XIN CAI

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Education

Institute of Computing Technology, Chinese Academy of Sciences, Beijing, China 2020 – Present
M.Eng. in Applied Computer Technology, expected June 2023 **Supervisor: Prof. Shiguang Shan**

University of Chinese Academy of Sciences (UCAS), Beijing, China 2016 – 2020
B.S. in Computer Science and Technology **Cumulative GPA: 3.90/4.00 Rank: 2/68**

Research Interests

Data-Efficient Machine Learning: Weakly- and Self-supervised Learning, Transfer Learning
Applied Computer Vision Techniques: Gaze Estimation, Emotion Recognition
3D Computer Vision: 3D-aware Image Synthesis

Research Projects

Real-Time Point-of-Gaze Estimation System
Sep. 2020 – Present

Primary Contributor Supervisor: Prof. Shiguang Shan and Prof. Jiabei Zeng

Developed a system that estimates the Point-of-Gaze on a 24-inch screen according to the users' face images.

- Developed the system V1.0 by adapting the pre-trained Point-of-Gaze estimator to a new device and user under a meta-learning strategy, achieving an averaged error of 50 mm.
- Developed the system V2.0 by first estimating the gaze direction and then converting the direction to the Point-of-Gaze according to the screen-camera relationship, achieving an averaged error of 30 mm after the calibration with 9 points.
- Measured the screen-camera relationship by calibrating the camera's intrinsic parameters using Zhang's method and the camera's extrinsic parameters using a mirror-based method.
- Proposed and implemented a gaze estimation method using high resolution features and muti-channel attention mechanism.
- Proposed and implemented an unsupervised source-free domain adaptation gaze estimation method based on uncertainty reduction.

Winner of ETH-XGaze Gaze Estimation Challenge@CVPR 2021 Workshop
Jun. 2021

Primary Contributor Supervisor: Prof. Shiguang Shan and Prof. Jiabei Zeng

Developed an accurate gaze estimator according to monocular normalized face images under variation of viewpoints, extreme gaze angles, different illumination, and occlusions like glasses.

- Proposed a solution that ensembles four deep learning architectures: iTracker-MHSA, BoTNet, HRNet, and ResNeSt, which ranks the 1st in the challenge.
- Code: `https://github.com/VIPL-TAL-GAZE/GAZE2021`.

Self-Supervised Eye Semantic Segmentation
Jun. 2021 – Sep. 2021

First Author Supervisor: Prof. Shiguang Shan and Prof. Jiabei Zeng

Proposed a self-supervised eye segmentation method leveraging weak empirical prior on the eye shape.

- Designed a symmetrical auto-encoder architecture to learn disentangled representations of eye appearance and eye shape in a self-supervised manner.
- Segmented eye images into meaningful part leveraging unlabelled images and unpaired eye landmarks.
- Achieved comparable eye segmentation performance with the SOTA supervised methods.

AI-Aided Screening System for Autism Spectrum Disorder (ASD)
Sep. 2021 – Present

Primary Developer, in collaboration with Prof. Jiabei Zeng Supervisor: Prof. Shiguang Shan

Building an ASD screening system according to the children's point-of-gaze and facial behaviors.

- Developed the primitive system with Tobii Gaze Tracker and four cameras.
- Collected data using the primitive system, including $\sim$160 children's facial expressions and point of gaze on the screen when they watched specially designed materials.
- Training machine learning models to distinguish ASDs from typical developed children according to their facial expression and gaze features.

Publications

- **X. Cai**, J. Zeng, S. Shan and X. Chen, "Source-free Adaptive Gaze Estimation with Uncertainty Reduction, "The IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR), 2023.
- **X. Cai**, J. Zeng and S. Shan, "Landmark-aware Self-supervised Eye Semantic Segmentation," IEEE International Conference on Automatic Face and Gesture Recognition (FG), 2021.
- **X. Cai**, B. Chen, J. Zeng , et al. "Gaze Estimation with an Ensemble of Four Architectures." arXiv preprint arXiv:2107.01980, 2021. (Technical report for the winner solution in ETH-XGaze Gaze Estimation Challenge@CVPR 2021)

Honors and Awards

Academy Scholarship of University of Chinese Academy of Science	2017, 2018 and 2019
National Encouragement Scholarship	2017, 2018 and 2019
Merit Student of University of Chinese Academy of Sciences	2018 and 2021
The Tang Lixin Academic Excellence Scholarship	Jun. 2020
1st Prize, Award on ETH-XGaze Challenge	Jun. 2021

Skills

- Programming Languages: Python == C > C++
- Framework: PyTorch > TensorFlow
- Development: FFmpeg, Qt, Git