COVID-19 UK Social Media Dataset for Public Health Research: Methodology for Collection and Processing

A Preprint

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Abstract

We present a benchmark database of public social media postings from the United Kingdom related to the Covid-19 pandemic for academic research purposes, along with some initial analysis, including a taxonomy of key themes organised by keyword. This release supports the findings of a research study funded by the Scottish Government Chief Scientist Office that aims to investigate social sentiment in order to understand the response to public health measures implemented during the pandemic.

Keywords COVID-19 · Social Media · Datasets · NLP

1 Introduction

The SARS-Cov-2 novel coronavirus popularly known as Covid-19 has provoked a worldwide response since its designation as a worldwide pandemic by the World Health Organisation in March 2020. As of November 2020, almost 45 million cases have been confirmed, with more than 1.1 million deaths reported [11]. While the majority of cases involve mild symptoms including cough, fever, diarrhoea and pain, some affected individuals can develop much more acute symptoms, such as pneumonia or kidney failure. Especially vulnerable groups including elderly patients and those suffering multiple co-morbidities have proven more susceptible to severe infection, and have presented a correspondingly higher risk of hospitalisation [2].

The virus has been transmitted between humans primarily through respiratory action, with recent studies predicting the rate of transmission between non-immune carriers at 3.77% [3]. Public health action has concentrated on reducing the spread of the virus through travel travel restrictions, temporary closure of businesses and schools, social distancing guidelines, and the implementation of test-and-trace systems. While there are a large number of ongoing studies into vaccines and drug therapies [4,5,6,7], no widely accessible prophylactic treatment is currently available.

Much current research has responded to the pandemic by urgently striving to understand and communicate aspects of the social impacts to the public as well as combating pervasive myths [8,9], a key role for researchers especially when the public is faced with urgent choices demanding good access to information and the tools to understand potential trade-offs between public health, security, and other social goals [10,11].

Public health measures designed to restrict the spread of the virus like social distancing—reducing physical contact between people [12,13]—have however led to negative social effects such as the closure of many workplaces [14], restrictions on personal mobility [15], and the closure of schools and universities [16,17]. Under these circumstances, a great deal of public discourse has moved to online social networks [18,19], presenting an excellent opportunity to gauge the mood of users.
We present a benchmark dataset drawn from online conversations in the United Kingdom about Covid-19-related topics on both the Twitter and Facebook social networks. It is our hope that open access to this data will spur further research into better informing and understanding public sentiment around the pandemic, as well as helping public health professionals to make informed decisions when implementing.

2 Related Work

A number of datasets extracted from social media activity around the Covid-19 pandemic have previously been published. Among those targeting a much wider geographic lens are Chen et al. [20], which adopts 22 keywords to filter worldwide Twitter messages via the streaming API, resulting in a large multi-lingual unlabelled dataset. Lamsal [21] used a similar approach, filtering with a list of 90 keywords and hashtags, as well as annotating the resultant dataset with sentiment markers. Dimitrov et al. [22] extended this approach by adopting a 268 keyword list through which they filtered the existing large-scale TweetsKB dataset [23].

In addition to this, multiple smaller datasets have been produced from Twitter encompassing linked niche topics within the broader ambit of Covid-19, including the effects of Hydroxychloroquine [24], and various sources of treatment misinformation [25]. Two sets that we found particularly of note that were not produced from Twitter are the Weibo-COV dataset [26], extracted from the social network Weibo, and the Instagram dataset compiled by Zarei et al. [27].

We note the current scholarship around the ethics of releasing the data of participants in social media research without direct consent, especially [28, 29, 30]. However, we conducted a thorough assessment of the privacy risk to individuals posed by our research, and along with complying with social network policies and the relevant sections of the General Data Protection Regulation (GDPR), we believe our research is in the legitimate public interest. We have not shared or published direct tweets or posts by individuals, quotes from individuals or names or locations of users who are not public organisations/entities. We have also striven to comply with best practices for user protection [31, 32], as well as ensuring that no non-public material is included in our dataset.

3 Methodology

3.1 Data collection

Our solution demanded that we implement a platform agnostic collection system capable of integrating with multiple data sources. In order to achieve this, our primary data store was determined to be a Google Cloud-hosted BigQuery database, into which we would load all records. We therefore designed our collection modules for individual platforms as independent parts of the architecture, capable of being flexibly swapped in and out as required.

When working with Twitter data, we designed a containerised streaming listener application that could be deployed quickly on any available host, which would connect to the network endpoint, establish a stream connection with a number of possible pre-selected filters, and consume and log incoming messages constantly. This application was connected to the endpoint on the 23rd of June at 09:38 GMT, and so the set contains messages from this point onwards.

In this study, we harvested messages within our defined regional boundaries, and defined our stream filter parameters to harvest all messages tagged with a geographical location within the United Kingdom. The Twitter 1.1 API specification in use at the time of development allowed the use of bounding box location filters only, and only returns Tweets that have been tagged with Place information derived from the ‘fine-grained location’ permission enabled by users.

Building on previous work [33, 34, 35], we determined the best solution in order to build a low-latency message queuing and ingestion system was via Google Cloud Pub/Sub, through which we sent the extracted post fields to a Cloud Function written in Python that cleaned and sequenced the data into our preferred format, before inserting it into a BigQuery database. Table 1 for details of the fields included in the imported data.

We gained access to Facebook data through the Crowdtangle platform, a Facebook-owned venture which allows access to public post and group data through both visual dashboard tools and an API. In order to harvest Covid-related material, we manually curated lists of important groups, pages and profiles through the web interface. These lists were sorted into both Scotland-only and UK-wide.

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1 Exact bounding box parameters [-6.034129, 49.875160, -0.344459, 61.340529]
2 See https://developer.twitter.com/en/docs/twitter-api/v1/tweets/filter-realtime/api-reference/post-statuses-filter
3 https://www.crowdtangle.com/
Table 1: Input data formats

| Platform | Field Name                                | Data Type   |
|----------|-------------------------------------------|-------------|
| Twitter  | Message ID                                | Integer     |
| Twitter  | Date Created                              | Datetime    |
| Twitter  | Message Text                              | String      |
| Twitter  | Location (nearest Place)                  | String      |
| Facebook | Crowdtangle Post ID                       | String      |
| Facebook | Created Date                              | Datetime    |
| Facebook | Message Text                              | String      |
| Facebook | Description Text                          | String      |
| Facebook | Engagement Stats (likes, reacts, etc.)    | Integer     |

A scheduled script was set up to connect to the API, retrieve all lists attached to the project dashboard, retrieve all posts made by lists members during the preceding 24 hours, then directly upload the results to the BigQuery database. Unfortunately, the lack of a streaming interface precludes near-real-time updates, but this frequency of updates was judged to be acceptable by the project team. Since Facebook posts were available for archive retrieval, we collected posts beginning from the 1st of January 2020 at 00:01 GMT.

### 3.2 Processing

Pre-processing for data was limited to the removal of line ending characters (\n and \r), as well as annotation with a theme ID determined by keyword frequency analysis, drawn from a pre-determined list of themes and keywords. Any messages that could not have a theme label applied to them were tagged with a valence marker that ensured they would not be entered for further analysis, and have not been published in the released dataset.

A set of priority COVID-19 themes and keywords, as displayed in Table 2, was developed in close consultation with public health policy domain experts, led by the Covidtracker project co-Lead, Prof Sheikh at Edinburgh University (member of the Scottish Government’s CMO COVID-19 Advisory Group), for potential integration into the Scottish Government framework for decision making[36]. The latter is a policy document setting out the key focus of public health and decision-making bodies when dealing with the pandemic. The COVID-19 themes were also updated in light of public engagement exercises conducted by the government in order to derive priority topics of greatest public interest[37].

A full list of the keywords used to filter for each theme can be found in Appendix A. Note: the themes have a zero-based index for reasons of implementation.

### 4 Features

#### 4.1 Publication and Hydration

In order to comply with network policies for researchers conducting data collection via the Twitter [38] and Crowdtangle [39] platforms, we are able to share only the IDs of material that we collected. This precludes us from sharing the location or text of our collected posts directly.

There are several tools that will enable researchers to rehydrate this data to return the full content of the post or profile. For Twitter, we note that the DocNow Hydrator[4] and Tweepy Python library[5] can fulfil this function, however the only option for rehydration of Crowdtangle-provided data is to apply for access to the platform and gain access to the official API[6]. Examples of the structure and contents of the data returned from the network endpoints is contained in Appendices B and C.

4. https://github.com/DocNow/hydrator
5. https://www.tweepy.org/
6. https://github.com/CrowdTangle/API/wiki
Figure 1: Block diagram of Twitter collection pipeline.

1: Twitter streaming API 5: App monitoring and alerting
2: Containerised stream listener app 6: Google Cloud Function
3: Log management 7: BigQuery database
4: Google Pub/Sub subscription

Note: there are two separate IDs available for Facebook posts via the Crowdtangle API, the platform ID used by Facebook itself, and the Crowdtangle ID, used by the analytics platform. We have provided the Crowdtangle ID in our dataset, and so when hydrating posts the API endpoint http://api.crowdtangle.com/ctpost/:id should be used.

4.2 Fields

Table 3 shows the fields included, along with a short description of the contents and the data type.
| Number | Theme                                      |
|--------|--------------------------------------------|
| 0      | Test & Protect                             |
| 1      | Shielding                                  |
| 2      | Care homes                                 |
| 3      | Covid survivors                            |
| 4      | Resumption of health services              |
| 5      | Mental health & loneliness                 |
| 6      | Trust in Scottish Government               |
| 7      | Routemap to exit lockdown                  |
| 8      | Impact on BAME population                  |
| 9      | Inequalities                               |
| 10     | Community cohesion/solidarity              |
| 11     | Education                                  |
| 12     | Environment                                |
| 13     | Quality of life                            |
| 14     | Social/Family                              |
| 15     | Leisure/Entertainment                      |
| 16     | Travel                                     |
| 17     | Business restrictions                      |
| 18     | Work                                       |
| 19     | Hygiene                                    |
| 20     | Shopping                                   |
| 21     | Unemployment                               |
| 22     | Business growth                            |
| 23     | Other                                      |

Table 2: Theme names with associated ID numbers.

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| Feature     | Data Type | Description                                                                 |
|-------------|-----------|-----------------------------------------------------------------------------|
| ID          | String    | Unique identifier provided by platform                                       |
| Theme       | Integer   | ID of theme allocated by keyword analysis, see table 2.                     |

Table 3: Dataset features with data type declaration and description.

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## Appendices

### A Theme and Keyword Specification

| Theme No. | Theme/Class                  | Keyword/Topic/Idea                                                                 |
|-----------|-----------------------------|-----------------------------------------------------------------------------------|
| 0         | Test & Protect              | TTI, isolate, test trace, test protect, contact tracing, covid testing, self isolation, 14 day isolation, r number |
| 1         | Shielding                   | vulnerable, shielding, high risk, elderly, disability, shielded getting out        |
| 2         | Care homes                  | care home, old people home, nursing home, residential care, retirement home        |
| 3         | Covid survivors             | survivor, post-covid lethargy, deaths, long covid, long haulers, recover           |
| 4         | Resumption of health services| reopen NHS, reopen hospital, reopen GP surgeries, resume dental, reopen dental, non emergency procedure, dentist, health service, routine care, NHS capacity, mammogram, smear test, breast scan, bowel screening, reduction accidents, reduction in viral infections, reduction asthma, blood donations, pregnancy support, non-covid health |
| 5         | Mental health & loneliness  | depression, anxiety, mood, mental health, wellbeing, lonely, loneliness, social isolation, suicide, self harm, insomnia |
| 6         | Trust in Scottish Government| Scotland, Scottish, Scots, Scot Gov, SNP, SG approach, devolved administrations, Nicola Sturgeon, First Minister, Holyrood |
| 7         | Routemap to exit lockdown   | lockdown, restriction, measures, phase, routemap, mandatory quarantine, guideline, guidance, advice, enforce rules, suppress virus, tackling virus, exit strategy, public compliance, civil liberties, enforcement, freedom, herd immunity, human rights, law, legislation, mass gathering, scientific advice, timeline, circuit breaker |
| 8         | Impact on BAME population   | racism, ethnicity, minority, ethnicity outcomes, BAME, BME, black, non-white, discrimination, prejudice, disparities, bias, religion, Moslem, Muslim, Islam, Sikh, Hindu, Asian, Indian, Pakistani, Bangladeshi, South Asian, Chinese, Caribbean, Mixed, Multiple, South East Asian, Middle Eastern, Arab, African, Black Caribbean, Black African, Jewish, Jews, ethnic minorities, racial inequality, black ethnic minorities, migrant workforce, xenophobia, hate crime |
| 9         | Inequalities                | inequalities, rich, well-off, wealthy, working class, homeless, homelessness, poverty, less fortunate, healthy over 70s, older adults, equality, rural communities, digital equality, universal broadband, broadband access, broadband connectivity, vulnerable children, vulnerable families, vulnerable households, vulnerable communities, fair ethical, gender |
| 10        | Community cohesion/solidarity| increase xenophobia, crime rate, social stigma, increase racism, community support, increase volunteering, collective solidarity, togetherness, help neighbour, community spirit, rainbows in windows |
| 11        | Education                   | education, school, home schooling, teaching, blended learning, remote learning, online learning, student, pupil, teachers, virtual classes, class size, nursery, university, additional needs children, special needs child, exam |
| 12        | Environment                 | pollution, reduction traffic, green economy, green recovery, waste management, climate impact, environment impact, environment effect, nature impact, nature effect, sustainability, plastic waste, wildlife |
| 13        | Quality of life             | outdoor exercise, family time, quality of life, life balance, new normal, long term impact, social distancing, stay home |
| Page | Category            | Examples                                                                 |
|------|---------------------|--------------------------------------------------------------------------|
| 14   | Social/Family       | visit household, meet household, extended household, gathering, bubble,   |
|      |                     | family visit, family life, social life, social contact, meet friend,     |
|      |                     | see friend, see loved ones, wedding, marriage ceremony, civil partnership,|
|      |                     | divorce, childcare, places of worship, child adoption, child fostering,   |
|      |                     | domestic abuse, funeral, pets                                            |
| 15   | Leisure/Entertainment| gym, golf, tennis, camping, swimming pool, motorcycling, hill-walking,   |
|      |                     | outdoor activities, indoor activities, running, eating out, exercise,    |
|      |                     | fishing, hospitality, horse riding, personal services, haircut, beauty    |
|      |                     | treatment, facial, massage, cinema                                       |
| 16   | Travel              | drive to exercise, car journeys, holiday plans, holiday abroad, caravan  |
|      |                     | site, visit second home, self-catering, camping, hotel, public transport,|
|      |                     | travel, tourism, border control, border check, plane, airport, bus, tram,|
|      |                     | train, air bridge                                                        |
| 17   | Business restrictions| garden centre, barber, hairdresser, beauty salon, recycling centre,      |
|      |                     | property market, construction work, construction site, pub, business     |
|      |                     | damage, cafe, restaurant, shop, retail, shopping centers, nightclub,    |
|      |                     | music venue, theater, concert, business re-opening, body piercing, dog   |
|      |                     | grooming, soft play centre, small business, business restriction, curfew  |
| 18   | Work                | home working, work from home, remote work, office work, key worker,     |
|      |                     | healthcare worker, workplace, employees, early retirement, self employed |
| 19   | Hygiene             | handwashing, sanitiser, mask, face covering, facial covering, PPE, public |
|      |                     | hygiene, hygiene standards, hand hygiene                                |
| 20   | Shopping            | cashless, contactless, online shopping, home delivery, supermarkets,    |
|      |                     | shopping trip, shopping habits, high street shops                       |
| 21   | Unemployment        | job loss, unemployed, unemployment, made redundant, jobseeker, benefits,|
|      |                     | furlough, social security, dole, economic uncertainty, basic income,    |
|      |                     | universal credit, deprivation, low income                              |
| 22   | Business growth     | economic recovery, business support, economy, economic impact, business  |
|      |                     | recovery, sector, industry                                              |
| 23   | Other               | points system, renew, security risk, service return, statistics, transition, |
|      |                     | transition arrangements                                                 |
B Twitter Data Format

The following is an example of the JSON-formatted response data returned by a request to hydrate an ID via the Twitter API.

```
{  
  "created_at": "Wed Oct 10 20:19:24 +0000 2018",
  "id": 1050118621198921728,
  "id_str": "1050118621198921728",
  "text": "To make room for more expression, we will now count all emojis as equal—including those with gender and skin t... https://t.co/MkGjXf9aXm",
  "truncated": true,
  "entities": {
    "hashtags": [],
    "symbols": [],
    "user_mentions": [],
    "urls": [
      {
        "url": "https://t.co/MkGjXf9aXm",
        "expanded_url": "https://twitter.com/i/web/status/1050118621198921728",
        "display_url": "twitter.com/i/web/status/1...",
        "indices": [117, 140]
      }
    ]
  },
  "source": "<a href="http://twitter.com" rel="nofollow">Twitter Web Client</a>",
  "in_reply_to_status_id": null,
  "in_reply_to_status_id_str": null,
  "in_reply_to_user_id": null,
  "in_reply_to_user_id_str": null,
  "in_reply_to_screen_name": null,
  "user": {
    "id": 6253282,
    "id_str": "6253282",
    "name": "Twitter API",
    "screen_name": "TwitterAPI",
    "location": "San Francisco, CA",
    "description": "The Real Twitter API. Tweets about API changes, service issues and our Developer Platform. Don’t get an answer? It’s on my website.",
    "url": "https://t.co/8IkCzCDr19",
    "entities": {
      "url": {
        "urls": [
          {
            "url": "https://t.co/8IkCzCDr19",
            "expanded_url": "https://developer.twitter.com",
            "display_url": "developer.twitter.com",
            "indices": [0, 23]
          }
        ]
      }
    }
  }
}
```

7Obtained in response to GET [https://api.twitter.com/1.1/statuses/show.json?id=210462857140252672](https://api.twitter.com/1.1/statuses/show.json?id=210462857140252672)
C Facebook Data Format

The following is an example of the JSON-formatted response returned to a query against the Crowdtangle /posts/:id API endpoint.

```json
{
    "status": 200,
    "result": {
        "posts": [
            {
                "platformId": "47657117525_10154014482272526",
                "platform": "Facebook",
                "date": "2016-02-12 23:38:14",
                "updated": "2020-08-23 05:48:22",
                "type": "live_video_complete",
                "message": "Draymond at Foot Locker for NBAAllStarTO with a special shoutout to DubNation."
            }
        ],
        "link": "https://www.facebook.com/warriors/videos/10154014482272526/",
        "postUrl": "https://www.facebook.com/warriors/posts/10154014482272526/",
        "subscriberCount": 6041837,
        "score": 4.750579867017164,
        "media": [
            {
                "type": "video",
                "url": "https://video-seal-1.xx.fbcdn.net/v/t42.1790-29/12718926_12134646534694_1083747983_n.mp4?_nc_cat=109&_nc_sid=985c63&_efg=eyJybHIiOjQzNDiwLCJ2ZW5jb2RlX3RhZyI6InYyXzQwMF9jcMzFmZjFbWFpbl8zLjBfc3QifQX3D%3D&_nc_ohc=ek7Ygz2qv-v24AX-2wSWX2&rl=442&vabr=246&_nc_ht=video-seal-1.xx&oh=889e0d776d92a84bb57099cad3d28d55&oe=5F43C879",
                "height": 0,
                "width": 0
            },
            {
                "type": "photo",
                "url": "https://scontent-seal-1.xx.fbcdn.net/v/t15.5256-10/12526285_831341603658336_1493677499_n.jpg?_nc_cat=101&_nc_sid=1055be&_nc_ohc=DK66rQ6AGGcAX8ZEBc&v=400&width=400&height=400&full=http://scontent-seal-1.xx.fbcdn.net/v/t15.5256-10/12526285_831341603658336_1493677499_n.jpg?_nc_cat=101&_nc_sid=1055be&_nc_ohc=DK66rQ6AGGcAX8ZEBc&v=400&width=400&height=400&full=http://scontent-seal-1.xx.fbcdn.net/v/t15.5256-10/12526285_831341603658336_1493677499_n.jpg?_nc_cat=101&_nc_sid=1055be&_nc_ohc=DK66rQ6AGGcAX8ZEBc&v=400&width=400&height=400&full=http://scontent-seal-1.xx.fbcdn.net/v/t1
```


```json
{
  "statistics": {
    "actual": {
      "likeCount": 24235,
      "shareCount": 753,
      "commentCount": 5675,
      "videoPostViewCount": 0,
      "videoTotalViewCount": 244885,
      "videoAllCrosspostsViewCount": 0,
      "loveCount": 33,
      "wowCount": 18,
      "hahaCount": 3,
      "sadCount": 0,
      "angryCount": 5,
      "thankfulCount": 0,
      "careCount": 0
    },
    "expected": {
      "likeCount": 3927,
      "shareCount": 279,
      "commentCount": 1041,
      "videoPostViewCount": 113445,
      "videoTotalViewCount": 118592,
      "loveCount": 1046,
      "wowCount": 94,
      "hahaCount": 45,
      "sadCount": 14,
      "angryCount": 19,
      "thankfulCount": 0,
      "careCount": 2
    }
  },
  "account": {
    "id": 19889,
    "name": "Golden State Warriors",
    "handle": "warriors",
    "profileImage": "https://scontent-sea1-1.xx.fbcdn.net/v/t1.0-1/p200x200/74788912_10158146665972526_3545220405897723904_n.jpg?_nc_cat=1&ccb=2&_nc_sid=dbb9e7&_nc_ohc=9snUpG_pdlQAX90IhWM&_nc_ht=scontent-sea1-1.xx&tp=6&oh=f8a3d3b62b507966ecc68de3b557fe84&oe=5F696BE1",
    "subscriberCount": 11580228,
    "url": "https://www.facebook.com/47657117525",
    "platform": "Facebook",
    "platformId": "47657117525",
    "accountType": "facebook_page",
    "pageAdminTopCountry": "US",
    "verified": true
  }
}
```
} 
}