Project title:

Detecting consistent patterns of spatial-temporal spread of extremist content

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Topic

The rise of online social media brought with is a series of novel challenges, such as online radicalization [1], the meddling of socialbots in the democratic process [2] or the spread of misinformation (i.e. “fake news”) [3]. There are even growing concerns that the social media has been weaponized, in which foreign agencies attempt to sway and control the public opinion via factories of trolls [4].

One angle of studying the spread of extremist content – broadly defined as content which is outside the societal norms, ranging from extreme views, to dangerous activities and all the way to terrorism – is by studying the social network structure. The aim would be to understand where does the content originate, which are the online communities susceptible to the content, and who are the main transmission enablers. The second angle relates to the diffusions of information within the aforementioned social networks. Intuitively, the social network forms the backbone onto which the diffusions take place. Therefore the social network is the spatial structure onto which the diffusions temporally unfold. However, the current state of the art diffusion modelling accounts exclusively for the temporal component, while assuming a homogeneously connected underlying social network.

This project aims to build a set of tools and methods to model, predict and control the spread of types of content, such as extremist content. The main goal is to account for the topological structure of the network, and the links between communities. The privileged avenue is Topological Data Analysis, a modern mathematical framework aimed at analysing high-dimensional spatial data in such a manner that is insensitive to the particular metric chosen and provides dimensionality reduction and robustness to noise [5]. The main tool is the *persistent homology* – a method for computing topological features over a wide range of spatial scales, and for determining which features are more likely to represent true features of the underlying space rather than artifacts of sampling, noise, or particular choice of parameters. Persistent homology has previously been applied to differentiate betweem authorship networks and random networks [5]. In this project we will identify the persistent features that topologically describe the diffusions of extremist content, and use them to differentiate against the diffusions of mainstream content.

The PhD student will be located within the newly formed DataSci Research Centre at UTS, in the Behavioral Data Science group. DataSci counts 15 members, with research interests spanning across smart logistics, transportation, and human dynamics. The Research Centre has both strong ties with industry, as well as world-class research, providing the ideal environment for solving real-world originating issues, in close proximity to both academia and industry.

The candidate

Interested candidates must have solid background knowledge in statistics, machine learning, and strong programming capabilities. Experience with big social data, extracting and handling web- and social media-originating data is a big plus. We are looking for a candidate with a master by research qualification, and demonstrated research capabilities (preferably through publications). Candidates with publications in major conferences/journals will be prioritised. The position will be open until the ideal candidate is identified.

Collaborations

This project will advance both the theoretical tools, as well as apply it to real problems in applied mathematics, sociology and political science, through inter-disciplinary collaborations.

How to apply

To apply, please send by email (Marian-Andrei.Rizoiu@uts.edu.au) the following documents:

- your CV, showing your education and professional experience, prizes (such as university medals etc), awards and publications, if any;
- a cover letter (no more than one page), outlining I) your profile's match with the current subject, ii) your machine learning experience (example: describe one prior project involving Machine Learning) and iii) **why do you want to research machine learning in social media. Please be precise, not vague;**
- grades transcripts from undergrad and Masters;
- Masters thesis (if applicable) or equivalent **research thesis**;
- 3 referees (academic or industrial supervisors, co-authors): name, position and email;
- (if you have one) one of your publications **which is most relevant for this position**.

References

[1] Neumann, P. R. (2013). Options and Strategies for Countering Online Radicalization in the United States. Studies in Conflict & Terrorism, 36(6), 431–459.

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[3] Allcott, Hunt, and Matthew Gentzkow. "Social media and fake news in the 2016 election." Journal of economic perspectives 31.2 (2017): 211-36. https://web.stanford.edu/~gentzkow/research/fakenews.pdf

[4] Kim, D., Graham, T., Wan, Z., & Rizoiu, M.-A. (2019). Analysing user identity via time-sensitive semantic edit distance (t-SED): A case study of Russian trolls on Twitter. Journal of Computational Social Science. http://arxiv.org/abs/1901.05228

[5] Carstens, C. J.; Horadam, K. J. (2013-06-04). "Persistent Homology of Collaboration Networks". Mathematical Problems in Engineering. 2013: 1–7. https://doi.org/10.1155/2013/815035