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Adding a layer to drought sensing – Closing the gap between remotely sensed drought and human stress levels: An interdisciplinary case study of digital traces in Tanzania

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Existing drought assessment frameworks cover a wide variety of metrics, from remotely sensed food prices and trading data to food availability statistics. However, population stress levels are hardly ever measured, notwithstanding their importance for human well-being. The worldwide increasing adoption of social media allows citizens to document their social and natural environment in countries along the whole development spectrum. Millions of users voluntarily generate digital traces that can be accessed instantly from anywhere with an Internet connection, allowing new kinds of remote sensing of social, environmental, and health signals.

We present a study of digital traces generated during the Tanzania drought of 2015/2016. We analyzed digital trace data publicly shared by Twitter users in the sub-humid south and the semi-arid central north regions of Tanzania, comparing activity against the recent normal year of 2014. We collected more than 14 Million tweets generated by a panel of 22,884 users located in Tanzania, and combined them with remotely sensed data (daily rainfall estimates and decadal eMODIS NDVI composites), remote monitoring reports produced by the famine early warning system network, and publicly available statistics (World Bank & FAO country stats). To understand social sensing of health sentiment and cognition, we applied the psycholinguistic method of LIWC (Linguistic Inquiry and Word Count), which identifies sentiment and topics in tweets by matching words against lexica validated in psychological studies. Our results show a significant decrease in sentiment related to health and personal issues during the drought in the affected north as compared to the less affected south. These results point to the potential of crowdsourced citizen datasets for stress measurement in developing countries.

In our ongoing work, we assess the potential of greenness of time- and geo-tagged, publicly available pictures as a proxy for NDVI where remote sensing is not possible or only available after considerable delay by creating cloudless composites due to smog of frequent cloud cover. We are processing two large databases of pictures from Twitter and Instagram to identify outdoor pictures with Convolutional Neural Networks and to extract color measurements using thresholds for hue, saturation, and value. We aim to produce a framework that can simultaneously measure greenness from crowdsourced images as well as stress from social media text, to shed new light on the evolution and effects of adverse environmental conditions.