Available Post-Doc Position
Grenoble Alpes Data Institute
Starting : September 1st 2018
Duration : 1 year
Salary : ?
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Multi-level modelling of information diffusion and opinion dynamics

Understanding the diffusion process in social networks has several practical applications, as the identification of influence hubs, the choice of initial diffusers for a maximal diffusion, or the identification of links one has to remove in order to limit the diffusion (e.g. for stopping rumours). So far, studies on information diffusion in social networks have primarily aimed at predicting information cascades, i.e. at predicting how a piece of information, issued by a given user, spreads over the network, from users to users through the links they share ([1,2,3] to name but a few). The underlying models thus focus on the individuals in the network. Some works (e.g. [4]) have also studied whether one can predict the number (usually called the « volume ») of users an information will reach through its diffusion in the network. In this latter case, one is not interested in the individuals involved in the diffusion process, but rather in an undetermined set of users that depends on the topology of the network and the original diffuser.

In this post-doc, we are interested in adopting a multi-scale point of view on information diffusion and opinion dynamics by designing diffusion models that can work at different levels, namely individual and community levels. By doing so, we aim at better understanding the diffusion process and the dynamics of opinions through the interactions between the two levels. In particular, we would like to provide answers to the following questions: How does the behaviour, in terms of information diffusion, of the individuals within a community determine the structure of the community and its dynamics? How does the community influence the diffusion behaviour of individuals? What are the main types of diffusion within and across communities?

To do so, we want to investigate diffusion models that are multi-scale (to capture both individual and community levels), content aware (as advocated in [5]) and scalable (to be deployed on standard social networks as Twitter). Among the possible models, Hawkes processes [6] seem particularly promising as they are self-exciting and thus directly account for « preferential attachment » phenomena (i.e. the fact users tend to form links with other users that already have a lot of links). They need however to be extended to take into account profiles (sociological, behavioral, etc.) in addition to the content being diffused and to be deployed in large-scale networks. Other models are also good candidates and will also be studied.

The person recruited will participate to the initiative of the Grenoble Alpes Data Institute on « Data science, Social sciences and Social Media ». In this framework, he/she will work with a team of sociologists, computer and information scientists, probabilists and statisticians. The models developed will be tested (at least) on a collection from Twitter available at Univ. Grenoble Alpes. This collection was designed around fundamental themes (democracy, identity, diversity, etc.) that underlied the major cleavages in the political debates during the latest French political campaign. Exhaustive data of this continuous flow were collected in the long duration of the life cycle of this media event (9 months).

[1] D. Kempe, J. Kleinberg, E. Tardos. Influential nodes in a diffusion model for social networks. ICALP 2015, Springer Verlag.
[2] K. Saito, M. Kimura, K. Ohara, H. Motoda. Learning continuous-time information diffusion model for social behavioral data analysis. Learning, 2009.
[3] M. Gomez-Rodriguez, D. Balduzzi, B. Schölkopf. Uncovering the tem- poral dynamics of diffusion networks. Proceedings of the 28th International Conference on Machine Learning, ICML 2011).
[4] J. Yang, J. Leskovec. Modeling Information Diffusion in Implicit Networks. IEEE International Conference on Data Mining, ICDM 2010.
[5] C. Lagnier, L. Denoyer, E. Gaussier, P. Gallinari. Predicting Information Diffusion in Social Networks Using COntent and Use's Profiles. European Conference on Information Retrieval, 2013.
[6] P. Laub, T. Taimre, P. Pollet. Hawkes processes. arXiv:1507.02822