New human movement model can aid in studying epidemic outbreaks, public planning

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Researchers have developed a new statistical model that simulates human mobility patterns, mimicking the way people move over the course of a day, a month or longer. The model, developed by scientists at North Carolina State University and the Korea Advanced Institute of Science and Technology (KAIST), is the first to represent the regular movement patterns of humans using statistical data. The model has a host of potential uses, ranging from land use planning to public health studies of epidemic disease.

The researchers gave global positioning system (GPS) devices to approximately 100 volunteers at five locations in the U.S. and South Korea and tracked the participants' movements over time, according to study co-author Dr. Injong Rhee, a professor of computer science at NC State. By plotting the points where the study participants stopped, and their movement trajectories, researchers were able to determine patterns of mobility behavior.

For example, Rhee says, the researchers found that people tend to perform multiple activities in clusters that are in close proximity to each other - such as going to a bank, a dry-cleaner and a pharmacy that are all located on the same street. Furthermore, the researchers found that the study participants tend to more frequently visit locations that are popular among other people.

These behaviors illustrated statistical patterns. For example, Rhee explains, people will try to make the most efficient use of their time and

effort by clustering activities together that are in geographical proximity to each other. This behavior creates patterns in which people make many short "jumps" within the clustered areas while making a few long jumps among the clustered areas. These patterns are best explained by statistical processes called self-similar points of visits and power-law distribution of jumping distances.

The researchers were then able to emulate these fundamental statistical properties of human mobility into a model that could be used to represent the regular daily movement of humans, Rhee says. The model is called the Self-similar Least Action Walk (SLAW), which could have a wide array of practical applications.

For example, Rhee says, "a realistic human mobility model could be used by civil engineers to plan roads, by public health officials to study virus outbreak spread, or by telecommunication companies for planning where to locate cell-phone towers. Any situation where you would want to be able to predict where people will go."

The research, "SLAW: A Mobility Model for Human Walks," was presented April 20 at the 28th IEEE Conference on Computer Communications in Rio de Janeiro, Brazil.

The research team that developed the model includes Rhee, NC State Ph.D. candidate Seongik Hong, NC State post-doctoral research associate Seong Joon Kim, and KAIST researchers Kyunghan Lee and Song Chong. The National Science Foundation funded the research.

Source: North Carolina State University (news : web)