

COVID-19 data visualization public welfare activity

Yiting Wang^a, Ting Wang^a, Ying Cui^a, Honghui Mei^a, Xiao Wen^a, Jinzhi Lu^b, Wei Chen^{b,*}

^a Alicloud, China

^b State Key Laboratory of CAD & CG, Zhejiang University, China

ARTICLE INFO

Article history:

Available online 12 September 2020

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic started in early 2020. At the beginning of February, a public welfare activity in epidemic data visualization, jointly launched by China Computer Federation (CCF) (CCF) CAD & CG Technical Committee, Alibaba Cloud Tianchi (Alibaba Cloud Tianchi), JiqiZhixin (JiqiZhixin), Alibaba Cloud DataV (Alibaba Cloud DataV), and DataWhale (DataWhale), was launched with the theme “Fighting the Epidemic with One Mind and Talents like Tianchi.” Developers in general are expected to focus on several demand scenarios, such as epidemic situation display, epidemic popular science, trend prediction, material-supply situation, and rework and return situation of employees from all sectors and areas, to discover the relationship between complex heterogeneous multi-source data, develop various upbeat works and present useful information to the public in a coherent manner.

The entry works take the form of data visualization and are divided into two categories: popular science publicity and application scenarios. The popular science publicity category includes works for the public, focused on epidemic situation display, epidemic popular science publicity, epidemic prevention and control, and others. The application scenario category consists of the works of frontline officers, which can provide anti-epidemic workers with effective data tools for efficient and intuitive epidemic analysis; offer reliable, understandable, and easily transmitted information for disease prevention; and assist governments, enterprises, and institutions in the fight against COVID-19.

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1. Motivation

The global outbreak of COVID-19 has had a strong impact on economic and social life in various countries. In the early stage of epidemic prevention, lack of transparency in information, insufficient understanding of the virus, and various and frequent rumors brought challenges to prevention and control, and increasingly highlighted the weakness of traditional governance. A key issue in scientific epidemic prevention and control is how to use a new generation of information technology to break data islands to track virus transmission and achieve precise prevention and control. At the same time, we are delighted that many developers have taken action to fight the epidemic. For example, the visualization work “Importance of Self-Isolation to Epidemic Control”, created by programmer Yuan Ren, abstracts complex concepts into graphics and animations. This work was broadcast on the “News 1+1” program and had influenced hundreds of millions

of viewers early in the outbreak. “Simulating Virus Transmission based on SIR Model”, another work by the same programmer, employs computer simulation to assist users in analyzing and understanding the virus transmission, thereby highlighting the role of science in preventing the spread of the disease.

The Tianchi Big Data Crowd Intelligence Platform (tianchi.aliyun.com) is the largest artificial intelligence (AI) developer community in China. This community opened its big data (from Alibaba and third parties) and computing resources to society to enable young developers to use their algorithms in solving various social and business problems. As the initiator of this public welfare activity, the Tianchi platform discussed plans with Wei Chen, Professor at Zhejiang University and Secretary General of the CCF, CAD, and CG Technical Committee, to inspire developers to contribute toward the fight against the epidemic and provide a stage for communicating, learning, sharing, and brainstorming for those who want to participate. This activity has gained support from the Alibaba Foundation and Alibaba Technology Philanthropic Committee.

2. Activity

All information about this activity is available from [Tianchi](http://tianchi.aliyun.com). In the call for participation, the works should focus on the theme

* Corresponding author.

E-mail addresses: yiting.wangyt@alibaba-inc.com (Y. Wang), tiandu.wangt@alibaba-inc.com (T. Wang), ying.cuiy@alibaba-inc.com (Y. Cui), honghui.mhh@alibaba-inc.com (H. Mei), ninglang.wx@alibaba-inc.com (X. Wen), lujinzhicad@zju.edu.cn (J. Lu), chenvis@zju.edu.cn (W. Chen).

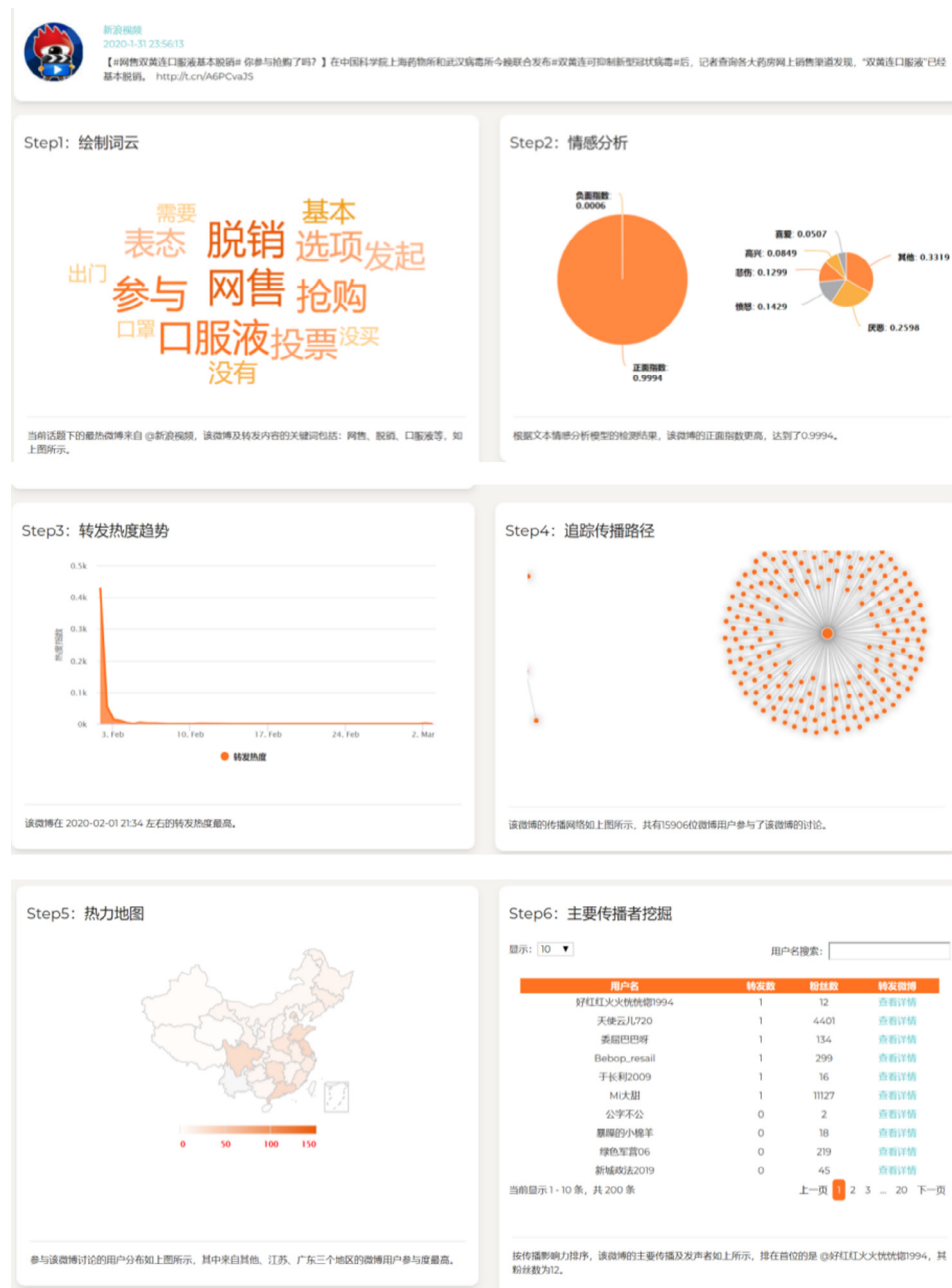


Fig. 1. Visualizing the process of public emotion data includes six steps: word segmentation and word frequency statistical analysis, emotion analysis, forwarding heat analysis, propagation path analysis, regional heat analysis, and main spreader detection.

of fighting the COVID-19 pandemic. The topic selection direction includes, but is not limited to, understanding the epidemic situation, epidemic trend prediction, community prevention and control situation, supplies and logistics, and rework and return situation of people from everywhere and all walks of life.

Participating teams are expected to analyze and extract data models based on the epidemic data to provide references for the public or frontline officers, and then generate a visual display. Entries in visual form are divided into two categories: popular science publicity and application scenarios. Visualization forms include but are not limited to

- electronic posters,
- infographics,
- images,
- videos,

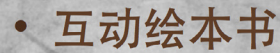
- flash animation,
- dynamic webpage,
- analysis view based on data analysis software, and
- executable data analysis system.

Works on Popular Science Publicity Direction

These works should propagate scientific knowledge about COVID-19, popularize information on disease prevention and control, promote positive social energy, assist in establishing a rational mindset toward the epidemic in society, and support frontline anti-epidemic efforts.

Works on Application Scenarios

The works on application scenarios should be based on real epidemic data and provide anti-epidemic workers with efficient and intuitive tools for presenting, understanding, analyzing, predicting, preventing, and controlling the spread of COVID-19.



用卡通沙画的表现形式，来为小朋友讲解病毒的相关常识。

Fig. 2. An interactive illustration through cartoon sand painting explains common knowledge about the virus to children.



地区

病程

深圳

发病

治愈

02.18

死亡



深圳	黄冈	阳江	宜昌	中山	珠海	南京	东莞	成都	烟台
260	5	2	2	1	1	1	1	1	1
武汉	鄂州	黄石	孝感	鄂城	伊川	蚌埠	襄阳	平遥	广东广州
108	3	2	2	1	1	1	1	1	1
荆州	十堰	荆门	咸宁	佛山	北京	公安	惠州	孝感	汉川
6	3	2	2	1	1	1	1	1	1



30-39	40-49	70-79
92	63	16
60-69	20-29	10-19
91	35	14
50-59	0-9	80-89
82	20	2



有接触	327
无接触	88



治疗中	262
治愈	151
死亡	2



男	220
女	195

Fig. 3. With this visualization, users can switch among the four options of Qingdao, Shenzhen, contact-occurrence, and occurrence-cure. In the contact-occurrence dimension, when the curve intersects the horizontal axis of time and turns yellow, it means that the patient is sick. In the occurrence-cure dimension, when the curve intersects the upper horizontal axis and turns yellow, it means that the patient has been cured. When the curve intersects the lower horizontal axis and turns yellow, it means that the patient is dead. The white curve extending backward indicates that the treatment of the patient is in progress.

• Epidemic Situation

By processing and analyzing epidemic data of the entire nation, some provinces, some regions, or specific locations, the works should intuitively display the disease distribution, public emotion, multidimensional information, and epidemic trend globally or in specific places, and provide an efficient information view for epidemic prevention and control.

• Supplies and Logistics

Anti-epidemic supplies touch the heart of each frontline worker and patient. An important task is how to accurately know the reserve situation of necessary supplies in advance, as well as sources and destinations of supplies to be deployed in the future, and how to distribute these supplies efficiently. Visualizing such information greatly improves the efficiency of supply management.

• Rework and Return

With the epidemic trend, some cities and companies are about to face the peak of rework and return, which brings increased difficulty in the fight against the disease. Therefore, predicting and displaying the population flow efficiently and identifying the risks of cities in the form of visualized data is important.

3. Cases report

This public welfare activity has attracted 394 teams and received more than 100 submissions. Many participating teams of enterprises, universities, and individual developers have supported “anti-epidemic through science and technology” efforts by means of innovative technologies, showed a good sense of social responsibility, and achieved gratifying results. At the same time, *JiqiZhixin*, the country’s top media company in the AI field, serialized and publicized the works of this public welfare activity, which has produced strong social influence and recognition. The three cases are described in the following subsections.

3.1. *Televis: Visualization of COVID-19 news based on NLP*

The work presents a visual analysis of the pandemic situation and public emotion changes by gathering public information such as news and microblogs, and provides end-to-end public emotion management plans through large screen, computer, and mobile applications. These tools include “Yuan Lin Bang”, a 3D interactive large screen for displaying supply interaction; “Wang Feng Tai”, a visual analysis application driven by natural language search; and “Yu Cha Cha”, a mobile query tool for public emotion.

The work can help relevant institutions to monitor the changes of public emotion, channel public emotion in a timely manner, and transmit information efficiently. The solution integrates various applications on large screens, computers, and mobile terminals, which are suitable for users with different needs and environments (see Fig. 1).

3.2. *Interactive simulation book of epidemic situation for children*

“Mom, why can’t I go out to play?” This may be the most frequent question that many parents have heard during the epidemic. With the help of images, animation, data query, statistics, and process simulation, the creators can explain to children the occurrence of this widespread disease in a way that is easy

for young minds to understand and accept. The simulation can show the sacrifice made by every person, and what societies can do to solve the problem. Through 3D real-time rendering and paper-cut cartoon comic style combined with open data from Dr. Dingxiang, the “Interactive Simulation Book of Epidemic Situation for Children” presented a dynamic sand-painting story, virus spreading process display, global infection data view, and sand table of transmission process simulation. Based on these elements, a short film was made to display the entire process of answering questions for children in four languages (see Fig. 2).

3.3. *COVID-19 patient tracking*

By capturing public data from sources such as news and Weibo, this work visually analyzes the novel coronavirus pneumonia (NCP) epidemic in some cities from the two dimensions of contact-occurrence and occurrence-cure. Through the design of the visual chart, this work provides the public and analysis institutions explicit knowledge of the relationship among the virus, the occurrence, and the patient. The work is available both on PCs and mobile devices, making it suitable for users with various circumstances and needs (see Fig. 3).

4. Summary

This public welfare activity of visualization of NCP epidemic data shows the power and social responsibility of young developers to fight the epidemic using science and technology. Many developers have created various effective and influential works involving epidemic situation display, epidemic popular science, epidemic trend prediction, epidemic material situation, resumption of production, and work and study, which has played a good role in preventing the spread of the virus. Developers have also provided reliable, understandable, and easy-to-communicate information tools for epidemic prevention and control, assisting governments, enterprises, and institutions in the fight against the disease. We are moved by the participation of the post-1990 generation and even younger people born after 2000. Through the Alibaba Cloud’s inclusive platform, we can use technology to support public welfare effectively.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

This project is partially funded by Alibaba–Zhejiang University Joint Institute of Frontier Technologies.

References

- Alibaba Cloud DataV, <https://github.com/DataV-Team/DataV>.
- Alibaba Cloud Tianchi, <http://tianchi.aliyun.com>.
- CCF, <http://www.ccf.org.cn>.
- DataWhale, <http://www.datawhale.com>.
- JiqiZhixin, <https://www.jiqizhixin.com/>.
- Tianchi, <https://tianchi.aliyun.com/competition/entrance/231779/introduction>.