When are you calling whom? The timings of your calls tell how strong your social ties are

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It is possible to learn about the strength of social ties using data collected from mobile - say the frequency of calls, the timing of interactions or the daily activity. Javier Ureña Carrión, a Master’s student majoring in Complex Systems at Aalto University, presents new ways to characterize strong and weak ties in social networks in his thesis titled “Temporal features as measures of tie strength in mobile phone networks”. The analysis of large-scale communication data has revolutionized our understanding of human dynamics and social systems, and a crucial concept in social network analysis is the idea of the strength of a tie. Here, Ureña Carrión explores this concept by relating the behaviour of two people in a tie to their network topology - the structures and connections around them.

When analyzing social networks from communication data it is common to want to infer or quantify the strength of a tie based on the sequence of communication events. These tie strengths are usually measured in terms of communication intensity - whether the total number of calls, total call duration or average call length. These metrics, however, ignore the widely diverse ways in which people communicate in time. In his work, Ureña Carrión uses the network topology as a proxy for tie strength based on Granovetter's hypothesis: the idea that strong ties are embedded in community structures, while weak ties serve as inter-community bridges. In the study, he analyzes a network of mobile phone calls with more than 77 million people during an observation period of 4 months.

This study has uncovered some previously unknown relationships. “There is a lot of information about network structure hidden on behavioural patterns. For instance, people with similar daily activity patterns tend to have stronger ties, which is probably an effect of different latent structures, such as age”, he says. “Although more culturally determined, we found that there are specific times during the week when calls are more informative of the underlying social structure. We expected to observe this during the weekend, but it was also true for other times, such as weekday mornings”.

In his work he concludes that many of these features can help us understand the strength of ties, adding that these tend to be quite complex and multi-dimensional, and measures of communication intensity only tell part of the story. “This type of data is used for studying and understanding social systems. Knowing that there is a world of features that reveal information about topological tie strength might help other studies in the construction of social networks”, he concludes.

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