

## Fiche doctorat

**Titre :** Exploring Human Interactions for Influence Modeling in Online Social Networks

**Mots clefs :** Social networks; influence; trust; reputation; popularity; social scoring

**Nom Prénom :** Monika RAKOCZY

**Directeur de la thèse :** Prof. Amel Bouzeghoub

**Ecole doctoral :** Paris Saclay (STIC)

**En collaboration :** Télécom Paris Sud

**Laboratoire d'accueil :** Télécom Paris Sud (Samovar) et Efrei Paris (AlliansTIC)

**Encadrant AlliansTIC :** Katarzyna Wegrzyn-Wolska

**Financeur :** Bourse d'excellence Institut Carnot Mines-Télécom

**Description :** Online social networking systems are constantly growing in popularity. They are enabling users to interact with one another, and shifting their relations to virtual world. Users utilize social media platforms as a mean for a rich variety of activities. Indeed, users are able to express their opinions, share their experiences, react to other users' views and exchange ideas. Such online human interactions take place within a dynamic hierarchy where we can observe and distinguish many roles related to relations between the users, concerning, amongst others, influential, trusted or popular individuals. In particular, influence within social networks has been a recent focus of the state-of-the-art. Many systems, such as recommender systems or social networking sites, incorporate and use the information about influence of users. Therefore, the models discovering and estimating influence for users are an important part of current research and are useful in various disciplines, such as marketing, political and social campaigns, recommendations and others. Discovering and evaluation of influence between users poses a several challenges, such as issues of how to model social networks, in what way to utilize the information available in the network, or how to value the influence. Interestingly, the interactions between

users can not only indicate influence but also involve trust, popularity or reputation of users. However, all of these notions concerning such relations are still vaguely defined and not meeting the consensus in the Social Network Analysis community. Defining, distinguishing and measuring the strength of those relations between the users are also posing numerous challenges, both on theoretical and practical ground, and are yet to be explored.

In this thesis, we focus on the roles of users connected to four important concepts: influence, reputation, trust, and popularity, in the scope of Social Networks Analysis for influence modeling. We analyze existing works utilizing these notions and we compare and contrast their interpretations. Consequently, we emphasize the most important features that these concepts should include and we make a comparative analysis of them. Accordingly, we present a global classification of the notions concerning their abstract level and distinction of the terms from one another, which is a first and required contribution of the thesis. Consequently, we then propose a theoretical model of influence and present influence related ontology. We also present a distinction of notion not yet explored in SNA discipline micro-influence, which targets new phenomena of social network users with small but highly involved audience, who are observed to be still highly impactful.

Basing on established theoretical background, we then propose a practical model, called Action-Reaction Influence Model (ARIM). This model considers type, quality, quantity and frequency of actions performed by users in social networks, and is adaptive to different social network types. We also focus on the quantification of influence over time, and representation of influence casual effect. In order to do that, we focus on a particular social network with a specific characteristic, that is citation network. Indeed, citation networks are particularly time sensitive. Accordingly, we propose Time Dependent Influence Estimation (TiDIE), a model for determining influence during a particular time period between communities within time-dependent citation networks. Finally, we also combine the abovementioned examination of various users interactions in social networks with the proposed TiDIE model for influence evaluation in citation networks, in order to investigate the dependencies between two of the explored notions, namely influence and reputation. In particular, we propose a transition method, ReTiDIE, that uses existing influence information from a social network (using TiDIE) for predicting the collective trustworthiness of a node, or, in other

words, its reputation. For each of the proposed approaches, experiments have been conducted on real-world datasets and demonstrate suitability of the meth