NISHANT KUMAR

EDUCATION

Doctor of Sciences (Dr. sc.), ETH Zurich, Switzerland Dec 2020–2025
Department of Civil, Environmental and Geomatic Engineering · Institute for Cartography and Geoinformation
Thesis Supervisor: Prof. Dr. Martin Raubal
Dissertation: *Data-driven Congestion Prediction — Challenges, Solutions, and its Impact on Connected Infrastructures*
https://www.research-collection.ethz.ch/handle/20.500.11850/737852

Master of Technology (M.Tech.) — Computer Science, Indian Statistical Institute, Kolkata, India 2014–2016
Dissertation: *On the Identification of Grocery Products*
Award: TCS Gold Medal for best dissertation
Thesis Supervisor: Prof. Dr. Dipti Prasad Mukherjee
http://dspace.isical.ac.in:8080/jspui/handle/10263/6846

Bachelor of Technology (B.Tech.) — Civil Engineering, Delhi Technological University, New Delhi, India 2010–2014
First Division

ACADEMIC APPOINTMENTS

National University of Singapore (NUS), Singapore
Postdoctoral Research Fellow Feb 2026–present
PI: Dr. Prateek Bansal

NTNU — Norwegian University of Science and Technology, Trondheim, Norway
Research Fellow (PhD Stipendiat) Jun 2019–Nov 2019
PI: Prof. Dr. Zhirong Yang

Ariel University, Israel
Visiting Researcher Jul 2019
PI: Dr. Bat-Hen Nahmias-Biran

Singapore-MIT Alliance for Research and Technology (SMART) — Future Urban Mobility, Singapore
Senior Research Engineer Jan 2018–May 2019
Research Engineer Aug 2016–Dec 2017
PI: Prof. Dr. Moshe Ben-Akiva (both roles)

Indian Statistical Institute, Kolkata, India
Visiting Research Scholar Jun 2016–Aug 2016
PI: Prof. Dr. Dipti Prasad Mukherjee

TEACHING EXPERIENCE

Teaching Assistant — TDT4173: Modern Machine Learning in Practice, NTNU, Norway 2019
Instructor: Prof. Dr. Zhirong Yang. Assisted with a project-driven course using real-world transport datasets; responsible for marking, student consultations, and structuring open-ended group challenges.

Co-supervision of Master's Theses, ETH Zurich
- Alexander Timmans — now PhD student, University of Amsterdam.
- Jingyan Li — now PhD student, Cornell University.

TECHNICAL SKILLS

- **ML & Modelling:** Spatio-temporal forecasting, time-series feature engineering, complexity-aware deep learning, interpretable ML, Bayesian modelling, uncertainty quantification
- **Programming & Software Engineering:** Python, C/C++, MATLAB, SQL, Git, Linux shell scripting; Python package development, CLI tools, testing, CI/CD, PyPI publishing, reproducible research workflows
- **Simulation & Transport Modelling:** Agent-based transport simulation and calibration using SimMobility — mid-term and pre-day planning modules
- **Open-source & Research Software:** Contributor to Matplotlib, trackintel, and simmobility-prod; creator of smartprint Python package, 46.5K+ downloads; developer of meaningful-pdf-names and LitSearch for PDF organisation, document search, and literature-review automation
- **Data Apps & Community:** Streamlit-based interactive data tools; Stack Overflow contributor with 1,300+ reputation

PEER REVIEW SERVICE

Peer-review to publication ratio: 1.7:1 (per Web of Science profile)

- **IEEE Transactions on Intelligent Transportation Systems** (IF 8.4)
- **Archives of Computational Methods in Engineering** (Springer Nature, IF 9.7)
- **Applied Soft Computing Journal** (Elsevier, IF 6.6)
- **Sustainable Production and Consumption** (Elsevier, IF 9.6)
- **Journal of Traffic and Transportation Engineering — English Edition** (Elsevier)
- **Transportation Planning and Technology** (Taylor & Francis)
- **Research in Transportation Economics** (Elsevier, IF 4.6)
- **Nonlinear Dynamics** (Springer Nature, IF 5.1)
- **Transportation Letters** (Taylor & Francis, IF 3.3)
- **Physica A: Statistical Mechanics and its Applications** (Elsevier, IF 2.8)
- **Environmental Monitoring and Assessment** (Elsevier, IF 2.9)
- **The Journal of Supercomputing** (Springer Nature, IF 2.7)
- **Scientific Reports** (Nature Portfolio, IF 3.9)
- **Sadhana — Academy Proceedings in Engineering Sciences** (Springer Nature, IF 1.4)

AWARDS AND RECOGNITION

- **TCS Gold Medal** — Best M.Tech. Dissertation, Indian Statistical Institute, Kolkata (2016)
- Among 27 students selected nationally for the fully-funded M.Tech. programme at ISI Kolkata
- **IIT-JEE 2010: All India Rank (AIR) 8654, percentile >98** (approx. 0.4 million students) | **AIEEE 2010: All India Rank (AIR) 9899, percentile >99** (approx. 1.2 million students) — *national-level engineering college joint examinations*
- **13th rank, Regional Mathematical Olympiad (RMO) 2005**, Board of Higher Mathematics, Dept. of Atomic Energy, Govt. of India

PATENT

System and method for object recognition based estimation of planogram compliance. Application No. WO2018069861A1. Granted in US, WO, and AUS regions.

PUBLICATIONS

Full citation followed by a brief description of my role and contribution.

1. *Quantifying the impacts of non-recurrent congestion on workplace EV charging infrastructures.*
   Kumar, N., Wang, Y., Chin, J.-X., & Raubal, M. (2025)
   Transportation Research Part D: Transport and Environment, 146, 104869.
   https://doi.org/10.1016/j.trd.2025.104869
   Role & contribution: I was the lead and corresponding author. I conceived the study design, which couples a traffic simulation model (cell transmission model) with an EV charging demand simulator to quantify how unpredictable congestion affects charging cost variability at workplaces. I led the data analysis, developed the simulation pipeline, and wrote the manuscript.
2. *Enhancing Deep Learning-Based City-Wide Traffic Prediction Pipelines Through Complexity Analysis.*
   Kumar, N., Martin, H., & Raubal, M. (2024)
   Data Science for Transportation, 6(3), Article 24.

https://doi.org/10.1007/s42421-024-00109-x
Role & contribution: I was the lead and corresponding author. I developed the complexity analysis framework, designed and ran all experiments across multiple cities, and produced the core finding that models of "just enough complexity" generalise better than over-parameterised ones — challenging the "bigger is better" assumption in deep learning for transport.

3. *Applications of Deep Learning in Congestion Detection, Prediction and Alleviation: A Survey.*
Kumar, N., & Raubal, M. (2021)
Transportation Research Part C: Emerging Technologies, 133, 103432.
https://doi.org/10.1016/j.trc.2021.103432
Role & contribution: I was the sole first author, responsible for the full literature review, taxonomy design, and synthesis. This survey (150+ citations) has become a standard reference in the field, covering detection, short- and long-term prediction, and alleviation methods, and identifying key open research gaps including transferability and model complexity.

4. *Activity-based epidemic propagation and contact network scaling in auto-dependent metropolitan areas.*
Kumar, N., Oke, J. B., & Nahmias-Biran, B.-H. (2021)
Scientific Reports, 11, 22665.
https://doi.org/10.1038/s41598-021-01522-w
Role & contribution: I was the lead author. I designed the cross-domain coupling between an activity-based transport simulation and an epidemic spread model, ran the experiments on three auto-dependent cities, and led the writing. This work demonstrates my ability to build novel cross-domain simulation frameworks beyond traffic.

5. *A multiscale interpretability framework for identifying actionable road network features to mitigate congestion in highly congested cities.*
Kumar, N., Zhang, Y., Wiedemann, N., Oke, J. B., & Raubal, M. (2025)
Under Revision at Scientific Reports; ResearchSquare preprint.
https://www.researchsquare.com/article/rs-4952650/v2
Role & contribution: I was the lead and corresponding author. I designed the multi-city, multi-scale analysis of road network features and their relationship to congestion, and developed the aggregated directionality metric that translates complex regression outputs into succinct, policymaker-facing guidance. I led all writing and the collaboration across institutions.

6. *Who benefits from AVs? Equity implications of automated vehicles policies in full-scale prototype cities.*
Nahmias-Biran, B.-H., Oke, J. B., & **Kumar, N.** (2021)
Transportation Research Part A: Policy and Practice, 154, 92–107.
https://doi.org/10.1016/j.tra.2021.09.013
Role & contribution: I contributed the simulation runs and data analysis underlying the equity comparisons across demographic groups and city types. This paper applied the SimMobility platform — which I had helped calibrate and validate — to evaluate the distributional impacts of AV deployment policies.

7. *Evaluating the impacts of shared automated mobility on-demand services: an activity-based accessibility approach.*
Nahmias-Biran, B.-H., Oke, J. B., **Kumar, N.**, Lima Azevedo, C., & Ben-Akiva, M. (2021)
Transportation, 48(4), 1613–1638.
https://doi.org/10.1007/s11116-020-10106-y
Role & contribution: I contributed to the simulation framework and the accessibility analysis (software) pipeline. My role centred on the mid-term simulator calibration that underpins the activity-based demand generation, and investigation of some results to support the lead author.

8. *Assessing the impacts of automated mobility-on-demand through agent-based simulation: A study of Singapore.*
Oh, S., Seshadri, R., Lima Azevedo, C., **Kumar, N.**, Basak, K., & Ben-Akiva, M. (2020)
Transportation Research Part A: Policy and Practice.
https://doi.org/10.1016/j.tra.2020.06.009
Role & contribution: I contributed to the mid-term SimMobility simulator, including pre-day activity planning models and calibration procedures, which generate the demand inputs for the AMoD assessment. This reflects my technical expertise in large-scale simulation platform over three years.

9. *From Traditional to Automated Mobility on Demand: A Comprehensive Framework for Modeling On-Demand Services in SimMobility.*
Nahmias-Biran, B.-H., Oke, J. B., **Kumar, N.**, et al. (2019)
Transportation Research Record, 2673(12), 15–29.
https://journals.sagepub.com/doi/10.1177/0361198119853553
Role & contribution: I contributed to the design and implementation of the pre-day planning module in SimMobility that handles mode choice and trip scheduling under both traditional and AMoD scenarios. This paper documents the full framework that underpins several subsequent policy papers.

10. *U-PC: Unsupervised Planogram Compliance.*
Ray, A., **Kumar, N.**, Shaw, A., & Mukherjee, D. P. (2018)
European Conference on Computer Vision (ECCV), pp. 586–600.
https://openaccess.thecvf.com/content_ECCV_2018/html/Archan_Ray_U-PC_Unsupervised_Planogram_ECCV_2018_paper.html
Role & contribution: I contributed to the development of the unsupervised matching pipeline and the experimental evaluation on retail shelf imagery. This work, published at a top-tier computer vision venue, led directly to the granted international patent (WO2018069861A1).

TALKS AND PRESENTATIONS

- **World Cities Summit 2022** — 10-minute talk: *"Improving post-accident rescue routing: A complexity-aware approach"*. Video: WCS 2022 — Explaining Road Network Resilience using Spatial Variations of Network Topology
- **ETH Risk Centre Webinar, 7 November 2022** — Invited talk (1 hour): *"Modelling cross-domain risks through simulator coupling"*. Video: Modelling Cross-domain Risks through Simulator-Coupling
- **International Conference on Resilient Systems (ICRS 2024)**, Singapore, 28–30 August 2024 — 10-minute talk: *"Explaining Road Network Resilience using Spatial Variations of Network Topology: A Case Study of Singapore"*

REFERENCES

On request