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THNS 2025
"The Value of Transport"

ABSTRACTS
OF
AWARD WINNERS

"Transports à Haut Niveau de Service" 2025 Edition
The 18th International Symposium on Sustainable Development of Urban Transport Systems

THNS2025, the 18th International Symposium on the Sustainable Development of Urban Transport Systems,with a main theme of "The Value of Transport", is aimed to reporting on recent or emerging advances in six respects-Accessiblity, Safety & Resilience, TOD & Funding Issues, Shared Transportation, Spatial Features & Mobility, CAVs, in relation to socioeconomic operations as well as to technological progress.
THNS2025 is co-organized by Tongji University & École nationale des ponts et chaussée – Institut Polytechnique de Paris (ENPC) , supported by Université Gustave Eiffel,Aristotle University of Thessaloniki,Arts et Métiers Institute of Technology,CentraleSupélec, INSA Lyon,Université Polytechnique Hauts-de-France,INSA Hauts-de-France,Ecole Spéciale des Travaux Publics,Tpower 3(Territories in Transformation for Transitions),EELISA network of technological universities in Europe,WCTRS (World Conference on Transport Research Society),World Road Association.

（Winners are listed in no particular order within the same award level）

Best Research Gold Award

STOCHASTIC OPTIMIZATION FOR EFFICIENT AND SCALABLE RIDE-SHARING SYSTEMS

Alisoltani Negin [1, 2, 3] , Oukhellou Latifa [1, 2, 3] , Eduardo Loayza Meneses Nicolas [1, 2, 3]
1.University Gustave Eiffel ; 2. GRETTIA ; 3. COSYS

Key Words: Ride-Sharing, Fleet Management, Stochastic Optimization

Abstract: Mobility-on-Demand services have significantly altered urban transportation, offering flexible and convenient alternatives to private vehicles. However, their rapid adoption has contributed to increased congestion and emissions, especially when substituting public transport or active mobility modes. To mitigate these negative impacts, this study presents a novel fleet management framework that integrates stochastic optimization, ride-sharing, and real-time rebalancing strategies within a Model Predictive Control (MPC) architecture. The approach explicitly considers demand uncertainty by using a probabilistic deep learning-based forecasting module to generate multiple future demand scenarios. These scenarios are incorporated into the decision-making process through a Sample Average Approximation (SAA) method, allowing for robust and anticipatory fleet control. The system is tested in a realistic simulation using historical ride-hailing data from Chicago. Experiments are focused on peak-hour demand patterns and consider community areas with high trip frequencies. Sensitivity analyses are conducted to evaluate how varying initial fleet sizes and distributions influence system performance under stochastic demand. Results show that with fewer than half the historical fleet size, the proposed method can serve more passengers, reduce waiting times, and lower total vehicle kilometers traveled by optimizing ride-sharing and rebalancing strategies. Specifically, the integration of probabilistic forecasts and scenario-based decision-making enables the system to maintain service quality even under demand fluctuations. The proposed framework thus demonstrates its potential to improve efficiency, reduce operational costs, and contribute to more sustainable urban mobility.

SEMANTIC CODING AND ITS APPLICATIONS TO INTERNET OF VEHICLES

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Keywords: Internet of vehicles, cooperative vehicle-infrastructure system, data compression, information theory

Abstract: Cooperative vehicle-infrastructure sensing plays an essential role in Internet of vehicles to support intelligent applications. Nowadays, massive, multimodal sensing data is collected, which results in heavy transmission load for traditional V2X communication network, complex multimodal data processing, and potential leakage of privacy-sensitive information. In this work, emerging semantic communication technology is developed to address those challenges by preserving cooperative sensing task-critical semantic information and masking privacy-sensitive information. Specifically, we focus on the semantic coding with side information at the receiver and prove the fundamental trade-off among data compression, source reconstruction, semantic extraction, and privacy preservation from an information-theoretic perspective. Grounded in the theoretic results, novel generative models are developed for data-driven deep semantic coding design. We demonstrate the effectiveness of theoretic results and generative models in the experiments on the standard IoV datasets as well as testbeds in Tongji campus.

Best Research Silver Award

ENHANCING RESILIENCE AND MANAGING CONGESTION: PLANNING AND FIELD EXPERIMENTS WITH CAVS

Ameli Mostafa

COSYS - GRETTIA,University Gustave Eiffel

Key Words： Connected Automated Vehicles, Traffic Congestion Mitigation, Resilience-as-a-Service , Bilevel Optimization, Agent-Based Simulation

Abstract： This study presents two frameworks based on deployments of Connected Automated Vehicles (CAVs), one for enhancing resilience in urban transportation networks and the other for improving congestion on highways through the integration of optimization modelling and agent-based simulation experimentation. The first framework introduces a methodological framework for Resilience-as-a-Service (RaaS) model designed to dynamically reallocate multimodal transport resources, including buses, taxis, and CAVs, in response to unplanned public transit disruptions. It employs a bi-level optimization approach that accounts for cost, availability, passenger wait times, and network constraints, ensuring service continuity while minimizing both user inconvenience and operator costs. The second framework focuses on congestion mitigation through a large-scale field experiment involving 100 CAVs deployed on a congested interstate corridor. These vehicles were equipped with adaptive cruise control algorithms governed by hierarchical speed planners and localized feedback controllers, designed to smooth traffic flow and suppress stop-and-go waves. Both frameworks are underpinned by agent-based simulations. The second one was validated through extensive field deployment. The talk will focus on how carefully coordinated CAV-based interventions can provide both proactive congestion reduction and reactive resilience enhancement, offering a replicable methodology for more efficient, adaptive, and robust urban mobility systems.

EXPLORING THE HIGH INCOME TRIP CHARACTERISTICS OF TAXIS

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Key words: urban traffic; wage rate; Random Forest; Multinomial Logistic Regression; taxi driver; trip indicator

Abstract: To improve the efficiency of taxi operation and service level, the correlation mechanism between taxi trip characteristics and taxi drivers' income per unit time(IPUT) is studied. A random forest prediction model is constructed to analyze the relative importance and significance of trip characteristics on IPUT. The results show that trip characteristics can be used to predict drivers' IPUT with good accuracy, and the relative importance of delivery speed, search time and number of long orders is the greatest in predicting the average IPUT, and the increase in search trip detour, delivery trip detour and search mileage significantly increases the probability that the ordinary benefit drivers fall to the low benefit drivers, while the increase in search trip detour, search area preference, search mileage and delivery speed significantly increase the probability that the ordinary benefit drivers rise to the high benefit drivers. High benefit drivers have the characteristics of being proactive in searching for passengers, not preferring specific areas, tending to anticipate short routes with high travel speeds, and favoring long orders but not deliberately pursuing them. This study bridges the gaps in previous related research on the construction of correlations between trip characteristics and benefits, the characterisation and prediction of diverse trip characteristics on IPUT, and the outlining of operating characteristics of high benefit taxi drivers. The study may provide theoretical references and technical support for urban traffic management, taxi quantity regulation and fare adjustment.

DETERMINANTS OF ROAD SAFETY IN THE MUNICIPALITY OF ABOBO: AN INTEGRATED MIXED-METHODS ANALYSIS

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Key Words : Road safety, traffic accidents, urban transport, informal mobility, Abobo, driver behaviour, infrastructure, transport policy, sustainable mobility, public health

Abstract : Road traffic accidents remain a critical public health concern in the municipality of Abobo, resulting in significant mortality, long-term disability, and considerable psychological, economic, and social consequences. Survivors often face substantial challenges reintegrating into the workforce and broader society, further magnifying the societal burden of road traffic injuries. Despite targeted interventions, the incidence of accidents in Abobo remains high, particularly those involving informal and underregulated transport modes such as gbakas and wôrô-wôrô. This study aims to identify the key determinants of road safety in this densely populated urban area and to inform a sustainable and targeted prevention strategy. A mixed-methods approach was adopted, combining a quantitative analysis of accident data collected from the Office of Road Safety (2017–2021) with qualitative data derived from field observations and semi-structured interviews with transport stakeholders. The expressway in Abobo served as the primary observation site, focusing on high-risk transport behaviours and conditions. Key findings include: • 30% of traffic accidents occur during weekends; • 32.29% of fatalities take place between 6:00 p.m. and 10:00 p.m.; • Pedestrian–vehicle collisions account for 50.28% of road traffic deaths; • Informal and unregistered vehicles are implicated in 53% of reported accidents. In addition, the analysis reveals a higher likelihood of accident involvement among younger drivers, whereas greater driving experience is associated with reduced risk. Vehicle age is positively correlated with accident frequency. Structural deficiencies—such as deteriorated road surfaces, poor signage, inadequate lighting, and the encroachment of vehicles onto roadways and service lanes—are found to significantly increase the likelihood of accidents. This study provides a comprehensive understanding of the multifactorial nature of urban traffic safety in Abobo and lays the groundwork for policy innovation. By targeting the three pillars of road safety—user behaviour, vehicle regulation, and infrastructure quality—it supports evidence-based decision-making among local authorities and transport planners. A coordinated and data-driven policy response is essential to improve road safety outcomes. Gradual, measurable interventions across these areas are necessary to reduce accident-related fatalities and injuries while fostering a culture of sustainable urban mobility.

Best Research Bronze Award

REVEALING THE DRIVING FORCES OF URBAN FORM AT THE DISTRICT SCALE USING A MULTI-GROUP ANALYSIS BASED ON THE PLS-SEM APPROACH

Zhong Ming

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Key Words: Urban Form; Urban quality; Driving factors; PLS-SEM; Multi-Group Analysis

Abstract: Urban expansion has led to significant spatial and socio-economic disparities among districts/counties within each city, driven by fragmented planning and inter-district competition. While municipal authorities regulate land use and public facilities to enhance district quality, their tendency to emulate economically advanced districts often results in systemic imbalances and inefficient allocation of urban resource, such as inefficient land use, over-provisioned public facilities. Therefore, we have expanded the measurement dimensions of district quality far beyond the narrow definitions previously focused solely on economic or environmental aspects. Furthermore, we classified and analyzed districts to provide quantitative evidence for examining the heterogeneous impacts of functional form on different categories of urban quality at district/county level The study decomposes conventional urban form into two distinct dimensions: the functionality of urban form, which pertains to the spatial distribution of human-designed and built elements such as land use, transportation networks, and employment opportunities; and the quality of urban form, which relates to the spatial distribution of outcomes and effects—economic activity, equity, efficiency, and sustainability—that emerge from the interaction of functional elements. This conceptual separation allows for a more nuanced understanding of how planned interventions translate into measurable urban outcomes. Building upon this foundation, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to model the relationships between these two dimensions and identify the key drivers influencing urban quality at district/county level. In addition, we apply Multi-Group Analysis (MGA) to enable systematic comparisons of these driving factors across different district/county types. To support the MGA, we developed an advanced clustering methodology that integrates the K-Average Nearest Neighbor (KANN) algorithm with DBSCAN, optimized through Bayesian techniques for parameter tuning. Taking the City of Wuhan as a case study, this method identified eight distinct district clusters based on their urban quality indicators, revealing a concentric spatial distribution pattern. The study also finds that an increase in density of economic activities correlates with a more equal distribution of these activities. However, the agglomeration (or dispersal) of economic activities does not show a strong correlation with the

density of economic activities. The MGA results demonstrate significant heterogeneity in how the functional forms influence urban quality across these district clusters. Specifically, the level of multimodal transportation shows its strongest impact on public transit share in downtown clusters, while its effect on service accessibility proves more pronounced in suburban clusters. Land use characteristics exhibit divergent importance across districts, with intensity being more influential in suburbs while size exerts greater impacts in downtown areas. The above findings carry important implications for urban planning. They suggest that standardized planning approaches may be ineffective due to inherent spatial variations in how districts respond to interventions. Instead, this study demonstrates the need for differentiated policies that account for a district's position in the urban system and its specific quality-form characteristics. The methodological framework developed in this study offers a replicable approach for analyzing intra-urban disparities, providing both theoretical insights for urban form research and practical tools for evidence-based urban planning.

MULTIMODAL ACCESSIBILITY AND SPATIAL EQUITY IN CAEN: A PCA-BASED ASSESSMENT OF LEZ IMPACTS

Bonsu Kofi
University Gustave Eiffel

Key Words： Accessibility Analysis, Equity in Mobility, Principal Component Analysis (PCA), Multimodal Transport, Low Emission Zones (LEZ)

Abstract： As Low Emission Zones (LEZs) are increasingly adopted across European cities to curb pollution, they raise important questions about mobility justice. This study assesses spatial equity in Caen, France, by analyzing multimodal accessibility—via car, bicycle, and public transit—to essential services such as healthcare, education, and retail. Using Geographic Information Systems (GIS), OpenStreetMap data, and OpenTripPlanner, we computed isochrones from a fine-scale (200 m) population grid. Accessibility indicators were derived and synthesized using Principal Component Analysis (PCA), followed by hierarchical clustering to classify urban areas by accessibility patterns. The results reveal stark disparities: car travel ensures the highest accessibility, while cycling and public transit lag behind—particularly in suburban and peripheral neighborhoods. These gaps pose significant challenges for vulnerable populations, including low-income households, the elderly, and those without private vehicles, who are disproportionately affected by LEZ policies.

As older vehicles are restricted, these groups may face reduced access to essential services without viable alternatives. The study highlights the spatial consequences of sustainability policies that do not fully account for transport equity. Recommendations include improving public transport frequency and coverage, enhancing cycling infrastructure, and decentralizing key services. Our open -source, replicable method offers a practical tool for identifying mobility inequalities and guiding inclusive urban policy.

MINING BICYCLE SHARING SYSTEM STATION FUNCTIONS CONSIDERING BUILT ENVIRONMENT: A CASE STUDY IN LYON

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Key Words： bicycle sharing system station function, built environment, Machine Learning, Big Data, bicycle sharing system

Abstract： In the city, active modes are praised for their crucial roles in ecological transition of urban centres. Bicycles play an important role in this transition for being cheap, clean, healthy, and faster than walking. Numerous countless studies have been conducted in the last few decades. Cyclists are prone to act heterogeneously to indicators like road or bicycle infrastructure, cycling frequency, etc. Typologies such as Geller's "four types of cyclists" and the "Level of Traffic Stress" framework have guided research and urban design, yet their top-down methodologies overlook key indicators, including traffic dynamics, and risk introducing biases. With the rise of Big Data since 2010s and the rapid development of artificial intelligence in the current decade, data-driven approaches to understanding cyclist behavior have gained momentum. Studies proposing to better understand cyclist behaviors using Big Data and Machine Learning approaches are skyrocketing. As a core component of transportation systems in metropolises, the bicycle sharing system (BSS) is essential in this digital transition. BSS, now transitioning to their fourth generation, provide unprecedented opportunities to collect revealed preference data, facilitating new insights into cycling practices. To this end, this study uses an AI-based data-driven approach to explore the functional

roles of Lyon's BSS stations by using a Machine Learning approach, Latent Dirichlet Allocation algorithm, based on a whole month's BSS Oringin-Destination data in October 2022 in Lyon, and data from the built environment. The analysis identifies distinct station functions and services in both emission and attraction modes. Results demonstrate that the selected indicators are sufficient to cluster stations spatially without explicit geographic information, revealing recurring archetypes of bicycle trips across the network.

FUNDING LOCAL MOBILITY SERVICES OUTSIDE CITIES: UNCOVERING A BLIND SPOT IN THE FRENCH DEBATE OVER MOBILITY FINANCING REFORM

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Key Words: mobility services, financing reform, organizing authorities, low-density areas

Abstract: Over the last 10 years, France has set up an ambitious regulatory framework to foster the development of local public mobility services beyond urban transport, and to make sure these services are organized throughout the country, including in sparsely populated areas. However, the new regulations have not significantly revised the public transport funding framework in force since the 1970s: businesses and administrations over 11 employees, which are submitted to a "mobility tax" based on their total payroll, have remained the main source of funding for mobility organizing authorities. The appropriateness of this funding framework has been growingly questioned. On the one hand, the "mobility tax" turned out to be unfair (mismatch between tax payers and service beneficiaries), often ineffective (the modal share of cars remains overwhelming), and too heavy for businesses in contexts of economic stagnation. On the other hand, the amounts raised appear insufficient to meet increased financing needs for mobility investment and operation. In this contribution, we propose to add to the debate on the "mobility tax", investigating the adverse effects of the restrictive conditions for levying the tax (type of mobility organizing authority, type of services offered, population size) in the face of the diversity of local organizational patterns and mobility needs, and assessing the scale of the problem. Focusing on the Region Nouvelle-Aquitaine in South West France and using a mix of qualitative and quantitative methods, we show that this framework leaves unfunded many authorities charged with local mobility services, especially in rural areas. We provide new lines of analysis regarding the current mismatch between legal competence

and access to financial resources and we describe how local authorities muddle through to secure alternative funding sources. Ultimately, we provide some recommendations to update the French regulatory framework and foster sustainable mobility throughout the country.

INTERPRETING JOB FLOWS THROUGH SPATIAL ECONOMETRICS: LESSONS FROM CRETE, GREECE

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Key Words: spatial econometrics, job flows, functional labour clusters, regional integration

Abstract: Understanding commuting patterns is crucial for effective spatial and transport planning, as job flows reflect the underlying dynamics of spatial interaction and labour mobility. The main objective of this study is to explore how social, spatial, economic and administrative factors influence daily work-related mobility, contributing to both theoretical and practical discussions in regional and transport economics. For this purpose, we examine the determinants of job flows across the municipal units (LAU2) of the island of Crete, Greece, using a theoretically sound spatial econometric framework, that is, the Spatial Durbin Model (SDM). The dependent variable, i.e., job flows, is analysed as a function of several variables, such as population density, human capital, economic specialisation, economic diversity, and building use mix (. Moreover, dummy variables are introduced to capture the administrative role (as a capital) and the mountainous character of each municipal unit. Spatial dependencies are incorporated through a spatial weight matrix, whose entries are expressed as a function of travel time between municipal units, so that represents actual commuting conditions and be policy relevant. Alongside the spatial econometric approach, an exploratory spatial data analysis is performed using univariate and bivariate Local Moran's I statistics to identify underlying spatial clusters. The findings indicate that job flows are influenced by a complex interplay of demographic, economic, infrastructure and geographical characteristics, highlighting the need for accessibility enhancement and coordinated spatial and economic policy approaches to reinforce the island's regional economic integration. The recognition of spatial (functional labour) clusters further enhances our understanding of commuting dynamics and potential regional disparities. This study has both academic research and policy-meaningful contributions. It explicitly offers valuable insights into spatial econometric applications, while

providing evidence-based information for policymakers engaged in mobility and regional development planning, particularly in insular areas.