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Digital Humanities and Big Data

Tado Jurić*

Big (Crisis) Data in Refugee and Migration Studies – Case Study of Ukrainian Refugees

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Abstract: This paper presents a review of Big Data sources that could be helpful in determining, estimating, and forecasting the forced emigration flows of refugees from Ukraine. The text shows how a Big Data approach can help assess refugees' intentions. Using insights from social-media platforms such as Facebook, Instagram, and YouTube is useful, because data here are available faster than any official data in the refugee crisis triggered by the Russian attack on Ukraine on 24 February 2022.

Keywords: digital humanities, big data, Ukraine, refugees

Big (Crisis) Data: An Opportunity for Refugee and Forced Migration Studies

As shown many times over the recent past (e.g. UNHCR Global Trends 2016), the current refugee crisis of Ukrainians shows that reliable data about the flows of people and their intentions would assist the United Nations High Commissioner for Refugees (UNHCR) and governments in projecting such emergencies and creating the best possible conditions for those in need (Jurić 2022c). However, such data are unavailable when the crisis is ongoing, or at any rate available in a more systematic manner only with a considerable time lag. Traditional data sources, based either on surveys or registers, generally fail in quickly providing statistical information on refugee flows and do not facilitate short-term anticipation of these flows (Wladyka 2017). This essay demonstrates how

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new methods based on alternative sources, so-called Big Data, could help (c.f. Jurić 2022a).¹

In 2014, the United Nations (UN) conducted the first research on the use of Big Data for demographic research, with its report released in 2018. Since the UN confirmed the relevance of these data, demographic research has been carried out on social networks (Zagheni et al. 2017; Zagheni and Weber 2015), and several studies have used Big-Data sources to analyse migration-related phenomena directly (e.g. Dubois et al. 2018; Hawelka et al. 2014; State et al. 2014). The first successful analysis of this type in the field of migration was undertaken during the 2015 migration crisis. This study showed that digital prints left by internet searches could provide insight into the movement of migrants (Connor 2017): during their travels, many migrants used smartphones that provided access to information and maps (c.f. Jurić 2022b). As I will show, the analytical tool Google Trends (GT) can give valuable complementary data in migration and refugee studies and be useful in the current Ukrainian refugee crisis.

Although Facebook (FB), Instagram, and YouTube are the most used social platforms (Statista 2022), very few studies have been undertaken about their potential for migration studies and integration insights (c.f. Jurić 2022c; UNHCR Global Data Service 2021). I will show that there are several approaches to using insights obtained from digital traces left on social networks, in order to identify and model migration flows and, later, the integration of immigrants, in this case, refugees who did not leave their homes voluntarily.

FB and Instagram can provide insights into geolocation and particular interests of the observed population, based on many signals such as “likes”, pages visited and specific cultural interests, while insights from YouTube can be obtained by analysing keyword searches (Jurić 2022b). If one seeks with these tools, for example, to measure integration willingness, i.e. receive hints about whether refugees have any intention to stay, indicators that address issues of education, employment, and language (learning) are included.

When it comes to Ukrainian emigrants, the advantage of FB and Instagram over YouTube is that they provide more precise sociodemographic data. On the other hand, the advantage of YouTube is that it better reveals user intentions. Compared to data from *Meta*, the advantage of YouTube is that limitations related to penetration rates and double fake accounts are not prevalent (Jurić 2022b). The

¹ The pre-print version of the here presented analysis, Jurić, T. 2022. Predicting Refugee Flows from Ukraine with an Approach to Big (Crisis) Data: a New Opportunity for Refugee and Humanitarian Studies; and Jurić, T. 2022. Ukrainian Refugee Integration and Flows Analysis with an Approach of Big Data: Social Media Insights, were published on 16 March 2022 and 18 April 2022 on the pre-print server Medrxiv, <https://doi.org/10.1101/2022.03.15.22272428>; and <https://doi.org/10.1101/2022.04.18.22273958>.

control mechanism for testing this sort of data was performed by comparing those insights with the official databases from UNHCR and national governments, which were available two months later.

Google Trends

Searching for queries from Ukraine in Ukrainian, Russian, and English in Google Trends shows that “border crossing”, “кордону” (Ukr. border), “граница” (Rus. border) from 7 December 2021 to 3 March 2022 (Figure 1), that is a few days into the outbreak of the war, show an upward trend.

The fastest-growing Google search terms in Ukraine (7 December 2021 to 7 March 2022), except the mentioned term “border”, are “Western Union”, “asylum”, “refugee”, and “Schengen”. When looking at the interest in refugee destination countries, the internet traces correspond to the official data of the UNHCR. Namely, GT, just like the UNHCR, shows that the interest is focused primarily on Poland, Hungary, Slovakia, and Germany (Figure 2).

The basic hypothesis of my studies is that a third of refugees from Ukraine are planning to emigrate further to Germany after arriving in an adjacent EU country (and Moldova). The data received with the GT application show a high increase in interest in Germany, but also a set of inquiries related to the “German way of life”, jobs opportunities, children’s enrolment in schools, and other markers that indicate the expectation, or intention, of refugees to stay longer in Germany (Figure 3).

Further confirmation of this hypothesis is the increase in specific searches that seem to reveal the intention to move or flee to Germany. One of the most common searches is focused on the question “Германия принимает беженцев из Украины” (Does Germany accept refugees from Ukraine?). This specific search



Figure 1: Search queries in English, Ukrainian, Russian, and German from Ukraine: “border crossing”, “кордону” (Ukr. border), “граница” (Rus. border), “Grenze” (Germ. border) (7 December 2021 – 3 March 2022).

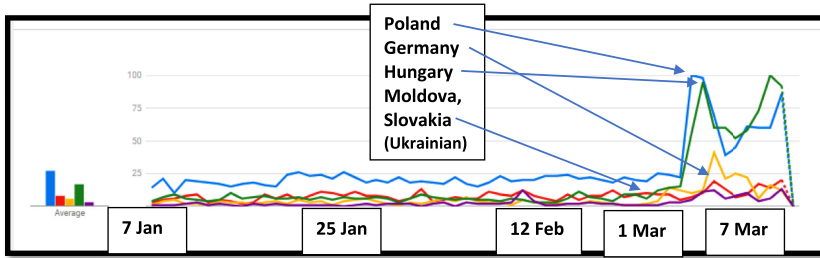


Figure 2: Search queries in Ukrainian from Ukraine “Польща”, “Німеччина”, “Угорщина”, “Молдова”, “Словаччина” (Poland, Germany, Hungary, Moldova, Slovakia) (7 January 2021 – 3 March 2022).

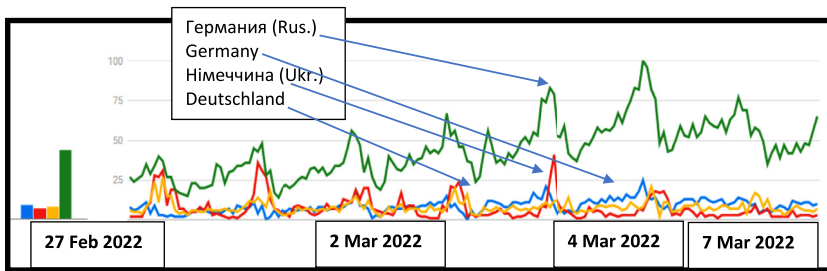


Figure 3: Interest in the search term “Germany” in Ukraine in English, German, Russian, and Ukrainian since the outbreak of war (27 February – 7 March 2022).

also correlates with the regions most affected by the war, such as Donetsk, Luhansk, Kharkiv, Odessa, and Kyiv (Figure 4).

As time goes on, refugees had to realise that the war and its consequences will last much longer than initially hoped. When people notice this, their interest shifts even more towards countries that offer high economic and financial security. The most frequent search in Poland since the outbreak of the war is “Border crossing + Germany” (Figure 5). The search in Poland for terms related to crossing the border into Germany has increased precisely in the regions located near Ukraine.

If half of the affected population flee, as the Crimean population did when Russia occupied the peninsula in 2014, there would be 12 million Ukrainian refugees. That this number could be correct is demonstrated by comparing the search query “Германия принимает беженцев из Украины” (Does Germany accept refugees from Ukraine) during the annexation of Crimea in 2014 with the current crisis. During the peak of the Crimean crisis in 2014, the search index for this query

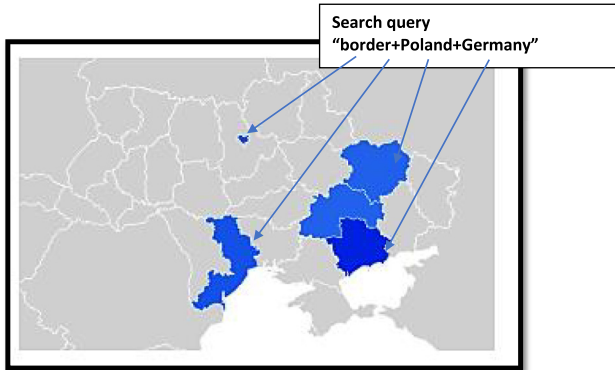


Figure 4: Correlation of Google search “border+Poland” with the regions in Ukraine most affected by the war, such as Donetsk, Lugansk, Kharkiv, Odessa, and Kyiv (6 March 2022).

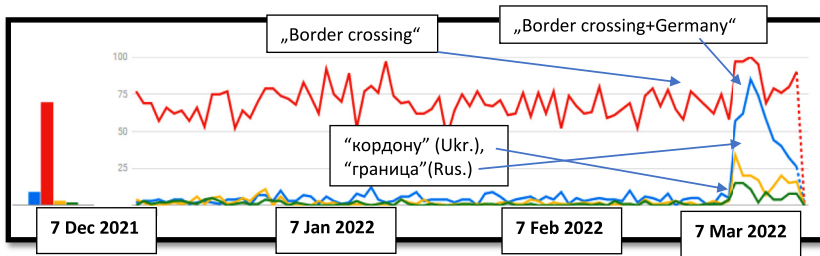


Figure 5: A common Internet search in Poland: “Border crossing + Germany”, “border crossing”, “кордону” (Ukr. border), “граница” (Russ. border) (7 December 2021 – 7 March 2022).

was 4, and in 2022 it is 12, which means that the interest in fleeing the country now seems to be three times higher.

I also tested several search keywords in Germany, such as “Ukrainian–German translator” and “English–Ukrainian translator”. Since 13 March 2022, all queries show a rapid increase compared to a month earlier: “точний перекладач з української на німецьку” (+250%), “перекладач з англійської на українську” (+190%), “українсько–німецький перекладач” (+150%) (Figure 6).

In further proceedings to standardise the data, I requested the data from 1 February to 11 March 2022, divided the keyword frequency for the most searched terms “граница” and “кордону” (border), and compared this search index with official statistics from the UNHCR (2022), which were available one to two months later, to prove the significance of my results.



Figure 6: Queries “перекладач” (Ukr. translator) and “переводчик” (Rus. translator) in Germany (from 23 December 2021 – 13 March 2022).

The increase in Google search for the query “кордону” (border) in Ukrainian correlates with the rise of externally displaced persons from Ukraine to Poland (24 February – 11 March 2022). R^2 is 0.1831 and shows a positive correlation. All tested migration-related search queries (20) that indicate emigration planning show a positive linear association between the Google index and data from official statistics, UNHCR; $R^2 = 0.1211$ for queries in Russian and $R^2 = 0.1831$ for queries in Ukrainian. The p-value is statistically significant. The increase in Google search is correlated with the rise in the number of refugees in the EU (Figure 7).

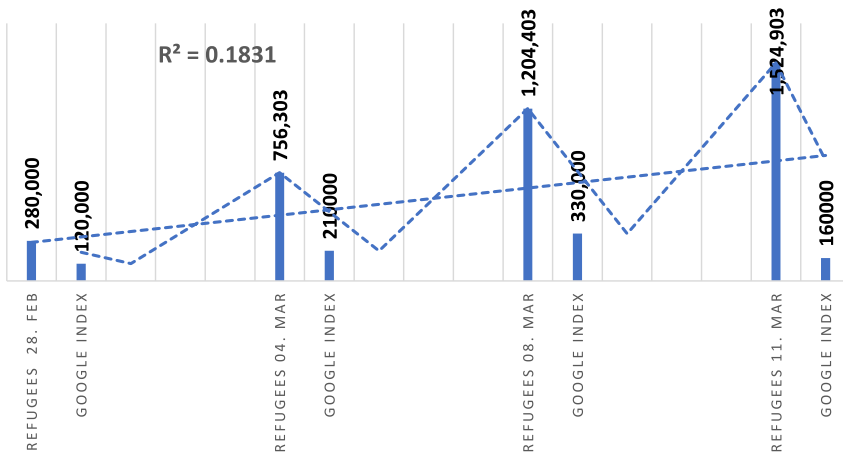


Figure 7: Correlation between Google search index for query “кордону” (border) in Ukrainian and the UNHCR statistics for externally displaced persons from Ukraine to Poland (24 February – 11 March 2022).

In contrast, the subsequent decrease of relevant queries in Google search mirrors the decrease in externally displaced persons. For example, if at the end of May 2022 the Google index is 10,000 (meaning that 1.5 million refugees came to the EU), if the Google index is 5000 at the end of September, it is forecasting that between 700,000 and 750,000 individuals will emigrate to the EU.

Social Media as a Source of Migration Data

Before I look at the results obtained on social networks, I briefly present the official UNHCR data (April 2022) to compare these two data sources as they were published by *Mediendienst Integration*, an information platform in Germany providing data for journalists on flight, migration, and discrimination. The UNHCR stated that on 1 April 2022 there were 2,405,703 Ukrainian refugees in Poland, 379,988 in Hungary, 292,309 in Slovakia, 390,187 in Moldova, 623,627 in Romania, and 737,000 in other Western European countries. Of the other, not directly neighbouring, countries, 310,000 arrived in Germany (Mediendienst Integration 2022).

My approach via social-media platforms shows that the number of FB and Instagram users increased rapidly in Poland, Slovakia, Hungary, Moldova, Romania, and Germany after the outbreak of war in Ukraine. In this first phase, FB and Instagram, on average, registered 17% to 20% of the refugee population in these countries. Below (Figure 8) are two examples of the apparent increase in the number of FB and Instagram platform users, which coincides with the trend of immigration of Ukrainian citizens into Poland and Germany due to forced migration.

Figure 9 shows that in 19 days the estimated users of FB and Instagram in Ukrainian in Poland increased by 67,000 users. It is to be noted that in the first period in which I monitored these data (from 1 March to 5 March), I noticed every day that the number of users of FB and Instagram in Ukrainian in Poland grew by

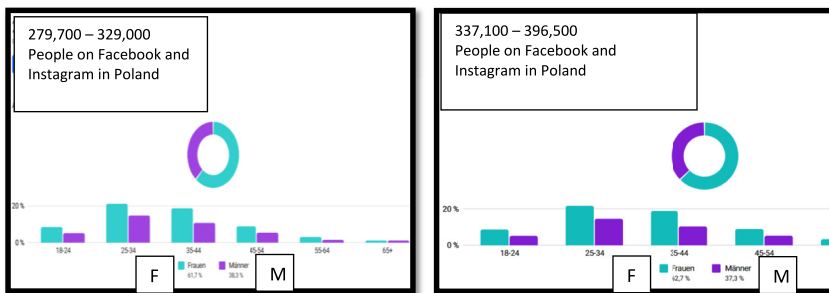


Figure 8: Facebook and Instagram users in Ukrainian (Ukrainian refugees) in Poland (13 March and 2 April 2022). Source: Meta Business Suite n.d.

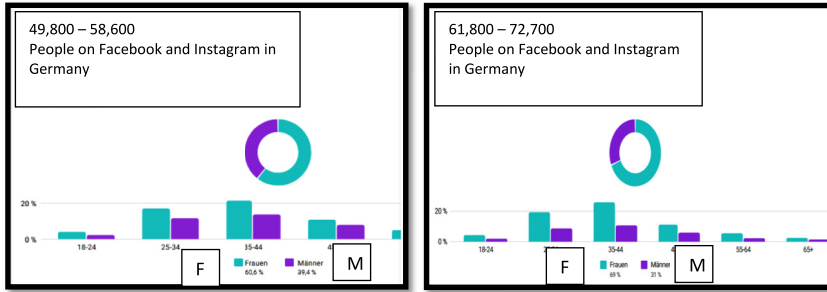


Figure 9: Facebook and Instagram users in Ukrainian (Ukrainian refugees) in Germany (13 March and 2 April 2022). Source: Meta.

7,000 to 10,000, while in Germany it grew by 1,000 to 2,000 new users daily. Later, this trend was confirmed.

These examples confirm that FB and Instagram correctly notice migration trends. The study from Mediendienst Integration (2022) shows that refugees in Germany mainly arrive in Berlin and Hamburg and are then distributed to other *Länder*. 42% stay in large cities—especially in Berlin (14%), Munich (5%), and Hamburg (3%) (BMI 2022). Table 1 shows that data obtained by FB and Instagram coincide with the first official data available from Germany. For other countries, in the absence of official indicators, I have compared the data from my Big-Data approach with that reported in the media, with the same results.

Table 1: Cities with the most Facebook and Instagram users in Ukrainian (Ukrainian Refugees) in Poland, Slovakia, Hungary, Moldova (and Transnistria), Romania, and Germany.

Year 2022	Poland	Slovakia	Hungary	Moldova	Romania	Germany
7 Mar – 2 Apr	Warsaw	Bratislava	Budapest	Chişinău	Bucharest	Berlin
	11.94%	25.62%	32.2%	25.58%	59.73%	8.51%
	Wrocław	Košice	Tatabánya	Tiraspol	Laşi	Munich
	5.31%	4.94%	2.48%	9.78%	8.93%	2.68%
	Łódź	Nitra	Jászberény	Bălţi	Braşov	Hamburg
	3.66%	3.84%	2.29%	5.98%	8.66%	2.59%
	Cracow	Prešov	Sárvár	Rîbniţa	Cluj-Napoca	Cologne
3.53%	2.56%	2.08%	3.74%	8.23%	2.03%	
Gdańsk	Trnava	Mosonmag-	Bender	Sighetu	Frankfurt	am Main
			1.96%	5.25%		

Note: Percentages indicate the increase in the number of users from 7 March to 2 April. Source: Meta Business Suite, data collected and systematised by the author.

The analysis of the age and sex of FB and Instagram users in Ukrainian (Ukrainian refugees) in Poland, Slovakia, Hungary, Moldova, Romania, and Germany (1 March – 2 April) shows that the users are most represented in the age group 25–44 and that there are almost twice as many women in this age group—which overlaps with the survey of the German Federal Ministry of the Interior and Homeland (BMI 2022). According to *Meta*, the share of women in the refugee population from Ukraine is 62.7% in Poland and 69% in Germany. Regarding the cities with the highest activity of Ukrainians in Germany and Poland, these findings again correspond to what official German statistics reported (BMI 2022)—most Ukrainians are in Berlin, Munich, and Hamburg. The FB and Instagram data by the *Länder* also correlate with the official German data. So, here too the data obtained using Big Data accurately recorded these trends two months before the first official study. In the following (Figure 10), I tested the correlation between the number of refugees from Ukraine in Poland and FB and Instagram users in Ukrainian in Poland. This tested correlation shows that the increase in the FB and Instagram index frequency is correlated with stepped-up emigration from Ukraine. R^2 is 0.1324 and shows a positive correlation, and the p-value is statistically significant.

The FB group analysis offers useful insights too. From analyses of FB group members of the Ukrainian diaspora in Germany, Poland, Hungary, the Czech Republic, and Croatia, those groups serve as an essential source of information for those who still plan to emigrate (in this case, flee). A rapid increase in members from 1 March to 14 April was noticeable. These FB groups allow efficient exchange

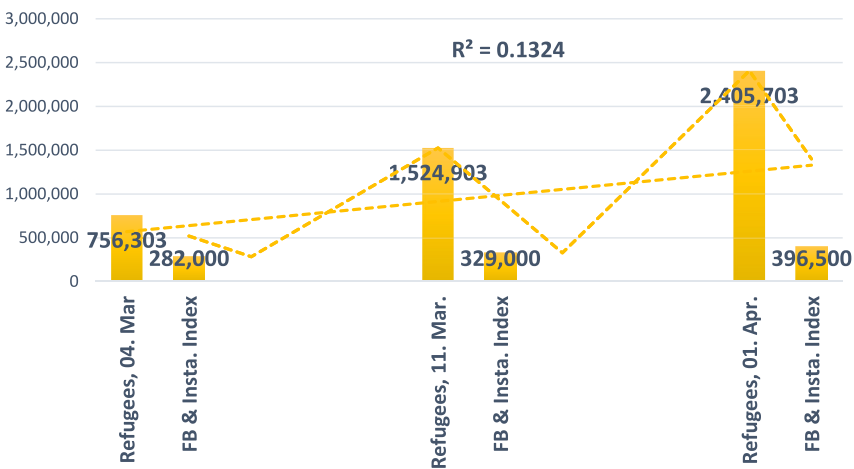


Figure 10: Correlation between Refugees from Ukraine in Poland and Facebook and Instagram users in Ukrainian in Poland (on 4 and 11 March and 1 April 2022).

of information with compatriots who have already emigrated, which can facilitate other refugees' intention to flee to a specific country. An analysis of the FB group *Українці в Німеччині* (Ukrainians in Germany) showed that most of the comments and life experiences of this FB group confirm that moving to Germany was a good decision for many members, which is a strong message to those who plan to flee to Germany.

Another way to use this data source is to analyse users' interests on their FB profiles, which can hint at willingness to integrate into the recipient society. For example, Ukrainians increasingly express interest in German language learning sites. I have shown elsewhere (Jurić 2022a) that a high degree of integration willingness is presumable when, regarding the interests expressed online, one of the first three places is occupied by pages where the German language can be learned. As another, simplified indication of such integration willingness of Ukrainians into German society, potentially linked to their intention to stay, can serve interests typical for German society, such as media, web portals, series, films, music, etc. Since it is far too early to collect reliable data of this type, monitoring interest of FB and Instagram users in the Ukrainian language about Germany and learning German are the best indicators about potential intentions to stay (cf. Jurić 2022c).

Although previous research has shown the feasibility of using Big Data for migration studies, many open methodological issues exist. The primary limitations regarding FB and Instagram data in this study are as follows: Those data are not representative—they depend on internet penetration rate in a specific group and do not include all age groups equally. For example, due to General Data Protection Regulation (GDPR) children are not included at all. A problem also lies in the possibility that users have multiple unlinked FB and Instagram accounts, leading to data distortion.

Many FB users are my target group but use FB, Instagram, and YouTube in Russian. Using the FB and the Instagram analytical tool is especially problematic because it provides data only for the current period, so it is necessary to monitor changes every day and keep your data archive. On the other hand, the advantage of this approach is that it allows obtaining data on vulnerable groups for crisis management without further traumatising respondents who are inherent in traditional interview methods.

The YouTube platform is, according to my analyses, another valuable source of migration data. When users search for relevant video material on the platform, their intention to migrate or, in this case, to flee from Ukraine, can be estimated. I assumed that informing themselves by watching videos on YouTube from Ukraine about Poland or Germany is an indicator of the intention to migrate, i.e. flee to these countries. Figure 11 shows the high increase in video searches related to Germany and Poland.

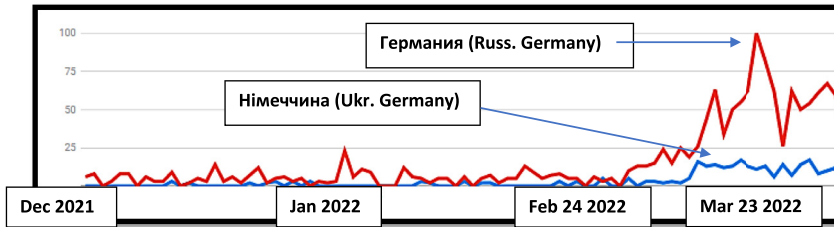


Figure 11: YouTube Searches in Ukrainian and Russian Related to Life in Germany in Poland (23 December 2021 – 23 March 2022).

It is to be noted that many Ukrainians’ first language is Russian. One among many explanations (Jurić 2022b, c) is that the citizens of Ukraine probably expect to find more information in Russian.

Figure 12 shows a rapid increase in video searching trends in Russian about Germany in Germany itself after the outbreak of the war in Ukraine, which is a clear indicator of new users, i.e. the refugees from Ukraine. Namely, no one else, or very few, would search in Russian or Ukrainian because it is logical that the requested materials are much more available in the German language.

Figure 13 shows that the YouTube searches with the query “Germany” in Ukrainian and Russian correlate with the regions where the most Ukrainian refugees came in Germany.

YouTube can also provide several clues when it comes to the everyday life of refugees. For example, Figure 14 shows an increased interest in learning German among Ukrainian refugees. An important limitation of YouTube data is that we do not know the exact number of searches, just the trends.

At the very end, this text mentions one more useful social network—Twitter—which with its conversation tracking option, enables monitoring of the increase in interactions and the growth of interest in topics related to migration. The basic idea is to use forcibly displaced people’s social-media activities as a tracking device for

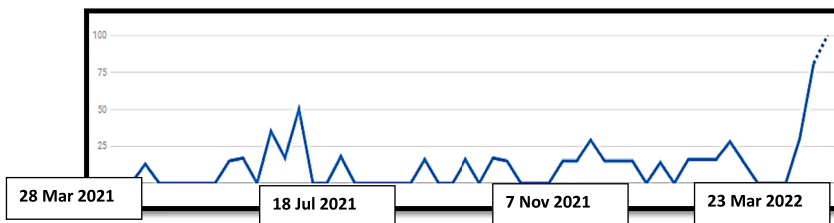


Figure 12: YouTube Searches in Russian “Германия” (Germany) in Germany (28 March 2021 – 23 March 2022).



Figure 13: Overlap of YouTube data and official data on the prevalence of Ukrainian refugees in Germany. Source: Google Trends. n.d. Note: darker red indicates a higher percentage of Ukrainian-language searches in Germany.

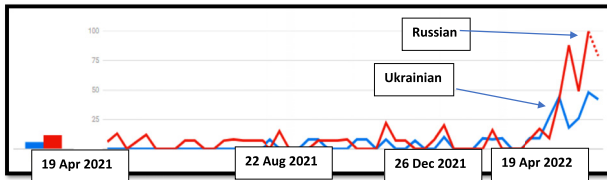


Figure 14: YouTube searches in Ukrainian “Вивчення німецької мови” and Russian “Изучение немецкого языка” (learning German) in Germany (April 2021 – April 2022).

their movements or new place of residence (Jurić 2022c). Tweets provide information on the location, nationality, birthplace, and the user’s language chosen when generating their account.

Conclusion

The method described in this paper shows that Google Trends and social networks (YouTube, Instagram, FB, and Twitter) capture valuable sociodemographic insights on Ukrainian refugees and that this data source is of great use in a situation where there is no official data yet. Thus, these data can help crisis managers. The usefulness and main advantage of this approach is the timely identification of

external migrations from Ukraine, which can be used, based on past time series, to model projections and make assumptions about future trends. This method showed that 27% more refugees were expected than the UN predicted in March 2022, and the modelling proved correct. The analysis of digital traces showed that refugees most often searched for the term “border”.

According to geolocations, the crosschecks of migration-related searches correspond to the official UNHCR data that were available two months later. Ukrainian refugees do not necessarily stay in the countries of first immigration, such as Poland for example, as almost one third continue their journey to Germany. According to the Big (Crisis) Data approach, by mid-2023 Germany can expect 1.5 million Ukrainian refugees.

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Bionote

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