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Professional Summary

Experienced machine learning R&D with 8+ years at the intersection of **medical image analysis**, **machine learning**, and **digital human modeling**. Led the development of a CT-based framework segmenting 235+ anatomical structures, laying the structural foundation for digital twins and full-body modeling. Enabled **oncologic analyses**, **phenotype quantification**, and **tumor characterization with prognosis prediction**, powered by scalable **multimodal pipelines**. Backed by **60+ publications & patented** work in top venues, delivering clinically proven AI systems that enable precision health at scale.

Core Competencies & Contributions

Digital Human-Level Anatomical Segmentation

- **Covered the most comprehensive anatomical structures** from whole-body CT scans, enabling fine-grained organ-level analysis.
- **Established the structural foundation** for digital twin construction and full-body modeling.
- **Supported AI-driven chronic disease management** at population scale through anatomically grounded modeling infrastructure.

Lymph Node and Nodal Station Segmentation for Oncologic Modeling

- **Developed SOTA segmentation models** for thoracic and head-and-neck lymph nodes, enabling accurate detection, labeling, and spatial localization of malignant lesions.
- **Introduced nodal station stratification frameworks**, encoding anatomical context and region-specific priors to support precise staging and downstream prognostic modeling.
- **Enabled clinical applications** in cancer staging, radiation planning, and risk assessment, especially for lung and head-and-neck malignancies.

Multimodal Integration & Prognosis Prediction

- **Orchestrated multimodal data fusion** across **CT, PET, MRI, and EHR** into scalable and stratified AI pipelines.
- **Conducted longitudinal imaging-behavior correlation studies**, demonstrating how early damage to specific white matter tracts predicts long-term functional outcomes.
- **Delivered personalized treatment strategies** by developing robust disease and tumor prediction models with high clinical fidelity.

Scientific Leadership & Product Delivery

- **Led the development of clinically deployed AI models** that consistently outperformed domain experts in segmentation and diagnostic tasks.
- **Drove research-to-product translation**, ensuring scientific rigor and regulatory awareness across real-world deployment pipelines.
- **Collaborated closely with clinicians and engineering teams**, aligning model design with clinical workflows and end-user requirements.

Professional Experiences

Senior Algorithm Engineer, Alibaba DAMO Academy

2025 – Present **Lead the development of accurate lung nodule detection and segmentation**

- Conducted 3D RetinaUNet-based automated screening to identify and remove erroneous lung nodule annotations, collaborating closely with oncologists to ensure high-precision labels.
- Cleaned, standardized, and categorized a comprehensive dataset containing more than 20K CT scans sourced from five medical centers, producing a collection of over 100K individual lung nodule labels.
- *Tech Stack*: ConvNets, 3D Detection, Monai, etc.

2023 – 2024 **Lead the development of the continual learning-driven framework for accurate and generalizable whole-body anatomies segmentation *(3 papers, 1 submitted, 2 filed patents)***

- Developed a single unified AI model capable of segmenting hundreds of anatomies across CT scans by leveraging multiple partially labeled datasets without catastrophic forgetting.
- Cleaned, standardized, and categorized 20 public and 18 private datasets, resulting in a comprehensive collection of 14K+ high-quality CT images and more than 235 anatomical labels.
- Shipped online models that consistently improve DSC by an average of 5% relative to an ensemble of specialist nnUNets trained on a per-dataset basis, and surpass the segmentation accuracy of "Segment Anything"/SAM-style foundation models by over 9.9% DSC.
- Led initiatives to consolidate and analyze models by systematically collecting and categorizing corner cases, evaluating the impacts of different body parts, assessing self-supervised pre-training, implementing model pruning, and addressing additional optimization challenges.
- *Tech Stack*: Continual Learning, Partial Label Learning, Self-supervised Pretraining, ConvNets, 3D Segmentation, SAM, Transformers, Low-rank Adaptation, Model Pruning, Model Optimization.

2023 – 2024 **Co-developed the accurate pretreatment identification of extra-nodal extension (ENE) in laryngeal and hypopharyngeal cancers *(2 papers, 2 filed patents)***

- Conducted a size-independent and size-aware two-branch network architecture to simultaneously encode unaltered lymph node features and zoomed-in features that better account for localized subtle changes in textures and boundaries.
- Curated a dataset comprising 1,824 malignant lymph nodes from 248 patients across 4 centers with lymph nodes semi-automatically segmented, labeled, and subsequently confirmed by oncologists.
- Trained and delivered models that outperformed head and neck specialists (AUC, 0.96 vs [0.79, 0.92]) in prediction of ENE, especially in early-stage ENE detection (AUC, 0.87 vs [0.33, 0.69]).
- *Tech Stack*: ConvNets, 2.5D Classification, Monai, Transformer, etc.

2022 – 2023 **Lead the development of the thoracic lymph node segmentation framework in CT imaging via lymph node station stratification and size encoding *(1 paper, 1 filed patent)***

- Developed a 3D stratified segmentation framework that encodes both lymph node station and size variations by mapping thoracic lymph node stations into three super stations and subsequently learning station-specific size differences.
- Achieved the state-of-the-art performance with an average DSC of 74.2% (a 9.9% increase) and a detection recall of 72.0% (a 15.6% improvement), while reducing false positives to 4.0 per patient—a reduction of 1.9 FP per patient.
- Led the lymph node data collection and annotation pipeline, achieving a five times speedup compared to manual delineation.
- *Tech stack*: ConvNets, Network Stratification, Network Architecture Search, etc.

Senior Research Scientist, PAII Inc.

2021 – 2022 **Lead the development of the thoracic lymph node station (LNS) parsing segmentation framework and lymph node detection framework in CT scans *(3 papers, 3 filed patents)***

- Developed an automated search module to identify key organs that optimize LNS parsing performance, achieving an average DSC of 81.1%—a 5.0% improvement over pure CT-based CNN models and a 19.2% increase compared to the previous representative approach.

- Co-developed a malignant lymph node detection model using distance-sensitive gating, achieving 65.7% and 70.1% recall at 4 and 8 FPs per patient (9.2% improvement).
- Co-developed the malignant lymph node segmentation model using distance-based GNN.
- *Tech stack*: ConvNets, Network Architecture Search, Mask-RCNN, FCOS, GNN, etc.

2019 – 2021 **Co-Lead the development of organ at risk segmentation framework for head & neck cancer using stratified learning and neural architecture search *(2 papers, 1 filed patent)***

- Developed a comprehensive framework to stratify organs into anchor, mid-level, and small & hard OAR categories, with each category addressed by tailored segmentors optimized through neural architecture search.
- Cleaned, standardized, and categorized CT scans from six centers covering 42 head and neck OARs, yielding a comprehensive collection of over 1,600 high-quality CT images.
- Led initiatives to consolidate and analyze the model through multi-center retrospective studies, comprehensively evaluating performance and spearheading targeted revision efforts.
- Shipped online models that enhanced DSC by at least 3–5% relative to the nnUNet benchmark. Multi-user studies demonstrated that 98% of model predictions required only minor (< 1 min) or no revisions to meet clinical acceptance, reducing workloads by 90%.
- *Tech stack*: ConvNets, 3D Segmentation, Organ Stratification, Small/Hard Organ Detection, Network Architecture Search, etc.

Research Intern at PAII Inc. & TuSimple LLC

2018 – 2019 **Developed the automatic segmentation and parsing models for esophageal gross tumor volume, clinical target volume *(3 papers, 2 filed patents)***

- Collected and cleaned a retrospective dataset of 606 esophageal cancer patients from four centers: 354 underwent CT scans only, while 252 received additional diagnostic FDG-PET/CT scans.
- Developed and deployed online models achieving an average DSC of 81.0% using CT images alone, with performance increasing to 83.1% when incorporating PET scans. Multi-user studies showed that 88% of model predictions required only minor (<1 min) or no revisions for clinical acceptance, resulting in a 48% reduction in workload and a 37.6% decrease in inter-user variation.
- *Tech stack*: DEEDS, 3D Segmentation, small/hard object segmentation, Imbalanced learning, etc.

2017 **Developed Deep Segmentation Assisted Lane Marking Detection Using LiDAR Point Cloud Data *(2 filed patents)***

- Conducted deep segmentation assisted algorithm to detect landmark/traffic-sign on 3D LiDAR point cloud and localization of vehicle using 3D LiDAR prior map and image assisted low-cost GPS/IMU.
- *Tech stack*: Point Cloud, SLAM, Segmentation, small/hard object detection, etc.

Invited Talks

SyncedTech

2023 Continual Segment: Towards a Single, Unified and Accessible Continual Segmentation Model of 143 Whole-body Organs in CT Scans

2021 Accurate Parsing and Segmentation of Target Volumes and Organs at Risk in Radiotherapy Planning

MICCAI Industry Talk

2020 Organ at Risk for Head and Neck Cancer using Stratified Learning and Neural Architecture Search

Professional Activities & Awards

Award MICCAI-2020 NIH Award

Award Medical Image Analysis MICCAI-2019 selected papers

Editor Machine Learning for Quantitative Neuroimaging Analysis (link)

Reviewer CVPR, ICCV, AAAI, MICCAI, IEEE TPAMI, IEEE TIP, IEEE Multimedia, IEEE TMI, etc.

Selected Publications

[1] **Guo D**, Ji Z, Su Y, et al. A Continual Learning-driven Model for Accurate and Generalizable Segmentation of Clinically Comprehensive and Fine-grained Whole-body Anatomies in CT. arXiv preprint arXiv:2503.12698, 2025.

[2] Ye X*, **Guo D***, Zhao L, et al. Development and validation of AI delineation of the thoracic RTOG organs at risk with deep learning on multi-institutional datasets. Intelligent Oncology, 2025, 1(1): 61-71.

[3] Wang P, **Guo D**, Zheng D, et al. Accurate airway tree segmentation in ct scans via anatomy-aware multi-class segmentation and topology-guided iterative learning. IEEE transactions on medical imaging, 2024, 43(12): 4294-4306.

[4] Ji Z*, **Guo D***, Wang P, et al. Continual segment: Towards a single, unified and non-forgetting continual segmentation model of 143 whole-body organs in ct scans. Proceedings of the IEEE/CVF International Conference on Computer Vision. 2023: 21140-21151.

[5] Ye X*, **Guo D***, Ge J, et al. Comprehensive and clinically accurate head and neck cancer organs-at-risk delineation on a multi-institutional study. **Nature communications**, 2022, 13(1): 6137.

[6] **Guo D**, Ge J, Yan K, et al. Thoracic lymph node segmentation in CT imaging via lymph node station stratification and size encoding. International Conference on Medical Image Computing and Computer-Assisted Intervention. Cham: Springer Nature Switzerland, 2022: 55-65.

[7] **Guo D**, Ye X, Ge J, et al. Deepstationing: thoracic lymph node station parsing in ct scans using anatomical context encoding and key organ auto-search, International Conference on Medical Image Computing and Computer-Assisted Intervention. Cham: Springer International Publishing, 2021: 3-12.

[8] Jin D*, **Guo D***, Ho T Y, et al. DeepTarget: Gross tumor and clinical target volume segmentation in esophageal cancer radiotherapy. Medical Image Analysis, 2021, 68: 101909.

[9] **Guo D**, Jin D, Zhu Z, et al. Organ at risk segmentation for head and neck cancer using stratified learning and neural architecture search. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2020: 4223-4232.

[10] Jin D, **Guo D**, Ho T Y, et al. Accurate esophageal gross tumor volume segmentation in PET/CT using two-stream chained 3D deep network fusion. International Conference on Medical Image Computing and Computer-Assisted Intervention. Cham: Springer International Publishing, 2019: 182-191.

Patents >10 patents filed for projects in Alibaba DAMO Academy, PAII Inc and TuSimple LLC.

Abstracts >10 clinical abstracts in RSNA and ASTRO.

Full List `https://scholar.google.com/citations?user=GG4UXqsAAAAJ&hl`