



UTM
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Section : 01

Task: PROJECT - Low Fidelity Prototype

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Introduction

It has been proven that in order to get a handle on this covid 19 pandemic we must learn from previous viruses so that we can not only map the structure of the virus but also tell us how to contain and hence eliminate it. This is where AI comes into play as it can study the virus' history, transmission, and diagnostics from previous epidemics so that we are able to make a calculated next move in combating today's Covid-19 pandemic. AI also plays a crucial role to predict the evolution of the virus. This makes the AI technologies essential to the efficiency of Covid-19 crisis response. AI tools and technologies can be employed to support efforts of policy makers, the medical community, and society at large to manage every stage of the crisis and its aftermath: detection, prevention, response, recovery and to accelerate research. This is where our team will be introducing our application "AlertMe".

The main motivation behind creating "AlertMe" is to create an application with AI capabilities to analyse and predict the outbreak hotspots of the Covid-19 virus in addition to calculating the action that needed to be taken. By accumulating unprocessed data from the general public together with our own AI formula we are able to achieve the information needed to prevent more covid cases. By recognizing and predicting areas that are more likely to have an outbreak, it is much easier for the authorities to take early measures within the area and the general public to avoid that particular area.

Content of report

Artificial Intelligence (AI) tools and systems can support countries in their response to the COVID-19 crisis. For example, AI can help policymakers and the medical community understand the COVID-19 virus and accelerate research on treatments by rapidly analysing large volumes of research data. It can also be employed to help detect, diagnose and prevent the spread of the virus. Conversational and interactive AI systems help respond to the health crisis through personalised information, advice and treatment. However, in order to make the most of these innovative solutions, AI systems need to be designed, developed and deployed in a trustworthy manner, consistent with the recommendation: we should respect human rights and privacy; be transparent, explainable, robust, secure and safe.

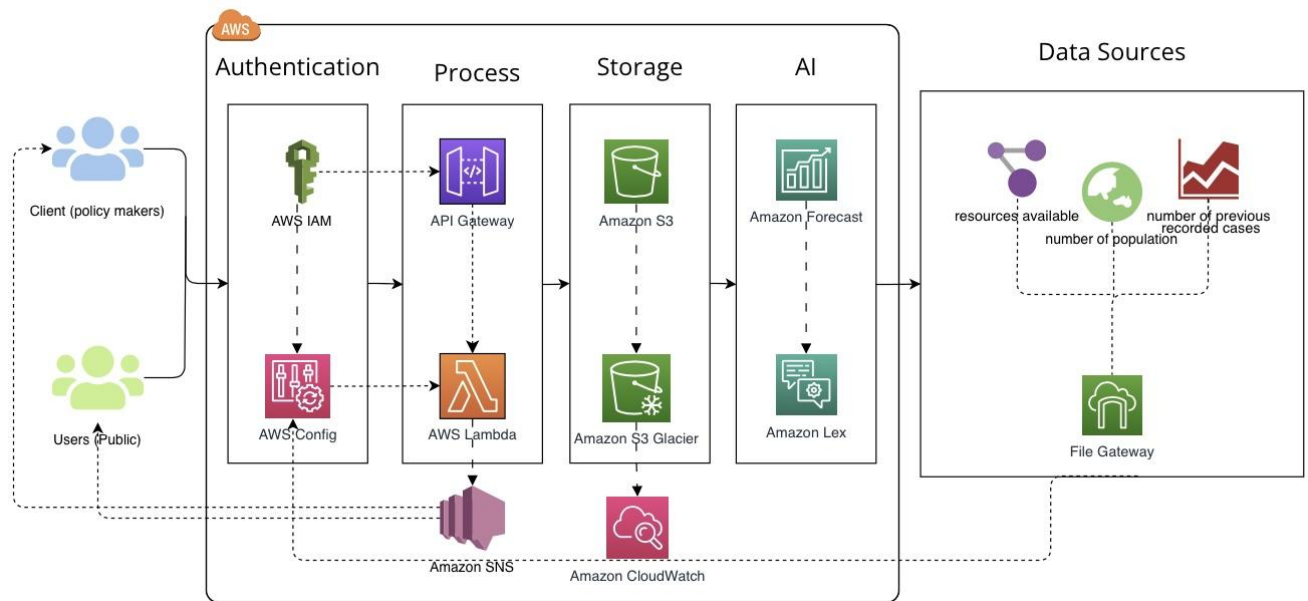
This report focuses on the prevention of covid19 using application of AI for early detection of outbreak. The main targeted client is the government, our policymakers however our product can also cater to the citizen as some of the data will be made public. The main problem faced by our customer in this climate is the late prevention of the covid 19 outbreaks around the country as well as the amount of aid needed and actions that needs to be taken. If only there is a better way of estimating the probability of infection in certain areas and what needs to be done. Well, we came up with a solution which is using AI, creating a database that is able to solve this specific problem.

In order to prevent the outbreaks predictions, surveillance and information should be presented. For the prediction, the AI algorithm will calculate the probability of infection from an area. Then we can monitor & track contagion in real time, to simply put it into a term, it is called the 'contact tracing'. After that, we need to inform the application user about the information that we got from the AI databases. By doing this, we are able to personalise news and content moderation to fight misinformation. So with just a click of a button in AlertMe, we are able to see where the problem area in the neighborhood is as well as what we can do to stop/help it. This can all be achieved by using our application, AlertMe.

Moreover using this AI application into our database, we are able to achieve early detection of the outbreaks via digital diagnosis. This result is achievable by our very own unique formula which uses a trend recognition database. The key attributes that will be taken into account by this formula is the number of population in that area, resources available in that area as well as number of recorded covid cases. All this raw information will be processed into predicting the area of potential outbreaks as well as the action that needs to be taken.

With the availability of this database the government will be able to see the problem areas and send in interference before it becomes a bigger problem. An example of scenario where our database could be beneficial is, after the government receives our prediction about the problem areas for instance location at Taman X, they can then send in concentrated covid 19 resources to fix the issues. As an added bonus when our database specifies the amount of aid needed, no excessive covid 19 resources will be wasted.

Architecture planning design



Operational Excellence - Process

1. **API Gateway** - this service acts as the “front door” to access our data sources from resources available, number of previous recorded cases and also number of population. By using this service, after sources are updated, “AlertMe” application makes a REST API to call the endpoint which enables real-time communication. Moreover, this service handles all the tasks involved in accepting and processing up to hundreds or thousands of concurrent API calls, including traffic management and throttling monitoring.
2. **AWS Lambda** - when users or clients run our “AlertMe” application, API Gateway makes a REST API call to the endpoint, and then lambda is triggered. AWS Lambda runs code to post the updated version of the news and content from data sources, and it also can initiate notification to warn the policymakers on the next possible outbreak areas. Furthermore, AWS Lambda monitor and track contagion to trace the close contact. It will initiate notifications to tell users if they have close contact with an infected person. Thus, these can reduce the number of cases and also early detection in order to flatten the curve.
3. **Amazon SNS** - by using this service, notifications are pushed after AWS Lambda initiates notification. Our “AlertMe ” application will send notification directly to policymakers and the public by using Amazon SNS. Moreover, this service provides encrypted topics to protect the messages from any unauthorized access. The encryption uses a 256-bit AES-GCM algorithm.

Security - Authentication

1. **AWS IAM** - by using this service, we can ensure that only authorized and authenticated users are able to access our resources on the application and only in ways that we allowed the users to access. For example, the client or the policy maker can access the application and view the number of previous recorded cases and the number of population. Meanwhile, the public also can have their own accounts that need to be signed up before it is recorded in the database. Furthermore, users are also required to create strong passwords that consist of complexity level, avoiding re-use, and enforcing multi-factor authentication.
2. **AWS Config** - for better security and governance, AWS Config can manage resource inventory, configuration history and configuration change notifications. It is also easy as it will automatically check the configuration when we set the rules. Depending on the rules, AWS Config will evaluate resources. Each rule is associated with an AWS Lambda function that contains the evaluation logic for the rule. When AWS Config evaluates resources, it invokes the rule's AWS Lambda function. The function returns the compliance status of the evaluated resources. If a resource violates the condition of a rule, AWS Config flags the resource and the rule as noncompliant.

Reliability - Storage

1. **Amazon S3**- Developers can use Amazon S3 to handle the data processing at a large scale. Amazon S3's facilities are highly-scalable, secured and low latency data storage from the cloud enables developers to gather, store and retrieve data with ease from anywhere on the web. They need to choose a region, create a S3 bucket and start storing data. Developers don't need to worry about the data usage as the Amazon S3 can store and access as much data that is needed. It also creates multiple replicas of our data so that the data is never lost. Developers need to secure the data that they gained and the data should be available to them anytime in order to take any action regarding the problem of estimating the probability of infections in certain areas. So, Amazon S3 is suitable to store data as it gives reliable security and all-time availability.
2. **Amazon Simple Storage Service Glacier**- Developers can use Amazon S3 Glacier for data archiving and backup of cold data. Cold data is the files that are infrequently accessed but are kept in case they are needed later. So, developers can keep the data for a certain area which is not affected by the infection but can use it later on when they need it. The database backups can be moved from tape storage media to the cloud for long term Glacier storage. This will reduce the burden of managing archival data and backups. Mostly, this Glacier can help developers meet regulatory requirements by archiving affected people's record data securely and cost-effectively. Developers can group archives together into a vault, which helps organise data. Developers can configure a resource-based access policy to each vault, governing who can access a specific set of archives and attach notification policies to each vault.

Performance efficiency

1. **Amazon CloudWatch** - Performance of our resources is a vital aspect of this project. By using Amazon Cloudwatch, our DevOps engineers and developers can be provided with multiple insights to monitor our application. CloudWatch collects monitoring and operational data in the form of logs, metrics, and events. Developers can get a unified view of operational health and gain complete visibility of the AWS resources, applications, and services running on AWS and on-premises. Developers can use CloudWatch to detect anomalous behavior in the environments, set alarms, visualize logs and metrics side by side, take automated actions, troubleshoot issues, and discover insights to keep our "AlertMe" applications running smoothly. Conclusively, Amazon CloudWatch is a very important service in order to maximize the optimization of our resources and "AlertMe" to work smoothly.

AI

1. **Amazon Forecast**- Amazon Forecast automates much of the time-series forecasting process, enabling our "AlertMe" application to prepare our datasets and interpret predictions based on our data sources. By using this artificial intelligence service, it automates complex machine learning tasks by finding optimal combinations of machine learning algorithms from our data sources. This service also includes additional built-in datasets that are already feature engineered and do not require additional configuration. Thus, possible outbreak areas and new clusters can be detected early.
2. **Amazon Lex** - User interface is an important aspect in the development of AlertMe. By using Amazon Lex, we can build an AI based conversational interface for our application using text or voice. For example, we can provide chatbots by using Amazon Lex for us to boost the efficiency of our customer service. Amazon Lex requires no deep learning. To create a bot, we just specify the basic conversation flow in the Amazon Lex console. Amazon Lex manages the dialogue and dynamically adjusts the responses in the conversation. Other than that, we can also automate informational responses such as designing conversational solutions that provide responses to frequently asked questions. Conclusively, Amazon Lex plays an important role in order for AlertMe users to be more connected to the developers hence boosts the user experience aspect.

Cost Optimization- The services used to build this application are cost optimized because all the services above have the ability to run the systems at the lowest-price point. Cost optimization contains five design principles that all the services follow which are implementing cloud financial management, adopting a consumption model, measuring overall efficiency, stop spending money on undifferentiated heavy lifting and analyzing and attribute expenditure. Since the services are built based on these five design principles it is available at low cost.

Conclusion

With the deployment of AlertMe, we are able to efficiently prevent new clusters of Covid-19 from forming. This indirectly will help with the overall fight against the deadly virus and has the potential to save thousands of lives. Through the development of AlertMe, we can contribute to humankind's battle in fighting & assisting users in the crisis of pandemic outbreaks in the future. Despite that, there is a limitation in the deployment of AlertMe which is the participation of the users and the volume of data needed for the AI algorithm to work in order to provide more accurate predictions to the users. Cooperations between the users and the customers are our main concern due to our application relying on the data we have collected from the general public. Without this cooperation, our data can be inconclusive and making predictions will be ineffective.

References

- Mario Cannataro, Andrew Harrison, Bioinformatics helping to mitigate the impact of COVID-19 – Editorial, Briefings in Bioinformatics, Volume 22, Issue 2, March 2021, Pages 613–615, <https://academic.oup.com/bib/article/22/2/613/6161423>
- OECD Legal Instruments. (2019, 9 25). OECD Legal Instruments. OECD Legal Instruments. Retrieved December 27, 2021, from <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449>
- OECD Legal Instruments. (2020, April 23). Tracking and tracing COVID: Protecting privacy and data while using apps and biometrics. OECD. Retrieved December 27, 2021, from <https://www.oecd.org/coronavirus/policy-responses/tracking-and-tracing-covid-protecting-privacy-and-data-while-using-apps-and-biometrics-8f394636/>
- Swami Sivasubramanian. (2020, May 28). How AI and machine learning are helping to tackle COVID-19. The World Economic Forum. Retrieved December 27, 2021, from <https://www.weforum.org/agenda/2020/05/how-ai-and-machine-learning-are-helping-to-fight-covid-19/>
- <https://aws.amazon.com/machine-learning/ai-services/>
- <https://www.blazeclan.com/blog/5-key-benefits-of-amazon-s3/>
- <https://data-flair.training/blogs/amazon-glacier/>