

Shuwei Pei

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RESEARCH INTEREST

Automated Driving, Intelligent Transportation, Deep Reinforcement Learning, Vehicle Dynamics and Control, Multi-agent System, Game Theory, Adversarial Learning, Multi-objective Optimization

EDUCATION

University of Science and Technology Beijing

M.E. in Mechanical Engineering

GPA: 3.62/4.0—Beijing, CHN

September 2021 - June 2024

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

Exchange Student in Mechanical Engineering

GPA: 3.82/4.0—Taipei, CHN

September 2019 - January 2020

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

University of Science and Technology Beijing

B.E. in Vehicle Engineering

GPA: 3.68/4.0—Beijing, CHN

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

- **Multi-agent Deep Reinforcement Learning to Improve Dispatch System for Autonomous Trucks**
Shuwei, Pei and Jue, Yang *Journal of Intelligent Transportation Systems* (Submitted) Sep,2023.
- **A Multi-Objective Velocity Trajectory Optimization Method for Autonomous Mining Vehicles**
Shuwei, Pei and Jue, Yang *International Journal of Automotive Technology* Nov,2023.

RESEARCH EXPERIENCE

Multi-agent Reinforcement Learning-Based Fleet Dispatching

August 2023 - June 2024

1. **Simulation Platform Development:** Mining haulage fuel consumption accounts for over half of the greenhouse gas emissions, highlighting the need for optimized solutions. Developed a fleet dispatch simulation platform using PyTorch and SimPy, modeling mountainous scenarios, including assembly, real-time dynamic scheduling, and resupply.
2. **Multi-Agent Reinforcement Learning System:** Each truck is treated as an independent agent with a standardized set of state variables. Integrated Deep Q-Network (DQN), a model-free reinforcement learning system, with dynamic programming optimization methods to enhance transportation efficiency, reducing waiting time and energy consumption. The DQN algorithm enable them to learn and refine dispatching policies by maximizing rewards.
3. **Results and Advantages:** The system demonstrated superior adaptability and efficiency compared to traditional methods. Achieved a 10% reduction in energy consumption per kilogram transported and a 3,800-ton increase in production. It quickly adjusts fleet deployment in response to unexpected situations and complex transport environments. The system showed improved task balancing and robustness against truck failures.

The Electric Autonomous Truck Without Cabin

December 2022 – April 2024

1. **Fault Analysis:** Contributed to the development of autonomous electric mining trucks by analyzing and debugging issues related to braking, steering, and traction distribution to ensure vehicle stability.
2. **Infrastructure Design:** Designed and optimized the battery exchange and transfer system, remote control solutions, and sensor installation to enhance vehicle adaptability and performance.
3. **Operational Enhancement:** Deployed 10 homogeneous autonomous vehicles in a closed mining area, improving real-time coordination and achieving over 120% of the performance compared to manual operations.
4. **Technology Transfer:** Assisted in the conversion of intellectual property and technology standards into practical applications, contributing to the preparation of 8 technical patents and advancing the development of autonomous vehicles.

Multi-objective Optimization of Vehicle Speed and Trajectory

May 2022 – May 2023

1. **Eco-Driving and Cost Reduction:** Investigated velocity optimization techniques for manned vehicles to reduce overall transport costs, focusing on eco-driving strategies to enhance efficiency.
2. **Multi-Objective Optimization Method:** Proposed a multi-objective optimization method utilizing dynamic programming to balance travel time, energy consumption, and battery lifespan. The method was tested on both fuel and electric vehicle models, demonstrating its applicability in cost control for mining operations.
3. **Results and Trade-Offs:** It adjusted acceleration and coasting frequencies for varying road gradients. It achieved Pareto optimal solutions, reducing travel time and velocity fluctuations while enhancing battery lifespan, though with a slight increase in energy consumption, representing a trade-off between efficiency and energy use.

Theoretical Research on Autonomous Vehicles Based on ROS2

September 2022 – January 2023

1. **System Development:** Built perception, localization, path planning, and MPC tracking nodes on ROS2 with Ubuntu 22.04.
2. **Node Design:** Implemented publish-subscribe topics in C++, simulated and debugged in the Gazebo environment.
3. **Path Planning:** Applied RRT for pathfinding and MPC for control, incorporating SLAM for mapping.

WORKING EXPERIENCE

National Innovation Center of Intelligent and Connected Vehicles

Intern in Industry Analyst

Beijing, CHN

June 2024 - August 2024

- 1. **Standards Development:** Contributed to quality standards for automotive, including quality management, software development, and safety, while coordinating with government, industry, and research institutions.
- 2. **Industry Research:** Investigated key issues such as real-time operating systems for high-performance automotive computing, cybersecurity, toolchain systems, and functional safety certification.
- 3. **Technical Roadmap:** Developed a technical roadmap outlining the current state and trends of automotive operating systems, setting technology targets for 2030, and promoting innovation in China’s automotive.

China National Heavy Duty Truck Group Co., Ltd.

Intern in Light Truck

Jinan, CHN

July 2022 - September 2022

- 1. **Market Analysis:** Conducted analysis of the refrigerated truck market, including current demands and industry standards. Utilized CATIA software to modify the truck chassis, ensuring compliance with national standards.
- 2. **Chassis Modification:** Managed the upgrade process and conducted extensive testing to validate the performance of these modifications, ensuring they met refrigeration, insulation, storage, and monitoring capabilities.

German Association of the Automotive Industry

Intern in China Office

Beijing, CHN

September 2020 - December 2020

- 1. **Cross-Cultural Coordination:** Coordinated logistical details for meetings and events. Provided translation services for speeches and documents, ensuring interactions between teams from different cultural backgrounds.
- 2. **Market and Policy Analysis:** Conducted comprehensive analysis of the electric vehicle markets in Europe and China, offering actionable insights and supporting strategic decision-making for the association’s initiatives.

Midea Group Co., Ltd.

Intern in Lean Management

Foshan, CHN

June 2020 - August 2020

- 1. **Production Line Optimization:** Conducted detailed analysis of manufacturing line operation times, balanced assembly line processes, and adjusted production sequences to reduce overall manufacturing time.
- 2. **Automated Logistics:** Introduced and simulated automatic guided vehicles in the plant, enhancing transport efficiency by 1.2% and achieving 80 transport cycles per hour.

AWARDS & HONORS

- o Outstanding Graduates, University of Science and Technology Beijing, 2021&2024
- o The Second Price Scholarship, University of Science and Technology Beijing, 2023&2022
- o The Second Price Scholarship,Roberto Rocca Scholarship, 2023
- o Merit Student, University of Science and Technology Beijing, 2018&2022
- o National Second Prize,China Industrial Internet Contest, 2021

SKILLS

Programming	Matlab, LaTeX, Python, Pytorch, C/C++, Simpy
Software	Solidworks, CAD, Carsim, Simulink
Languages	IELTS 7.5, CET 6