Haoyuan Zhang | Robotics

University of Pennsylvania – GRASP Laboratory

+86-13126617215 • haoyuan.zhang@horizon.ai • haoyuanz13.github.io/
Github: github.com/haoyuanz13

Graduated student from Robotics program at the University of Pennsylvania. Supervised by Prof. Jianbo Shi, worked as Research Assistant in Vijay Kumar Group, GRASP Lab. Passionate and experienced about Computer Vision algorithms, including Deep Learning, Visual SLAM and Structure From Motion, also with strong coding skills and algorithm implementation ability. Actively looking for Computer Vision Developer position.

Education Background

- **University of Pennsylvania** — **Philadelphia, PA, USA**
  Master of Science Engineering, Robotics, Major GPA: 3.77/4.00 — *2016.8 – 2018.5*
- **Beijing Institute of Technology** — **Beijing, CHN**
  Bachelor in Science Engineering, Electrical Engineering, Major GPA: 3.90/4.00 — *2012.8 – 2016.6*
- **The Hong Kong Polytechnic University(Poly U)** — **Hong Kong, CHN**
  Exchange Program, Computer Science, Major GPA: 3.75/4.00 — *2015.8 – 2016.1*

Programming and Algorithm Skills

- **Programming Languages:** C++ • C • Python • Java • Matlab
- **Frameworks and Tools :** ROS • Linux(Ubuntu) • Tensorflow • Mxnet • PyTorch • OpenCV • Git • Vim • g2O
- **Vision Algorithm Skills:** Camera Calibration • Visual SLAM(VO&VIO) • Structure From Motion • Object Recognition • Image Processing
- **Other Algorithms Skills:** Deep Learning Network • Convex Optimization • UKF • Polynomial Trajectory Generation

Working Experience

- **DJI, Pennovation Branch** — **Philadelphia, PA, USA**
  Summer Research Intern, Pennovation Works Center — *2017.5 – 2017.8*

  - Worked on SDK development project sponsored by DJI and Vijay Kumar's Lab.
  - Focused on solving NLP(Nonlinear Programming Problem) applied in flight vehicle to generate the polynomial trajectory, mainly utilized one of the Interior-Point Methods, Barrier Method, to improve the performance of flight such as reducing the total trajectory duration and cost.
  - Designed a package via ROS and C++ that allowed user to generate optimal trajectory for their drones just by picking up wanted waypoints and inputting some constraints if they prefer.
  - Applied the designed package to the real drone platform for flight test, the result in the practice test reached less than 2 pixels error per waypoint compared with simulated trajectory.

- **Computer and Information Science Department** — **Philadelphia, PA, USA**
  Teaching Assistant (CIS 581: Computer Vision/Advisor: Jianbo Shi) — *2017.8 – 2017.12*

  - The course mainly focuses on computer vision algorithm that applied in image processing, including Edge detector, image morphing, feature detection, construction and matching, image stitching, optical flow, face recognition and replacement, also cover CNN implementation.
  - Help professor to design and review course homework and projects. Review and solve questions for students on the course online platform PIAZZA and during office hours.

  Teaching Assistant (CIS 580: Machine Perception/Advisor: Kostas Daniilidis) — *2018.1 – 2018.5*

  - The course mainly focuses on the problems of computer vision and machine perception that can be solved using geometrical approaches, with emphasis on analytical and computational techniques. This course is designed to provide students with an exposure to fundamental mathematical and algorithmic techniques that are used to tackle challenging image-based modeling problems. The content of this course finds application in the fields of Artifical Intelligence and Robotics. Some of the topics that are covered are: projective geometry, camera calibration, image formation and transformations, computational stereopsis, and structure from motion.

Projects Experience

- **Computer Vision &Deep Learning** **Philadelphia, PA, USA**
  Academic Project, CIS Department, Advisor: Jianbo Shi *2016.8 – 2018.5*

  The Face Detection and Replacement Package Design

  - Utilized human skin color as feature to train GMM model to filter out face region candidates. Combined with edge mask to separate union face regions for better detection.
  - Implemented PCA to construct Eigen Faces dataset and included the third-part package Face++ to improve detection performance. The final accuracy of detection reached 82.6%.
  - Implemented image morphing such as TPS and gradient blending to complete face replacement task. *Source Code Link* (2016.8 - 2017.2)

  Deep Learning on Computer Vision and Perception

  - Mastered Deep Learning algorithms, including the vanishing gradient problem, adversarial images generation, data augmentation and so on.
  - Know well on 2D object recognition algorithm such as Faster RCNN, have achieved a simple Faster RCNN network to detect cifar10 objects in the cifar100 background. *Source Code Link* (2017.8 - 2017.10)
  - Familiar with most generative models(AE, VAE, GANs), succeeded to implement the *Paired and Unpaired Image-to-Image Translation using cGAN and cycleGAN*, respectively. *Source Code Links: Im2im-cGAN; Im2im-cycleGAN* (2017.9 - 2017.12)
  - Currently focusing on the 3D object recognition using deep network, the main idea is to predict object class of the detected 3D dense point clouds in the environment, estimating 3D Bounding box, and showing the semantic label as well. *Source Code Link* (2017.12 - 2018.5)

- **Structure From Motion &Visual Odometry &Visual-Inertial Odometry** **Philadelphia, PA, USA**
  Research Assistant, Vijay Kumar Group, GRASP Lab, Source Code Link *2017.1 – 2017.12*

  - Implemented filter-based 2D SLAM, used IMU data for prediction, Laser-scan data for update, and particle filter for state converge as well as 2D log-odds map optimization. (2017.1 - 2017.3)
  - Mastered epipolar geometry algorithm, achieved Structure From Motion (SFM) package. Implemented Triangulation, PnP and Bundle Adjustment manually with Jacobian for camera state and 3D landmarks optimization. Finally, the reprojection error of landmarks is 0.32 pixels per point. (2017.2 - 2017.4)
  - Based on SFM structure, succeeded to implement Visual Odometry(VO), applied local BA(Bundle Adjustment) and combined g2O package to increase the SLAM efficiency as well as performance. (2017.3 - 2017.5)
  - Contributing to the Visual-Inertial Odometry project in Vijay Kumar's group. Main responsibility is the Loop Closure Detection package design that will be applied in the Quadrotor, also implementing graph optimization algorithms to achieve real-time and better Visual SLAM performance. (2017.8 - 2017.12)

Course Work

- **Undergraduate School**
  C Programming • Data Structure • Human Computer Interaction • Machine Learning Theory • Probabilistic Theory • Optimization Theory
- **Graduate School**
  Computer Vision(2D & 3D) • Deep learning and Vision • Machine Learning in Robotics • Object-Oriented Programming • Convex Optimization • Software System Design

Awards

- Excellent Engineer Cultivation Program of the Ministry of Education, 2016.6
- Excellent Students Scholarship, Chinese Academy of Science, 2014.3
- 2nd Prize of the 30th National Physics Competition, Beijing Physics Society, 2013.12
- The 1st Class Excellent Student Scholarship(3 times), Beijing Institute of Technology, 2013.1 – 2014.10

Recommendation

- Dr.Giuseppe Loianno, Research Scientist and Team leader, GRASP Lab, University of Pennsylvania.
  E-mail: loiannog@seas.upenn.edu, Homepage: http://wpage.unina.it/giuseppe.loianno/