin Yang. "Improving deep pancreas segmentation in CT and MRI images via recurrent neural contextual learning and direct loss function." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 674-682. Springer, Cham, 2017.

15. **Cai, Jinzheng**, Le Lu, Zizhao Zhang, Fuyong Xing, Lin Yang, and Qian Yin. "Pancreas segmentation in MRI using graph-based decision fusion on convolutional neural networks." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 442-450. Springer, Cham, 2016.
16. Xing, Fuyong, Xiaoshuang Shi, Zizhao Zhang, **Jinzheng Cai**, Yuanpu Xie, and Lin Yang. "Transfer shape modeling towards high-throughput microscopy image segmentation." In International Conference on Medical Image Computing and Computer-Assisted Intervention, pp. 183-190. Springer, Cham, 2016.
17. Shi, Xiaoshuang, Fuyong Xing, **Jinzheng Cai**, Zizhao Zhang, Yuanpu Xie, and Lin Yang. "Kernel-based supervised discrete hashing for image retrieval." In European Conference on Computer Vision, pp. 419-433. Springer, Cham, 2016.

Conference Abstracts

1. **Jinzheng Cai**, Ke Yan, Chi-Tung Cheng, Chien-Hung Liao, Wei Teng, Yuchao Wang, Jing Xiao, Le Lu, Adam P. Harrison. "Automatic Hepatocellular Carcinoma Detection in Patients with Chronic Liver Diseases Using Dynamic Contrast-enhanced CT and Light-Weight 3D Convolutional Neural Network." RSNA 2020.
2. Yuankai Huo, **Jinzheng Cai**, Chi-Tung Cheng, Ke Yan, Chien-Hung Liao, Adam Harrison, Bennett Landman, Jing Xiao, Le Lu. "Identifying and Characterizing Indeterministic Liver Lesions via Deep Learning on Large-scale Dynamic Contrast Enhanced CT Imaging Data from Patients Receiving Invasive Procedures." RSNA 2020.
3. Teng, Wei, Chi-Tung Cheng, **Jinzheng Cai**, Yu-Chao Wang, Le Lu, Chun-Nan Yeh, Chun-Yen Lin et al. "Automatic Hepatocellular Carcinoma Detection in Non-contrast and Venous Computed Tomography of Cirrhotic Patients-A Three Dimensional Deep Learning Based Approach." In Hepatology, vol. 72, pp. 84A-84A. 111 River St, Hoboken 07030-5774, NJ USA: Wiley, 2020.
4. Hai, Su, Manish Sapkota, Fujun Liu, **Jinzheng Cai**, Pingjun Chen, and Lin Yang. "Nucleus Detection and Segmentation for Pathology Images Using Deep Convolutional Neural Network and Variational Autoencoder." In Laboratory Investigation, vol. 98, pp. 66-66. 75 Varick St, 9th Flr, New York, NY 10013-1917 USA: Nature Publishing Group, 2018.
5. Xie, Yuanpu, Pingjun Chen, **Jinzheng Cai**, Fuyong Xing, and Lin Yang. "Efficient and Robust Cell Segmentation in Breast Microscopy Image using Fully Convolutional Neural Network with Multi-Context Aggregation." In Laboratory Investigation, vol. 98, pp. 66-66. 75 Varick St, 9th Flr, New York, NY 10013-1917 USA: Nature Publishing Group, 2018.

Google Scholar: 485 citations till 12/13/2020.

INVITED TALKS

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- Automatic Hepatocellular Carcinoma Detection in Patients with Chronic Liver Diseases Using Dynamic Contrast-enhanced CT and Light-Weight 3D Convolutional Neural Network Nov. 2020
RSNA 2020
 - Deep Volumetric Universal Lesion Detection using Light-Weight Pseudo 3D Convolution and Surface Point Regression Oct. 2020
23rd International Conference on Medical Image Computing & Computer Assisted Intervention, Lima, Peru.
 - End-to-End Adversarial Shape Learning for Abdomen Organ Deep Segmentation Jul. 2018
NVIDIA Crop., Bethesda, MD
 - Improving deep pancreas segmentation in CT and MRI images via recurrent neural contextual learning and direct loss function Jul. 2017
National Institutes of Health, Imaging Biomarkers and Computer-Aided Diagnosis Laboratory at department of Radiology and Imaging Science, Bethesda, MD
 - Pancreas Segmentation in MRI using Graph-Based Decision Fusion on CNNs Nov. 2016
Pruitt Research Day, University of Florida, Gainesville, FL

AWARDS & HONORS

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- **Third place** in the challenge of medical segmentation decathlon 2018. Sep. 2018
 - **Second Prize** of the Scholarship for Outstanding Students at Fudan University. 2011 – 2013

EDITORIAL SERVICES

Pioneer Reviewer of Journals

- IEEE Transactions on Medical Imaging
- IEEE Journal of Biomedical And Health Informatics
- Medical Image Analysis
- Cancer Science & Research Open Access
- Pattern Recognition

Pioneer Reviewer of Conferences

- The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
- The IEEE International Conference on Computer Vision (ICCV)
- The International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI)
- The IEEE International Symposium on Biomedical Imaging (ISBI)
- The Proceedings of the Neural Information Processing Systems Conference (NuralIPS)