Identifying 'friends' in an objective manner: A new method for extracting the backbone of networked social interactions

January 16 2019

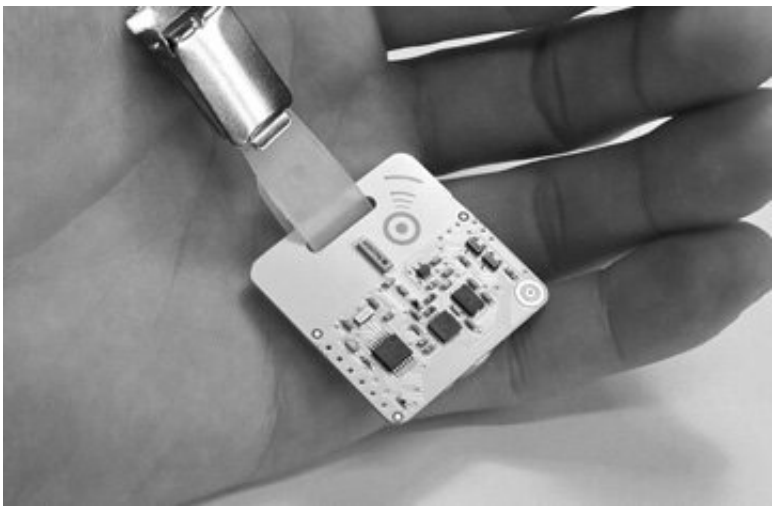

Fig. 1 Wearable sensor. Credit: SocioPatterns

In recent years, behavioral patterns of social creatures, such as humans, cattle, ants, etc., have been discovered by using wearable sensors called Radio Frequency Identification (RFID) devices (Figs. 1).

The SocioPatterns project led by Dr. Alain Barrat and colleagues has made public the dataset of contact records of individual pairs collected by RFID devices. However, since the RFID datasets contain any kind of contacts between individuals, they can include non-essential contacts that are observed merely by chance, as opposed to intentional events such as

conversation among close friends.

Dr. Teruyoshi Kobayashi of Kobe University and his team developed a new method for identifying individuals that have essential connections between them – what they call "significant ties". Dr. Kobayashi says: "The point is that we need to distinguish between the contact events that could happen by chance and the events that would not happen without a significant relationship between two individuals." Their findings were published in *Nature Communications* on January 15.

Naturally, the total number of contacts recorded will be larger for those who are socially very active than for those who are shy. This means that counting the numbers of bilateral interactions is not enough to find "friends" in social networks. The new method proposed by Dr. Kobayashi and his team allows one to control for the difference in individuals' activity levels. Interestingly, the extracted significant ties based on face-to-face networks collected in a primary school in Lyon, France form several clusters, each of which accurately mimics an actual school class (Fig. 2). Dr. Kobayashi comments: "It is quite natural that contacts within each class explain most of the significant ties, but this phenomenon is not well captured by the existing methods that were originally developed for static networks."

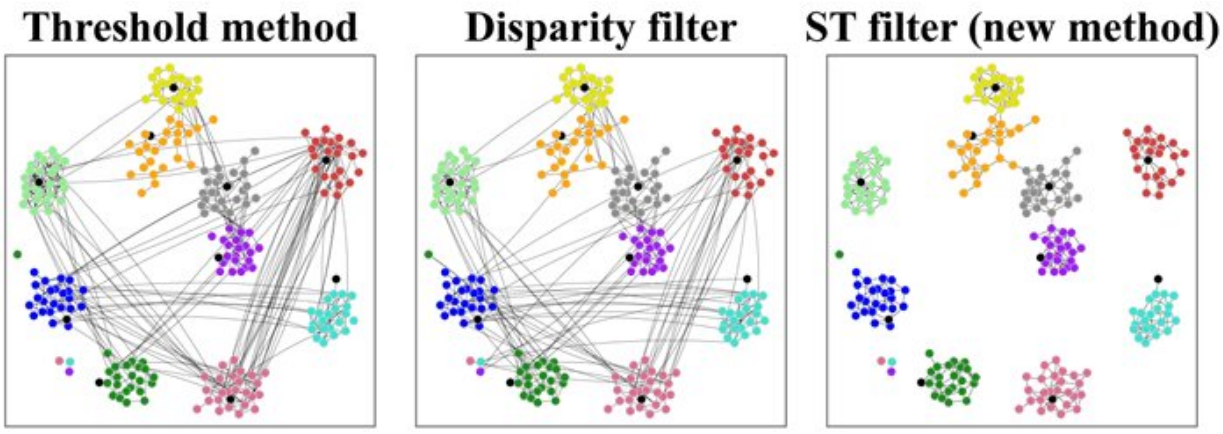

Fig. 2 Significant ties in a primary school in Lyon, France. Each dot represents a student and color denotes a class (Teachers are indicated by black dots). Lines represent significant ties. The number of essential edges is kept constant across three panels. Left: essential edges are selected in a descending order of the number of contacts. Middle: essential edges are detected by the Disparity filter (Serrano et al., 2009). Right: new method. Credit: Kobe University

An advantage of this method is that it can be applied to any kind of dynamic networks formed by bilateral temporal interactions. For example, Dr. Kobayashi and Dr. Taro Takaguchi (one of the coauthors) investigated the interbank market in Italy and confirmed that the fraction of banks that are regarded as being connected by significant ties increased particularly at the time of the global financial crisis in 2008-2009.

On the possibility of future application, Dr. Kobayashi adds: "This method is expected to capture the evolution of various complex networks from interbank markets to a flock of cows. If it's implemented on a face-to-face network of students, for instance, one may be able to detect signs of bullying and/or ostracism."

More information: Teruyoshi Kobayashi et al. The structured backbone of temporal social ties, *Nature Communications* (2019). DOI: 10.1038/s41467-018-08160-3

Provided by Kobe University

https://phys.org/news/2019-01-friends-manner-method-backbone-networked.html