DUO ZHANG

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EDUCATION

Shandong University
B.E. in Computer Science Department *2018/06 - 2020/06*
Undergraduate in Energy and Power Engineering Department *2016/09 - 2018/06*

RESEARCH EXPERIENCES

Changhe Tu's lab, Interdiscipinary Research Center, Shandong University *2020/01 - Present*
Research Assistant *Qingdao, Shandong, China*

- **Grasp Planning as Infinite Programming Under Complementary Constraints**
  I was supervised by Prof Xifeng Gao and Dr. Zherong Pan, and we proposed an optimization-based approach to grasp planning, which takes into consider contact positions, forces, and kinematic constraints for general 3D objects and robot gripper modalities. Central to our method is a refor- mulation of grasp planning as an infinite program under complementary constraints (IPCC). IPCC allows contacts to happen between arbitrary pairs of points on the object and the robot gripper. As a result, IPCC allows a numerical optimizer to search for both precision and power grasps over a large solution space. Furthermore, our method is guaranteed to generate penetration- and self-collision-free grasps. We show that IPCC can be reduced to a conventional finite-dimensional nonlinear program (NLP) by using a kernel-integral relaxation, for which efficient algorithm exists. Moreover, the values and Jacobian matrices of the kernel-integral can be evaluated efficiently using a modified Fast Multipole Method (FMM). We demonstrate the effectiveness, robustness, and efficiency of our grasp planner on a row of challenging 3D objects and high-DOF grippers.

- **Human-like Trajectories Generation for Robot Arms Given Certain Properties**
  I designed a model using VAE + LSGAN which can generate human-like trajectories for some scenarios involving human robot interactions with certain given properties like smoothness and length etc. The main purpose of this project is to make the robot behavior more understandable and legible for human partners.

Sriram Sankararaman's lab, Computer Sciense Department, UCLA *2019/07 - 2019/09*
Research Assistant, Cross-disciplinary Scholars in Science and Technology Program *LA, CA, USA*

- **Identification of Cell-type-specific Genetic Regulation of Gene Expression for Transcriptome-wide Association Studies**
  We developed a new approach leveraging Tensor Component Analysis (TCA) to estimate cell-specific expression levels from bulk tissue measurements using single nucleotide polymorphisms (SNPs) as predictors. We show that this model performs well in simulations and applied it to a cohort of around 1,500 individuals with expression measured in blood, identifying SNPs that predict a significant proportion of variation in expression levels in four major white blood cells. These SNPs and their estimated effects can be used for cell-specific TWAS in large cohorts with genetic data such as the UK Biobank, which includes over 500,000 samples. I also built and published a R package named TWAS for our project. Here is our project's Poster. (Our Poster Link)

Youjun Lu's lab, National Astronomical Observatories, CAS *2018/04 - 2018-05*
Undergraduate Researcher *Beijing, China*

- **Determination of Physical Parameters of Binary Black Holes and the Origin of Binary Black Holes with Gravitational Wave Data**
  I simulated various gravitational wave signals with different parameters in a wide range and set them

as templates. Given the templates I trained a Bayesian Classifier determine the likelihood for a signal to be a gravitational wave and matching the parameters with the templates.

Guochao Gu's Lab, Material Science Department, Shandong University *2017/07 - 2018/07*
Undergraduate Researcher *Jinan, Shandong, China*

- **Solid-Liquid Coordinated Deformation Mechanism and Defect Control in the Process of Deformation Forging of Deformed Aluminum Alloy**
  I was taking charge of metal grain modeling and grain edge recognition. The grain modeling part was intended to build the 3D grain voronoi cells to simulate the shape of grain cells when the cells are worn and the gap between cells are filled with liquid. Then the simulated grain cells are exported to ABAQUS for analyzing the mechanic performance.

PRESENTATION

Identification of cell-type-specific genetic regulation of gene expression for transcriptome-wide association studies
Poster presentation at UCLA CSST program

HONORS AND REWARDS

National Scholarship
Sponsored by Ministry of Education of the People's Republic of China
Excellent Cadre Scholarship
Sponsored by Shandong University
Excellent Student Scholarship
Sponsored by Shandong University
Provincial Third Prize of China Undergraduate Mathematical Contest in Modeling
Sponsored by China Society for Industrial and Applied Mathematics
Provincial Third Prize of The Chinese Mathematics Competitions
Sponsored by China Mathematics Society
Honorable Mention of Mathematical Contest in Modelling (MCM)
Sponsored by Mathematical Association of America
Provincal Third Prize of Internet+ Innovation and Entrepreneurship Competition
Sponsored by Ministry of Education of the People's Republic of China
Shandong University Basketball Game Advanced Individual
Sponsored by ANTA sports

SKILLS

Programming Languages
C++, Python, JavaScript, Java, Matlab, R
Other Skills
Metal Material Processing (including turning, milling, planing, forging, casting, molding, 3D printing and some CNC technologies)

GRADES

English Test

- **TOEFL**
  Reading: 28 Listening: 28 Speaking: 23 Writing: 28 Total: 107

Robotics Involved Tests

- **Application in Robotics:** *Grade: 98, Level: First Class*
  I trained a simple Convolutional Neural Network to classify different types of trash (Cubes with different

colors) and employed the network to a simple DOBOT Robot Arm with a sucker and a camera on it. Then the Dobot robot arm can correctly accomplish the trash classification and pick up the trash and drop it to the right trash bin.

- **Basics of Robotics:** *Grade: 95, Level: First Class*
- **Machine Learning** *Grade: 89, Level: First Class*
- **Theoretical Mechanics** *Grade: 85, Level: First Class*
- **Circuits and Electrical Technology** *Grade: 95, Level: First Class*
- **Advanced Mathematics** *Grade: 95, Level: First Class*
- **Complex Functions and Laplace Transformation** *Grade: 94, Level: First Class*
- **Probability Theory and Mathematical Statistics** *Grade: 95, Level: First Class*
- **Numerical Analysis** *Grade: 91, Level: First Class*
- **Computer Vision** *Grade: 92, Level: First Class*
- **Human Computer Interaction** *Grade: 90, Level: First Class*
- **Cognitive Science and Brain-like Calculation** *Grade: 90, Level: First Class*
- **Basic Physics** *Grade: 90, Level: First Class*

GPA

- **Freshman**
  3.97/4.00
- **Sophomore**
  3.92/4.00
- **Junior**
  3.66/4.00
- **Senior**
  3.64/4.00

TOTAL: 3.77

PERSONAL TRAITS

Highly motivated and eager to learn new things
Strong leadership and cooperation skills
Ability to work as an individual as well as in group
Enthusiast for basketball and power lifting (newbie in power lifting)
Skilled calligrapher in Chinese