

# Human Mobility with Agent-based Modeling and Particle Filter Following Mobile Spatial Statistics

Mingfei Cai, Yanbo Pang, Takehiro Kashiya, Yoshihide Sekimoto

## Introduction

In this study, we propose a novel approach that combines the particle filter method with the agent-based model to generate daily people flow. Our motivation is to use low-cost and accessible data to simulate the citywide human movement.

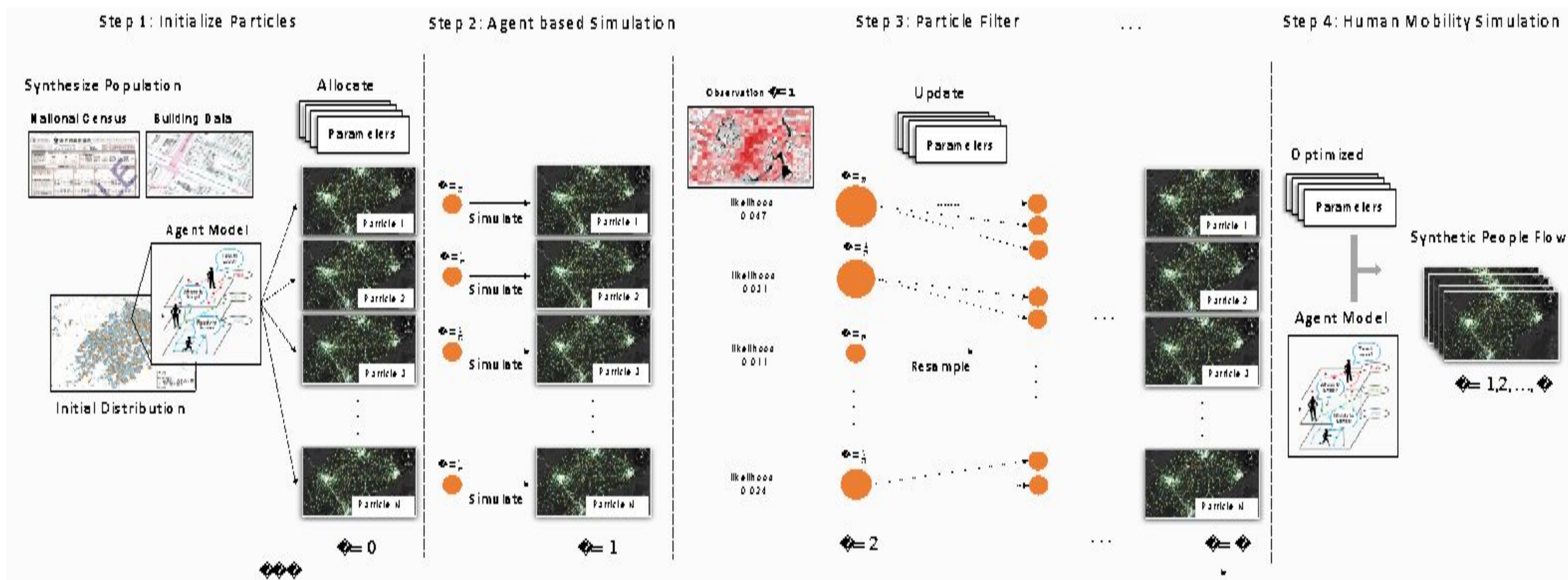


Fig. 1. Overall structure of this research.

## Methodology

For the agent model, we assign moving patterns according to the national census and use the multinomial logit model for choices of destinations. For the particle filter, we use many particles to represent different possible states of the world. The final result is generated by the weighted average sum of all particles.

## Result

The performance is evaluated by several metrics. In Figure 2, we analyze difference of link traffic volumes. Over-estimation occurs for trips between the east and west, as the comparison only includes base roads.

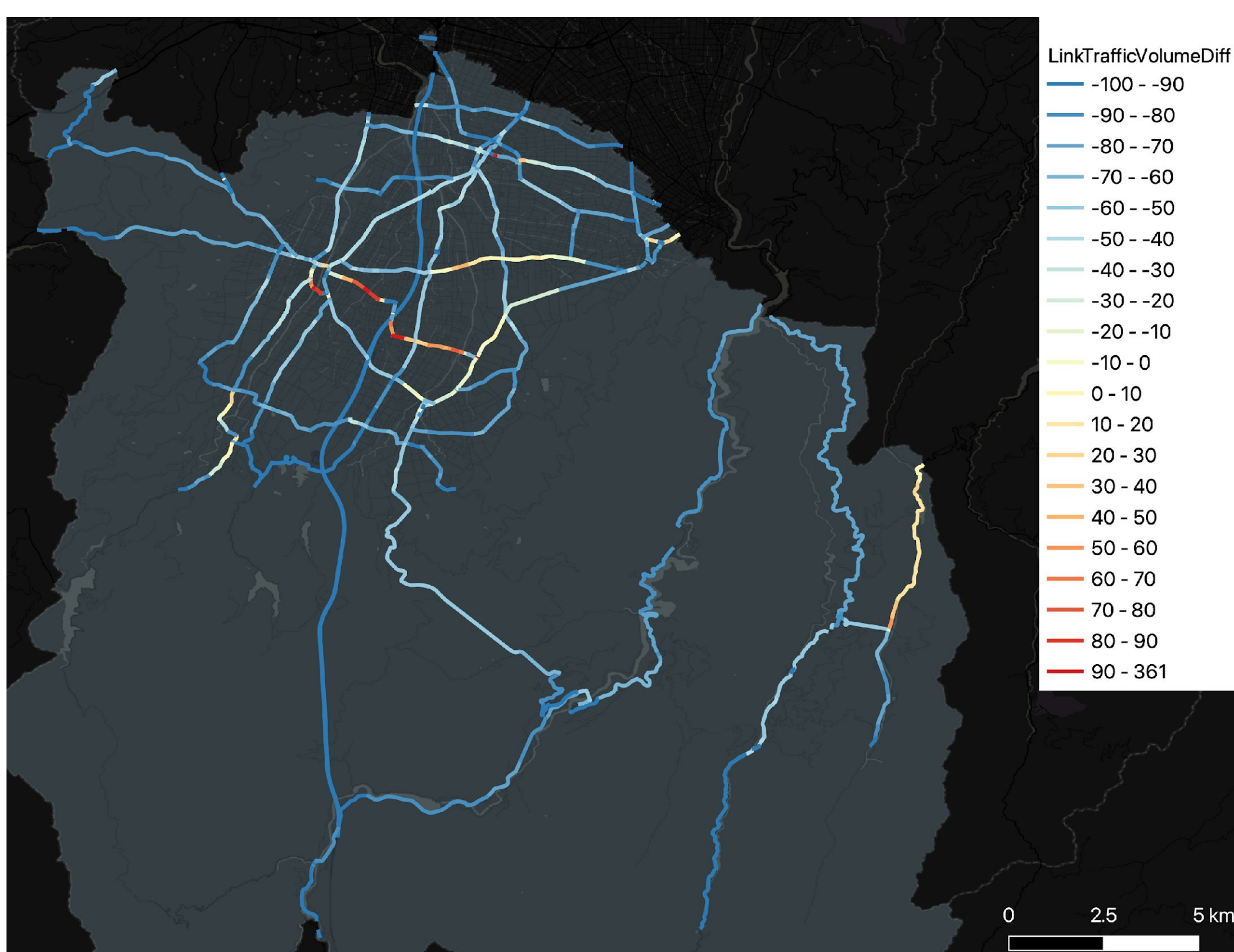


Fig.2. Visualization of link traffic volume.

We also conduct regression analysis for mesh population in Figure 3. The result has a good correlation coefficient with the observation data for the whole day.

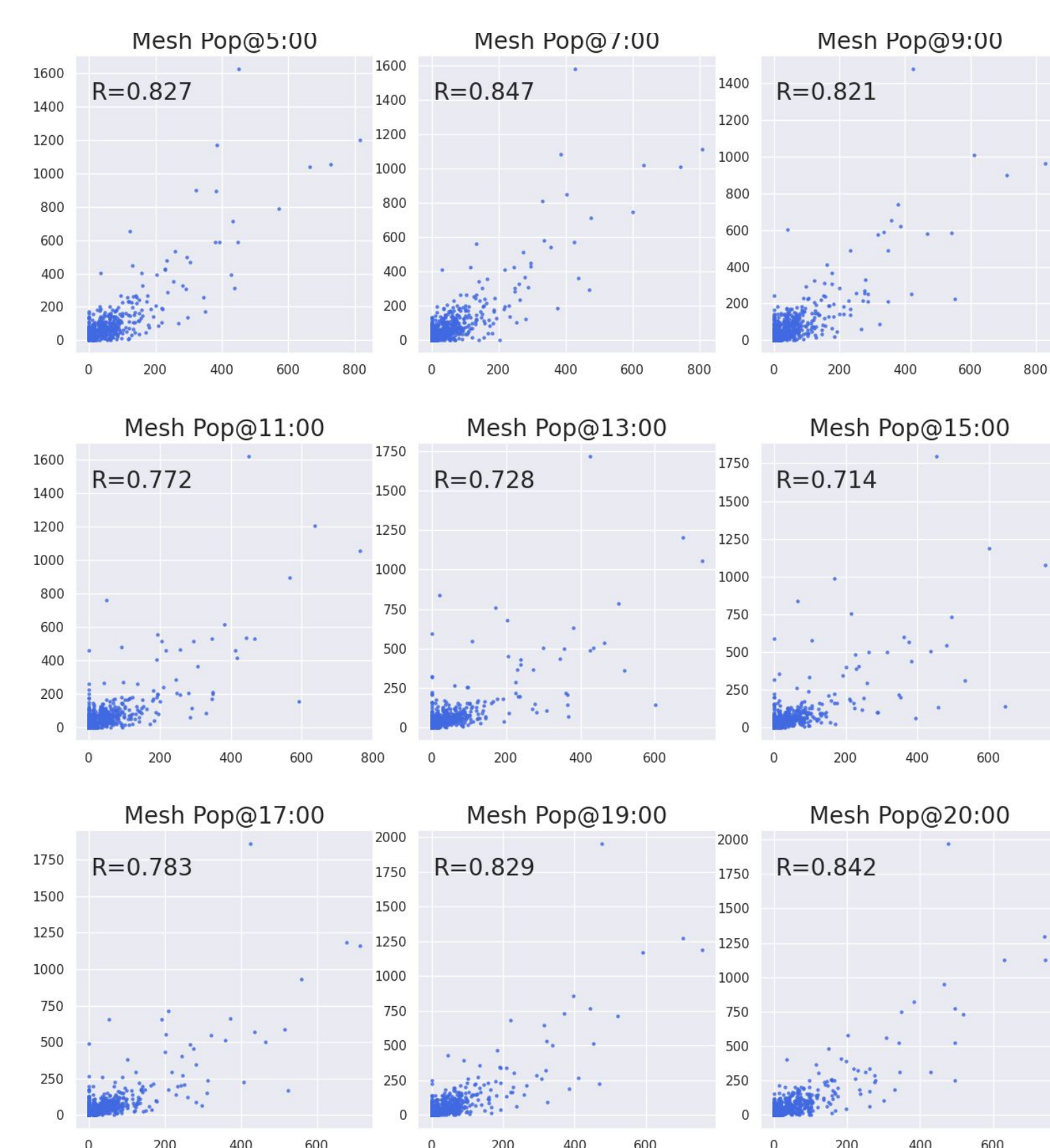


Fig. 3. Pearson correlation coefficient between the observation and simulation, each pot represents population of a 500 x 500 m grid in the target area, x-axis is the observation, y-axis is the simulation.

In conclusion, our agent-based model with particle filter can generate acceptable daily citywide trajectories considering several metrics. The limitation comes from the neglect of contextual information, which captures complicated patterns.