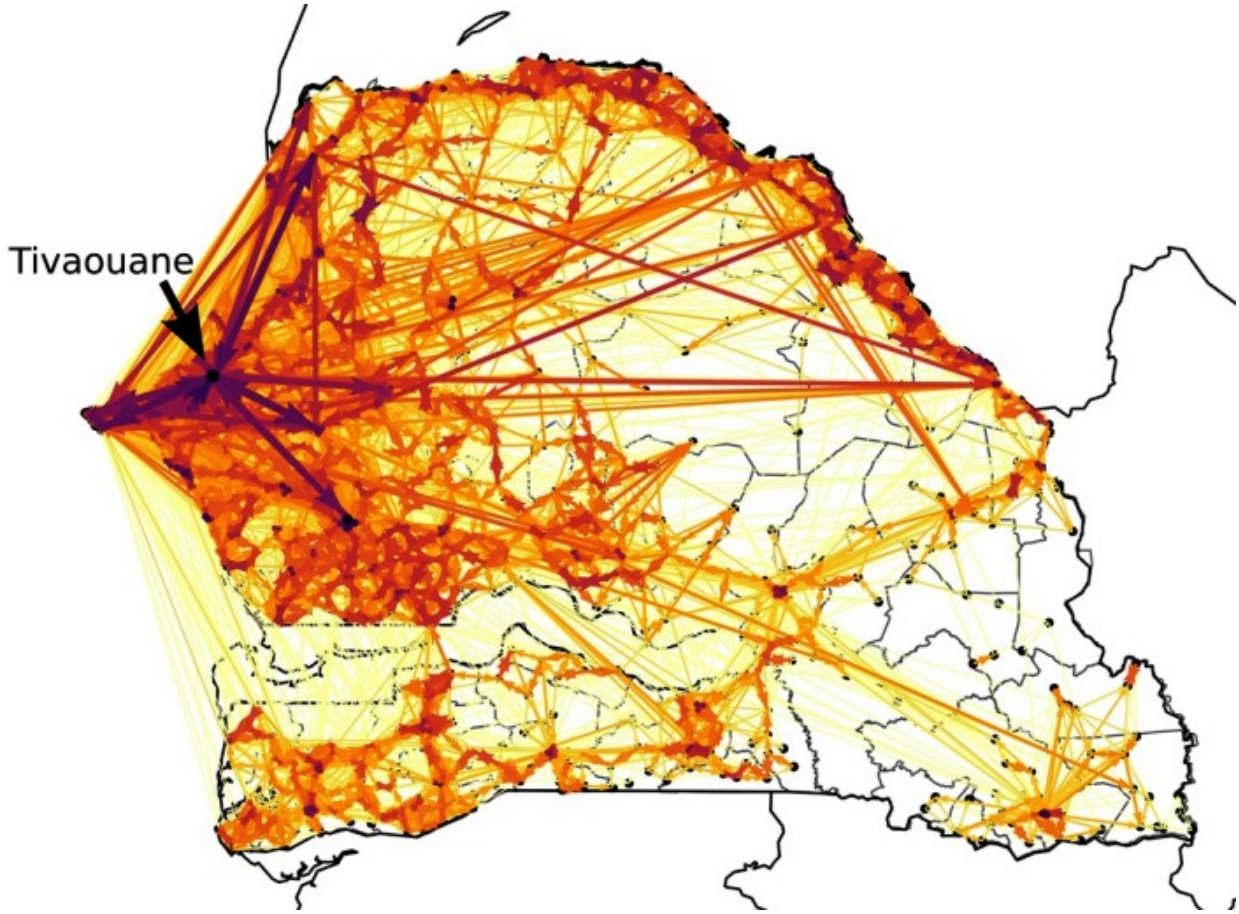
Mapping migrations by using mobile phone data

November 21 2016



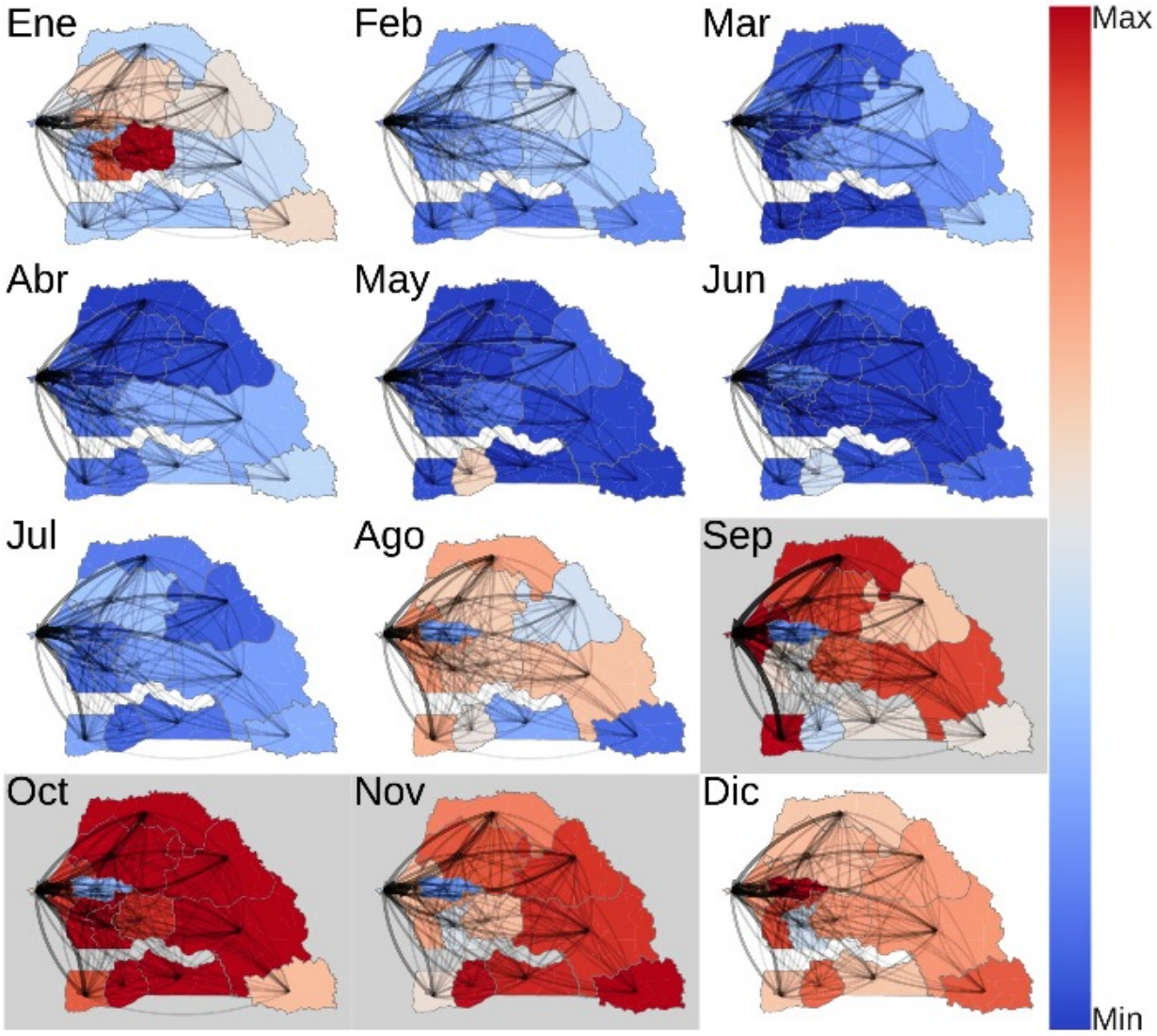
Detection of the celebration of the birth of Muhammad or Mawlid in the Senegalese city of Tivaouane. Credit: UPM

Researchers from the Complex Systems Group (GSC) at Universidad

Politécnica de Madrid (UPM) have used mobile phone data generated by 9 million users to study the mobility of population from Senegal. Results show a clear correlation between the increase of telephone calls and the migratory flows with agricultural activities and religious holidays held in this country. The usage of this data to know the communication and migration patterns can be of great utility to detect extreme events such as natural disasters, and to provide complementary information in order to optimize the management resources of such events.

Every time we make a phone call a series of data is generated: time of the call, duration, the antenna from which is connected, etc. This data is used by the telephone company to calculate de bill. This data is a reflection of our daily activity in a way that if we have access to a sufficiently large volume of this data, it is possible to use it for other purposes. We can reveal socioeconomic structures and dynamics, detect and predict unusual events or reveal social issues. Because of this, the utility of this phone data has become important over the last years as information source for sociological studies at great scale through Big Data techniques.

One of the most important challenges in this field is to extract the communication patterns of the data and discerning the cause that has generated it. Are these patterns the results of the daily routine of users? Have they appeared due to an extraordinary event? First of all it is needed to understand and characterize properly the fingerprint generated by routine activities, since the unusual events are reflected on the data as an alteration of the regular patterns.



Evolution of the migratory flows in Senegal. There is more migration (red) during the harvest season from September to November. Credit: UPM

In this type of studies is essential to take into account the context in which this data has been generated. In the case of Senegal, we need to ask ourselves what events can be sufficiently relevant to be able to detect their effects on telecommunications networks. Firstly, the economy of Senegal is mainly based on agriculture. Due to the climatology of this

country and the scarcity of exploitations through artificial irrigation, the harvest season is always towards the end of the rainy season, around October, causing the massive migration of seasonal workers. Secondly, the majority religion is Islam thus certain festivities, such as the birth of Muhammad, are reflected on the data in certain way.

Based on the data generated by billions of phone calls, the researchers from the Complex Systems Group (UPM) have traced migratory flows produced in Senegal by assessing the displacement of seasonal workers. Thus, researchers have detected the celebration of massive events associated to religious holidays by using techniques of network science.

The authors explain "this work is part of a research line that aims to detect and characterize socioeconomic and cultural events through data of mobile phones and social networks." The goal, they say, "is to provide innovative solutions that allow us to monitor in real time communication and mobility patterns of people in order to detect extreme events and improve the resource management of such situations."

More information: S. Martin-Gutierrez et al. Agricultural activity shapes the communication and migration patterns in Senegal, *Chaos: An Interdisciplinary Journal of Nonlinear Science* (2016). DOI: 10.1063/1.4952961

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