Guanghan Ning

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Personal Statement

I actively conduct AI-related research; my first-authored scholarly publications have 300+ citations. I am also an initiative AI practitioner contributing open-sourced code to the community; my github repos have been starred 1600+ times with 600+ forks. As the primary contributor, I have participated several AI challenges hosted by ICCV 2017, ECCV 2018 and CVPR 2020. Having experience with real-world long-tail problems, I am able to distinguish between solving well-defined problems for cutting-edge research and, carefully re-defining open-set problems to maximize marginal utility for industrial production.

Education

University of Missouri - Columbia — Columbia, MO
Ph.D.& M.S. in Electrical and Computer Engineering — *Aug 2012 - May 2018*

Beijing Jiaotong University — Beijing, China
B.S. in Communication Engineering — *Aug 2008 - May 2012*

Research Interest

Computer Vision, Machine Learning, Artificial Intelligence

2D/3D object detection and tracking, 2D/3D human keypoints estimation and tracking, semantic/instance/panoptic segmentation, 3D human pose and shape estimation, adversarial learning, self-supervised learning and neural rendering.

Work Experience

JD.COM (JD Digits) — Mountain View, CA
Computer Vision Scientist — *Dec 2017 - Present*

- **Image Understanding & Review**:
  - 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.
- **LightTrack**: A generic online human pose tracking framework [Paper, Github, Rank] [Tensorflow | 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.
  - Standardized json format for object detection, keypoint estimation and tracking, instance segmentation.
  - Implemented utilities including common dataset format conversion (e.g., COCO/PoseTrack to/from openSVAI), visualization, etc; sharing bash scripts to reduce repetitive implementations and environment set-ups from SVAI members.
  - 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 | C++]
  - Designed and implemented an efficient HPE algorithm, which is deployed on thousands of android boards by JD MuMei; Speed(CPU): 4 FPS on low-end android board; 25 FPS on IphoneX; 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 — San Jose, CA
Visiting Researcher — *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 workshop. 2018.

[3] **Ning, Guanghan**, He Zhihai (Henry). "Dual-Path Networks for Human Pose Estimation", IEEE International Conference on Computer Vision (ICCV), PoseTrack workshop, 2017.

[4] **Ning, Guanghan**, Zhi Zhang, and Zhiquan 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-Columbia, 2018.

[9] **Ning, Guanghan**. "Vehicle license plate detection and recognition." Master Thesis. University of Missouri-Columbia, 2013.

[10] 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).

[11] 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).

[12] Zhang, Zhi, **Guanghan Ning** and Zhihai He. "Knowledge projection for deep neural networks." arXiv preprint:1710.09505 (2017).

[13] **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).

[14] He, Zhihai, Roland Kays, Zhi Zhang, **Guanghan Ning**, Chen Huang, Tony Han X, Josh Millspaugh, 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**, Haohong Wang, Wenqiang Bo, and Xiaobo Ren. "Method and system for vision-centric deep-learning-based road situation analysis." U.S. Patent 9,760,806, issued September 12, 2017.

[P2] Wang, Haohong, **Guanghan Ning**, Zhi Zhang, and Xiaobo Ren. "Method and system for content retrieval based on rate-coverage optimization." U.S. Patent 9,836,535, issued December 5, 2017.

[P3] 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 9,807,453, issued October 31, 2017.

[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 Application 15/248,639, filed March 1, 2018.

[P5] 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.

[P6] **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 Application 16/388,854, filed 2018 (pending).

[P7] **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.

[P8] **Ning, Guanghan**, Heng Huang. "LightTrack: System and Method for Online Top-down Human Pose Tracking." U.S. Patent Application 16/576,856, filed 2019.

[P9] **Ning, Guanghan** and Heng Huang. "System and Method for 3D Object Detection and Tracking With Monocular Surveillance Cameras." U.S. Patent Application 16/929,838, filed 2020.

[P10] 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.

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 the scene with board images and stick images
  - Developed a tool to measure the distances with the calibrated scene, to help researchers learn the body length and animal strides.
- **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 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++, Java
- **CG Libraries**: Maya, OpenGL, FLTK, GLUT, MotionBuilder
- **CV Libraries**: TensorFlow, PyTorch, MXNet, Caffe, Darknet, OpenCV, VLFeat