Hao GONG

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Summary

Seasoned and innovative computer vision/machine learning professional with over 10 years experience in learning based visual perception, localization and optimization, with applications to autonomous driving, intelligent traffic, and medical image analysis, as well as the large-scale commercial mass production of related products. Accomplished in developing and deploying cutting-edge computer vision technologies for both startups and well-established companies. Recently, I'm focusing on cominatorial optimization, modern deep learning, sensor fusion, 3D vision geometry, semantic visual SLAM, and other high-level learning based computer vision topics including object-level segmentation, tracking, classification, and scene-level understanding.

Work Experience

Enjoy Move Technology Co., Ltd. Sep 2022 – Nov 2023
Expert in Autonomous Driving/Visual Perception Tech Lead Shanghai, China

- In charge of all the research and engineering related to visual perception and localization problems (from visual-semantic feature representation to mapping and localization optimization).
- Spearheaded a team of 2 senior researchers and 4 junior engineers to build from scratch a semantic vSLAM framework for self-localization in L4 Automated Valet Parking (AVP) application. Designed and implemented the proposed algorithms using inputs from CNN-based semantic detection of Bird's Eye View of road markings and IMU-wheel encoder coupled odometry. Re-localization initialized via trajectory matching and pre-intergration of GNSS/IMU/in-vehicle sensors. (Ceres Solver/ROS2/C++)
- Enhanced stereotype performance: Achieved mapping capabilities up to 1 km, positioning accuracy within 20 cm, angular error within 1°, over 98% positioning success rate, and real-time performance on NVIDIA Jetson AGX Orin at cruising speed of 15 kph.
- Closely worked with planning and control engineers to improve the driving behavior of AVP.

Landmark Vision Technology Co., Ltd. Jan 2019 – Jul 2022
Co-Founder/Algorithm Scientist - lead core algorithm research and product development Shanghai, China

- Proposed an innovative class-wise triplet loss function to efficiently enhance the discriminative capability and reduce computational costs for face verification tasks [**code**]. Combined w/ face detection and multi-object tracking (MOT), enables high-accuracy, low-resolution facial recognition in uncontrolled environments for real-time performance on both CPU/GPU servers in smart access control systems. (C++/TensorFlow)
- Led a core R&D project for real-time and high accuracy 2.5D multi-target multi-camera human tracking with ReID. Proposed and co-implemented a Pose Estimation and Occlusion Augmentation Based Vision Transformer for significant improvement on real-world occluded person re-identification. Details in [Wei+22]. Responsible for building the pipeline system comprising an anchor-free pedestrian detector, a multi-object tracker using generic data association compatible with ReID feature similarity to handle occlusions and a homography-based perspective mapping to convert 2D pedestrian positions into real-world coordinates for trajectory plotting. This system enables inter-camera MOT and intra-camera ID assignment, optimized for real-time performance across platforms via inferencing accelerators (TensorRT/ONNX/OpenVINO). Work patented in[5] and[6].

OFilm Group Co., Ltd. Jun 2016 – Nov 2018
Expert in ADAS/Auto-Driving R&D Shanghai, China

- Built independently an optimized vehicle motion model, deployed to core ADAS/Auto-Driving products of the company. (C/C++)
- Designed and implemented independently an ADAS feature: Moving Object Detection via Non-stationary Fisheye Cameras, which leverages epipolar constraints to segment dynamic objects from static backgrounds while SfM, with detection rate over 95%, false alarm rate less than 1% and latency less than 65 ms on TI Jacinto 5 upon delivery to leading domestic OEMs with initial mass-production orders of over 200,000 units and cumulative sales of 243 million CNY. Related work is patented in[2]. (C++/OpenCV)
- Led a core R&D project for Trained Parking with mapping distance up to 100 m and centimeter-level localization accuracy. First in China to apply vSLAM to mass-produced L3 self-parking solution, launched on SAIC Motor's premium e-SUV, Roewe Marvel X.
- Redesigned ORB-SLAM and developed a multi-fisheye visual SLAM system tailored to vehicle trims and delivery standards. To address the lack of loop-closing and fisheye-induced radial distortions, I proposed special descriptors to enhance feature matching and integrated precise absolute scale information from my vehicle motion model. Led the validation through real-world ground truth and the "Multi-FoV" synthetic datasets, confirming centimeter-level accuracy in 3D landmark reconstruction. Proposed a mapping environment evaluator and a map quality evaluator to improve practicality and deployability. (C++/OpenCV/DBoW/g2o)
- In close collaboration with embedded software engineers to enhance system performance on Renesas RH850 MCU and TI TDA2x SoC for real-time operation at 15 fps during the localization phase.

Third Research Institute of Ministry of Public (TRIMP) Sep 2013 – May 2016
Research Scientist Shanghai, China

- Responsible for R&D on information retrieval, object identification and tracking on image and video data from traffic management network and intersection control scenario.

- Led a team of 2 PhD researchers and 3 junior engineers in developing the main pipeline for vehicle image retrieval based on annual inspection marks. Proposed for coarse-detection of vehicle to fine-localization of annual inspection marks. Image retrieval with Bag of Words and re-ranking subsequently applied to identify target vehicles within seconds from a large gallery database containing hundreds of thousands of high-definition vehicle surveillance images. Related work is patented in [3]. (Matlab/C++/OpenCV)

Education

Université Grenoble Alpes

Ph.D. in Signal and Image Processing, GIPSA (Grenoble Images Parole Signal et Automatique)-Lab — Grenoble, France

- Research Topic: Medical Image Segmentation and Classification. Publications at ICIP[GD12a][Kéc+14] and ICIAR[GD12b]
- Thesis: Segmentation d'Images Couleurs et Multispectrales de la Peau[Gon13] (Matlab/C++)
- Advisor: Prof. Michel Desvignes
- Awards: National Scholarship of China (01/11/2010 - 01/10/2013)

Southeast University

B.S. in Automation and M.S. in Pattern Recognition & Intelligent System, School of Automation — Nanjing, China

- Research Topic: Image Inpainting and Restoration. Related work patented[4].
- Thesis: Study on Digital Image Inpainting and Its Application in Blotches Removal in Video Image Sequences (C++)
- Advisor: Prof. Xiaohui Yuan
- Awards: Outstanding Graduate of School of Automation (2007); Second-Class Academic Scholarship of Southeast University (2007)

Academic Services

Conference Reviewer: ICIP2014, ACCV2022, ICASSP2023, ICASSP2024

Skills

Programming Languages: C/C++, Python, Matlab
Frameworks and Tools: TensorFlow, PyTorch, OpenCV, Git, ROS
Tech Skills: Combinatorial Optimization, Dimensionality Reduction, 3D Vision Geometry, CNN, Transformer

Publications

[Link] to my Google Scholar Profile.

[GD12a] H. Gong, and M. Desvignes, "Quantification of pigmentation in human skin images," in *19th IEEE Int. Conf. Image Process. (ICIP 2012)*, Oct. 2012A, pp. 2853–2856, doi: 10.1109/ICIP.2012.6467494.

[GD12b] H. Gong, and M. Desvignes, "Hemoglobin and melanin quantification on skin images," in *9th Int. Conf. Image Anal. Recognit. (ICIAR 2012)*, Berlin, Heidelberg, Jun. 2012B, pp. 198–205, doi: 10.1007/978-3-642-31298-4_24.

[Gon13] H. Gong, "Segmentation d'images couleurs et multispectrales de la peau," Thesis, Université de Grenoble, 2013. [Online]. Available: https://theses.hal.science/tel-00934789

[Kéc+14] R. Kéchichian*, H. Gong*, M. Revenu, O. Lezoray, and M. Desvignes, "New data model for graph-cut segmentation: application to automatic melanoma delineation," in *21st IEEE Int. Conf. Image Process. (ICIP 2014)*, Oct. 2014, pp. 892–896, doi: 10.1109/ICIP.2014.7025179.

[Tan+20a] T. Tang, H. Wang, X. Zhou, and H. Gong, "Understanding electric bikers' red-light running behavior: predictive utility of theory of planned behavior vs prototype willingness model," *J. Adv. Transp.*, vol. 2020, p. 7097302, Feb. 17, 2020A, doi: 10.1155/2020/7097302. [Online]. Available: https://doi.org/10.1155/2020/7097302

[Tan+20b] T. Tang, Y. Guo, X. Zhou, Q. Shi, and H. Gong, "Identifying psychological factors of e-bike riders' traffic rule violating intention and accident proneness in china," in *20th COTA Int. Conf. Transp. Professionals (CICTP 2020)*, Aug. 2020B, pp. 4420–4432, doi: 10.1061/9780784482933.379.

[Wei+22] Y. Wei, D. Niu, H. Gong, Y. Dong, and X. Chen, "Pose estimation and occlusion augmentation based vision transformer for occluded person re-identification," in *Jiangsu Annu. Conf. Automat. (JACA 2022)*, vol. 2022, Nov. 2022, pp. 82–87, doi: 10.1049/icp.2023.0150.

Patents

[1] H. Gong, L. Mei et al. "System and method for realizing gait recognition by virtue of fusion of depth information and gray-scale information". C.N. Patent 104200200, filed Aug. 28, 2014, and issued Nov. 10, 2017.

[2] H. Gong, B. Duan et al. "Moving object detection system, moving object detection method and vehicle". C.N. Patent 109598747, filed Sep. 30, 2017, and issued Apr. 09, 2019.

[3] H. Gong, T. Tang et al. "Traffic checkpoint vehicle intelligent retrieval system and method based on annual inspection marks". C.N. Patent 110807415, filed Oct. 31, 2019, and issued Apr. 07, 2023.

[4] H. Gong, F. Deng et al. "Digital video file restoration method and device". C.N. Patent 111127376, filed Dec. 13, 2019, and issued May 23, 2023.

[5] H. Gong, D. Niu et al. "Intelligent building online cross-camera multi-object tracking method". C.N. Patent 114240997, filed Nov. 16, 2021, and issued Jul. 28, 2023.

[6] H. Gong, Y. Wei et al. "Occluded pedestrian re-identification method based on pose estimation and Transformer". C.N. Patent 115841682, filed Nov. 08, 2022. Patent Pending.