Yefan Zhou

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EDUCATION BACKGROUND

University of California Berkeley (UCB), CA 01/2019 – 05/2019
Exchange Student | Overall GPA: 4.0/4.0

Southeast University (SEU), P.R.China 09/2016 - 06/2020
B.E. in Information Engineering | Overall GPA: 3.71/4.0 | Ranking: 7/43

Coursework (Math & Software): Multivariable Calculus | Probability, Statistics & Stochastic Processes | Linear Algebra | Differential Equations | Artificial Intelligence | C++/MATLAB Programming | Data Structures | Big Data in Python | Database System | Cloud Computing | Computational Structures in Data Science | Comprehensive Course Design of Computer Science | Information Security

Coursework (Hardware): Microcontrollers | Embedded Linux System | Control Theory | Signals & Systems | Computer Architecture | Robotic Manipulation and Interaction | Electromagnetism | Digital/Analog Circuits | Communication Principles | Microwave Engineering | Microcomputer System & Interfaces | Mechanical Graphing

RESEARCH EXPERIENCES

3D Object Reconstruction from a Single Image
Information Science and Engineering Lab, SEU | Advisor: Prof. L.X. Yang 07/2019 - Present

- Leveraged NumPy and PyTorch in Python to build a deep neural network model (Encoder-Decoder) for 3D object shape (represented by point cloud) reconstruction from a single RGB image; trained the model on ShapeNet and Pix3D: Dataset and Methods for Single-Image 3D Shape Modeling.
- Derived a mathematical model for transformation from point cloud coordinate to image raster space.
- Further improved the reconstruction workflow based on point cloud perceptual loss function constructed by pre-trained encoder and the optimization of local geometric feature represented by k-nearest neighbors covariance.

Robotic Upper Limb Exoskeleton and Humanoid Trajectory Planning
Human-Assistive Robotic Technologies Lab, UCB | Advisor: Prof. R. Bajcsy 06/2019 - 09/2019

- The aim of the project is to develop trajectory planner and low-level controller for wearable robotic upper limb exoskeleton to assist patient's arm movement in gaze-based rehabilitation training especially reaching tasks.
- Applied Minimum Angle/Hand Jerk Algorithm to trajectory planner so as to realize Cartesian Space and Joint Space real-time humanoid trajectory planning and execution.
- Developed a PD controller for exoskeleton active assistance, allowing joint angle and end effector position/velocity control.
- Developed controller for exoskeleton upper arm part passive assistance based on Mass-Spring-Damper system for prediction, allowing exoskeleton to mimic human shoulder motion in horizontal plane, with force compensation added.
- Implemented the planner and controller in MATLAB and on STM32 board; enabled joint angle sensing based on encoders and motion actuation based on servo motors and linear actuators; built in MATLAB a GUI for exoskeleton system, allowing simulation and 3D visualization of planning algorithm, controller parameter tuning, real-time hardware control and data analysis.

Design and Implementation of a Software for Detecting Loose Nuts at Gezhouba Dam
Information Science and Engineering Lab, SEU | Advisor: Prof. L.X. Yang 07/2018 - 08/2018

- Leveraged OpenCV and a field camera to build an image acquisition and preprocessing system, focusing on 1) image denoising based on fuzzy, median and Gaussian filters and 2) foreground segmentation based on Gaussian mixture model, 3) object extraction based on Hough Transform.
- Built, trained and validated in Python a Region-based Fully Convolutional Networks (R-FCN) model for detecting the state of loose nuts for safety inspection purposes.
- Built in PyQt a GUI, allowing interactive and intuitive software control and result visualization.

SEU Mathematical Modeling Contest 05/2018

- Built a mathematical model in MATLAB to characterize the current status and predict the future growth of taxi services market in China's city of Nanjing, covering logistic population dynamics model, grey system theory, network time series modeling, and control variable method.
- Proposed, based on analysis, a suite of recommendations for improving taxi market; garnered the 1st Prize.

SEU Intelligent Car Contest 10/2017 - 03/2018

- Designed a racing robot which can follow a curving and self-crossing racetrack using a Freescale racing chassis as the platform for all the hardware, including microcontroller (Cortex-M4 Freescale Kinetis K60), CMOS cameras (OV7620), brush motor, servo and a self-designed PCB circuit. The car reached a speed of 2.3 m/s on smooth ground.
- Developed a Gaussian Smoothing algorithm for line detection.
- Designed and tuned PD controller for steering servo.

COURSE PROJECT

***Robotic Manipulation and Interaction Course Projects*, UCB | Instructor: Prof. R. Bajcsy** 01/2019 - 05/2019

- Systematically studied robotic dynamics, grasping and manipulation, covering fundamentals of robot manipulators, perception guided constrained manipulation, concepts of holonomy and non-holonomy and soft robotic modeling:
- **Project I**: Implemented closed-loop PD control on Baxter for trajectory tracking, compared with the default controller (MoveIt!), covering workspace/joint-space velocity, and joint-space torque control.
- **Project II**: Grasp planning with Baxter and Sawyer, focusing on stable grasp planning based on metrics of Force Closure, Gravity Resistance and Robust Force Closure, reaching lifting success rate of 60% for Gearbox object in ten grasps.
- **Project III**: Developed controllers for a 2nd order nonholonomic system (Modified TurtleBot) based on 1) Lie algebra and 2) steering with sinusoids method for more efficient open loop control; verified the superiority of sinusoids control.
- **Project IV**: Conducted system identification of a soft robotic finger (built by EcoFlex-30), followed by parameter fitting and optimization based on rigid/elastic manipulator model with a nonlinear least squares solver.
- **Final project:** Built and experimentally characterized a compliance-modulating fingertip-inspired tactile sensor using pneumatic sealed elastic membrane and a depth-sensing camera as an add-on to the Baxter robot for scanning a 3D terrain and measuring the distribution of stiffness:
  - Applied Point Cloud Library in C++, ROS and a RGBD camera to enable image segmentation, geometry recognition, and Baxter robot arm control.
  - Determined an empirical model of the device's force-deformation characteristics based on simplifying Hertz Contact Theory and further accomplished the derivation of stiffness estimation matrices for external contact region.
  - Built a software to enable real-time 3D visualization of point cloud registration and integration including stiffness distribution information in mapping.
  - Completed a full testing and identified opportunities for future improvements.

***Intro. to Artificial Intelligence* Course Projects, UCB | Instructor: Prof. S. Levine & Prof. S. Russell** 01/2019 - 05/2019

- Systematically studied Markov decision processes, reinforcement learning, decision trees, HMM, particle filtering, game tree, etc, and their applications to probabilistic robotics and robotic inference.
- **Project I:** Implemented in Python multiple path search algorithms, covering DFS, BFS, UCS, A*.
- **Project II:** Implemented in Python value iteration and Q-learning, applying them to a simulated robot controller (Crawler) and simulated game Pacman.
- **Project III:** Implemented in Python Digits Classification based on MNIST dataset, Language Identification based on Recurrent Neural Network (RNN), Perceptron, Nonlinear Regression.

Development of an Optically Navigated Vehicle with Autonomous Maneuverability
***Microcontrollers* Course Project, SEU** 11/2018 - 01/2019

- Designed and prototyped a vehicle with optoelectronic autopilot for navigating through a network of intersections and performing garage parking via automatically tracking road marks.
- Designed an integrated navigation system incorporating CMOS camera, optical glass, photoelectric encoder and a programmable microcontroller (STM32).
- Significantly bolstered programming skill and reinforced understanding of analog & digital circuit and optical system.

Implementation of a Flight Control System Based on Kalman Filter and PID Controller
***Control Theory* Course Project, SEU** 10/2018 - 12/2018

- Implemented in MATLAB an integrated flight controller based on Kalman filter and PID controller to allow the speed and roll/yaw/pitch angles control of a fixed-wing unmanned air vehicle (UAV) with short transition, decent stability and good anti-disturbance characteristics.
- Key steps include 1) derivation of flight dynamics model and transfer function of UAV; 2) PID controller design; 3) Kalman filter for UAV state estimation; and 4) simulation of PID controller and Kalman estimator using MATLAB Simulink.

***Digital System Course Designs* Course Project, SEU** 08/2018 - 10/2018

- **Project 1**: Built a dual-mode signal light intensity controller, allowing manual and automatic control modes; key components include PWM-based LED brightness control, and a Cortex-M3 microcontroller with control logic implemented in Verilog.
- **Project 2**: Built an infrared speed measurement device based on a Cortex-M3 microcontroller with VHDL programming to allow signal processing and timing, a phototransistor module, a power supply module, a LED segment display module, etc.
- **Project 3**: Designed, built and tested an intelligent traffic signal control system, allowing 1) variable control logic based on changing traffic flow patterns, 2) variable signal intensity based on weather conditions, and 3) three control modes (emergency, fixed timing and variable timing); leveraged a phototransistor module to allow traffic flowrate measurement, and a humidity sensor to allow weather condition monitoring.

STANDARDIZED TESTS

GRE General: V: 152 / Q: 170 / AW: 4.0 / Total: 322 | **TOEFL:** R:29 / L:27 / S:24 / W:28 / Total: 108

SKILLS

Programming Languages: C/C++ | Python | Java | MATLAB | SQL | Verilog | Assembly
Libraries: OpenCV | PyTorch | TensorFlow | Point Cloud Library | NumPy | SciPy | Panda | Scikit-Learn | Scrapy | Matplotlib | Selenium
Software/Hardware: LaTex | Altium Designer | SolidWorks | Android | Arduino | ARM | Multisim | Linux | Robot Operating System