Shuwei Pei

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RESEARCH INTEREST

Automated driving, Intelligent transportation, Deep reinforcement learning, Vehicle Dynamics and Control

EDUCATION

University of Science and Technology Beijing **GPA: 3.62/4.0—Beijing, CHN**
M.E. in Mechanical Engineering *September 2021 - June 2024 (expected)*

Operational Research (82), Mathematical Modeling (92), Modern Control Theory (90), Intelligent Algorithm (92), Vehicle System Dynamics (87), Digital Image Processing (88)

National Taipei University of Technology **GPA: 3.82/4.0—Taipei, CHN**
Exchange Student in Mechanical Engineering *September 2019 - January 2020*

Principles and Applications of Microcomputers (99), Automatic Transmission (95)

University of Science and Technology Beijing **GPA: 3.68/4.0—Beijing, CHN**
B.E. in Vehicle Engineering *September 2017 - June 2021*

Calculus (93), Engineering Physics (93), Theoretical Mechanics A (98), Mechanics of Materials (90), Probability & Mathematical Statistics A (92), Automatic Control Theory (97), Mechanical Design (90)

PUBLICATIONS

- **A Novel Integrated Deep Reinforcement Learning Approach with Trajectory Optimization for Mining Autonomous Truck Dispatch**
  Shuwei, Pei and Jue, Yang *Resources, Conversation and Recycling* (Submitted) Sep,2023.
- **A Multi-Objective Velocity Trajectory Optimization Method for Autonomous Mining Vehicles**
  Shuwei, Pei and Jue, Yang *International Journal of Automotive Technology* (Accepted) Sep,2023.

RESEARCH EXPERIENCE

Optimal Speed Trajectory of Mining Vehicle *2021 – 2022*

1. In conventional manned vehicles, the overall transport cost is mainly related to the driver's driving habits and experience. Velocity optimization of vehicles is one of the main eco-driving techniques.
2. A multi-objective speed trajectory optimization method using dynamic programming was proposed considering travel time, energy consumption, and battery lifetime. And it is verified on the fuel and electric vehicle models.
3. The results spend less time and it runs with less velocity fluctuations. Moreover, it can reduce battery capacity loss, which prolongs the battery's lifetime for electric vehicles. It will adopt different frequencies of PnG approach as the gradient of routes changes.
4. However, it leads to an increment in energy consumption. It is a kind of Pareto optimal trade-off.

Reinforcement Learning-Based Fleet Dispatching with Trajectory Optimization *2022 - Present*

1. The concept of smart mining has emerged as an attractive topic worldwide. Mining haulage fuel consumption contributes to more than half of the greenhouse gas emissions in this sector.
2. A novel mining haulage simulation environment is established to facilitate dispatching operations. By integrating the Deep Q-Network, a model-free reinforcement learning system, with the dynamic programming optimization method, the efficiency of mining operations can be enhanced, thereby reducing waiting times and energy consumption.
3. It results in a 10% reduction in average energy consumption for transporting 1 kg and a 3.8k ton increase in total production compared to the conventional fixed schedule strategy. The policy generated by the DQN demonstrates more balanced tasks between dump and shovel sites. It also shows robustness in handling truck failures.

The Electric Autonomous Mining Truck Without Cabin *2022 – Present*

1. Autonomous driving mining vehicles without the cabin can improve the existing transportation and production in terms of safety, transportation efficiency, and energy consumption.
2. Designed a solution for battery exchange transfer system, remote control, and install the various sensors. Analyzed and diagnosed the breakdown of autonomous vehicle, including TCS, EBS and Hydraulic steering system.
3. Dispatched 10 homogeneous autonomous vehicles in a closed mining area by using the intelligent system in real-time. Enhanced the full-time autonomous operation capability to reach more than 120% of the manual by EV trucks.

Theoretical Research on Autonomous Vehicles Based on ROS2 *2021 – 2022*

1. Based on ROS2 in the Ubuntu22.04 system, built nodes for perception, localization, path planning, and MPC tracking.
2. Designed topics of publish-subscribe nodes using C++, and debugged vehicles in the gazebo simulation environment.
3. RRT search algorithm was used to find the feasible path, and MPC was used to track and control.

WORKING EXPERIENCE

China National Heavy Duty Truck Group Co., Ltd. **Jinan, CHN**
Intern in Light Truck *July 2022-September 2022*

- Analyzed the market of refrigerator cars and modified the chassis structure of light trucks to meet the national standard.The truck chassis was changed to achieve refrigeration, insulation, storage, freshing.

German Association of the Automotive Industry **Beijing, CHN**
Intern in China Office *September 2020 - December 2020*

- Coordinated with Chinese and German staff in English and updated the German manager's calendar. Dealt with the office administrative work and supported the company to organize automobile forum activities. Analyzed European and Chinese electric vehicle market data and development policies.

Midea Group Co., Ltd. **Foshan, CHN**
Intern in Lean Management *June 2020 - August 2020*

- Made statistics on operation time of different manufacturing lines, and accurately adjusted the production sequence. Implemented automatic logistics vehicles in plants and improved transport efficiency by 1.2%.

AWARDS & HONORS

- **The Second Price Scholarship**, University of Science and Technology Beijing, 2023&2022
- **The Second Price Scholarship**,Roberto Rocca Scholarship, 2023
- **National Second Prize**,China Industrial Internet Contest, 2021
- **Outstanding Graduates**, University of Science and Technology Beijing, 2021
- **Merit Student**, University of Science and Technology Beijing, 2018

SKILLS

Programming	Matlab, LaTex, Python, Pytorch, C/C++, Simpy
Software	Solidworks, CAD, Carsim, Simulink
Languages	IELTS 7.5