

Yupeng HAN

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EDUCATION

Purdue University, West Lafayette, IN

Aug. 2017 – Dec. 2018

Master of Science in Mechanical Engineering | GPA: **3.96/4.00**

- **Twelve years** of Olympic math training with substantial programming expertise (Independently implemented a fusion network with a modified faster-RCNN from scripts, **>6k** lines' project) in Python, C/C++, Pytorch, MXNet, Caffe, MATLAB, SQL, ROS.
- **CS Courses:** AI Meets Sustainability (A+), Graduate Level Algorithm Design (A), AI (A), Robotics (A), Statistical Methods (A+), Data Mining (A-), Numerical Analysis (A), Programming in C (A-), System Programming, Database Management (A).

Shanghai Jiao Tong University, Tsien Hsue-Shen Honor Program, Shanghai, China

Aug. 2013 – Jun. 2017

Bachelor of Science in Mechanical Engineering | Major GPA: 3.75/4.30 (Top 15%)

- Awarded **Outstanding Individual**, reported by SJTU News Academic Website due to scientific competition awards and leadership.
- Received waivers for National College Entrance Exam to SJTU, as **1st Prize** in National Olympics in Math (top **0.01%**, Jilin Area).
- Awards: The **First Prize** of National University Student Science Contest (Rank **32/ 3600**), Academic Excellent Student Awards (top 2%), Student Leader Awards (top 2%), Ele.me Scholarship (top 1%).

Purdue University, West Lafayette, IN

Aug. 2016 – May. 2017

Exchange Student in Mechanical Engineering | GPA: 3.85/4.00

RESEARCH EXPERIENCE

Robotic Perception by Generation | Research Assistant

Oct. 2019 - Present

Advisor: **Prof. Maxim Likhachev**, Search Based Planning Lab, **Robotics Institute, Carnegie Mellon University**

- Noticed the distinct advantages of detecting occluded objects with generative approaches that estimated the pose of every object in the scene by constantly reconstructing the scene and evaluating the difference between the reconstructed scene and the input scene.
- Enhanced robotic perception performance under especially poor visual conditions by bridging the generative approaches with learning-based perception and prior knowledge embedded in the probabilistic graphical model.
- Covered state-of-the-art probabilistic graphical models to explore the possibility of embedding prior knowledge into those models.
- Tested generative approaches with multiple evaluation functions and utilized prior knowledge, such as cars runs on the road, to reduce the number of reconstructed scenes significantly; Experimented on 3D object detection task of KITTI Dataset.

2D Image and 3D Point Cloud Feature Fusion | Research Assistant

Jul. 2019 - Oct. 2019

Advisor: **Prof. Cewu LU**, CS Department, Machine Vision and Intelligence Group, SJTU

- 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 pipeline of the fusion network, 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.
- Implemented a modified version of Faster-RCNN from scripts to feed in RGB images and output bounding boxes, classification labels, estimated depths, and proposal orientations with bird's-eye view; this project had over 6k lines of code.
- Selected the sparse convolution network as the backbone of the 3D point cloud feature extractor due to its performance on ScanNet.

Data-Aware Algorithm to Solve Discrete Integration | Research Assistant

Aug. 2018 - Feb. 2019

Advisor: Prof. Yexiang Xue, CS Department, Purdue University

- Inspired by "Taming the Curse of Dimensionality: Discrete Integration by Hashing and Optimization," exploited a data-aware strategy to modify the original algorithm.
- Generated a novel adaptive comparison strategy to reduce the expectation of computational complexity without loss of constant estimation guarantee and compared the new algorithm with an imaginary "optimal" algorithm to provide a regret bound for the new algorithm.

Ego-Splitting Framework Re-Accomplishment in Julia | Research Assistant

Jun. 2018 - Sept. 2018

Advisor: Prof. David F. Gleich, CS Department, Purdue University

- Explored ego-splitting from previous papers, a highly scalable and flexible framework that reduces the complex overlapping clustering problem to a more straightforward and amenable non-overlapping partitioning problem.
- Re-accomplished the Ego-splitting framework in Julia; the new framework was able to handle a large graph (millions of edges) within a few minutes (less than 10).
- Validated the program with the original paper's experiments and obtained similar outputs.

Modeling and Analysis of Complex System | Research Assistant

Aug. 2017 - May. 2018

Advisor: Prof. Jitesh Panchal, ME Department, DELP Lab, Purdue University

- Solved the challenge of service seekers when faced with a large number of service providers, and also addressed the drawbacks of the First-In First-Out (FIFO) matching mechanism by developing a stable matching system based on utility theory to generate the preference lists of service providers and service seekers, which was based on different utility interests; searched for the optimal matching frequency using the provided matching.
- Extracted distribution characteristics of the collected data to derive extra data for simulation.
- Implemented the matching algorithm based on MATLAB and simulated service seekers arrivals as a Poisson process with a fixed number of service providers offering resources; the service providers could serve only one service-seeker at a time
- Tuned the hyper-parameter to identify the optimal frequency for the matching system based on different purposes and analyzed the effects of individual parameters for different interests.

PROFESSIONAL EXPERIENCE

Deptrum | Intern Computer Vision Algorithm Engineer, Shanghai, China

Apr. 2019 - Jul. 2019

- Received a return offer to work as an Algorithm Engineer from supervisor Stanford Ph.D., **CTO** of Deptrum, **Bo WANG**.
- Independently implemented a modified version of the multi-task cascade CNN model based on Caffe and Python from scripts, which solved the problem of facial detection on completed depth images; optimized the model to obtain **99.93% precision** and over **97% recall**.
- Fine-tuned the multi-task cascade CNN model and predicted the bounding box of human faces with the fine-tuned model on the RGB images corresponding to the depth images and saved the results as the labels for depth image face detection; transferred the RGB bounding box to depth images according to the camera model's intrinsic parameters.
- Utilized median blur filters to address pepper-salt noises; applied histogram equalization to preprocessing near-infrared speckle pictures

ME452 Senior Machine Design | Teaching Assistant, Purdue University

Jan. 2018 - May. 2018

- Assisted the professor in designing midterm exam questions.

Bosch Automotive Steering | Intern Mechanical Engineer, Shanghai, China

Jun. 2017 - Aug. 2017

- Developed a GUI APP by using MATLAB GUIDE to enable the efficient calculation of gearbox stiffness.

PROJECT EXPERIENCE

Toxic Molecule: Prediction (Kaggle Project) | Individual Project

Jan. 2018 - May. 2018

Department of Computer Science, Course CS57300 Data Mining, Purdue University

- Generated a satisfying prediction (over 84% accuracy on an unseen dataset three-times larger than the training dataset) of whether a molecule is toxic to humans based on feature integration, feature extraction, and data preprocessing on limited training data.
- Selected the Gradient Boost Decision Tree as the classifier to solve the task, considering the limited computing resources.
- Utilized K-fold cross-validation and the re-sample procedure to gain a better evaluation of the model and handle unbalanced data.
- Replaced redundant features with generated molecule fingerprints and created a new feature based on molecule geometry similarity, which proved beneficial for the final result.

Intelligent Tennis Ball Collector | Core Member

Jan. 2017 - May. 2017

Department of Mechanical Engineering, Course ME58800 Mechatronics, Purdue University

- Designed and manufactured a fully autonomous robot that could retrieve multiple randomly located tennis balls from a 16m² enclosure and put the tennis balls back into a random located container within one minute.
- Applied computer vision (OpenCV installed on Raspberry Pi) to locate and track the tennis balls, randomly locate containers, and avoid obstacles based on the objects' color and outline shape under different experimental lighting conditions.
- Utilized Raspberry Pi as the central controller and set Arduino as a motion controller; searched and tracked the tennis ball based on the color and object outline and accomplished the movements by controlling the motor with self-programmed PID functions.

PUBLICATIONS & PATENTS

- Thekinen J., **Han Yupeng**, and Panchal J. H., "Designing market thickness and optimal frequency of multi-period stable matching in CBDM". ASME 2018 International Design Engineering Technical Conferences Computers and Information in Engineering Conference
- **Yupeng Han**, Yexiang Xue "Data-aware Algorithm to Solve Discrete Integration by Parity Constraints" in manuscripts.
- China Innovation Patent: Small Household Dumpling Machine, Patent No.CN105724504B

TECHNICAL SKILLS

- Programming Skills: C++/C, Python, Pytorch, MXNet, ROS, Caffe, Julia, MATLAB, SQL, Linux, and shell scripting.
- Technical Capabilities: Robotic Perception, Computer Vision in 3D and 2D, Algorithm Design and Optimization, Probabilistic Graphical Models, Statistic System Modeling, Data Analysis, Robot Trajectory Planning, Database Development.
- Other Skills: LATEX, English (proficient), Chinese (native)