HoaxItaly: a collection of Italian disinformation and fact-checking stories shared on Twitter in 2019

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Abstract

We released over 1 million tweets shared during 2019 and containing links to thousands of news articles published on two classes of Italian outlets: (1) disinformation websites, i.e. outlets which have been repeatedly flagged by journalists and fact-checkers for producing low-credibility content such as false news, hoaxes, click-bait, misleading and hyper-partisan stories; (2) fact-checking websites which notably debunk and verify online news and claims. The dataset, which includes also title and body for approximately 37k news articles, is publicly available at https://doi.org/10.7910/DVN/PGVDHX.

Introduction

We are witnessing an ever growing concern over the presence and the influence of deceptive and malicious information spreading on online social media (Pieri and Ceri 2019)(Allcott and Gentzkow 2017). Researchers use different terms to indicate the same issue, namely disinformation, misinformation, propaganda, junk news and click-bait. In this work we use the word disinformation, rather than the more popular “fake news”, to refer to a variety of low-credibility content which comprises false news intended to harm, misleading and non-factual reporting, hyper-partisan news and propaganda, and unverified rumors (Pieri, Piccardi, and Ceri 2019).

Most of the research on this issue has focused on past 2016 US Presidential elections: it has been shown that false news spread deeper and faster than reliable news, with social bots and echo chambers playing a primary role in the diffusion (Vosoughi, Roy, and Aral 2018)(Vosoughi, Roy, and Aral 2018)(Shao et al. 2018a)(Shao et al. 2018b); however, misleading information usually amounts to a negligible fraction of overall online news, and it is mostly shared by old and conservative leaning people, highly engaged with politics (Grinberg et al. 2019)(Bovet and Makse 2019).

Nevertheless, disinformation spreading on social platforms has been also reported in European countries in different circumstances, including 2016 Brexit (Bastos and Mercea 2019), 2017 French Presidential Elections (Howard et al. 2018) and 2017 Catalan referendum (Stella, Ferrara 2017), 2017 French Presidential Elections (Howard et al. 2018), 2017 Catalan referendum (Stella, Ferrara 2017), 2016 Brexit (Bastos and Mercea 2019). Researchers use different terms to indicate the same issue, namely disinformation, misinformation, propaganda, junk news and click-bait. In this work we use the word disinformation, rather than the more popular “fake news”, to refer to a variety of low-credibility content which comprises false news intended to harm, misleading and non-factual reporting, hyper-partisan news and propaganda, and unverified rumors (Pieri, Piccardi, and Ceri 2019).

For what concerns Italy, where according to Reuters trust in news is today particularly low (Nielsen et al. 2019), previous research has highlighted the existence of segregated communities (Del Vicario et al. 2017) when it comes to consume online news, and remarkable exposure to online disinformation was discovered in the run-up to 2018 Italian General elections (Giglietto et al. 2018), a result which was also substantiated in a report of the Italian Authority for Communications Guarantees (AGCOM) (AGCOM 2018). Besides, Facebook has recently shut down several pages and accounts for violating platform’s terms of use, thanks to the insights provided by Avaaz (Avaaz 2019), which revealed the existence of a network of agents spreading low-credibility and inflammatory content about controversial themes such as immigration, national safety and anti-establishment.

In the following we first describe previous research contributions that relate to our work; next we provide a description of the collection procedure and the dataset itself, which is available at https://doi.org/10.7910/DVN/PGVDHX; finally we briefly describe two applications of this dataset and we conclude.

Related work

There are a few references in the literature which relate to this work.

As the title of this paper suggests, we based our contribution on Hoaxy platform (Shao et al. 2016)(Hui et al. 2018), which has been tracking—since 2016—the diffusion on Twitter of hundreds of thousands of news articles published on US disinformation and fact-checking websites, collecting millions of tweets containing explicit links to these domains. Authors provide an API to easily download their data (available at https://rapidapi.com/truthy/api/hoaxy), and also the source code for developing the collection pipeline (available at https://github.com/IUNetSci/hoaxy-backend), which we implemented starting from our own list of Italian sources.

NELA-GT-2018 (Nørregaard, Horne, and Adalı 2019) is a large political news data set which contains 700k articles collected in 2018 from almost 200 US news outlets which
include mainstream, hyper-partisan, and conspiracy sources. Authors used 8 different assessment sites to assess veracity, reliability, bias, transparency, adherence to journalistic standards, and consumer trust of these sources.

Authors in Brena et al. 2019 built a pipeline for collecting data describing news sharing behaviour on Twitter: they take as input a list of news sources and collect articles shared on Twitter, as well as metadata about users sharing such stories. They released an associated dataset concerning the US landscape which contains approx. 1 million tweets and 300k articles.

Authors in Balestrucci et al. 2019 provide a dataset of thousands of so-called credulous Twitter users, i.e. human-operated accounts who exhibit a high percentage of bots among their followings. These might be particularly exposed to the harmful activities of social bots and they could become spreaders of misleading information. Authors also provide a supervised classifier to accurately recognize such users with accuracy up to 93.27%.

**Data collection**

As previously mentioned, we referred to Hoaxy (Shao et al. 2016) to setup our collection pipeline. We used Twitter Streaming API (via `tweepy` Python package) from January to December 2019 to filter tweets containing URLs of 66 Italian disinformation outlets and a few fact-checking agencies, namely PagellaPolitica, Bufale.net, Butac.it, and Lavoce.info. We referred to the blacklists compiled by these websites in order to build our list of untrustworthy websites, i.e. outlets who notably publish hoaxes and false news, but also conspiracy theories, hyper-partisan news, clickbait and pseudoscience.

We used web domains as `track` parameter as described in Twitter documentation to capture all related tweets, e.g. “voxnews info OR ilprimatonazionale it OR ...”. We also built our own crawler in Python to scrape news articles and perform URL canonicalization.

We first remark that we can only release tweet IDs—which can be used to retrieve original tweets via Twitter API using the `status/lookup` Twitter endpoint—in accordance with Twitter terms of use, whereas we provide title and body for news articles which are publicly accessible. Secondly, we are aware of the limitation of Twitter Streaming endpoint, which cuts out matched tweets when they reach 1% of daily volume of shared tweets (Morstatter et al. 2013); however, we did not incur in missing data as we collected roughly $10^8$ tweets per day, which is far less than the 1% of current daily volume of tweets that exceeds $2 \cdot 10^8$ shared tweets.

**Data description**

In Figure 1 we show the time series of collected tweets on a daily basis, for both disinformation (black) and fact-checking news (orange). We collected the data in two phases: the first goes from January to mid-July, when we experienced a pause in the collection; we then resumed it at the beginning of September and ran it until December. Blank spaces correspond to temporary network failures. A breakdown of the dataset in terms of articles, tweets and users is provided in Table 1. We can notice that the presence of fact-checking stories is negligible compared to disinformation news–less than 5% of total tweets contain a link to fact-checking stories which amount to less than 10% of total shared articles–in line with findings in the US (Shao et al. 2016).

In Figure 2 we show the distribution of the number of shared tweets for Top-10 disinformation sources (which account for over 99% of related tweets) and fact-checking sources, whereas in Table 3 we show Top-10 disinformation and fact-checking articles w.r.t the total number of shares.

Table 1: Breakdown of the dataset in terms of articles, tweets and users.

| Domain       | Articles | Tweets   | Users   |
|--------------|----------|----------|---------|
| Fact-checking| 3,566    | 50,662   | 17,155  |
| Disinformation| 32,686   | 1,068,102| 45,112  |

a) From January to July 2019

b) From September to December 2019

Figure 1: Time series (in two halves) of the number of collected tweets, on a daily basis, for disinformation (blue) and fact-checking articles (orange).

![Image of data collection chart](https://www.internetlivestats.com/twitter-statistics/)

A complete list of these websites is available at [https://docs.google.com/spreadsheets/d/1YRNFXrr47w8pa1j3GmPnPbJtJar99](https://docs.google.com/spreadsheets/d/1YRNFXrr47w8pa1j3GmPnPbJtJar99).
We can notice that there are only a handful of highly active outlets which are responsible for most of the misleading information spreading on Twitter. In particular, "voxnews.info" (and most other websites in the Top-10) notably publish hoaxes and fake news which usually involve immigrants, refugees and national safety; "ilprimatonazionale.it" is the reference news outlet for Italian far-right community (and official website of former party Casa Pound), and it has often been compared to BreitbartNews for its propaganda and hyper-partisan reporting; finally, "byoblu.com" is rather involved with the Italian euro-skeptical community and it regularly spreads conspiracy theories.

Applications

In the following we describe two applications of our dataset referring to our previous works, namely (1) a detailed investigation of disinformation spreading on the Italian Twitterverse in the run-up to 2019 European Parliament elections (Pierri, Artoni, and Ceri 2019), and (2) a classification of mainstream and disinformation news based on multilayer networks (Pierri, Piccardi, and Ceri 2020).

Disinformation in the run-up to 2019 European Parliament elections. We analyzed the 5-month period preceding the 2019 European Parliament elections (which took place on the May, 26th) to investigate the presence and influence of disinformation in the Italian Twitterverse. The dataset analyzed corresponds to part of the collection we release in this paper.

We observed that most of the deceptive information was shared by a few outlets, and a dictionary-based topic analysis revealed that misleading news mostly focused on controversial and polarizing topics of debate such as immigration, national safety and (Italian) nationalism.

We also analyzed the main K-core (Batagelj and Zaversnik 2003) of the diffusion network and noticed that the spread of disinformation on Twitter was confined in a limited community, strongly (and explicitly) related to the Italian conservative and far-right political environment; a network dismantling analysis showed that this could be easily dismantled with several strategies based on node centrality measures.

Finally, we searched hyperlinks contained in news articles and discovered connections between different disinformation outlets across Europe, U.S. and Russia, which often featured similar, even translated, articles.

We show in Figure 3 the core of the global diffusion
network (where colors indicate groups identified with a community-detection algorithm) and the network of hyperlinks between websites (where colors indicate different countries). We refer the interested reader to (Pierri, Artoni, and Ceri 2019) for more details on the results.

**Disinformation detection via multilayer diffusion networks.** We developed a machine learning framework to classify news articles published on disinformation vs mainstream news outlets based on Twitter diffusion networks. For each article we built a multi-layer diffusion network (see Figure 4) based on different social interactions on Twitter, namely tweets, retweets, mentions, replies and quotes. We selected a set of global network properties, which quantify different aspects of the sharing process, to encode different networks with a tuple of features. These range from traditional indicators, e.g. network density, number of strong/weakly connected components and diameter, to more elaborated ones such as main K-core number (Batagelj and Zaversnik 2003) and structural virality (Goel et al. 2015).

We performed classification experiments with a simple Logistic Regression model using two different datasets of mainstream and disinformation news shared on Twitter respectively in the United States and in Italy during 2019 (the latter is part of the collection we release in this work).

We were able to classify credible vs non-credible articles with high accuracy (AUROC up to 94%), and we observed that the layer of mentions alone conveys useful information for the classification, suggesting a different usage of mentions when sharing news belonging to the two news domains. We also highlighted that most discriminative features, which are relative to the breadth and depth of largest cascades in different layers, are the same across the two countries. We refer the interested reader to (Pierri, Piccardi, and Ceri 2020) for more details.

**Conclusions**

We released a large-scale dataset of tweets and articles concerning disinformation and fact-checking stories circulating on the Italian Twitterverse in 2019, and we provided a related descriptive statistics of sources, articles, tweets and users. We also described two past applications of this dataset which concern (1) the analysis of disinformation spreading in Italy before 2019 European Parliament elections and (2) an approach to detect disinformation based on Twitter diffusion networks represented in a multi-layer flavor.

We hope that the research community might successfully embody this data as to further investigate the issue of malicious information outside the United States context, where most of the research focus has been devoted in the past.

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**References**

[AGCOM 2018] AGCOM. 2018. News vs fake nel sistema dell’informazione. Report available at: [https://www.agcom.it/documents/10179/12791486/Pubblicazione+23-11-2018/93869b4f-0a8d-4380-aad2-c10a0e426d83?version=1.0](https://www.agcom.it/documents/10179/12791486/Pubblicazione+23-11-2018/93869b4f-0a8d-4380-aad2-c10a0e426d83?version=1.0).

[Allcott and Gentzkow 2017] Allcott, H., and Gentzkow, M. 2017. Social media and fake news in the 2016 election. *Journal of Economic Perspectives* 31(2):211–36.

[Avaaz 2019] Avaaz. 2019. Far right networks of deception. Available at: [https://avaazimages.avaaz.org/Avaaz%20Report%20Network%20Deception%2020190522.pdf](https://avaazimages.avaaz.org/Avaaz%20Report%20Network%20Deception%2020190522.pdf).

[Balestrucci et al. 2019] Balestrucci, A.; De Nicola, R.; Petrocchi, M.; and Trubiani, C. 2019. Do you really follow them? automatic detection of credulous twitter users. In *International Conference on Intelligent Data Engineering and Automated Learning*, 402–410. Springer.

[Bastos and Mercea 2019] Bastos, M. T., and Mercea, D. 2019. The brexit botnet and user-generated hyperpartisan news. *Social Science Computer Review* 37(1):38–54.

[Batagelj and Zaversnik 2003] Batagelj, V., and Zaversnik, M. 2003. An o(m) algorithm for cores decomposition of networks. *arXiv preprint cs/0310049*.

[Bovet and Makse 2019] Bovet, A., and Makse, H. A. 2019. Influence of fake news in Twitter during the 2016 US presidential election. *Nature Communications* 10(1):7.

[Brena et al. 2019] Brena, G.; Brambilla, M.; Ceri, S.; Di Giovanni, M.; Pierri, F.; and Ramponi, G. 2019. News sharing user behaviour on twitter: A comprehensive data collection of news articles and social interactions. In *Proceedings of the International AAAI Conference on Web and Social Media*, volume 13, 592–597.

[Cantarella, Fraccaroli, and Volpe 2019] Cantarella, M.; Fraccaroli, N.; and Volpe, R. 2019. Does fake
| Title | Website | No. tweets |
|-------|---------|------------|
| Chi sono davvero le sardine apartitiche. La schedatura dei leader nazionali e locali | ilprimatonazionale.it | 2490 |
| La Consulta bocca lomogenitorialità: Le coppie gay non sono famiglie | ilprimatonazionale.it | 2200 |
| La figuraccia di Italia Viva: firme false nella petizione contro i profili fake | ilprimatonazionale.it | 2047 |
| CasaPound vince la causa contro Facebook. Il giudice ordina la riattivazione della pagina | ilprimatonazionale.it | 1978 |
| Pi della met degli account Twitter che seguono Boldrini e Saviano sono falsi | ilprimatonazionale.it | 1928 |
| Giulia Berberi, medico della nave Alex? E una dentista | ilprimatonazionale.it | 1891 |
| Matteo Salvini, frena tutti: Non cambio idea sui migranti, i porti restano chiusi | lettoquotidiano.it | 1846 |
| Pakistano violentatore, la giudice pro Ong lo aveva protetto perché lui dichiarava di essere gay | lettopolitica.it | 1690 |
| La Luiss fa fuori il prof Gervasoni: Io cacciato per un tweet sovranista | ilprimatonazionale.it | 1553 |
| 11 barconi tunisini assaltano Lampedusa, poliziotto: Sbarcano galeotti tunisini e TG ve lo nascondono | voxnews.info | 1477 |

Table 2: Top-10 disinformation articles per number of shared tweets.

| Title | Website | No. tweets |
|-------|---------|------------|
| Fact-checking: i cartelli di Salvini sull'immigrazione a Porta a Porta | pagellapolitica.it | 1395 |
| No, Laura Boldrini non ha occupato il posto dei disabili in aereo | pagellapolitica.it | 898 |
| Le sposed bambine Vol.2 | butac.it | 797 |
| Sciolti i falsi profili su Facebook: CasaPound vince la causa | bufale.net | 712 |
| Quanto costa allo Stato un cervello in fuga? | pagellapolitica.it | 534 |
| NOTIZIA VERA Quando Salvini disse a Iliaria Cucchi Mi fa schifo. Ecco la audio | bufale.net | 471 |
| Se Di Battista svela il complotto sul franco Cfa | lavoce.info | 469 |
| Il 66% delle bufale politiche arrivano dai fan di Salvini e Meloni: i dettagli sul nuovo studio | bufale.net | 469 |
| Di Maio confuso sui soldi alle banche | lavoce.info | 423 |
| La effetto Salvini sugli sbarchi conta met delleffetto Minniti | lavoce.info | 378 |

Table 3: Top-10 fact-checking articles per number of shared tweets.

news affect voting behaviour? Available at SSRN: https://ssrn.com/abstract=3402913.

[Del Vicario et al. 2017] Del Vicario, M.; Gaito, S.; Quattrociocchi, W.; Zignani, M.; and Zollo, F. 2017. News consumption during the italian referendum: A cross-platform analysis on facebook and twitter. In 2017 IEEE International Conference on Data Science and Advanced Analytics (DSAA), 648–657. IEEE.

[Ferrara 2017] Ferrara, E. 2017. Disinformation and social bot operations in the run up to the 2017 french presidential election. First Monday 22(8).

[Giglietto et al. 2018] Giglietto, F.; Iannelli, L.; Rossi, L.; Valeriani, A.; Righetti, N.; Carabini, F.; Marino, G.; Usai, S.; and Zurovac, E. 2018. Mapping italian news media political coverage in the lead-up to 2018 general election. Available at SSRN: https://ssrn.com/abstract=3179930.

[Goel et al. 2015] Goel, S.; Anderson, A.; Hofman, J.; and Watts, D. J. 2015. The structural virality of online diffusion. Management Science 62(1):180–196.

[Grinberg et al. 2019] Grinberg, N.; Joseph, K.; Friedland, L.; Swire-Thompson, B.; and Lazer, D. 2019. Fake news on twitter during the 2016 u.s. presidential election. Science 363(6425):374–378.

[Hedman, Sivnert, and Howard 2018] Hedman, F.; Sivnert, F.; and Howard, P. 2018. News and political information consumption in sweden: Mapping the 2018 swedish general election on twitter.

[Howard et al.] Howard, P. N.; Bradshaw, S.; Kollanyi, B.; and Bolsolver, G. Junk news and bots during the french presidential election: What are french voters sharing over twitter in round two?

[Hui et al. 2018] Hui, P.-M.; Shao, C.; Flammini, A.; Menczer, F.; and Ciampaglia, G. L. 2018. The hoax misinformation and fact-checking diffusion network. In Twelfth International AAAI Conference on Web and Social Media.

[Kollanyi and Howard 2017] Kollanyi, B., and Howard, P. N. 2017. Junk news and bots during the german parliamentary election: What are german voters sharing over twitter.

[Marchal et al. 2019] Marchal, N.; Kollanyi, B.; Neudert, L.-M.; and Howard, P. N. 2019. Junk news during the eu parliamentary elections: Lessons from a seven-language study of twitter and facebook.

[Morstatter et al. 2013] Morstatter, F.; Pfeffer, J.; Liu, H.; and Carley, K. M. 2013. Is the sample good enough? comparing data from twitter’s streaming api with twitter’s firehose. In Seventh international AAAI conference on weblogs and social media.

[Nielsen et al. 2019] Nielsen, R. K.; Newman, N.; Fletcher, R.; and Kalogeropoulos, A. 2019. Reuters institute digital news report 2019. Report of the Reuters Institute for the Study of Journalism.

[Nørregaard, Horne, and Adalı 2019] Nørregaard, J.; Horne, B. D.; and Adalı, S. 2019. Nela-gt-2018: A large multi-labeled news dataset for the study of misinformation in news articles. In Proceedings of the International AAAI Conference on Web and Social Media, volume 13, 630–638.

[Pierri and Ceri 2019] Pierri, F., and Ceri, S. 2019. False
news on social media: a data-driven survey. *ACM Sigmod Record* 48(2).

[Pierri, Artoni, and Ceri 2019] Pierri, F.; Artoni, A.; and Ceri, S. 2019. Investigating italian disinformation spreading on twitter in the context of 2019 european elections. *arXiv preprint arXiv:1907.08170*.

[Pierri, Piccardi, and Ceri 2019] Pierri, F.; Piccardi, C.; and Ceri, S. 2019. Topology comparison of twitter diffusion networks reliably reveals disinformation news. *arXiv preprint arXiv:1905.03043*.

[Pierri, Piccardi, and Ceri 2020] Pierri, F.; Piccardi, C.; and Ceri, S. 2020. A multilayer approach to disinformation detection on twitter. *arXiv preprint*.

[Shao et al. 2016] Shao, C.; Ciampaglia, G. L.; Flammini, A.; and Menczer, F. 2016. Hoaxy: A platform for tracking online misinformation. In *Proceedings of the 25th International Conference Companion on World Wide Web*, WWW ’16 Companion, 745–750. Republic and Canton of Geneva, Switzerland: International World Wide Web Conferences Steering Committee.

[Shao et al. 2018a] Shao, C.; Ciampaglia, G. L.; Varol, O.; Yang, K.-C.; Flammini, A.; and Menczer, F. 2018a. The spread of low-credibility content by social bots. *Nature Communications* 9(1):4787.

[Shao et al. 2018b] Shao, C.; Hui, P.-M.; Wang, L.; Jiang, X.; Flammini, A.; Menczer, F.; and Ciampaglia, G. L. 2018b. Anatomy of an online misinformation network. *PLOS ONE* 13(4):1–23.

[Stella, Ferrara, and De Domenico 2018] Stella, M.; Ferrara, E.; and De Domenico, M. 2018. Bots increase exposure to negative and inflammatory content in online social systems. *Proceedings of the National Academy of Sciences* 115(49):12435–12440.

[Vosoughi, Roy, and Aral 2018] Vosoughi, S.; Roy, D.; and Aral, S. 2018. The spread of true and false news online. *Science* 359(6380):1146–1151.