Data Science Applications in Pandemic: A survey on COVID-19 Outbreak Tools

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Abstract

While the world steps backward, Saudi Arabia took two steps forward. the Saudi Vision 2030 framework was launched in 2017 to create digital transformation in the various sector to improve the quality of life. The COVID-19 has made it possible to promote and test the strength of digital transformation and adoption. In Saudi Arabia, the use of artificial intelligence applications to integrate multiple data sources across potential outbreaks should be further discussed. Decreasing the number of smartphone apps and combining their features may also improve and encourage their use. In this paper, in this paper we present an exhaustive survey on COVID-19 outbreak tools/apps and the role of Saudi Data and Artificial Intelligence Authority (SDAIA).

I. Introduction

Data Science is growing exponentially to occupy all the sectors of the world today. In this paper we will study how the data science is changing the healthcare sector and specially during pandemic. We can understand the different basic principles of data science used in medicine and biotechnology. The medicine and healthcare are two of the most critical parts of our human lives. Traditionally, the prescription relied entirely on the discretion advised by the physicians. For example, the doctor will have to recommend appropriate medications depending on the conditions of the patient. This was not necessarily right, though, and was vulnerable to humans' errors. However, it is now possible to obtain accurate diagnostic measures with advances in computers and in particular in data science There are several fields in healthcare such as medical imaging, drug discovery, genetics, predictive diagnosis and several others that make use of data science.

Dr. Mark Lambrecht, Director of Global Practices in Health and Life Sciences at SAS, confirmed that business leaders in many sectors are resorting to modern technologies to face new challenges, and here artificial intelligence, especially machine learning techniques, promises to improve the ability to reduce The impact of epidemics.

Machine learning is designed to handle huge amounts of data, find specific patterns in that data, and in many cases provide predictions. We find that in cases of outbreaks of infectious diseases such as "Covid 19", artificial intelligence and machine learning have an amazing value in helping to make and enable sound decisions, especially in the areas of automating analyzes, tasks and processes.

Coronaviruses are still emerging. Examples include the Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS) that triggered fatal outbreaks earlier, and now the current emerging Coronavirus Diseases 2019 (COVID-19), caused by SARS-2 Coronavirus (SARS-CoV-2), initially identified as pneumonia of unknown origin, presenting a potential danger to public health worldwide. COVID-19 has had a major negative effect on the economies of China as well as a few other nations. The lessons of such earlier challenges from SARS, MERS and the new COVID-19 situations need to be mindful of these and other changing situations when drawing up plans. Lessons learned from such earlier risks

from SARS, MERS and existing COVID-19 circumstances ought to be held in mind when formulating strategies to tackle such and other evolving and zoonotic pathogens that could pose pandemic threats thus placing human lives at risk.

The Saudi Data and Artificial Intelligence Authority "SADAYA" presented four initiatives during the "Covid-19" pandemic, in keeping with the authority's various governmental efforts during the pandemic.

Initiatives included in "decision support", including the "Operations Center to Support Security and Health Authorities", by supporting decision-making using advanced tools to analyze data, with anticipation of future damage, numbers of injured, and the effects of the pandemic on cities and government facilities, in addition to providing accurate and real-time analyzes on The current situation, sorting the citizens coming from abroad according to the employers, with determining the spatial distribution of those coming from abroad according to the national address, counting the number of Saudis stranded abroad, and specifying the number of people coming from the affected countries.

The initiative also included the "Saudi Covid-19 Index", a project between Sadaya and the Ministry of Health to analyze and anticipate the spread of the virus using artificial intelligence techniques, which contributed to supporting decision-makers to form a future view of the pandemic, its spread, and health absorption capacity.

The second initiative launched by "SADAYA" was the "Containing the Crisis" initiative and included the "Tawakalna" system, which helped in its inception to manage the curfew period, and now the contribution to the cautious return has become, and it had a role in automating transactions and reducing health, economic and social damages, and through This system has issued more than 33.7 million extracted permits, while the number of active users has reached more than 7 million users, and more than 50 government agencies have benefited from services from the validity of permits. The Kingdom is the third country in the world to run such an application, which tracks contacts with the latest technologies. The "Brooq" Platform for Secure Visual Communication" enabled state leaders and all sectors of government to meet "remotely" More than 470 meetings were registered. It has more than 5,353 participants.

Among the competitions that focus on searching for solutions was the "Humathon" competition. More than 10 thousand participated in this competition. Programmer, from more than 50 countries.

The purpose of this paper is to illustrate how, during the COVID-19 pandemic, Saudi Arabia used digital technologies in the field of public health, health services, and risk communication.

The paper is organized as follows: The state-of-art discussion on the application of data science for corona virus is presented in section II while section III present discussion Tools to prevent and monitor outbreak created by SDAIA. Finally, in Section IV, conclusions are provided.

II. State-of-art

With the volume and diversity of social and telephonic data and devices, along with new technologies and tools, data science today plays a wider role than ever before. Companies see data science and artificial intelligence as the technology enabling strategy. For data science to be effective, its entire life cycle must not only support traditional analytics, but must also work in harmony with modern applications. This means that the practice of data science must evolve Beyond routine and tedious tasks - 85% of the time a data scientist spends is spent purifying, shaping and moving data from one place to another, often to fuel machine learning. This leaves only a small percentage of the time for finding patterns and trends, building models, predicting and projecting outcomes, and interpreting results. Fortunately, there is some relief. As the latest development in modern data science is the Auto AI capabilities that automate the data preparation and model extraction stages in the data science life cycle. Now, not only data scientists can use their specialized skills in the intended way; But there are more companies out there that can benefit from data science, from forecasting to optimization.

The Unified Security Operations Center (911) in Riyadh aims to achieve coordination and integration among all security and service authorities through a unified system. In addition to the capital, it serves 22 provinces and has 62 operating rooms centralized on one roof. It is specialized in receiving both public safety, civil defense and environmental security specialized emergency appeals. It is one of the key projects undertaken by the Interior Ministry.

The official smartphone application authorized by the Ministry of Health, Saudi Arabia, concerns Tawakkalna. The purpose of this application is to promote the emergency movement of persons during lockout and curfew.

Figure 1. application number one in Saudi Arabia during COVID-19

In addition, the program contains statistics on COVID-19, such as the number of infections in various areas. The application requires Saudi residents to apply for travel permits in the event of a curfew emergency. The program also notify users when they are near to infectious or polluted areas. The count of Saudi citizens and expatriates who have registered in the Ministry of Health's application of Tawakkalna In the last 15 months since its launch, it has surpassed 17 million and increased to 20 million in 2021.

It is a virtual version of a Chinese program which was evolved by Saudi National Information Center that uses a color-coded QR to represent the condition of the user. Green reveals that the individual is safe and has the right to fly. Yellow means that the person accused of having COVID-19 is not able to travel. Red means that the individual is sick, is not able to drive, and must be in quarantine.

Figure 2. the color-coded QR to represent the condition of the user.

In conjunction with the number of "Tawakkalna" users reaching this number, which reflects the users' confidence in its services, the application added new features aimed at supporting government efforts

aimed at curbing the infection of the emerging corona virus (COVID-19), to contribute to a safe return to normal life.

The new services are (alert status service, safe gathering management feature, and dependent care), and the latter enables parents to follow up on their children who are under 15 years old. And check on them in the locations that they go to, as well as providing the ability to notify Ministry of Health in the event of a suspected case.

The application enhanced its presence among non-Arabic speaking users, through five new languages, in addition to Arabic and English (Hindi, Filipino, Urdu, Bengali and Indonesian)

These are all the services that "Tawakkalna" provide:

1. Vaccine Covid-19

A functionality that allows users to make a confirmation of eligibility for COVID-19 vaccine appointment.

2. Preview of PoA

This feature allows users to preview their legal power (PoA) registered in the Justice system of the Ministry.

3. Preview of behavior

This feature allows users to preview their deeds recorded in the framework of the Department of Justice.

4. Verification of mobile numbers

A function enabling the verification of the mobile number of employees in Tawakkalna, supported or other users.

5. Address National

This functionality helps users to add, upgrade and print their national Saudi Post address registered.

6. Passport on health

A Tawakkalna function confirms that you are now immune to all doses of COVID-19.

7. Identity digital

Digital Identities is a functionality that provides users with a digital snapshot of their official records, national identity and Iqama.

8. Digital identification

This function helps users in Tawakkalna to preview their national ID.

9. Public infringements

A function that enables users to preview their abuses in public security, the General Social Insurance Organization, the MUR, Tourism, Housing and Human Resources and Social Development Ministries.

10. Address National

This functionality helps users to display and share their domestic address information.

11. Allows Eatmarna:

A feature that allows users to pre-examine all Eatmarna permits such as Two Holy Mosques prayer permissions, Tawaf results, Rawdah prayer permissions, and Prophet's Tomb visit.

12. Appointments for legal, civil and passport

Users may access appointments linked to their ID number, as well as appointment information, in their Ministry of Justice.

13. Preview of public breaches

This functionality enables users to preview violations relating to Public Security, the Ministry of Municipal and Rural Affairs, the Social Insurance Organization under its identity number and to preview specifics of each violation.

14. Cards for sharing health

A program enabling guardians to share the health card with other Tawakkalna users.

15. View the appointments for your MoJ

This function gives you the ability to preview your Justice Ministry appointments relevant to your ID number and appointment specifics.

16. Permit Feature of Umrah

The permit is immediately revoked if the status of the pilgrim varies, guaranteeing a peaceful Umrah for everyone. This functionality is connected to the Eatmarna App for viewing Umrah permission on Tawakkalna.

17. Test COVID-19

This feature helps users to book a Test Termination COVID-19 and quickly see results on the app.

18. Alerts from Tawakkalna

This feature enables users to preview their personal app updates.

19. Diehboard

A function that enables users to preview personal details on their driving license, passport and car.

20. Education status of children

A function allowing parents to monitor the education status of their children through the Tawakkalna Services screen.

21. Mode of deposit

This function allows users to view other users' health status in busy environments. Bluetooth must be switched on to allow "Caution Mode." If an infected, exposed or perpetrator is present, the user is alerted. To function on the element, the app must run in the foreground.

22. Provision of care for employees

It allows guardians to submit requests for treatment to the Twakkalna accounts of their dependents (the dependent must be under 15). Upon approval, the recipient can access the dependent's location and details and revoke the request at any time.

23. Permits to collect

The collection authority is a new function in Tawakkalna that allows users (government, business or personal) to issue collection authorizations and receive visitor QR codes. The code can be exchanged and used for reporting suspicious incidents, editing or deleting permits, status check allows and user utilization data to be recorded.

24. Check-in manual for visitors

25. This function allows the host who has allowed the guest to search by scanning their QR codes for their health conditions or entering their ID\Iqama number manually.

26. Hajj Allowance

The app's home page is shown when the Hajj permission is issued by the Ministry of Hajj and Umrah. The applicant will then check the permit information on the permit page.

27. Status of Health

The coded colors protect anonymity and display the wellbeing of consumers by encrypted personal data in compliance with the Ministry of Health.

28. Allow Tawakkalna visitors to register

Visitors may register in Tawakkalna with this facility.

29. The results of Qiyas

Users can see their Qiyas results by using the service.

30. Violations Explore

It allows consumers to investigate their infringements of the curfew.

31. Another person's service violations

The program lets civilians and residents who have been unable to enrol or use the Tawakkalna account display their infringement passes. To access a ticket for infringement, you must have the person's ID number, birth date and ticket numbers for violation.

32. Electronically allows flow of requests

For required provisions during the application curfew time, for automated processing of applications.

33. Electronically permitting travel requests

for materials required within the community over the whole application curfew cycle so that instructions are immediately collected.

34. The electronically shown work permits

Enabling organizations to send online permits of their staff through Tawakkalna to facilitate the travel from and to work of employees from both the public and the private sectors exempt from the curfew - hospital workers, pharmacy workers, caterers and other critical entities.

35. Medical questions to assist the Ministry of Health in monitoring cases are often answered.

The consumer should also record suspicious Covid-19 cases in order to ensure people get medical help and thus prevent the virus from spreading.

36. Show the security guy user code "QR"

to accelerate the citizen and resident traffic control and traffic operation.

37. Checking news about fitness

and updates on the dissemination and prevention of COVID-19.

38. The right to ask the private driver for an extra travel permit.

39. Show medical appointments for users.
40. 1 hour daily Jogging license (within the district)
41. Hospital Emergency Allowance
42. give you the opportunity to apply for a license for instant healthcare cases. The patient's partner is included in the permit.
43. Allow students
44. Enables students to take Qiyas tests in compliance with the Committee on Education and Evaluation. The license also allows students to apply for a driver's licence.
45. Report on suspected cases

In case of a suspicious Covid-19 case, this program allows people and residents to inform the Saudi Ministry of Health. The service would contribute to the development of a social responsibility context to reduce the risk of virus transmission.

43.Reports of violations

In the event of observing activities which could increase the probability of the Covid-19 outbreak, this program allows people and inhabitants to raise complaints with the knowledgeable authorities. The consumer can express concern about a person, a group of people gathered in a spot or a person entering a restricted area. The appropriate steps will be taken by the responsible authority.

With life returning to normal, and everyone sensing the importance of downloading the "Tawakklna" application, the new "Cautious Status" service comes to enable the user to know the health status of those in crowded places, when activated using Bluetooth technology, which in turn will alert him if there is a person infected with the Coronavirus Or close contacts, while ensuring privacy for the injured and the contacts, In order for personal events, official meetings and events to be safer and more secure, the gathering management feature enables users to achieve the highest levels of safety and security for their gatherings, whether (personal, governmental, or commercial) by issuing a permit and obtaining a "QR" code so that visitors can scan it when they enter Appropriate, and through that the authorization builder will ensure the safety of health visitors. "SADAYA" request that all citizens and residents to download the applications "Tawakklna" and "Sehatey" through the App Gallery Google Play and App Store because of their benefits in creating healthy and smart environments within business premises and public and commercial gathering areas

iii. Research Methods

Adopting wellness approaches using emerging technology such as Bluetooth-integrated mobile health apps, the Global Positioning System (GPS), Artificial Intelligence (AI) and Machine Learning (ML) strategies will greatly enhance the delivery of healthcare services remotely while pursuing prevention

steps such as social distancing and home quarantine. In the same way, telemedicine, computer apps and virtual treatment are helpful methods. Data and Connectivity Technologies (ICTs) for remote care of COVID-19 patients. These digital tools are ubiquitous and mitigate the susceptibility of patients and doctors to the COVID-19 virus. In 2019 the worldwide penetration of smartphone-related ICTs amounted to 3.2 billion and by 2021 it is projected to reach 3.8 billion.

A. Identifies Mobile Applications

In this analysis the free smartphone application linked to COVID-19 is identified via a systemic search approach available in the App and Google Play Stores. This search was made based on keywords such as COVID, monitor, trace, secure COVID, appointments as well as COVID data.

B. Criteria to include and exclude

The following inclusion criterion was used to choose the applications accessible ,the applications had to be free of cost and had to be launched and updated during the COVID-19 outbreak for the management of COVID-19; 2) The applications had to start and be funded by the governments of those countries; for search simplification, seven countries were selected with a spectrum between high (India and the United States) and medium (Saudi Arabia, Italy and the United Kingdom) and poor (COVID 19) patients (Singapore and Australia). Requests not meeting these criteria were exempt.

Public Health Informatics Tools

The Minister of Health, Dr. Tawfiq Al-Rabiah, and the President of the Saudi Authority for Data and Artificial Intelligence (SADAIA), Dr. Abdullah Al-Ghamdi request to register in application (My Health) to take the Corona vaccine, confirmed that it is free to receive any kind of vaccine for all citizens and residents.

Figure 3. Announcement and the Ministry of Health started registering to take the Corona vaccine

It is an interesting extension to Tawakklna is Health Passport service to confirm that the person has completed all doses of the emerging (Corona) virus vaccine and has become immunized "against the virus."

The unified health file service was launched with the participation of the following sectors: "The Ministry of Health, the Saudi Red Crescent Authority, the General Administration of Medical Services in the Security Forces, the Health Affairs of the National Guard, the King Faisal Specialist Hospital, and the Medical Services of the Armed Forces"; Seeking to link health care providers in the Kingdom with a system that facilitates the work of health practitioners, promotes public health, and contributes to reducing costs. The unified health file aims to eliminate double entry of data regardless of where that data is stored, besides standardization of standards and procedures used in the transaction, architecture and operation of the high-security and reliable electronic systems, with a commitment to confidentiality in transmitting information, and improving the quality of services provided. Through this system, the doctor

can know the medications, previous visits, diagnosis, and allergy that the patient suffers from, and he can also add vaccinations, laboratory analysis results, medical diagnostic imaging, and surgical notes, in addition to linking the common health system to the hospital system to facilitate access. Perhaps the health sector in the Kingdom was not aware of the near future of a global pandemic that requires complete isolation and humanitarian action by doctors and nurses who expose their lives to daily risks. In order to save several lives, but the performance of the Kingdom's Ministry of Health, which is based on digital transformation, whether in raising awareness or taking the first treatment steps, remains a strong basis for the world to follow.

In Saudi Arabia, Sehhaty App offers medical services. Sehhaty aims to provide users with health and health information services provided by various health organizations in the Republic, such as COVID-19 Test Termination Booking, the Coronavirus Self-assessment Test, updates on vital signals, prescribed medicinal medicine monitoring, the recovery and sharing of sick leaves, the promotion of a good lifestyle.

Sehhaty is provided in accordance with its vision for improving quality of healthcare and developing its facilities, under the oversight of the Health Minister in Saudi Arabia.

includes Sehhaty:

- Book your COVID-19 evaluation appointment.

Teleservice.

- Search the closest pharmacy to have medicines and medicines.
- Sick leave released view.

See medicine prescribed.

- Book a primary medical center consultation.
- Recording of readings for vital signs.
- Dependency added
- Screening outcomes of school.
- Tracking steps

The importance of collecting and analysing data in Saudi Arabia has multiplied over the past few years as the country moves towards digital transformation and prioritizes the introduction of digital technologies in government operations. Since digital transformation is a fundamental pillar of the Saudi Vision 2030, the government seeks to build partnerships with the private sector and support local

investments in order to help develop the telecommunications, health and information technology sectors and contribute to building a digital economy by collecting and analysing data.

In our current world, it is imperative to take advantage of some modern technological systems and opportunities; In order to support the health sector, and solve many of the problems it faces, starting with the hospital information management system; Which enables the actors in the sector to operate in an integrated manner, leading to the system of exchanging data and responding to expectations, as well as electronic transport when needed.

There is no doubt that many hospitals are using various appointment systems, sharing identities, managing resources, in addition to “electronic filtering” processes that enable them to perform their duties to the fullest, while sending health data to national centres and laboratories. The digital transformation of the health file contributes to completing the entire process of caring for people; Knowing that the steps are closely related to each other, arranging images and information, and maintaining flexible communication systems, reflects positively on improving management, and thus supporting decision-making, and a smooth workflow, and in the end, the sector performs its work in an ideal way that preserves human life.

Iv. Conclusion

The crisis situation that the world witnessed overnight due to the spread of the new Corona virus has strengthened the importance of digital transformation in the health sector in particular, and all different sectors in general and the Kingdom of Saudi Arabia is a good proof of that, because the imposition of the use of technology made access to most people easy, and without it we will resort to traditional methods from imposing quarantines and curfews to prevent the problems from getting worse.

Digital transformation in the health sector also helps in very powerful areas to fight any epidemics in the future, and also contribute to modifying and solving data collection problems and taking the necessary to give humanity a better chance in adjusting the level of health and thus we will form new horizons of hope.

Declarations

- Ethics approval and consent to participate (Not applicable)
- Consent for publication (Not applicable)
- Availability of data and materials (applicable)
- Competing interests (Not applicable)
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Figures

Figure 1

application number one in Saudi Arabia during COVID-19

Figure 2

the color-coded QR to represent the condition of the user.

وزارة الصحة
Ministry of Health

COVID-19
VIRUS
VACCIN

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Figure 3

Announcement and the Ministry of Health started registering to take the Corona vaccine

تطبيق صحة

بإمكانك استشارة طبيبك على مدار الساعة عبر تطبيق صحة

Figure 4

my health app (Sehthy)

Figure 5

number of Tawakkalna users