Pinpointing poverty with cellphone data

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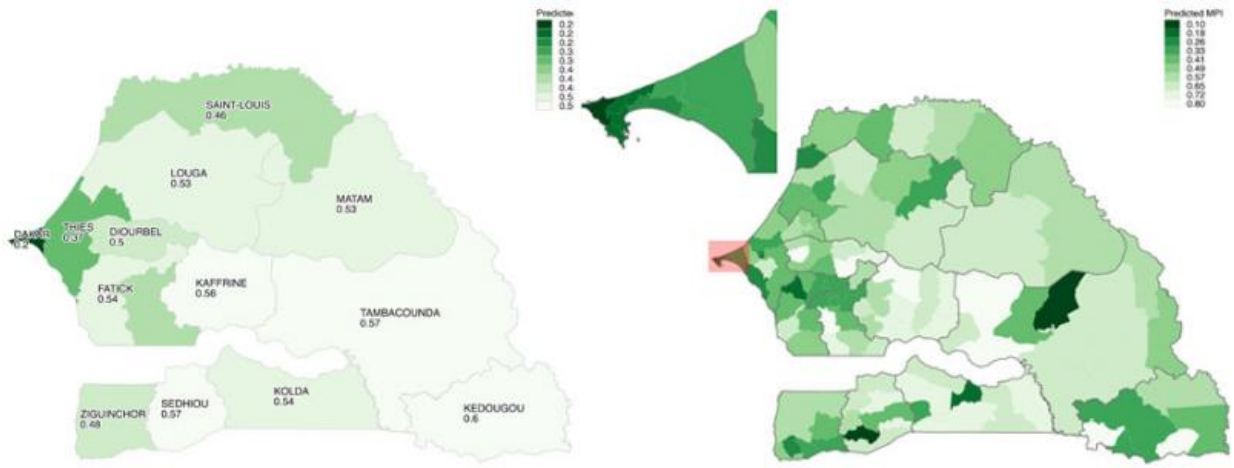

The images above are maps of Senegal. The lighter the color, the more poverty the region suffers. Using cellphone data records, University at Buffalo researchers were able to drill down from 14 regions (left map) to 123 areas (right map). Credit: Neeti Pokhriyal.

Mobile phone calls are analyzed to thwart crime and track diseases. Now, University at Buffalo researchers are studying if such data can help combat extreme poverty.

The effort, which focuses on Senegal, aims to improve maps that imprecisely break down poverty by 14 geographical regions in the African nation. For example, Tambacounda (an area roughly the size of Tennessee) receives a blanket poverty assessment that covers more than 680,000 people, regardless of where in the region they live and under

what circumstances.

Researchers believe that call data records from millions of people, when fused with census and household survey data, can be used to drill down to at least 123 arrondissements (similar to U.S. counties) nationwide, providing an unparalleled look at which communities lack access to food, health care, education and other human necessities.

The approach, described in a research paper presented at a Massachusetts Institute of Technology conference earlier this year, could be replicated in other developing nations. It also could provide aid organizations and government agencies a quick and cost-efficient tool to prescribe policy solutions for specific regions or groups of people often marginalized, such as women or the elderly.

"The lack of data in underdeveloped countries is a serious concern. It impedes development and disaster-relief, as well as efforts to provide hundreds of millions of people with basic necessities of education, health and livelihood," says Neeti Pokhriyal, a computer science PhD candidate who is analyzing the mobile phone records.

She is working under the guidance of Wen Dong, PhD, assistant professor, and Venu Govindarju, PhD, SUNY Distinguished Professor, both members of the Department of Computer Science and Engineering in UB's School of Engineering and Applied Sciences.

The researchers began the project in 2014, after the Senegalese Ministry of Higher Education and Research announced the Data for Development Senegal Challenge, a worldwide contest that provided to scientists anonymous data from the country's mobile phone network.

In April 2015, contest organizers declared the UB researchers team one of nine winning teams. They received an additional boost in July when

the Bill and Melinda Gates Foundation awarded the team a $17,000 grant to continue the research.

To create poverty maps, the team examines nationwide where mobile phone calls and texts are placed and where they are received. The greater the flow of information to and from a region, the less likely that region suffers from extreme poverty.

(Note: The information flow quantified from call data records serve as a proxy for the Multidimensional Poverty Index (MPI) for a region. MPI, which uses factors beyond income to determine poverty, was developed by the University of Oxford and it closely aligns with the United Nations' Human Development Index.)

Researchers then compare their findings to existing poverty maps at coarser resolution. The positive correlations between the two sets of data provides information that the team uses to generate poverty maps of increasingly finer resolution.

The team is working with the Senegalese government, as well as Sonatel, the nation's major telecom provider, to develop a model that can be implemented nationwide.

The ultimate goal, Pokhriyal says, is to provide a more in-depth analysis. For example, the team aims to drill down from the 123 arrondissements to individual communities, and provide information on women, the elderly and other demographics often marginalized.

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