

CURRICULUM VITAE

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Yukang Yang

🎓 EDUCATION

Tsinghua University, Department of Automation, Beijing, China 2019 – Present

Master student in Control Science and Engineering, expected June 2022, supervised by Gao Huang
GPA 3.94/4, Rank 8/194, *Major Courses* Matrix Analysis, Convex Optimization, Pattern Recognition

Beihang University, ShenYuan Honors College, Beijing, China 2015 – 2019

B.E. in Automation (ECE) (with honors)
GPA 3.84/4, Rank 1/43, *Major Courses* Automatic Control Theory, Image Processing, Probability Statistics

👥 RESEARCH PROJECTS

Sparsity-based image denoising via dictionary learning Nov. 2019 – Jan. 2020

MATLAB Group Project, , advisor: Fang-Ming Han

Brief introduction: using sparse representation to denoise and restore images

- K-SVD dictionary learning algorithm: update dictionary and do sparse decomposition alternately
- Compared with a fixed DCT dictionary, the K-SVD algorithm produced better denoising effects. (higher PSNR: 37.74dB>36.57dB)
- Designed a **multi-channel variant** of K-SVD algorithm for the denoising of RGB images, which produced higher PSNR value than the vanilla single-channel K-SVD algorithm did and was also faster than the latter.

Deep learning-based masked face detection Apr. 2020 – Jun. 2020

Python, Pytorch Individual Project, advisor: Changshui Zhang

Brief introduction: detecting human faces and identifying whether wearing a mask

- Used two algorithms (Faster R-CNN and SSD) to conduct contrastive experiments on the novel AIZOO dataset
- **Refined model design based on the properties of the dataset**
Faster R-CNN: added small-size anchors and changing the height-width ratio of anchors
SSD: resized the input images to 512×512
- SSD had less inference time than Faster R-CNN did
- The improved Faster R-CNN could detect small human face; improved SSD achieved the highest mAP

Anatomical prior knowledge-based vertebral landmark detection Aug. 2020 – Oct. 2021

Python, Pytorch collaborated with Dr. Tianyu Liu, advisors: Gao Huang and Wenhui Fan

Brief introduction: estimating the locations of corner/center landmarks for each vertebra on anterior-posterior spine X-ray images (thoracic and lumbar spine, 17 vertebrae per image)

- Basic Architecture: heatmap-based pose estimation algorithm (backbone: HRNet)
Multi-head mechanism: calculating corner offset with regard to center points after calibrating center landmark predictions, which are extracted from the 17-channel center heatmap.
- Proposed anatomy-related **metrics** reflecting how well predicted vertebrae comply with anatomical priors
- Proposed an anatomy-constraint **penalty** added into the training loss function
- Proposed an anatomy-aided **inference procedure**
- Landmark localization error on test dataset:
Heatmap-based Baseline (ISBI2020 paper): 39.67 ± 3.38
Our method: **34.11 ± 2.12**
- **Anatomy-related performance** on test dataset:
adding the anatomy-constraint penalty brought significant improvement on anatomy-related metrics while adopting the anatomy-aided inference procedure further boosted the anatomical plausibility.

- The relevant paper has been submitted to *IEEE Transactions on Medical Imaging* (1st author, IF=10.048). (Status: "Wait for Reviewers' Scores")
- The paper about our novel spine dataset of more than 1000 images, which is collected from the Peking University First Hospital and **annotated by me**, has been submitted to *Scientific Data* (IF=6.644).

Segmentation of remote sensing images

Oct. 2020 – Dec. 2020

Python, Pytorch/PaddlePaddle Contest, leader of a 5-person team, advisor: Wenwu Zhu

Brief introduction: a track of 2020 CCF BDCI Competition, 7-class semantic segmentation task on remote sensing images (training set: 140,000 images, testB set: 20,000 images)

- Used Deeplab v3+ algorithm; added the channel-wise and spatial-wise attention blocks
- For **tackling the class-imbalance problem**,
Used the weighted sum of the Weighted Cross-Entropy Loss and Lovasz Softmax Loss for training;
Chose samples of minor classes to construct U-Net based binary classifiers and merged the results
- Used ensemble strategies; Post-processing steps: dilation and corrosion
- Rank results: **9/116** on the Rank B board in the *1st Round*, **12/28** on the Rank B board in the *2nd Round*

Inference acceleration for indecent image classification

Oct. 2021 – Present

Python, Pytorch Collaborative Project with China Mobile Research Institute (CMRI), advisor: Gao Huang

Brief introduction: 6-class image classification task, reducing the inference latency without sacrificing accuracy (training set: 467,781 images, validation set: 22,824 images)

- Used GFNet to strategically select class-discriminative small image regions to employ adaptive inference.
- Programmed the early-exit scheme for batch inference
- Built a python-based SDK for actual deployment
- Compared with the HBP model: (both methods are based on ResNet50)
HBP: latency, 1.67ms; accuracy, 97.06%
GFNet: latency, 0.50ms (**-70%**) ; accuracy, 97.06%

PUBLICATIONS [GOOGLE SCHOLAR]

- Liu, T., **Yang, Y.**, Wang, Y., Sun, M., Fan, W., Wu, C. and Bunger, C., 2020, September. **Spinal curve assessment of idiopathic scoliosis with a small dataset via a multi-scale keypoint estimation approach.** In *Adjunct Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers (Ubicomp-ISWC'20)* (pp. 665-670). (CCF-A)
- Liu, T., **Yang, Y.**, Fan, W. and Wu, C., 2021. **Few-shot learning for cardiac arrhythmia detection based on electrocardiogram data from wearable devices.** *Digital Signal Processing*, 116, p.103094. (IF=3.381)
- Liu, T., Wang, Y., **Yang, Y.**, Sun, M., Fan, W., Bunger, C. and Wu, C., 2022. **A multi-scale keypoint estimation network with self-supervision for spinal curvature assessment of idiopathic scoliosis from the imperfect dataset.** *Artificial Intelligence In Medicine*, p.102235. (IF=5.326)

EXPERIENCES

Technische Universität Dresden, Dresden, Germany

2018.10 – 2019.03

Exchange student, sponsored by CSC full scholarship, Nanoelectronic Systems

Fundamentals of Estimation and Detection, 1.0; Lab Sessions Nanoelectronic Systems, 1.0; German (A1), 1.7

SKILLS

- Programming Languages: Python > MATLAB > C
- Basic Backgrounds: classical machine learning algorithms (e.g. SVM, Bayes classifier); deep learning methods applied in computer vision tasks (e.g. Object Detection, Semantic Segmentation, Pose Estimation); Optimization; Probability Statistics; Matrix Analysis

♡ HONORS AND AWARDS

<i>2nd class, Scholarship for Comprehensive Excellence</i> , Tsinghua / DongFang Electric (Top 5%)	12.2020
Beijing Outstanding Graduate Award , Beijing Municipal Commission of Education (Top 3%)	07.2019
Outstanding Student of the Academic Year 2017/18, Beihang University (Top 5%)	06.2019
CSC Scholarship for Outstanding Undergraduates , Chinese Scholarship Council(CSC)	10.2018-03.2019
<i>1st Class</i> , Scholarship for Academic Excellence, Beihang University (Top 5%)	12.2018
<i>Grand Prize</i> , Scholarship for Excellence on Academic Competitions, Beihang University (Top 3%)	12.2018
<i>3rd Prize</i> , the 2018 National English Competition for College Students, China	05.2018
Meritorious Winner, the 2018 Mathematical Contest in Modeling (MCM) , COMAP	04.2018
Outstanding Student of the Academic Year 2016/17, Beihang University (Top 5%)	12.2017
<i>1st Class</i> , Scholarship for Academic Excellence, Beihang University (Top 5%)	12.2017
<i>2nd Class</i> , Scholarship for Excellence on Academic Competitions, Beihang University (Top 7%)	12.2017
<i>2nd Class</i> , Scholarship for Comprehensive Development, Shenyuan Honors College (Top 3%)	12.2017
<i>2nd Prize</i> , the 2017 Mathematical Contest in Modeling, Beijing Normal University	05.2017
<i>2nd Prize</i> , the 8th National College Students Mathematical Competition, China	11.2016

📖 LANGUAGES

- TOEFL 102 (Sept. 2021)
- English - Fluent, Mandarin - Native speaker, German - Beginner

⚙️ EXTRACURRICULAR ACTIVITIES

Volunteer work: more than 200 hours

- 2017 World Women's Curling Championship; 110th anniversary of Tsinghua University

Work history in student organizations

- officer, Graduates Union of the Department of Automation, Tsinghua University Sept.2019 - July.2020
organized/hosted 2020 Beijing Universities Academic Forum of Artificial Intelligence
- officer, Graduates Union of Tsinghua University Sept.2020 - Jan.2021
organized 2020 Graduates Forum of the Global Alliance of Universities on Climate