Anomaly Detection with Joint Representation Learning of Content and Connection

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Introduction

Information Operations are a suite of methods used to influence others through the dissemination of propaganda and disinformation [1]. Below, we see an example network of Twitter users who were subsequently suspended for propagation of political disinformation.

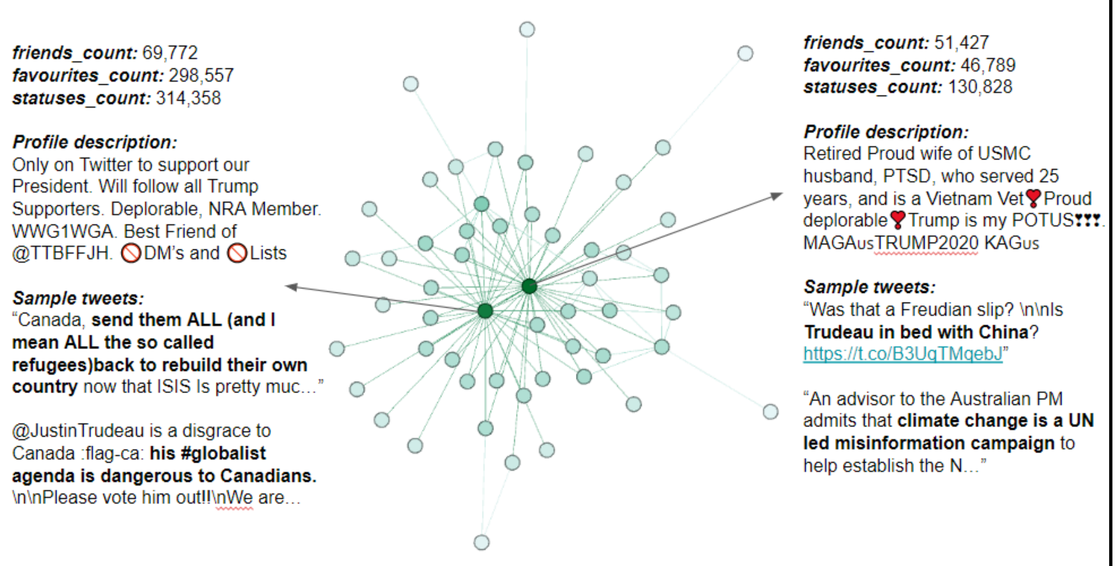


Figure 1: Mutually following network of suspended users who spread disinformation and propaganda during 2019 Canadian Federal Election

Our work aims to develop tools to identify such anomalous behavior. An example of such early detection is in **Figure 5**.

Problem Statement

- Detect Information Operations on Twitter in an unsupervised and interpretable fashion based on joint representation learning of content and connection.
- Applying our method to 2019 Canadian Federal Election reveals a sub-block of suspicious and tightly connected users, as well as a suspicious account exhibiting behaviors related to Information Operations.

Methodology

We learn a join embedding of a concatenated adjacency and attribute matrix of Twitter users and visualize clusters based on these embeddings, thereby determining anomalies (**Figure 2**)

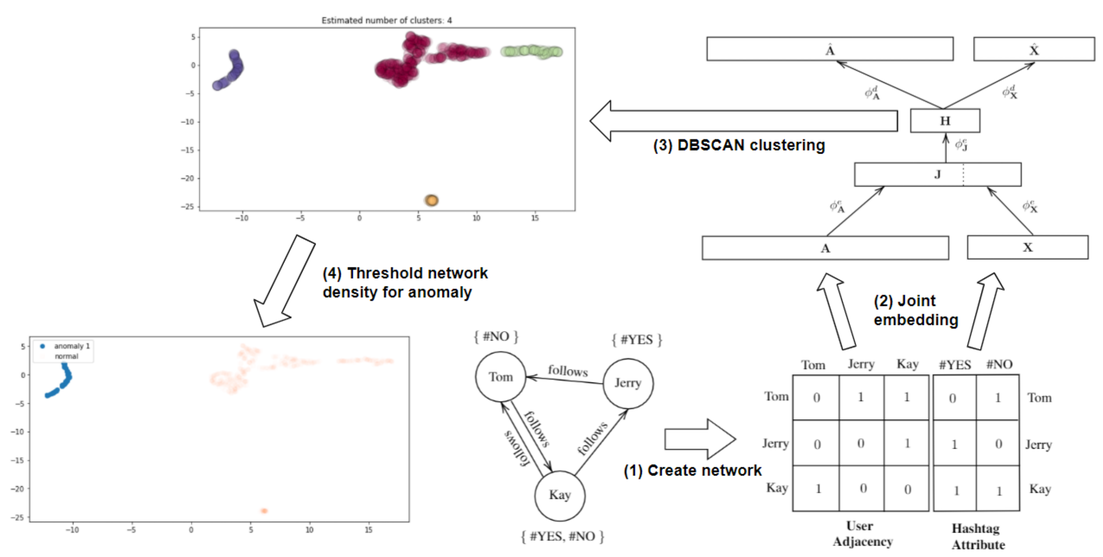


Figure 2: Anomaly detection pipeline

Results

We assess our method by computing F1 scores across injected anomaly blocks of increasing density.

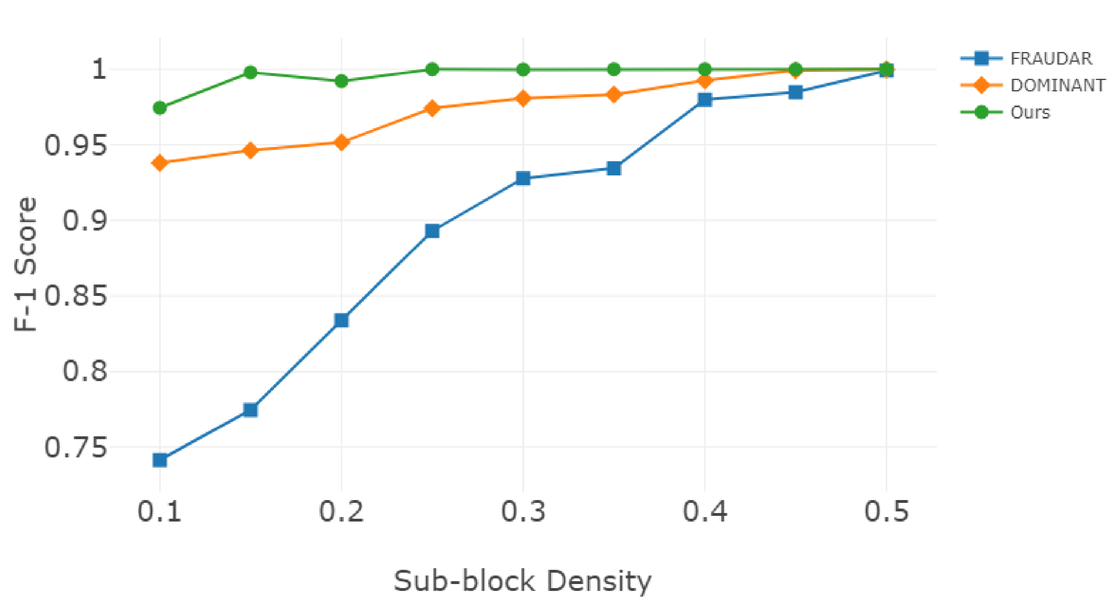


Figure 3: Our method is competitive with non-attributed anomaly detection methods as well as state-of-the-art GCN-based attributed methods.

To visualize our results, we analyze hashtag usage in particular clusters (clusters 1 and 9 given in **Figure 4**)

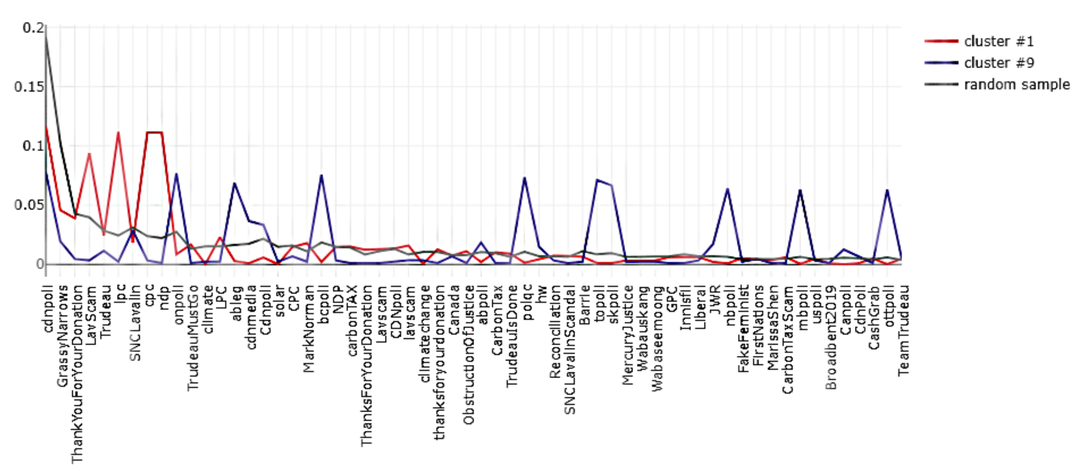
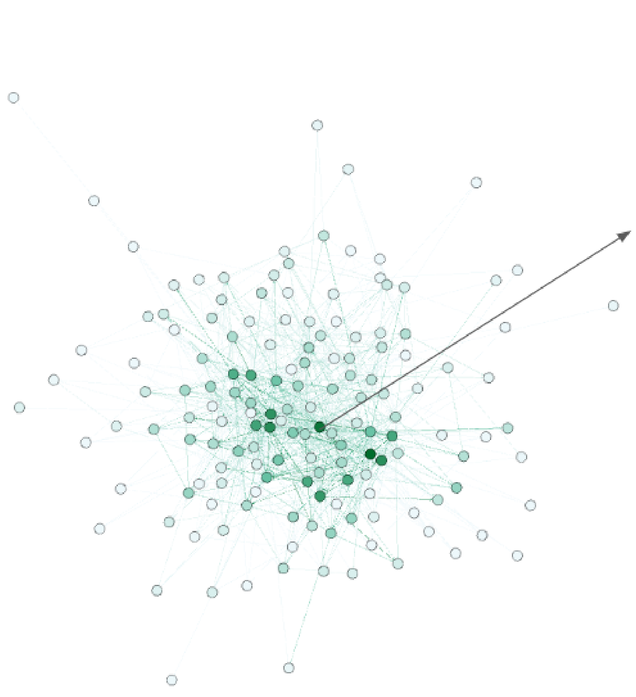


Figure 4: Distribution over relative usage frequencies of popular hashtags within clusters Cluster 9 corresponds to recent political scandal.



friends_count: 399
favourites_count: 60,900
statuses_count: 18,543

Profile description:
Portuguese born & raised; Catholic, Paralegal/Law major & Dog mama || In God we trust #TrudeauMustGo #NationalismOverGlobalism #MCGA #CanadaFirst

Sample tweets:
"Dear Trudeau and the rest of his **Liberal circus clowns** ... the higher your ego, the harder the **fall to humility**. Now, e..."

"The **Tofino Turd**, greenhouse gasser, Groper of taxes, tough guy, #fakefeminist"

"ENOUGH OF THIS ! \n\nQ: How much more are you willing to take CANADA???\n\n**These Islamic BASTARDS FROM HELL will rape**, en..."

Note:
This user **changed its username 2 times in one month**

Figure 5: Identification of a misinformation agent.

References

References

[1] Tom Wilson, Kaitlyn Zhou, and Kate Starbird. Assembling strategic narratives: Information operations as collaborative work within an online community. *Proceedings of the ACM on Human-Computer Interaction*, 2(CSCW):183, 2018.