Shubo Liu

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EDUCATION BACKGROUND

Queen Mary University of London (QMUL) and Northwestern Polytechnical University (NPU), China   09/2017 – 06/2021
B.E. in Materials Science and Engineering | GPA: **3.426**/4.0 | **84.68**/100
Coursework (Coursera): Robotics: Aerial Robotics, Computational Motion Planning, Mobility, Perception, Estimation and Learning, Capstone (6 Courses) | Advanced Data Structure and Algorithm | Embedded Software and Hardware Architecture

STANDARDIZED TESTS

GRE General: V: 147 / Q: 166 / AW: 3.0 / Total: 313 | **IELTS:** L: 7 .0/ R: 7.5 / W: 6.0 / S: 6.5 / Total: 7.0

SKILLS

Programming Languages: C/C++ | C# | Python | Linux | MATLAB | SQL | Verilog | Assembly
Software: Robot Operating System | Arduino | Altium Designer | UG/NX | LaTeX | ANSYS | ABAQUS | JMatPro | Proteus
Hobbies: Table Tennis | Badminton

AWARDS AND HONORS

Outstanding Student Scholarship, QMUL-NPU	2018 & 2019 & 2020
The 1st Prize	China National College Student "Innovation, Originality and Entrepreneurship" Challenge	08/2020
The 3rd Prize	National University Student Social Practice and Science Contest on Energy Saving & Emission Reduction	07/2020
The 1st Prize	Sanhang Cup Extracurricular Science and Technology Works Competition	04/2020
The 3rd Prize	iCAN International Innovation and Entrepreneurship Competition	12/2019
IOM3: The Institute of Materials, Minerals and Mining	Student Member	09/2019
Honorable Mention Award	Mathematical Contest in Modeling (MCM)	04/2019
The 2nd Prize	The China Undergraduate Mathematical Contest in Modeling (CUMCM)	10/2018
China Society of Automotive Engineers (SAE)	03/2018

ACADEMIC COMPETITIONS

Opioids Spread: More Counties Green or Red?
ICM/MCM (Problem C)   01/2019
➢ Led a team of three to build a series of mathematical models to analyze the spread pattern of opioids in five US states:
  ■ Built a graph network to simulate the drug spreading iteratively in discrete time domain; leveraged **Random Forest Combining Factor Analysis** (RFCFA) to cluster socio-economic data and identify high-priority areas for crime control.
  ■ Built a differential model with four independent factors to predict the crime rate trend.
  ■ Applied an **adjusted LASSO method** and a stepwise regression to analyze the relationship between opioid addiction and socioeconomic factors.
  ■ Proposed a strategy to mitigate the abuse of opioid, and defined the Crisis Index to evaluate the effectiveness.
  ■ Leveraged various geospatial data visualization techniques to facilitate pattern extraction and result presentation.
  ■ Composed a 20-page technical report; garnered the Honorable Mention Award.

Team Leader | China Undergraduate Mathematical Contest in Modeling (CUMCM)   09/2018
➢ Modeled heat conduction and convection through a thermal insulation suit based on a set of time-dependent partial differential equations (PDEs), with boundary and initial conditions properly defined.
➢ Numerically solved the **derived PDEs** in MATLAB for temperature field using **finite difference method**; tried an array of numerical schemes for optimal balance among computational overhead, truncation error, and numerical stability.
➢ Established a **multi-objective optimization model** for optimizing the material selection and thickness design; solved the problem using simulated annealing algorithm.

RESEARCH EXPERIENCES

Micro 5G Unmanned Aerial Vehicle (UAV) and its Cloud System   04/2019 – 04/2020
National Engineering Laboratory of Big Data Application Technology for Air, Space, Ground and Sea Integration, NPU
➢ Led a team of four to design, prototype and test an autonomous UAV system based on 5G communication for remote control; key components include:
  ■ **Computer Vision:** Implemented a set of deep learning and classical computer vision algorithms in Python (PyTorch) and OpenCV for object detection, tracking and aiming.
  ■ **Communication:** Enabled 5G broadband cellular communication for operating range exceeding 1K+ miles; measured packet loss for various heights, locations, and signal strengthens for validating the system robustness.
  ■ **Control Platform:** Established a Cloud-based data storage and processing system for real-time flight monitoring and management.
  ■ **Navigation:** Implemented a Simultaneous Localization and Mapping (SLAM) algorithm in MATLAB for concurrent location tracking and map updating.
  ■ **Electronic Hardware:** Integrated an onboard microcontroller, a field camera, and a set of sensors and actuators to enable 6 degrees-of-freedom flight control; performed PCB design/testing using Altium Designer and Proteus.
  ■ **Software:** Built a control application in C# and Linux, allowing two-way real-time flight control and flight data visualization.
  ■ **Mechanical Hardware:** Conducted CAD design, material procurement, parts machining, and system assembly; performed computational fluid dynamics (CFD) simulation in ANSYS-Fluent to optimize the propeller geometry for noise reduction and efficiency enhancement.
➢ **A Chinese patent gained** (202020156197.9); **two software copyrights granted** (2020SR0135810) and (2020SR0838390)

- ➢ Technical merit and novelty recognized with **two national awards**, **three provincial awards**, and **eight university awards**.
- ➢ **Presented the work in the 2019 International Innovation and Entrepreneurship Exp (国际创新创业博览会)**; the work highlighted by multiple national newspapers and presented the work to chairman of China Youth Federation; **selected into the National College Students' Innovation and Entrepreneurship Annual Exchange Program**; participated in the **proposal of Key R&D Projects of Shaanxi Province in 2020 (陕西省重点研发项目计划"面上项目")**
- ➢ Coordinated cross-departmental collaboration following divide-and-conquer strategy; organized numerous meetings to drive brainstorming, alignment and troubleshooting; spearheaded the liaison with external stakeholders and secured external financial support; significantly bolstered technical leadership and interpersonal skills.

"iGuada" Campus Life WeChat Mini Program

China College Computer Competition 01/2019-08/2020
- ➢ Joined a team of three effort to develop the WeChat mini program to help users to quickly check the class schedule, remind of courses, and share learning materials on campus
- ➢ "Seed Program for Innovation and Entrepreneurship" supported; **three software copyrights granted** (2020SR0993804) (2020SR0992659) and (2020SR0956715)

Development of an Autonomous Race Car, NPU 12/2017 - 12/2018
- ➢ Led a team of three to design and implement an autonomous racing car capable of navigating through a track with electromagnetic markers.
- ➢ Designed circuits and PCBs, including:
  - ■ An array of electromagnetic wave detectors incorporating Operational Amplifiers, Inductor-Capacitor pairs, and modules for signal amplification and A/Q conversion.
  - ■ An integrated controller incorporating NXP 32bit microcontroller, power supply, and drive circuits associated with steering servo and electric motor.
- ➢ Designed a suite of control algorithms to enable real-time steering, speed control, path-finding and road condition recognition based on sensor data.

China Collegiate Formula Race Car Challenge, NPU 10/2017 - 10 /2018
- ➢ Coordinated a team of four to design, prototype and test a single-seat, open-wheel, open-cockpit race car with excellent acceleration/deceleration performance and maneuverability.
- ➢ Designed the powertrain system; performed **finite element analysis (FEA)** in ANSYS software package on the engine, transmission, drive shafts, differentials, and the final drive, covering static, dynamic, and thermal analyses.

Development of a Pleurobot, NPU 11/2018 - 02/2019
- ➢ Designed and manufactured a biomimetic mechanoid "Pleurobot", which imitates the locomotion of the salamander with its own articulated vertebrae, allowing it to slither along on land or in water.
  - ■ Designed mechanical parts in UG/NX, followed by 3D printing for prototyping; leveraged an array of motion planning and inverse kinematics algorithms to optimize mechanical design.
  - ■ Integrated an Arduino microcontroller, a Bluetooth module, and 30+ micro servo motors to enable motion actuation and remote control.

Implementation of a Flight Control System Based on Kalman Filter and PID Controller, NPU 03/2019 - 06/2019
- ➢ 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.

EXTRACURRICULAR EXPERIENCES

Translator | 2020 ArduPilot Developer Online Conference 04/2020
- ➢ Translated the presentation "Equivariant Visual Odometry" delivered by Pieter van Goor from Australia Center for Robotic Vision; gained exposure to the state-of-the-art advancement in robotic vision field.

Team Leader | Current Status and Future Reform of State-Owned Enterprises in China's Shanxi Province 08/2018
- ➢ Conducted field survey on the reform of six major state-owned enterprises (SOEs) in China's Shanxi Province, spanning energy, automobile, and heavy machinery sectors.
- ➢ Interviewed 100+ management personnel and government officials; collected first-hand data regarding the history, operational models, and development prospects of SOEs; generated recommendations for promoting health growth of SOEs.

Summer School at Queen Mary University of London, UK 07/2019
- ➢ Studied and practiced an array of materials analysis techniques and equipment, including bending tester, universal testing machine, etc.

Attendee | International Innovation and Entrepreneurship Competition, Osaka, Japan 11/2019
- ➢ Attended a series of seminars, forums and training sessions with fellowship students from 50+ countries.

Member | China Initiative in Developing English Courses (Linear Algebra) 07/2019
- ➢ Led a team effort to develop a comprehensive teaching plan and curriculum syllabus regarding the subject of Determinant; edited and proof-read course materials and assignments.

Data-Driven Poverty Diagnosis and Elimination, Shanxi Province, China 08/2018
- ➢ Led a team of four to develop a quantitative model to assess the effectiveness of relocation-based poverty elimination in China's Shanxi Province, covering 1) data collection based on online questionnaires, phone interviews and in-person meetings; collectively applied hierarchical analysis, fuzzy evaluation and case study to build the model.

Summer School at Peter the Great St. Petersburg Polytechnic University (SPbPU), Russia 07/2018
- ➢ Systematically studied the principle, history and state-of-the-art technology of steam turbine, focusing on the advanced materials for manufacturing the turbine blades with excellent wear and corrosion resistance.
- ➢ Visited the Leningrad Nuclear Power Plant; systematically studied the Automatic Reactor Control Systems, including control algorithms, measurement instrumentation, and cutting-edge technology for improving control robustness.