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# Book of Short Papers

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# HateViz: a textual dashboard Twitter data-driven

## *HateViz: una Dashboard Twitter data-driven*

Emma Zavarrone<sup>1</sup>, Maria Gabriella Grassia<sup>2</sup>, Marina Marino<sup>3</sup>, Rocco Mazza<sup>4</sup>, Nicola Canestrari<sup>5</sup>

**Abstract** The paper introduces *HateViz* dashboard, an interactive platform Twitter based about hate speech against women. Starting from texts collected from Twitter, using R packages, the aim of dashboard is to provide to the community of decision-makers an easy-to-use tool to monitor this important phenomenon. The dashboard mixes three methods: textual mining, latent topic models and textual network analysis and proposes a new approach for explaining the network based on topics and terms. Joint usage of topic modelling and textual network approach results in a better description of semantic content of each topic.

**Abstract** *Il paper vuole introdurre la dashboard HateViz, una piattaforma interattiva che si appoggia a Twitter, riguardante l'hate speech contro le donne. Partendo dalla raccolta da Twitter di testi scaricati tramite pacchetti di R, l'obiettivo della dashboard è di fornire alla community dei decision-makers uno strumento semplice da utilizzare per monitorare un fenomeno così importante. HateViz unisce tre metodologie: textual mining, latent topic model e analisi delle reti testuali, e propone un nuovo tipo di approccio per spiegare il network formato da topic latenti e lemmi. L'uso congiunto degli approcci di topic modelling e delle misure di rete fornisce una migliore interpretazione del contenuto di ogni topic.*

**Key words:** *HateViz*, Dashboard, Text mining, Textual network analysis

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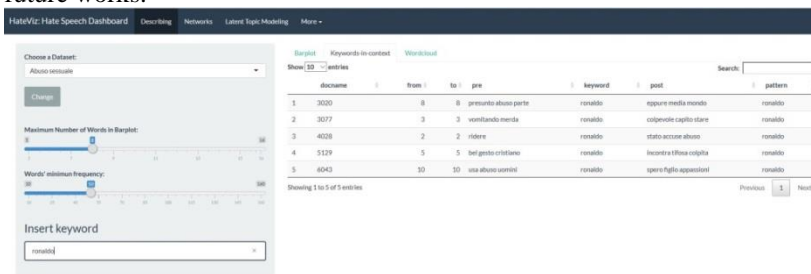
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## 1 Introduction

The paper focuses on the data visualization of the hate speech against women inside the Italian Twitter community. *HateViz* is the proposed shiny dashboard, to represent an alternative way for reading the social-political changes (Fig. 1). Hate speech based communication is increasing with the massive production of user generated content on social network. The literature defines hate speech as content that disparages a person or a group on the basis of some characteristic such as ethnicity, gender, sexual orientation (Davidson et al., 2017; Malmasi and Zampieri, 2018). Under this perspective, to provide the community of decision-makers with an easy-to-use tool to monitor these changes becomes more crucial. Starting from tweets, collected through API using R, the *HateViz* allows to explore the mining of contents extracted and study the lexical structure that link the principal discussion topics. The contribution at the state of the art is a new point of view studies that focus on communities' discourse and a development of a representation tool for our results. This paper is structured as follows: section 2 show the methods and the data visualization tools used, section 3 more specifically discusses the results of the research, and in section 4 there are the future works.



**Figure 1:** The dashboard user interface

## 2 Methodological approach

The *HateViz* mixes three methods: textual mining, latent topic models and social network analysis and proposes a new approach for explaining the network based on topics and terms. Figure 2 shows the dashboard's flowchart: (1) content extraction and corpus pre-processing; (2) descriptive study of texts: most frequent words and co-occurrence network analysis; (3) applying a model to extract and identify the latent topics within the contents collected; (4) using network analysis's both a better interpretation of each topic and the semantic relationships between the extracted topics and documents' terms. The corpus was built with a random sample of tweets in Italian language and the pre-treatment operations (bag of words approach) have been applied. A final Document-Term Matrix has been generated without sparse words and empty documents. DTM allows to describe the corpus of tweets through common visualizations such as barplot of most frequent words and wordcloud. In addition, the

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DTM can be read like an affiliation matrix in which to analyse the relationships between words and the texts. We converted this in co-occurrence matrix to transform the collection of text into a visual maps of words, a similar approach has been applied by Segev (2020). In this step *HateViz* uses the networks and its centrality measures (Faust, 1997): degree and closeness. The search of semantic structure has been realized from a DTM through the Latent Dirichlet Allocation model (Blei et al., 2003; Griffiths and Steyvers, 2002; 2003; 2004; Hofmann, 1999; 2001). LDA is the method used both to extract latent topics and to construct the *terms-topics* matrix. The model is a generative and Bayesian inferential model and it allows to infer the latent structure of topics through by recreating the documents in the corpus considering the relative weight of the topic in the document and the word in the topic, in an iterative way. At the base of the LDA we find the following assumptions: a) documents are represented as mixtures of topics, where a topic is a probability distribution over words; b) the topics are partially hidden, latent precisely, within the structure of the document (Steyvers and Griffiths, 2007). At first glance, the main methodological challenges faced lie in the construction of a two-mode matrix of reduced order able to represent the terms topics network. The original contribution is the network construction, we operated a selection of terms based on a probability threshold derived from the model (LDA) results.

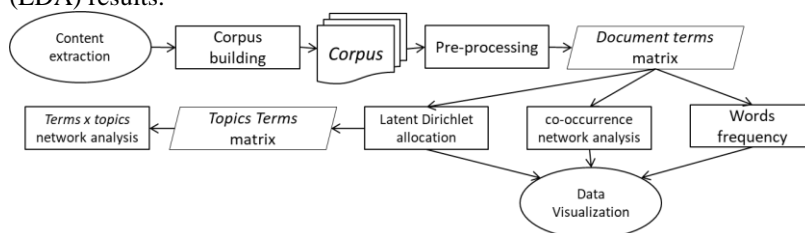


Figure 2: The *Hateviz* dashboard's flowchart

### 3 Results

The main outcome of the dashboard (Fig. 2) is to show results from the analysis in an easy and interpretable way. *HateViz* has an intuitive layout with a clear division between the control panel on the left and the plotting space on the right. The interactive control panel allows the selection of the datasets from different keywords and the customized plot output from different analysis: 1. Barplot of frequencies; 2. Keywords in context; 3. Co- occurrence network analysis; 4. Wordcloud of terms; 5. Latent Topics; 6. Terms Topics Network (A beta version of shiny web app is already on line at link: <https://rccmazza.shinyapps.io/Donne4/>). The dashboard has been developed on 403.612 tweets extracted from July 2018 to May 2019. The complete database is composed by seven sub-datasets, each one selected from specific keywords. *HateViz* allows an analysis for each textual dataset built with extraction keywords. The wordcloud in Figure 4 shows three semantic dimensions: the first one is banally referable to the cases of news commented by users on the social; the second



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1. First topic: a reference to the implementation of judgement, some examples of terms in this topic are “polizia” (police), “arrestato” (arrested), “denuncie” (denunciation/charge);
2. Second topic: referring to the public attention on social media, involving terms like “tweet”, “foto” (pictures), “gente” (people), “visto” (seen);
3. Third topic: a reference to the cultural dimension of the phenomenon, with terms like “genere” (gender), “uomini” (men), “donne” (women), “amore” (love);
4. Forth topic: a reference to the institutional dimension, involving terms like “ministro” (minister), “salvini”, “italia” (italy), “italiani” (italian)
5. Fifth topic: referred to legal and trial aspects, with terms like “reato” (crime), “omicidi” (murder), “pena” (sentence).

Through the words-topic network (Zuo, Zhao and Xu, 2015) it is possible to observe how the terms are associated with the referred topic. The network is composed by latent topics identified through the LDA technique giving the opportunity to examine how the terms from corpus are associated with them. A topic that takes a central position in the network represents the main semantic area identified in the dataset. A term, which represents a node connecting different topics indicates that is not only present in both thematic groups to which it is connected, but also represents a connection between semantic areas associated with each topic.

<i>Terms</i>	<i>Closeness centrality</i>
Vittime	0.699
Molestie	0.694
Ragazze	0.689
Stato	0.694

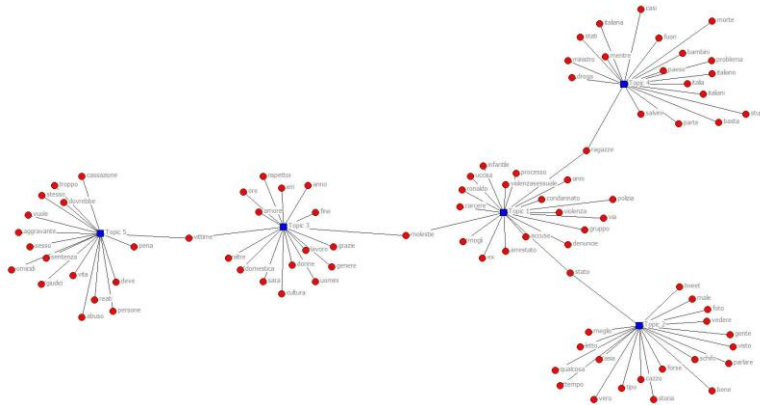
**Table 2:** Closeness centrality values calculated on two mode matrix

The words-topics graph shows how topic1 (implementation of judgement) and topic3 (cultural dimension) are positioned at the centre of the network, which means that they represent the most relevant semantics in the dataset. Its position in the network makes topic1 a bridge, a node connecting topic3 and topic5 (legal and trial aspects) with topic2 (public attention) and topic4 (institutional dimension), since topic1 is the node that connects the other topics, and without that node the whole network would collapse. It is possible to notice terms that belong to more than one topic, connecting them: topic1 and topic4 are linked by the term "ragazze" (girls); topic2 and topic1 are linked by the terms "stato" (country); topic1 and topic3 by the word "molestie" (harassment); topic3 and topic5 are linked by the term "vittime" (victims). In Tab. 1 there are the closeness centrality values for this hub terms.

## 4 Future works

This paper represents a work in progress, In the future we will extend the functionality of the application by implementation of machine learning tools that will intercept statements containing hate speech and can made a semantic map of it. The work presents this possible further development:

- Deep learning algorithm to report hate speech contents
- Control measure about the correct content identification



**Figure 6** Words and topics networks

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