# Agricultural activity shapes the communication and migration patterns in Senegal

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**Abstract**

During the last few years, there has been an explosion of human behavioral studies using data generated by different kinds of Information and Communication Technologies (ICT). One of the main causes can be found in the increasing availability of data, which is stimulated by the pervasiveness of mobile phones. In this work, we study the communication patterns of the country of Senegal and explore their correlations with underlying real world structures and dynamics. Our findings [1] show that agricultural activities have a key role in shaping the phenomena recorded in the data. Another important factor would be the traditional religious festivities.

Agriculture workers in Senegal represent over 70% of its labor force. The seasonal nature of an agriculture-based economy implies the alternation of periods of higher and lower laboral activity, which triggers the seasonal migration of workers. We have been able to detect communication patterns that seem to have been caused by these phenomena. In order to do that we have combined information extracted from mobile phone datasets with satellite images. We have then analyzed the temporal evolution of communication patterns and vegetation indices by means of networks and time series, finding correlations between deviations of the regular user behavior and periods of higher agricultural activity. Additionally, we have studied the seasonal migration of workers with the aid of mobility networks, showing the influence of the harvesting season on the migration flows.

In Senegal the predominant religion is Islam, which is organised in collectivities or brotherhoods. One of the most prominent is the Mouride brotherhood, which is characterized for considering work as a form of adoration. This philosophy has catalyzed the emergence of rural communities dedicated to agriculture; especially, to the cultivation of groundnuts, contributing to the consolidation of peanuts as one of the main cash crops of the country. Every year several Mouride celebrations are held. They usually imply a pilgrimage or *Magal* to some holy place, causing the displacement of large masses of people. We have identified and characterized these events by means of temporal evolving networks of trajectories.

Summarizing, in this work we combine information extracted from geolocalized mobile phone datasets with satellite images in order to obtain insight about the socioeconomic characteristics of Senegal. To this end, we analyze the temporal evolution of communication patterns and vegetation indices by means of networks and time series. This enables us to find correlations between deviations from the regular user behavior and periods of higher agricultural activity. We are also able to detect other relevant local events. Additionally, we study the seasonal migration of workers with the aid of mobility networks, showing the influence of the harvesting season on the migration flows.

# References

[1] S. Martín-Gutiérrez, J. Borondo, A. J. Morales, J. C. Losada, A. M. Tarquis, and R. M. Benito, "Agricultural activity shapes the communication and migration patterns in senegal," *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 2016. In press.