New human mobility prediction model offers scalability, requires less data

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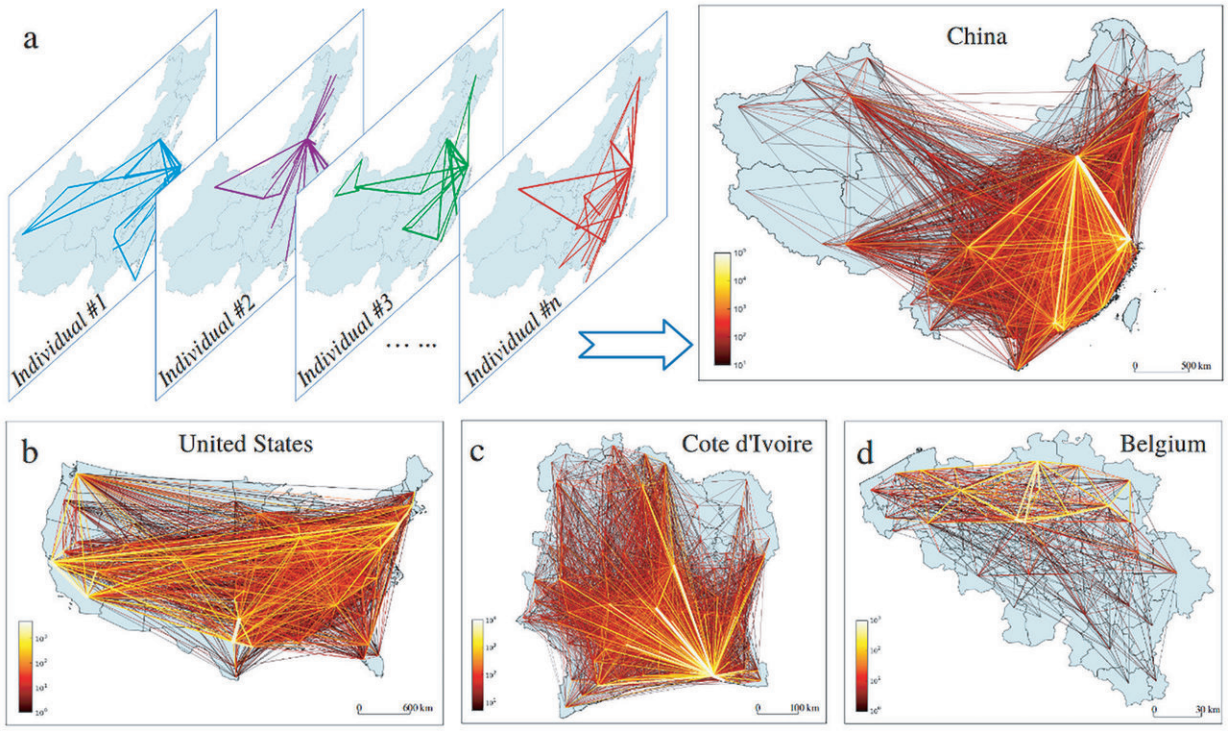

Real-world examples of individual trajectories and collective movements. (a) Four examples of an individual trajectory from an empirical data set from mainland China and the corresponding collective movements. (b-d) Collective movements embedded in the data sets from the continental United States, Cote d'Ivoire and Belgium. Here the color bar represents the amount of mobility flux among locations per unit time, where a brighter (darker) line indicates a stronger (weaker) flux. Note that the spatial scales associated with these data sets are drastically different. Credit: Arizona State University

A new method to predict human mobility—which can be used to chart the potential spread of disease or determine rush hour bottlenecks—has been developed by a team of researchers, including one from Arizona State University.

The research, Universal model of individual and population mobility on diverse spatial scales, was published in the Nov. 21 issue of *Nature Communications*.

The research was conducted by Ying-Cheng Lai, a professor of electrical, computer and energy engineering at ASU. He worked with Xio-Yong Yan and Zi-You-Gao from the Institute of Transportation System Science and Engineering at Beijing Jiaotong University and Wen Xu Wang from the School of Systems Science and Center for Complexity Research at Beijing Normal University.

The researchers found that, based on empirical data from cell phones and GPS records, people are most inclined to travel to "attractive" locations they've visited before, and these movements are independent of the size of a region. The new mobility method uses mathematical calculations based on that data, providing insights that can be discerned regardless of size of the region being tracked.

"The new mobility prediction method is important because it works at both individual and population scales, regardless of region size," explained Arizona State University Professor Ying-Cheng Lai. "Until now, different models were necessary for predicting movement in large countries versus small countries or cities. You could not use the same prediction methods for countries like the U.S. or China that you'd use for Belgium or France."

Information gathered using the new process will be valuable for a variety of prediction tasks, such as charting potential spread of disease, urban

transportation planning, and location planning for services and businesses like restaurants, hospitals and police and fire stations.

Tracking human movements began about a decade ago and revealed the necessity for two different prediction models - one for large geographic areas like large countries and one for small countries or cities. Additionally, tracking at scale currently relies on measuring travel flux between locations and travel trajectories during specific time frames, requiring large amounts of private data. The new algorithm, based solely on population distribution, provides an alternative, more practical approach.

More information: Xiao-Yong Yan et al, Universal model of individual and population mobility on diverse spatial scales, *Nature Communications* (2017). DOI: 10.1038/s41467-017-01892-8

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