Dazhou Guo

ADDRESS 410 Suite, 6720b Rockledge Dr., Bethesda, MD | TEL (240) 686-9877
LINKEDIN www.linkedin.com/in/guodazhou | EMAIL guo2004131@gmail.com

EDUCATION

2010 – 2019 **University of South Carolina, South Carolina, USA**
Ph. D. in Computer Science

2008 – 2010 **Tianjin University, Tianjin, China**
M. S. Eng. in Information and Informatics Engineering

2004 – 2008 **Dalian University of Technology, Dalian, China**
B. S. Eng. in Electronic Engineering

WORK EXPERIENCE

09/2019 – now **PAII Inc,**
Senior Research Scientist

02/2019 – 05/2019 **Pactera Technology**
Research Scientist Internship

05/2017 – 08/2017 **TuSimple LLC**
General Software Engineer Internship

08/2013 – 05/2019 **University of South Carolina**
Undergraduate Lecturer at Dept. of Computer Science & Engineering

08/2010 – 08/2013 **University of South Carolina**
Research Assistant at the Aphasia Laboratory

PUBLICATIONS

[1] **Dazhou Guo*,** Dakai Jin*, et al.: DeepTarget: Gross Tumor and Clinical Target Volume Segmentation in Esophageal Cancer Radiotherapy. to appear, MICCAI-2019 Selected Papers Special Issue by Elsevier, 2020.

[2] Zhuotun Zhu, Dakai Jin, Ke Yan, Tsung-Ying Ho, Xianghua Ye, **Dazhou Guo**, Chun Hung Chao, Jing Xiao, Alan Yuille, Le Lu. Lymph Node Gross Tumor Volume Detection and Segmentation via Distance-based Gating using 3D CT/PET Imaging in Radiotherapy. In International Conference on Medical Image Computing and Computer-Assisted Intervention, Lima, Peru, 2020

[3] Chun Hung Chao, Zhuotun Zhu, **Dazhou Guo**, Dakai Jin, Jinzheng Cai, Ke Yan, Tsung-Ying Ho, Xianghua Ye, Alan Yuille, Le Lu. 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, Lima, Peru, 2020

[4] **Guo, D.,** Jin, D., Zhu, Z., Ho, T., Harrison, A. P., Chao, C., Xiao, J., Yuille, A., Lu, L. (2020). Organ at Risk Segmentation for Head and Neck Cancer using Stratified Learning and Neural Architecture Search. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition.

[5] Yu, H., **Guo, D.,** Yan, Z., Fu, L., Simmons, J., Przybyla, C. P., & Wang, S. (2020). Weakly Supervised Easy-to-hard Learning for Object Detection in Image Sequences. Neurocomputing.

[6] Jin, D., **Guo, D.**, Ho, T. Y., Harrison, A. P., Xiao, J., Tseng, C. K., & Lu, L. (2019, October). Deep Esophageal Clinical Target Volume Delineation Using Encoded 3D Spatial Context of Tumors, Lymph Nodes, and Organs At Risk. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 603-612). Springer, Cham.

[7] Jin, D., **Guo, D.,** Ho, T. Y., Harrison, A. P., Xiao, J., Tseng, C. K., & Lu, L. (2019, October). Accurate esophageal gross tumor volume segmentation in pet/ct using two-stream chained 3d deep network fusion. In International Conference on Medical Image Computing and Computer-Assisted Intervention (pp. 182-191). Springer, Cham.

[8] Song, S., Yu, H., Miao, Z., **Guo, D.**, Ke, W., Ma, C., & Wang, S. (2019). An easy-to-hard learning strategy for within-image co-saliency detection. Neurocomputing, 358, 166-176.

[9] **Guo, D.,** Pei, Y., Zheng, K., Yu, H., Lu, Y., & Wang, S. (2019). Degraded Image Semantic Segmentation With Dense-Gram Networks. IEEE Transactions on Image Processing, 29, 782-795.

[10] **Guo, D.,** Zhu, L., Lu, Y., Yu, H., Wang, S. (2019) Small object sensitive segmentation of urban street scene with spatial adjacency between object classes. IEEE Transactions on Image Processing.

[11] **Guo, D.**, Zheng, K., & Wang, S. (2017, September). Lesion detection using T1-weighted MRI: A new approach based on functional cortical ROIs. *In Image Processing (ICIP), 2017 IEEE International Conference on* (pp. 4427-4431). IEEE.

[12] **Guo, D.**, Fridriksson, J., Fillmore, P., Rorden, C., Yu, H., Zheng, K., & Wang, S. (2015). Automated lesion detection on MRI scans using combined unsupervised and supervised methods. *BMC medical imaging*, 15(1), 50.

[13] Zheng, K., Fan, X., Lin, Y., Guo, H., Yu, H., **Guo, D.**, & Wang, S. (2017, October). Learning View-Invariant Features for Person Identification in Temporally Synchronized Videos Taken by Wearable Cameras. *In Computer Vision (ICCV), 2017 IEEE International Conference on* (pp. 2877-2885). IEEE.

[14] Zheng, K., Lin, Y., Zhou, Y., Salvi, D., Fan, X., **Guo, D.**, ... & Wang, S. (2014, September). Video-based action detection using multiple wearable cameras. *In Workshop at the European Conference on Computer Vision* (pp. 727-741). Springer.

[15] Basilakos, A., Fillmore, P. T., Rorden, C., **Guo, D.**, Bonilha, L., & Fridriksson, J. (2014). Regional white matter damage predicts speech fluency in chronic post-stroke aphasia. Frontiers in human neuroscience, 8, 845.

[16] Fridriksson, J., **Guo, D.**, Fillmore, P., Holland, A., & Rorden, C. (2013). Damage to the anterior arcuate fasciculus predicts non-fluent speech production in aphasia. *Brain*, 136(11), 3451-3460.

[17] Fridriksson, J., Fillmore, P., **Guo, D.**, & Rorden, C. (2014). Chronic Broca's aphasia is caused by damage to Broca's and Wernicke's areas. *Cerebral Cortex*, 25(12), 4689-4696.

PATENTS

[18] **Guo, D.**, Wei, Y., Mei, X., & Hou, X. (2020). U.S. Patent No. 10,528,823. Washington, DC: U.S. Patent and Trademark Office.
[19] Mei, X., Hou, X., Dazhou, **Guo, D.**, Wei, Y. (2019). U.S. Patent Application No. 15/822,689.

SELECTED PROJECTS

09/2019 - 11/2019 Deep Learning + Medical Imaging
Organ at Risk Segmentation for Head and Neck Cancer (1 publication)

- The leader of the project (8 members), tasks including main algorithm design, project componentization and prioritize work tasks.
- Published paper: Organ at risk segmentation for head and neck cancer using stratified learning and neural architecture search *(CVPR 2020, In process)*
- Developed a stratified organ at risk segmentation.

02/2019 –05/2019 Deep Learning + Computer Vision:
Gross Tumor And Clinical Target Volume segmentation for Esophageal Cancer (2 publications)

- Member of the project (7 members), tasks including main algorithm design, project componentization and prioritize work tasks.
- Published paper: Accurate esophageal gross tumor volume segmentation in pet/ct using two-stream chained 3d deep network fusion *(MICCAI 2019, Oral)*
  https://link.springer.com/chapter/10.1007/978-3-030-32245-8_21
- Published paper: Deep Esophageal Clinical Target Volume Delineation Using Encoded 3D Spatial Context of Tumors, Lymph Nodes, and Organs At Risk *(MICCAI 2019)*
  https://link.springer.com/chapter/10.1007/978-3-030-32226-7_67
- Developed two-stream chained 3D deep network fusion.
- Developed a progressive semantically nested network.

06/2018 –09/2018 Deep Learning + Computer Vision:
Degraded Image Semantic Segmentation with Dense-Gram Networks (1 publication)

- The leader of the project (4 members), tasks including main algorithm design, project componentization and prioritize work tasks.
- Published paper: Degraded image semantic segmentation with dense-gram network *(IEEE TIP)*
  https://ieeexplore.ieee.org/abstract/document/8812903
- Developed a Dense-Gram Network for degraded images semantic segmentation.

08/2017 – 12/2017 Deep Learning + Computer Vision:
Small Object Sensitive Segmentation of Urban Street Scene with Spatial Adjacency Between Object Classes (1 publication)

- The leader of the project (4 members), tasks including main framework design, project componentization and prioritize work tasks.
- Published paper: Small object sensitive segmentation of urban street scene with spatial adjacency between object classes *(IEEE TIP)*
  https://ieeexplore.ieee.org/document/8581453
- Developed a new boundary-based metric to measure the level of adjacency between each pair of object classes.
- Developed an encoder network to enforce the proposed metric to the segmentation loss without adding extra cost in deployment.

05/2017 – 08/2017 Deep Learning + Computer Vision:
Semantic Segmentation Assisted Lane Marking Detection Using LiDAR Point Cloud (2 submitted patents)

- Co-leader of the project (3 members), tasks including main framework design, project componentization and prioritize work tasks.
- Developed semantic segmentation assisted approaches for lane marking detection on 3D LiDAR point cloud.
- Patents: System and method for large-scale lane marking detection using multimodal sensor data
  https://patents.google.com/patent/US20190163990A1/en
  https://patents.google.com/patent/US10528823B2/en
- Awarded “Spot Bonus of August” (top 5%) and two pending patents.

05/2011 – 05/2015 Data Analysis + Medical Imaging:
Brain Impairment Statistical Analysis & GUI Design (3 publications)

- Member of the projects, task including data processing, data analysis, and GUI design.
- Published paper: Damage to the anterior arcuate fasciculus predicts non-fluent speech production in aphasia *(Brain 2013)*
  http://brain.oxfordjournals.org/content/136/11/3451.full
- Published paper: Chronic Broca’s aphasia is caused by damage to Broca’s and Wernicke’s areas *(Cerebral Cortex 2014)*
  http://cercor.oxfordjournals.org/content/25/12/4689.short
- Published paper: Regional white matter damage predicts speech fluency in chronic post-stroke aphasia *(Frontiers in Human Neuroscience 2014)*
  http://journal.frontiersin.org/article/10.3389/fnhum.2014.00845/full
- Developed a framework for evaluating the regressions between image intensity and clinical behavioral data.
- Developed a framework for 3D MRI data processing, data cleansing, and data modeling.

REFERENCE

Available upon request

SELECTED PAPER ABSTRACT

Organ at Risk Segmentation for Head and Neck Cancer using Stratified Learning and Neural Architecture Search (CVPR 2020)

Organ at risk (OAR) segmentation is a critical step in radiotherapy of head and neck (H&N) cancer, where inconsistencies across radiation oncologists and prohibitive labor costs motivate automated approaches. However, leading methods using standard fully convolutional network work-flows that are challenged when the number of OARs becomes large, e.g.>40. For such scenarios, insights can be gained from the stratification approaches seen in manual clinical OAR delineation. This is the goal of our work, where we introduce stratified organ at risk segmentation(SOARS), an approach that stratifies OARs into anchor, mid-level, and small & hard (S&H) categories. SOARS stratifies across two dimensions. The first dimension is that distinct processing frameworks are used for each OAR category. In particular, inspired by clinical practices, an-chor OARs are used to guide the mid-level and S&H categories. The second dimension is that distinct network architectures are used to manage the significant contrast, size, and anatomy variations between different OARs. We use differentiable neural architecture search (NAS), allowing the network to choose among 2D, 3D or Pseudo-3D con-volutions. Extensive 4-fold cross-validation on142 H&N cancer patients with 42 manually labeled OARs, the most comprehensive OAR dataset to date, demonstrates that both framework- and NAS-stratification significantly improves quantitative performance over the state-of-the-art (from 70.44% to 75.14% in absolute Dice scores). Thus, SOARSprovides a powerful and principled means to manage the highly complex segmentation space of OARs.

Accurate Esophageal Gross Tumor Volume Segmentation in PET/CT using Two-Stream Chained 3D Deep Network Fusion

Gross tumor volume (GTV) segmentation is a critical step in esophageal cancer radiotherapy treatment planning. Inconsistencies across oncologists and prohibitive labor costs motivate automated approaches for this task. However, leading approaches are only applied to radiotherapy computed tomography (RTCT) images taken prior to treatment. This limits the performance as RTCT suffers from low contrast between the esophagus, tumor, and surrounding tissues. In this paper, we aim to exploit both RTCT and positron emission tomography (PET) imaging modalities to facilitate more accurate GTV segmentation. By utilizing PET, we emulate medical professionals who frequently delineate GTV boundaries through observation of the RTCT images obtained after prescribing radiotherapy and PET/CT images acquired earlier for cancer staging. To take advantage of both modalities, we present a two-stream chained segmentation approach that effectively fuses the CT and PET modalities via early and late 3D deep-network-based fusion. Furthermore, to effect the fusion and segmentation we propose a simple yet effective progressive semantically nested network (PSNN) model that outperforms more complicated models. Extensive 5-fold cross-validation on 110 esophageal cancer patients, the largest analysis to date, demonstrates that both the proposed two-stream chained segmentation pipeline and the PSNN model can significantly improve the quantitative performance over the previous state-of-the-art work by 11% in absolute Dice score (DSC) (from 0.654 ± 0.210 to 0.764 ± 0.134) and, at the same time, reducing the Hausdorff distance from 129 ± 73mm to 47 ± 56mm.

Lymph Node Gross Tumor Volume Detection in Oncology Imaging via Relationship Learning Using Graph Neural Network

Determining the spread of lymph node gross tumor volume(GTVnd) is essential in defining the respective resection or irradiating regions for the downstream workflows of surgical resection and radiotherapy for many cancers. Different from the more common enlarged lymph node (LN), GTVnd also includes smaller ones if associated with high positron emission tomography signals and/or any metastasis signs in CT. This is a daunting task. In this work, we propose a unified appearance and inter-LN relationship learning framework to detect the true GTVnd. This is motivated by the prior clinical knowledge that LNs form a connected lymphatic system, and the spread of cancer cells amongLNs often follows certain pathways [1]. Specifically, we first utilize a 3Dconvolutional neural network with ROI-pooling to extract the GTVnd'sinstance-wise appearance features. Next, we introduce a graph neural network to further model the inter-LN relationships where the global LN-tumor spatial priors are included in the learning process. This leads to an end-to-end trainable network to detect by classifying GTVnd. We operate our model on a set of GTVnd candidates generated by a preliminary 1st-stage method, which has a sensitivity of>85% at the cost of high false positive (FP) (>15 FPs per patient). We validate our approach on a radiotherapy dataset with 142 paired PET/RTCT scans containing the chest and upper abdominal body parts. We obtain the sensitivity of 70% at 3 FP/patient and 80% at 6 FP/patient, with drastic improvements over previous state-of-the-art instance-wise LN classification work.

Small Object Sensitive Segmentation of Urban Street Scene with Spatial Adjacency Between Object Classes (IEEE TIP)

Recent advancements in deep learning have shown exciting promise in the urban street scene segmentation. However, many objects, such as poles and sign symbols, are relatively small and they usually cannot be accurately segmented since the larger objects usually contribute more to the segmentation loss. A new boundary-based metric is proposed to measure the level of spatial adjacency between each pair of object classes, which is robust against object size induced biases. A network is proposed, which starts with a segmentation network, followed by a new encoder to compute the proposed boundary-based metric, and then trains this network in an end-to-end fashion. In deployment, only the trained segmentation network is employed, without the encoder, to segment new unseen images. Experimentally, the proposed method is evaluated using CamVid and CityScapes datasets and achieves a favorable overall performance improvement and a substantial improvement in segmenting small objects.