# Enhancing Urban Public Transportation Efficiency through Accurate Passenger Volume Prediction: A Bayesian Spatial-Temporal Model Applied to Beijing Metro

*He Sun*[1], *Stefano Cabras*[2]

[1]sunhe1509@gmail.com, Department of Statistics, University Carlos III of Madrid and Beijing Metro Group Ltd (China)

[2]stefano.cabras@uc3m.es, Department of Statistics, University Carlos III of Madrid

With the purpose of diminishing the carbon emission, it is important to increase the efficiency of city public transportation and to do this, we have to predict the number of passengers. It is imperative to enhance the efficiency of urban public transportation systems. A critical component of this objective is the accurate prediction of passenger volume, which facilitates improved planning and resource allocation. This research introduces a Bayesian spatial-temporal model designed to forecast station occupancy in metropolitan subway transportation systems, thereby contributing to the reduction of traffic congestion and, consequently, the city's ecological footprint.

The proposed model not only yields precise point estimations of daily passenger flow but also provides a robust assessment of the associated uncertainty. This information enables a comprehensive understanding of traffic patterns, ultimately facilitating the development of more efficient public transportation networks. By optimizing these networks and decreasing reliance on private vehicles, this approach contributes to the reduction of carbon emissions and promotes ecological benefits.

In a practical context, the model has exhibited prediction accuracy that aligns with the standards set forth by the Beijing Metro enterprise. It is currently employed by Beijing Mertro Group Ltd to refine daily train schedules, exemplifying the potential of such models in fostering environmentally-conscious, efficient urban transportation systems that benefit both the environment and urban populations.

**Keywords**: Carbon emission, Bayesian spatial-temporal model, Public transportation efficiency.