

Human mobility with a bounded memory

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We propose a model of mobility considering exploration to new places and revisit to a limited number of frequent places.

Urban life is busy. People visit places with selection. Existing model has shown that a small fraction of destinations cover most of citizen's time spent. In the meantime, new sites of cities are built over time, bringing people to better choices to visit, i.e., the set of one's destinations are substitutive[1]. On the other hand, the upper-bound tolerance of the order of urban life is limited. For example, according to Marchetti's theorem[2], the commuting time and distance of urban lives seem to remain remarkably stable over time. Such tolerance of people leads to both individual property of substitutive destinations, and localization of urban site distribution. This result indicates some *memory* property of urban life[3]. In this Letter, we propose a kernel-based model to simulate citizens' preference substitutive to renewal destinations.

Assuming that the tolerant destination of an individual

includes n sites. We denote the frequency distribution at time t of the n sites as $\mathbf{p}(t) = (p_i(t))_{i=1,2,3,\dots}$. At each time t , an individual has a chance α to explore a new site.

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- [1] Jin, C., Song, C., Bjelland, J. et al. Emergence of scaling in complex substitutive systems. *Nat Hum Behav* 3, 837–846 (2019) doi:10.1038/s41562-019-0638-y
- [2] C. Marchetti Anthropological invariants in travel behavior. *Technological Forecasting and Social Change*
- [3] Campos D, Méndez V. Recurrence time correlations in random walks with preferential relocation to visited places. *Physical Review E*, 2019, 99(6): 062137.