ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ "СВ. КЛИМЕНТ ОХРИДСКИ" ФАКУЛТЕТ ПО МАТЕМАТИКА И ИНФОРМАТИКА

Tom 111

ANNUAL OF SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI" FACULTY OF MATHEMATICS AND INFORMATICS

Volume 111

SOCIAL MEDIA DATA MINING FOR EXPLORING READERS' LITERARY INTERESTS

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Digital humanities have become a booming field of study thanks to the application of computer and information science methods to the humanities and the accumulation of large-scale digital resources. The use of data mining techniques and quantitative methods is expanding and starting to dominate the domain of literary studies, focusing not only on the study of the text itself but also on the study of social influences and preferences of the readers. By analysing social network data from VK, the most popular Russian platform, the study investigates which authors and literary works resonate most with users. To analyse the quotations, we created a framework which combines tools for extracting and cleaning data, named entity recognition and finally, corpus analysis; this framework can be applied to other datasets to compare and expand our findings. We also noted that within the information behaviour research domain, such studies of sharing among communities are not yet very popular. The study showcases the importance of employing advanced computational tools in humanities research. The obtained quantitative results are subjected to a critical analysis, which can serve as a basis for humanitarian understanding based on data. The compelling findings of this pilot study confirm opportunities for further research using more advanced quantitative methodologies, as well as broadening the scope of criteria that potentially influence the formation of reading preferences, such as level of education, pop-culture trends, social environment, etc. Additionally, it sheds light on the underexplored domain of community building in social media networks, calling for broader research into information behaviour and online community dynamics.

Keywords: text analysis, data mining, quantitative analysis, digital humanities, literary studies

 $\textbf{2020 Mathematics Subject Classification:} \ 91D30$

CCS Concepts:

• Information systems~Information systems applications~Data mining~Clustering

1. Introduction

The synergy of sciences and humanities enlarged over the last decades within the new field of "digital humanities", which initially started as "humanities computing". Digital humanities are combining methodologies from humanities and the sciences, opening up new possibilities for data mining, analysis, and visualization of large-scale primary and secondary data. As Kathleen Fitzpatrick, a Director of Digital Humanities and Professor of English at Michigan State University argued, digital humanities could be understood as "a nexus of fields within which scholars use computing technologies to investigate the kinds of questions that are traditional to the humanities, or, as is more true of my own work, ask traditional kinds of humanities-oriented questions about computing technologies" [4].

Data mining quickly became popular within the field of digital humanities due to several key factors. On the one hand, the digital age has created an unprecedented volume of data in various forms and sources. This deluge of unstructured but content-rich data requires advanced techniques such as data mining to make sense of it and extract meaningful insights. In parallel, advances in computer hardware and processing capabilities have enabled more efficient handling and analysis of massive data sets, thus making it possible to apply data mining techniques to digital humanities research. Sifting through this wealth of data through advanced knowledge-mining techniques has created opportunities to uncover hidden patterns and gain new perspectives on historical and cultural phenomena [12]. The advances in natural language processing (NLP) became particularly important alongside machine learning techniques that have made it possible to analyse and interpret textual data at scale, expanding the scope and depth of digital humanities research on textual sources. It can be argued that the interdisciplinary efforts of computer scientists, data analysts, and humanities researchers are critical to the rapid adoption of data mining in the digital humanities. They also contribute to the growing recognition of the value of data-driven insights for understanding and preserving human cultural and historical heritage.

An important branch in this regard is data mining from the vast amount of data generated on social media platforms. The process involves using specialised algorithms and techniques to sift through user-generated content, interactions, and behaviour on platforms, such as Facebook, Twitter, Instagram, etc., and extracting hidden patterns and insights employed for market research, sentiment analysis, trend identification, and personalised content recommendations. As such, social media data mining is an extremely valuable tool for analysis.

Within our study, we focus on the intersection between data mining, literary studies, and social media research. Literary studies are not limited to close reading and comprehension of a literary text. Literature as a cultural artefact is surrounded by a much larger range of research issues from the positions of various social and humanitarian sciences. For instance, the sociology of literature deals with the issues of the social influence of literature, and the philosophy of literature focuses on the ontological, epistemological, axiological, and ethical properties of literature. From

the second half of the 19th century, literary studies began to interact closely with the sciences, and mathematics in particular. Researchers began to use quantitative methods to determine the frequency of words to attribute authorship to anonymous or disputed texts. Since then, the possibilities of quantitative methods have become wider, and they have more and more supporters. Nowadays, the application of quantitative methods is expanding and conquering literary studies, focusing not only on the study of the text but also on the study of social, philosophical, and other aspects of literature.

Our study focuses on a combination of the following research questions:

- RQ1. Is the geographic coverage of a social media community consistent with a preference for authors from the same geographic region?
- RQ2. Can we assume that posts containing poems will be the most popular among quotations from different literary genres? (we can assume poetry will be popular due to the ease of remembering poetry quotations and the popularity of the genre).

The first research questions are related to literary studies. The intention of exploring these questions is to investigate to what extent social media data can provide insights into literary perceptions and preferences. Applying the data collection and analysis methods while seeking the answers to these questions is also aimed at answering the following questions:

- RQ3. Can a common framework for analysing social media data be developed to support various literary studies?
- RQ4. Can this type of analysis be supported with data from other types of studies?

We have done a pilot study of the trends of readers' interests based on analysis of posts on social networks, which was presented and defended as the final project on the course "Cultural Data Mining" within the master's program in Digital Humanities at ITMO University in the 2023 year.

Within the study, we analysed social media data containing literary quotations by world-famous authors. This analysis allows us to determine which of the authors are most popular among the audience of the social network, as well as which of their works are most popular among the readers. We have chosen VK for our research, which is the most popular social media platform in Russia, according to Statista [11]. VK has multiple public pages, including numerous pages dedicated to literature. One of the most popular types of content within the literature pages on the social network is quotations from a literary text, usually mentioning the author and the title of the text. These quotations can be extracted into data sets which are unique in capturing trends in the readers' preferences.

The article is organised as follows. Section 2 provides a brief overview of recent relevant work. Section 3 presents the methodology of the study. Section 4 presents the dataset extraction and preprocessing steps. Section 5 shows the achieved results

of statistical analysis based on social network data and text analysis of the quotations. Finally, Section 6 offers some conclusions and discusses potential further research.

2. Related work

Social media can play multiple functions. Aichner et al. reviewed the definitions of social media in their 25 years of existence, exploring some 60,000 articles including definitions of social media [1]. While there is no agreement on the actual definition of social media, the various roles they play are summarised and include socialising with friends and family, romance and flirting, job seeking, interacting with companies and brands, and doing business. We can argue that today's social media grew as place for identity building (be it of users, especially influencers, brands, institutions or communities), for marketing and promotion, for finding new contacts and growing communities, and for keeping in touch. In the last years, particularly extensive research has explored a negative side of social media, the spread of disinformation and misinformation.

Within this article, our main interest is in the community function of social media combined with the identity-building one, especially in relation to communities which bring together users interested in literature who frequently share quotations from literature works.

Surprisingly, there is very little research on the information behaviour of communities with a literary interest. For example, Vlieghe et al. [15] explored in 2016 the reader engagement in social media environments. They proposed the following classification of the type of engagement: a place to share reading experiences, a place to meet enthusiasts, a place to create identity, a place to acknowledge and encourage participation. They also introduced the concept of "affinity spaces to develop an understanding of how readers engage in a variety of literary practices in social media environments that focus on literature and reading". Their study used the ethnographic method combined with interviews of a number of people engaged in the social media explored.

Mas-Baeda et al. [9] studied the social media posts of Spanish publishers on Twitter (the article precedes the rebranding of the platform as X). This research does not focus on community building but rather explores the marketing use of social media by book publishers.

There are a number of studies which explored social media use for specific domains and groups of users outside of our domain of focus but may be of interest as a methodological approach and for comparison of issues within other communities. For example, Bocala-Wiedemann [2] explored the target group of young adults within the context of evangelistic social media content and identified the most effective platforms, namely Instagram, TikTok, and YouTube (2022). Vanherle et al. [13] explored an interesting aspect of social media – how information shared in a particular group may answer specific needs or topics (e.g., adolescents sharing alcohol references).

A more in-depth study of quoting practices in social media related to journalists' use has been offered in [7]. Studies focusing on specific professional use of social media are helpful and there is a clear need for similar studies of other groups.

It is also worth noting, that while sharing and community building on social media are still being researched, a recent publication argues that this role of social media is fading away. John [8] analysed the home pages of 61 social networking sites in the decade 2011 and 2020, and argues that "'sharing' has lost its central place in the terminology employed by social media platforms in their self-presentation".

In conclusion, we see a growing number of research publications reporting on the behaviour of specific communities on social media. However, in relation to literature, the studies are limited. There is interest in the publishers' use of social media and some studies of specific communities based on ethnographic and survey methods. Generally, quoting practices on social media have not yet been studied in depth, and our study aims to bring additional evidence to the scholarly discourse.

3. Methodology

Within our study, we used quantitative methodologies and natural language processing techniques [6] on datasets obtained from specialised VK social media pages. Our approach adhered to the seminal framework elucidated by Fayyad et al. [3] during the nascent stages of knowledge discovery.

As a starting point of our research, we put forward two hypotheses that we will test in this study. First, we assume that native readers will prefer native authors who describe the culture most understandable to readers. Secondly, we assume that posts containing poems will be the most popular since the preparation of such content requires less effort from administrators of niche pages in the social network.

It is worth noting that our research does not set itself the task of making any conclusions on the most popular authors in Russia. We pursued the following goals:

- To determine whose texts of world literature authors are most often quoted by niche pages, as well as which of them are gaining more reactions from users;
- To term the topics of the most quoted texts;
- To detect tendencies in acquired data using statistical analysis.

Before starting the study, we had to scope the best sources of data. After a manual analysis of content across different social media, we decided to use VK and identified three groups which discuss literature-related topics. We are aware that there are potentially multiple sources for such content also on other social media, but our aim was to provide a proof of concept on the viability of our methodology rather than produce a comprehensive analysis of all relevant social media content.

At first, data was collected from the niche pages in social media using VK API (Application Programming Interface): the Implicit Flow method was applied to obtain the user's access key, after which the wall.get method was applied to parse data from niche pages. Although the VK API is open, it has limitations, in particular

in the amount of data available for uploading, but we managed to resolve this with the help of cyclic code.

Then, the named-entity recognition was made using Natasha¹ (a Python library for the Russian language) and the data was cleaned from irrelevant names. The data was cleaned up, primarily because we used the Natasha library to upload all proper names, and some of these names did not belong to the authors, but to characters. Such data needed additional manual processing.

We detected the most mentioned and shared literary authors. Moreover, we determined the topics of the literary texts and quotations from which users shared. To do this, we used Voyant Tools², having previously excluded prepositions, conjunctions, pronouns, interjections, and other noise from the textual data.

Finally, we have come to conclusions about the importance of world literature for Russian-native readers.

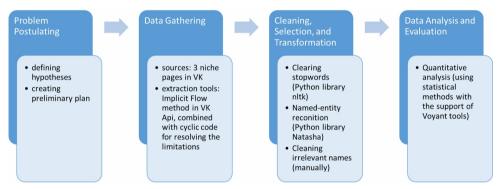


Figure 1. The process framework

4. Data sets and preprocessing

We decided to look for sources among niche pages in VK due to its open VK API [14]. When choosing sources, we preferred popular niche pages with the most subscribers, also meeting the following criteria:

- Published quotations are accompanied, at least, by a mention of the author (at most, by a mention of a precedent text);
- The content is published primarily in text format (we did not choose niche pages that published quotations exclusively as images, because it would require the use of other methods).

Finally, as a source of data, we have used the following resources:

¹GitHub – natasha/natasha: Solves basic Russian NLP tasks, API for lower level Natasha projects, https://github.com/natasha/natasha

²Voyant Tools, https://voyant-tools.org/.

- "Стихи давно забытого поэта" (Poems of a long-forgotten poet, https://vk.com/memorypoets)
- "Литература" (Literature, https://vk.com/litratre)
- "Сочная литература" (Juicy literature, https://vk.com/juicylit)

It is worth noting that even though the name of the first source hints at exclusively poetic content, it contains a large number of quotations from prose texts, therefore it is relevant to our research goals.

VK API has technical limitations and makes it possible to collect only the last 100 posts. However, we created a code loop that allowed us to parse 10,000 posts from the first two resources and 1000 posts from the third resource (because this resource is smaller than the others) by the following categories: text, likes, comments, reposts.

From the textual data were recognized names of literary authors. The final data sets included authors mentioned more than once and were not subscribers of the source (who published their texts in the group on the rights of advertising).

5. Data analysis results

We performed two types of quantitative analyses on the already pre-processed data set, aiming to interpret the obtained results from the point of view of the historical events in the creation of the works and the present. The first is aimed at highlighting the most frequently cited authors, and the second one analyses which passages from which works are most often the object of interest on the part of the virtual community.

5.1. Analysis of data extracted from the social media posts

According to the data we have collected, the most frequently mentioned author, that is, the most cited on niche pages, is Erich Maria Remarque, the Germanborn writer -323 posts are dedicated to him. Thus, both our hypotheses, are not supported by the data evidence.

Nevertheless, the second and third most popular authors in terms of the number of posts with quotations from their texts are just Russian poets: 243 posts contain full text or fragments from poems by Sergei Esenin, the Russian lyric poet, and 239 posts – from poems by Joseph Brodsky, the Russian-American poet. The most published poem by Sergei Esenin is "Tips of blue flame are dancing about . . .": it was posted 14 times. Brodsky's poems do not fundamentally differ in the frequency of publications, which is somewhat astonishing since the legendary poem "Don't leave the room, don't make a mistake" has already found a focal embodiment in memes and has become an independent cultural artefact.

Furthermore, as a result of the data analysis, we found a quotation that is mistakenly attributed to Brodsky, as is commonly believed: "When you are tired of endless introspection, call me. Let's dance." According to an alternative opinion, it belongs to a certain poetess Henrietta Lardan, but there is no reliable evidence of this. However, this is the most reposted line, signed in social media with Brodsky's name: 817 people shared this post.

Other significant authors in terms of the number of mentions are Marina Tsvetaeva, one of the most influential Russian women poets (153 quotations in posts), along with Anna Akhmatova (85 quotations in posts).

All the Russian authors mentioned at the moment worked in the 20th century and belong to the Silver Age of Russian Poetry.

Turning to the prose writers, Mikhail Bulgakov is the most mentioned, and the most cited novel is "The Master and Margarita": among 101 quotations from Bulgakov's texts, 71 are quotations from this novel.

Returning to the conversation about Remarque, we have analysed the most cited novels. According to the data, we can distinguish two of the most frequently cited: "Arch of Triumph" and "Three Comrades", 70 and 66 citations, respectively (Figure 2).

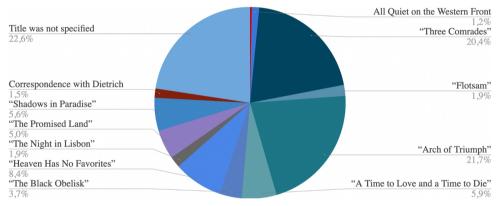


Figure 2. Relation of quotations from Remarque's texts in sources

Although Remarque is one of the main representatives of the Lost Generation and is known because of their texts about broken people in war and interwar periods, he won over many readers with his language of love. Therefore, "Arch of Triumph" is perceived by many not as a story about the broken destinies of people familiar with the war, but as a tragic love story. This explains why the most shared quotation is from his correspondence with Marlene Dietrich: 704 people shared this.

Such attention of Russian-native readers to German literature strengthens the position of German literature. In addition, we have seen increased attention to the military and emigrant texts of the Remark in recent years, this can be interpreted through the current political situation in which average citizens, like the characters of Remarque's novels, find themselves in the epicentre of a historical catastrophe.

Similarly to the popularity of poets, both Erich Maria Remarque and Mikhail Bulgakov also worked in the 20th century (Figure 3).

 ${\it Table \ 1}$ Statistical data on the most shared quotations of the most mentioned literary authors

		Statistics of quotations		
Quoted text	Author	in social media		
		Likes	Comments	Reposts
Correspondence with Marlene	Erich Maria Remarque	1492	10	704
Dietrich				
"The Master and Margarita"	Mikhail Bulgakov	3186	13	550
Unknown	Attributed to Joseph Brodsky	4443	11	817
"Tips of blue flame are dancing	Sergei Esenin	3470	43	1029
about"				
"Please take care of me!" (has	Marina Tsvetaeva	543	11	307
not been translated into En-				
glish)				
"Hands clasped, under the dark	Anna Akhmatova	1543	9	366
veil"				

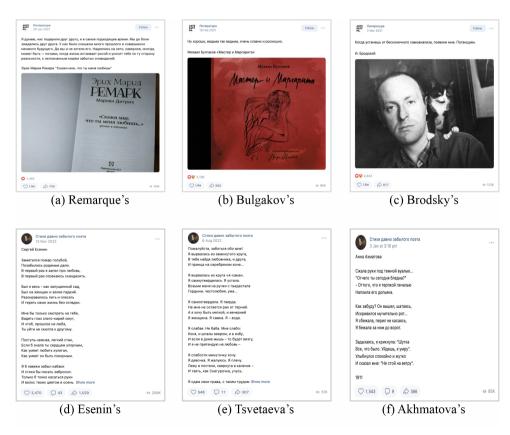


Figure 3. The most shared quotations of the most mentioned literary authors

5.2. Text Analysis of Literary Quotations

To study the topics that primarily concern readers, we researched the texts that they cite.

We have analysed the text of quotations using Voyant Tools to term the topics of the most quoted texts. At this stage of the research, we analyse the texts of quotations from prose texts, but not poetic ones, because poetic texts contain a large number of metaphors that are not interpreted literally and require knowledge of the content to understand them.

We loaded the corpus with 5687 total words after cleaning data from prepositions, conjunctions, pronouns, interjections, proper names, and the same words that do not reflect the topic of the precedent text.

The word "love" (nno6006) and its derivatives have a prominent appearance. In many of Remarque's texts, indeed, there is a love story. However, the most frequent words in the corpus emphasise the cross-cutting theme of all of Remarque's novels: the place of people broken by war in the world. The main figures for his characters are close social ties with friends and lovers. Thus, the word "friend" (∂pyz) appears 22 times, and the word "human" (venoek) – 17 times. These are some of the most common words (Figure 4).



Figure 4. Relation of quotations from Remarque's texts in sources



Figure 5. Relation of quotations from Bulgakov's "The Master and Margarita"

As we have already found out, among most novels of Remarque, there are novels included in the so-called emigrant pentalogy: "Flotsam", "Arch of Triumph", "The Night in Lisbon", "Shadows in Paradise", and "The Promised Land". As A. S. Porshneva, a researcher of Remarque's work, notes, "... in all these works, from the point of view of one or more emigrant heroes, a special world is being built – the world of emigration" [7]. The highest frequency of use of the words "friend" and "human" illustrates this thesis.

They are second only to the word "nothing" (nurveco), which occurs 26 times, and pessimistically, but realistically predicts the most likely fate of the heroes, in which there will be nothing bright. By the way, we notice the same situation with the text of quotations from the novel "The Master and Margarita": the word "nothing"

(*nuvero*) appears ten times, and the most appeared word is "never" ($nukor\partial a$) – it is occurring 20 times and in combination with the word "nothing" increases the hopelessness of the main Bulgakov's characters (Figure 5).

LIMITATIONS OF THE STUDY

Our study should be considered as an initial experiment which confirms the viability of research questions and introduces a framework which can be reused in subsequent studies. Here we would like to summarise some limitations:

- As with all studies using datasets, we extracted data from specific social media and selected groups matching our subject domain. Literary quotations are appearing less frequently in other social media content.
- We used one social media VK. Any such study can be expanded to include content from different social media.
- We used several tools without making any attempts to improve their quality –
 this meant adding some time for checking the outcomes at each stage and
 correcting manually any potential mistakes.
- We also have not analysed quotations which appear on images this is a
 very popular behaviour of social media users (and also some share videos with
 multiple quotations from the same author). These media can be analysed in a
 subsequent study using additional tools to extract texts from images/videos.

As a summary, our RQ1 and RQ2 are not confirmed by the evidence. However, we showed that the work with data from social media provides valuable insights thereby strengthening our understanding of the importance of literature in today's society. We have also provided a framework (see Figure 1) that can be adopted in other similar studies. Our last research question, RQ4, requires further exploration. Research has established channels to analyse the visibility of publications and there are specialised services around this (e.g. Altmetrics). Sharing literary quotations on social media requires further study as a form of information behaviour. It can be compared to the sharing of images of art but there are a limited number of in-depth studies on this topic, and even less on sharing poetic quotations.

On the other hand, the general tendency to share quotations is widespread and often results in spreading disinformation on the author's attribution of particular quotations. This aspect also requires further investigation.

6. Conclusions and next steps

In our study, we explored the nature of sharing literary quotations in the most popular Russian social media and arrived at the following conclusions.

Firstly, contrary to our hypothesis that Russian-native readers will prefer Russian-native authors, the most cited author turned out to be Erich Maria Remarque, the German-born writer of the Lost Generation.

Secondly, we also did not confirm the hypothesis that posts containing poems are the most popular. Nevertheless, they turn out to be the next few lines in the conditional rating according to the frequency of citation after Remarque.

The quantitative analysis showed that Russian readers prefer the poetry of the 20th century and representatives of a variety of literary trends: imagism (Sergei Esenin), acmeism (Anna Akhmatova), as well as poets who do not belong to any poetic school (Marina Tsvetaeva, Joseph Brodsky). In addition, we can see the importance of the work of Russian women poets for contemporary readers. Besides, we found a quotation of disputed authorship, which some people attribute to Joseph Brodsky.

We can draw some conclusions based on these results. The study suggests that an important place on the shelf of contemporary readers is occupied by texts, on the one hand, telling a tragic love story, and on the other hand, telling the difficult fate of a man of war. This is evidenced by several coincidences in the most frequent words used in such dissimilar novels as "The Master and Margarita" by Mikhail Bulgakov, the Russian writer, and Remarque's novels.

The compelling findings from this modest study not only affirm our commitment to further exploration but also inspire us to forge ahead, employing not just the same but even more cutting-edge quantitative methodologies in the future. The discoveries detected in the course of this study can serve as a basis for fundamental humanitarian research, in particular in the field of comparative literature. Finally, this study can be the basis for continuing the study of reading preferences using other quantitative and qualitative interdisciplinary methods and cover broader criteria that potentially affect the formation of reading preferences, such as the level of education, popcultural trends, social environment, and others.

In the general setting of information behaviour studies, we noted that community building within social media networks has not been extensively studied. We hope that this domain will attract some more attention and plan to expand our studies to other social media platforms and countries.

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Received on March 25, 2024 Revised on April 28, 2024 Accepted on May 10, 2024

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