Yupeng HAN

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Education

Purdue University West Lafayette, IN, USA

- *M.Sc in Mechanical Engineering* | GPA: **3.96**/4.0 *Aug. 2017 - Dec. 2018*
- *Exchange Student in Mechanical Engineering* | GPA: 3.85/4.0 *Aug. 2016 - May. 2017*
  - Dean's List and Semester Honors (**All Semesters**).
  - Courses: AI (A+), Algorithm (A), Robotic (A), Statistical Methods (A+), Data Mining (A-), Programming in C (A).

Shanghai Jiao Tong University (SJTU), *Tsien Hsue-Shen Honor Program* Shanghai, China

- *B.Sc in Mechanical Engineering* | GPA: 3.75/4.30 (Top 15%) *Aug. 2013 - Jun. 2017*
  - Received waiver for the National College Entrance Exam, as **1st Prize** in Chinese Math Olympiad (Jilin Area, top **0.01%**).
  - **Outstanding Individual of SJTU** (Top 1%) [Pressed by SJTU Academic News Website].
  - The **First Prize of National College Students Technology Contest** (Ranking 32/3600 in China).
  - Scholarships: ZF Friedrichshafen AG Scholarship (2014), ELE Scholarship (2015), Excellent Student Scholarship (2016).
  - Honors: Merit Student of SJTU, Outstanding Student Leader of SJTU, 2nd Place in Shanghai "Campus Soccer Cup".

Publications & Patents

[1] **Y Han**, S Aine and M Likhachev, "Real-time 3D Perception via Search for Vehicle Detection with No Pose Annotated Training Data", ***IEEE International Conference on Robotics and Automation*** *(ICRA) 2021* [Under Review].

[2] A Agarwal, **Y Han**, M Likhachev, "PERCH 2.0: Fast and Accurate GPU-based Perception via Search for Object Pose Estimation", ***IEEE International Conference on Intelligent Robots and Systems*** *(IROS) 2020* [Published].

[3] J. Thekinen, **Y Han**, J. Panchal, "Designing market thickness and optimal frequency of multi-period stable matching in CBDM", ***ASME International Design Engineering Technical Conferences*** *(IDETC) 2018* [Published].

[4] **Y Han**, Y Xue, "Data-aware Algorithm to Solve Discrete Integration by Parity Constraints" In manuscript.

[5] "Small Household Dumpling Machine", ***China Innovation Patent***, *Patent No.CN105724504B*.

Research Experience

Research Assistant (RA), *Search-based Planning Lab* **Robotics Institute, Carnegie Mellon University**

Advisor: Prof. Maxim Likhachev (*Associate Professor, School of Computer Science, Carnegie Mellon University*)

- **Topic 1**: *Outdoor 3D Vehicle Detection* (***[1]***) *Nov. 2019 - Oct.2020*
  - Proposed Vehicle-PERCH, a novel 3D vehicle detection framework that can detect vehicle 3D pose through an analysis-by-synthesis manner. The algorithm effectively integrates 2D and 3D information, thus provides **REAL-TIME** capability.
  - Use the unsupervised clustering method to distinguish different types of vehicles and create corresponding 3D models. Successfully estimate vehicle pose using these vehicle 3D model.
  - Experimented on the KITTI dataset. The results show that our approach achieves **ON PAR** 3D detection & localization performance with SOTA learning-based methods, **WITHOUT** using 3D pose annotation data.
- **Topic 2**: *Indoor Object 6-DOF Pose Estimation* (***[2]***) *Nov. 2019 - Oct.2020*
  - Studied Perception Via Search (PERCH) is a class of algorithms that is first rendering scenes with different object poses, then search for the best explanation of the observed scene in the space of possible rendered scenes, thus predict the object pose while accounting for occlusion.
  - Tested on the open dataset (YCB), results show that our algorithm **SURPASSES STATE-OF-THE-ART** 6-DOF pose estimation methods with remarkable margins **WITHOUT** need for any ground truth pose annotations.
- **Topic 3**: *Indoor Object 6-DOF Pose Estimation without learning-based process* *Nov. 2020 – Present*
  - Estimated object **6-DOF** pose by considering occlusion while trying to maintain **REAL-TIME** performance.
- **Topic 4**: *Outdoor 3D Vehicle Detection Based on Occlusion Reasoning* *Nov. 2020 – Present*
  - The algorithm based on Topic 1; this time not only considers the occlusion of the object itself but also considering the occlusion

between objects to improve accuracy. Combined the observed depth image with the ray-marching algorithm to speed up the reasoning on occlusion between objects.

RA, *Design Engineering Lab* **ME Department, Purdue University**
Advisor: Prof. Jitech H. Panchal (*Associate Professor, School of Mechanical Engineering, Purdue University*)

■ **Topic:** *Modeling and Analysis of Complex System* (***[3]***) *Aug. 2017 - May. 2018*

- Developed a stable matching system that matches the service seekers and service providers based on the utility theory.
- Studied the optimal matching frequency in line with different groups' interests in the system, where the service seekers arrive with a Poisson process; fixed number of service providers offering resources; service providers only serve one service-seeker at a time.

Projects

■ **2D and 3D Feature Fusion** *Fall 2019*

- Explored 3D detection in multi-scale objects using a single model; generated ideas to strengthen the 3D point cloud and extracted features by utilizing 2D RGB extracted features and dynamic anchor boxes' size determined by 2D images.
- Built the fusion network pipeline, including extracting different features from point clouds and RGB images, transforming 2D information to 3D proposal boxes, cropped key points, and their 3D features inside the proposal boxes, concatenated 3D features with 2D features, and performed post-processing.

■ **Data-Aware Algorithm to Solve Discrete Integration** (***[4]***) *Fall 2018*

- Inspired by "Taming the Curse of Dimensionality: Discrete Integration by Hashing and Optimization," proposed a data-aware strategy to reduce the amount of computation by adjusting the sequence of steps in the algorithm.

■ **Ego-Splitting Framework Re-Implement in Julia** *Summer 2018*

- Implemented Ego-splitting, a framework transfer overlapping clustering problem to non-overlapping partitioning problem.

■ **Toxic Molecule Prediction** *Spring 2018*

- Obtained a satisfying performance (over 84% accuracy on the unseen testing dataset, which is three times larger than the training dataset) of whether a molecule is toxic based on feature integration and data preprocessing on limited training data.

■ **Autonomous Tennis Ball Collector** *Spring 2017*

- Designed and manufactured a fully autonomous robot that could retrieve multiple randomly located tennis balls and put the tennis balls back in a randomly located container.

Working Experience

Computer Vision Engineer Intern, *Deptrum Co.Ltd.* **Supervisor: Dr. Bo Wang** (*CTO, Stanford Ph.D. in EE*)

■ **Face Detection on Depth Image** *Apr. 2019 - Jul. 2019*

- Independently developed a modified version of the multi-task cascade CNN based on Caffe and Python from scripts, which solved the problem of face detection on depth images; Obtained **99.93% PRECISION** and over **97% RECALL**.
- Received the invitation of **RETURN OFFER** to work as a Computer Vision Engineer.

Mechanical Engineer Intern, *Robert Bosch GmbH* **Supervisor: Qiuli Zhang** (*Principle Mechanical Engineer*)

■ **Automatic Stiffness Calculation** *Jun. 2017 - Aug. 2017*

- Developed a GUI APP to calculate of gearbox stiffness by processing raw data.

Teaching Experience

Teaching Assistant (TA), *Purdue University* **Lecturer: Prof. Gordon R. Pennock** (*Associate Professor of ME*)

■ **ME45200 Senior Machine Design** *Jan. 2018 - May. 2018*

- Constructed and Graded assignments and exams to facilitate materials covered in class.
- Held office hours to answer questions to increase understanding of mechanical design concepts.

Technical Skills

■ **Programming Skills**: C++/C, Python, CUDA, PyTorch, Caffe, MATLAB, SQL.

■ **Technical Capabilities**: RGB-D Perception, Parallel Computing, Algorithm Optimization, Data Analysis, Graphics Rendering.

■ **Other Skills**: English (proficient), Chinese (native), LaTeX, Video Production, Web Development.

■ **Standardized Tests**: GRE: 324 (V155-Q169), TOEFL: 104 (R28-L27-S25-W24).