

Guanghan Ning

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PERSONAL STATEMENT

I actively conduct AI-related research; my first-authored scholarly publications have received 600+ citations. I am an initiative AI practitioner contributing open-sourced code to the community; my github repos have been starred 1,900+ times with 600+ forks. As the primary contributor, I have participated AI challenges hosted by ICCV 2017, ECCV 2018 and CVPR 2020.

EDUCATION

University of Missouri - Columbia

Ph.D. & M.S. in Electrical and Computer Engineering

Columbia, MO

Aug 2012 - May 2018

Beijing Jiaotong University

B.S. in Communication Engineering

Beijing, China

Aug 2008 - May 2012

RESEARCH INTEREST

Computer Vision, Artificial Intelligence

Human-centric neural fields; 2D/3D keypoints estimation and tracking.

WORK EXPERIENCE & SELECTED PROJECTS

JD.COM (JD Digits)

Research Scientist

Mountain View, CA

Dec 2017 - Present

- **Digital Humans:** [Blender | Panda3d | Omniverse | Python | JAX]
 - * Maintain and improve the rendering pipeline; optimize cartoon and high-fidelity characters for rendering.
 - * Research on neural fields for human-centric reconstruction and novel-view synthesis [[Github](#)]
- **Image Understanding & Review:** [PyTorch | Flask | Python]
 - * Designed and implemented a keypoint-based object detection system for image review, served with Flask on K8S.
 - * Invented a novel data augmentation method for object detection based on neural rendering [[Paper](#), [Github](#)]
 - * Attempted neural architecture search with latency constraints [[Github](#)]
- **LightTrack:** A generic online human pose tracking framework [[Paper](#), [Github](#), [Rank](#)] [PyTorch | Python]
 - * Designed and implemented the first human pose tracking framework that is truly online in a top-down fashion; human skeletons are regarded as explicit visual features for tracking; Siamese graph convolution is employed for light-weight pose matching.
 - * Filed a US patent; published at CVPRW 2020; open-sourced at Github; ranking 1st (by May 24th) on PoseTrack'17 Leaderboard.
- **OpenSVAI:** An internal open-source library to ease computer vision research [[Paper](#), [Doc](#), [Rank](#)] [Tensorflow | MXNet | Python]
 - * Proposed, implemented and documented the library; filed a US patent.
 - * Participated ECCV'18 PoseTrack Challenge, 6th place in both pose estimation and tracking; published a paper.
- **Embedded HPE:** Human Pose Estimation (HPE) on Embedded System [Caffe | NCNN]
 - * Designed and implemented an efficient HPE algorithm that is deployed on android boards; Speed(CPU): 4 FPS on low-end android board; 25 FPS on iPhone X; 30 FPS on Pixel 2.
- **URFashion:** Fashion recommendation - recommending compatible garments [[Results](#)] [Tensorflow | Python]
 - * Implemented human parsing to batch process daily JD SKU with deeplab v3+. Improved the parsing performance on ATR dataset via training with labeled fashion data from the annotation team (1.05% and 2.31% increase in mIOU and pixel-wise accuracy, respectively). Classified SKU pictures to distinguish the detailed clothing picture from the main SKU. Classified poor parsing results from the good to improved the display quality of fashion recommendation results.
- **MeMeZhao APP:** A mobile APP for photography and entertainment [[App](#), [Features](#)] [Tensorflow | Python | Cython]
 - * Implemented two features for this app based on the estimation of human keypoints: (a) Add special effects to the person, e.g., add angle wings realistically; (b) Render the person slimmer. Implemented the image overlay with Cython to improve speed by 100x.

TCL Research America

Visiting Researcher

San Jose, CA

Dec 2014 - Aug 2016

- **Advanced Driver Assistance System:** Developed an algorithm for object tracking via spatio-temporal analysis with recurrent convolutional neural networks to tackle the occlusion problem. [[Paper\(oral\)](#), [Github](#), [Patent](#)] [Tensorflow]
- **Object Detection in Videos:** Customized YOLOv1 and trained traffic signs for street environment perception. [[Github](#)] [Darknet]
- **Face Verification and Person Tracking with Mobile-controlled Drone:** Built the deep learning kernels for face detection and person verification; built the front-end on the Android side for frame input. [Caffe | Android]
- **Camera Take Detection:** Camera Take is a series of camera shots within a movie taken by one camera set but cut by movie editor into discontinuous shots; improved the camera take detection quality with motion estimation and SIFT matching. [Java | C++]

PUBLICATIONS

- [1] **Ning, Guanghan**, and Heng Huang. "LightTrack: A Generic Framework for Online Top-Down Human Pose Tracking." Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops, 2020, pp. 1034-1035.
- [2] **Ning, Guanghan**, Ping Liu, Xiaochuan Fan, and Chi Zhang. "A Top-down Approach to Articulated Human Pose Estimation and Tracking." In Proceedings of the European Conference on Computer Vision (ECCV), PoseTrack 2018.
- [3] **Ning, Guanghan**, He Zhihai (Henry). "Dual-Path Networks for Human Pose Estimation", IEEE International Conference on Computer Vision (ICCV), PoseTrack 2017.
- [4] **Ning, Guanghan**, Zhi Zhang, and Zhiqian He. "Knowledge-guided deep fractal neural networks for human pose estimation." IEEE Transactions on Multimedia 20, no. 5 (2018): 1246-1259.
- [5] **Ning, Guanghan**, Zhi Zhang, Chen Huang, Xiaobo Ren, Haohong Wang and Zhihai He. "Spatially supervised recurrent convolutional neural networks for visual object tracking." In 2017 IEEE International Symposium on Circuits and Systems (ISCAS), pp. 1-4.
- [6] **Ning, Guanghan**, Zhi Zhang, Xiaobo Ren, Haohong Wang, and Zhihai He. "Rate-coverage analysis and optimization for joint audio-video multimedia retrieval." In 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 2911-2915.
- [7] **Ning, Guanghan**, Tony X. Han, and Zhihai He. "Scene text detection based on component-level fusion and region-level verification." In 2015 IEEE International Conference on Image Processing (ICIP), pp. 837-841.
- [8] **Ning, Guanghan**. "Learning human poses in natural scenes". Ph.D. Dissertation. University of Missouri, 2018.
- [9] **Ning, Guanghan**. "Vehicle license plate detection and recognition." Master Thesis. University of Missouri, 2013.
- [10] Sun, Hao, **Guanghan Ning**(equal contribution), Zhiqun Zhao, Zhongchao Huang, and Zhihai He. "Automated work efficiency analysis for smart manufacturing using human pose tracking and temporal action localization." Journal of Visual Communication and Image Representation (2020): 102948.
- [11] Wang, Haohong, Yaoyuan Fu, Yang Li, **Guanghan Ning**, Zhihai He and Mengwen Liu. "A New TV World for Kids-When ZUI Meets Deep Learning." In 2018 IEEE Conference on Multimedia Information Processing and Retrieval (MIPR).
- [12] Zhang, Zhi, **Guanghan Ning**, Yigang Cen, Yang Li, Zhiqun Zhao, Hao Sun and Zhihai He. "Progressive neural networks for image classification." arXiv preprint:1804.09803 (2018).
- [13] Zhang, Zhi, **Guanghan Ning** and Zhihai He. "Knowledge projection for deep neural networks." arXiv preprint:1710.09505 (2017).
- [14] **Ning, Guanghan**, Zhi Zhang, Xiaobo Ren, Haohong Wang and Zhihai He. "Joint audio-video fingerprint media retrieval using rate-coverage optimization." arXiv preprint:1609.01331 (2016).
- [15] He, Zhihai, Roland Kays, Zhi Zhang, **Guanghan Ning**, Chen Huang, Tony Han X, Josh Millsbaugh, Tavis Forrester and William McShea. "Visual informatics tools for supporting large-scale collaborative wildlife monitoring with citizen scientists." IEEE Circuits and Systems Magazine 16.1 (2016): 73-86.

PATENTS

- [P1] **Ning, Guanghan** and Heng Huang. "System and Method for 3D Object Detection and Tracking With Monocular Surveillance Cameras." U.S. Patent No. 11,379,995, issued July 15, 2022.
- [P2] **Ning, Guanghan**, Heng Huang. "LightTrack: System and Method for Online Top-down Human Pose Tracking." U.S. Patent No. 11,288,835, issued March 29, 2022.
- [P3] **Ning, Guanghan**, Ping Liu, Xiaochuan Fan, Chi Zhang. "Device and method of tracking poses of multiple objects based on single-object pose estimator." U.S. Patent No. 11,238,612, issued Feb 21, 2022.
- [P4] **Ning, Guanghan**, Haohong Wang, and Xiaobo Ren. "Method and system for optimized wake-up strategy via sleeping stage prediction with recurrent neural networks." U.S. Patent No. 10,636,524, issued April 28, 2020.
- [P5] **Ning, Guanghan**, Haohong Wang, Wenqiang Bo, and Xiaobo Ren. "Method and system for vision-centric deep-learning-based road situation analysis." U.S. Patent No. 9,760,806, issued September 12, 2017.
- [P6] Wang, Haohong, **Guanghan Ning**, Zhi Zhang, and Xiaobo Ren. "Method and system for content retrieval based on rate-coverage optimization." U.S. Patent No. 9,836,535, issued December 5, 2017.
- [P7] Wang, Haohong, Zhi Zhang, **Guanghan Ning**, and Xiaobo Ren. "Mobile search-ready smart display technology utilizing optimized content fingerprint coding and delivery." U.S. Patent No. 9,807,453, issued October 31, 2017.
- [P8] Lai, Larry, **Guanghan Ning**, Guifang Dong, Jia Lin, Chi Zhang. "System And Method for Fashion Style Recommendation." U.S. Patent Application 16/859,165, filed 2020.
- [P9] Liu, Shizhu, Min Li, Xiaochuan Fan, **Guanghan Ning**, Hui Zhou. "System and Method for Knowledge Graph Construction using Capsule Neural Network." U.S. Patent Application 17/116,906, filed 2020.
- [P10] **Ning, Guanghan**, Xiaofan Zhang, Jui-Hsin Lai, Chi Zhang. "Device and Method for Item Recommendation Based On Visual Elements." U.S. Patent Application 16/531,102, filed 2019.
- [P11] Wang, Haohong, Xiaobo Ren, Wenqiang Bo, **Guanghan Ning**, and Lifan Guo. "Experience-aware anomaly processing system and method." U.S. Patent Application 15/231,492, filed February 8, 2018.

HONORS & ACHIEVEMENTS

- PoseTrack 2017 Leaderboard, Multi-Person Pose Tracking, [Rank 1st](#)
- Leeds Sports (LSP), Single-Person Human Pose Estimation, Rank 2nd
- ICCV 2017 PoseTrack Challenge, Multi-Person Pose Estimation, 4th place
- ECCV 2018 PoseTrack Challenge, Multi-Person Pose Estimation and Tracking, 6th place

ACADEMIC PROJECTS

- **2D Human Pose Estimation:** A deep fractal neural network for 2d pose estimation, [[Paper1](#), [Github](#)] [[Paper2](#), [Rank](#)] [Caffe | Python | C++]
 - Developed a state-of-the-art single-person human pose estimator from scratch (MPII: 91.2%, LSP:93.9%).
 - Participated ICCV'17 PoseTrack Challenge for multi-person pose estimation, 4th place [Entry: FractalNet].
- **Calibration and Distance Measurement Tool:** Collaboration research with biologists researching in wild life animals, [OpenCV | C++]
 - Developed a tool to calibrate an uneven wild scene with board images and stick images [[Github](#)]
 - Developed a tool to measure the distances within the calibrated scene, helping researchers learn the body length and animal strides. [[Github](#)]
 - Built the software of the tool for researchers to use. [[Github](#)]
- **Visual Object Search:** Built a demo for arbitrary visual region search with OpenSURF, using SURF as the keypoint descriptor and k-means to build a histogram for each image as its feature, for further similarity computation. [[Demo](#)] [VLFeat | OpenSURF | C++]
- **Scene Text Detection:** Developed a text detection method incorporating SWT, MSER, Adaptive Binarization and Connected Components with an SVM classifier using LBP & HOG features; achieved SOTA performance (F-measure: 0.74) on ICDAR'11 dataset. [[Paper](#)] [matlab | C++]
- **License Plate Detection and Recognition:** Developed a system for license plate detection and recognition, using HOG features and SVM as classifier with a bag-of-words model; proposed a novel global alignment method to better align the license plate. [C++]
- **3D Fighting Game Development:** Developed a 3D fighting game using Unity3D and a fighting game engine, UFE. Built a MU campus stage using Autodesk 123D and Maya; built character Rigs and animations with Autodesk MotionBuilder; won the best course project award.

ACADEMIC SERVICE

Reviewer/PC member for CVPR, ICCV, IJCAI, NeurIPS, Pattern Recognition, IEEE Transactions on Multimedia (TMM), Neurocomputing, Journal of Electronic Imaging, TCSVT, IET Intelligent Transport Systems, Electronics Letters, IET Computer Vision, Plos One, et al.

SKILLS

- **Languages:** Python, C/C++, Java
- **CG Tools:** Maya, OpenGL, MotionBuilder, Blender, Omniverse, Unreal4, Panda3d
- **CV Frameworks & Libraries:** JAX, PyTorch, TensorFlow, MXNet, Caffe, Darknet, OpenCV, VLFeat