TALK TITLE:

Modelling Bias and Measuring Polarization in Social Networks

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ABSTRACT: Consider a group of users (agents) in a social network among whom some process of opinion formation takes place. In general, these users will take into account the opinions of others subject to their own biases. Indeed users in social networks may shape their beliefs by attributing more value to the opinions of influential figures. This common cognitive bias is known as *authority bias* [1]. Furthermore, social networks often target their users with information that they may already agree with to keep engagement. It is known that users tend to give more value to opinions that confirm their own pre-existing beliefs [2] in another common cognitive bias known as *confirmation bias*. As a result, users can become radical and isolated in their own ideological circle, causing dangerous splits in society [3] in a phenomenon known as polarization [2].

There is a growing interest in studying opinion formation, consensus and polarization in the context of social networks by adapting measures and models from economics and statistics such as Degroot learning and Esteban and Ray's polarization. Roughly speaking in these models the agents update their beliefs about the proposition of interest taking into account the beliefs of their neighbours in an underlying weighted influence graph. Agents update their beliefs giving more value to the opinion of agents with higher influence (authority bias) and to the opinion of agents with similar views (confirmation bias). Esteban and Ray's measure captures the intuition that polarization is accentuated by both intra-group homogeneity and inter-group heterogeneity.

In this talk I will motivate and introduce some of these models and measures, present our contributions to this subject and discuss some ongoing and future work. In particular, our more insightful result establishes that, under some natural assumptions, if polarization does not eventually vanish then either there is a disconnected subgroup of agents, or some agent influences others more than she is influenced.

[1] Ramos,V.J.: Analyzing the Role of Cognitive Biases in the Decision Making Process. IGI Global (2019)
[2] Aronson, E., Wilson, T., Akert, R.: Social Psychology. Upper Saddle River, NJ : Prentice Hall, 7 edn. (2010)
[3] Bozdag, E.: Bias in algorithmic filtering and personalization. Ethics and Information Technology (2013).

BIOGRAPHY

Frank Valencia is a CNRS permanent researcher at LIX Ecole Polytechnique de Paris at the INRIA team Comete. His main interests are within Formal Methods in Computer Science, in particular Concurrency Theory and Logic. He has published results on the computational expressiveness of well-established process calculi such as CCS (Calculus of Communicating Systems), the π-calculus and CCP (Concurrent Constraint Programming). In particular, he has given expressiveness distinctions between dynamic and static scope as well as replication and recursion in CCS and CCP, a Chomsky-like hierarchy of fragments of CCS, separation results for linear and persistent fragments of the π-calculus, and the Buchi automata characterization of timed CCP. Frank Valencia has established new connections between the areas of concurrency theory and logic by providing first-order, temporal and epistemic logic interpretations of concurrent phenomena such as mobile, timed, spatial behaviour. He has used these connections to prove new results in these areas such as the decidability of the observational equivalence for several fragments of the π-calculus and the decidability of satisfiability for the existential fragment of first-order temporal logic. He has been one of the originators of constraint-based process calculi for analysing timed, mobile, spatial and epistemic behaviour in concurrent systems. He also published work on search and consistency algorithms for CSP (Constraint Satisfaction Problems), and introduced the notion of *Infinite* (or *unbounded*) CSP.

More recently he has been working within foundations and applications of Concurrency Theory to modelling knowledge, belief evolution in computational systems exhibiting social phenomena. He has developed computational models and algorithms for reasoning about con- current systems whose agents (users) interact with each other like in social networks; i.e., by exchanging, updating and learning epistemic information such as facts, beliefs, and intentional lies. He is particularly interested in group phenomena such as Distributed Knowledge and Polarization. The former is, roughly speaking, the knowledge a group or community would have if they combine their individual knowledge. The latter refers to the tendency for a group to learn or acquire beliefs or to make decisions that are more extreme than the initial inclinations of its members.