

Shashank Rajput

FARE Fellow (Postdoc Researcher) at IIT Kanpur
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Personal Profile

Postdoctoral researcher specializing in traffic flow theory and disordered traffic systems, with a PhD from IIT Kanpur. Research interests include second-order macroscopic modeling, lateral vehicle interactions, and data-driven approaches for disordered traffic. Extensive experience in UAV-based trajectory data acquisition, data processing, numerical simulations, and statistical analysis.

Research Interests

Disordered Traffic; Machine Learning & Artificial Intelligence; Macroscopic Modelling; Physics-Informed Neural Networks; Traffic Simulations

Computer Skills

- Python, Matlab, R-Studio
- Working knowledge of QGIS

Experience

FARE Fellow / Postdoc Researcher

January 2026 – Present

Indian Institute of Technology Kanpur, India

- Physics-informed deep learning frameworks for traffic state estimation.
- Integration of trajectory data with macroscopic traffic flow equations through data-based and physics-based loss functions.
- Formulation and implementation of continuity and hydrodynamic equation within deep learning models for traffic dynamics.

Doctoral Research Scholar

August 2020 – January 2026

Indian Institute of Technology Kanpur, India

- Development of a two-dimensional second-order macroscopic traffic flow model for disordered traffic conditions.
- Modeling of coupled longitudinal and lateral vehicle dynamics within a continuum traffic framework.
- Analysis of the influence of relaxation, interaction and repulsive boundary forces on traffic flow evolution on disordered traffic.
- Collection, automatic extraction and development of the trajectory data in disordered traffic conditions using unmanned aerial vehicles (UAVs).

Research Associate

April 2024 – September 2024

TU Dresden, Germany (Funded by SPARC, Ministry of Education, Government of India)

- Mathematical formulation of a two-dimensional second-order macroscopic traffic flow model.
- Development and implementation of numerical schemes for solving the resulting coupled system of partial differential equations.

Intern

May 2019 – July 2019

Summer research project fellowship by Indian National Science Academy (INSA) at IIT Delhi.

- Analysis of travel behavior after residential relocation for twin cities in Karnataka, India.
- Analyzed human behavior dependency on the various state variables.
- Analysed and Quantified the behavior and its inter-dependency.

Projects

- **Large-scale trajectory data development for disordered traffic** Development of UAV-based vehicle trajectory datasets comprising over 2.5 million data points for Indian traffic using image-processing and deep learning techniques (YOLO). UAV recordings enabled non-intrusive data collection, minimizing measurement-induced disturbances in traffic flow.
- **Machine learning-based pavement crack detection** Conducted a project on automatic pavement crack detection using machine learning and deep learning techniques. Developed a convolutional neural network for crack classification and applied transfer learning with pre-trained ResNet50 models. Implemented pixel-level crack segmentation using a U-Net architecture, followed by skeletonization-based post-processing to extract crack geometry such as length and width.
- **Feeder bus network optimization and multimodal coordination** Performed a comprehensive study on feeder bus network optimization and bus–train schedule coordination for Raipur Railway Station. Identified optimal terminal-bound bus routes using Dijkstra’s shortest path algorithm on a nodal public transit network, followed by route optimization based on travel distance, demand distribution, and operational profitability. Developed multimodal coordination strategies through train schedule clustering and bus departure time adjustments using offset and headway-based methods. The analysis was implemented using custom C++ programs and real-world bus and train schedule data.

Publications (Refereed Journals/ Conferences)

- **Rajput, S.**, Kanagaraj, V., Treiber, M., Asaithambi, G., & Okhrin, O. (2026). Traffic State Estimation Using a Physics-Informed Deep Learning Framework. (Under Preparation).
- **Rajput, S.**, Kanagaraj, V., Treiber, M., Asaithambi, G., & Okhrin, O. (2026). Second-Order Continuum Model for Disordered Traffic. (Submitting soon in Transportation Research Part B: Methodological).
- **Rajput, S.**; Venkateshappa, S.; Kanagaraj, V.; Asaithambi, G.; Treiber, M. SPT: Obtaining long trajectory data of disordered traffic using a swarm of unmanned aerial vehicles. Transportation Research Part C: Emerging Technologies. 2026, 182, 105431. DOI: [10.1016/j.trc.2025.105431](https://doi.org/10.1016/j.trc.2025.105431) (I.F. 7.9).
- **Rajput, S.**, Kanagaraj, V., Asaithambi, G., Treiber, M., Okhrin, O. Second-order continuum model for disordered traffic. In 28th Young Scientists Workshop, East Bavarian Technical University– Germany, 2024.
- Venkateshappa, S., **Rajput, S.**, Asaithambi, G., Kanagaraj, V. Understanding Influence of Lateral Movements on Surrounding Vehicles in Disordered Traffic Conditions. In 26th Euro Working Group Transportation (EWGT), Lund University– Sweden, 2024.

Fellowships & Awards

- Summer Research Project Fellowship
- Institute Research Assistantship
- SPARC Project Fellowship
- FARE Fellowship

Education

Doctor of Philosophy (Ph.D.) in Civil Engineering

Transportation Engineering

2020 – 2026

Indian Institute of Technology Kanpur

CGPA: 8.85

Bachelor of Technology (B.Tech.) in Civil Engineering

2016 – 2020

National Institute of Technology Raipur

CGPA: 8.91