VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY
(An Autonomous Institute Affiliated to University of Mumbai)
Department of Computer Engineering

Project Report on

Image Recognition Using AWS

Submitted in partial fulfillment of the requirements of the degree

BACHELOR OF ENGINEERING IN **COMPUTER ENGINEERING**

By

Prerna Banswani/Roll No:5

Kalpana Gurnani/Roll No:21

Varsha Makhija/Roll No:43

Project Mentor
Mr. Richard Joseph

University of Mumbai
(AY 2023-24)

VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY

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CERTIFICATE

This is to certify that the Mini Project entitled **"Image Recognition using AWS "** is a bonafide work of **Prerna Banswani (5) Kalpana Gurnani(21) Varsha Makhija(43)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **"Bachelor of Engineering"** in **"Computer Engineering" .**

(Prof._____)

Mentor

(Prof._____) **(Prof._____)**

Head of Department

Mini Project Approval

This Mini Project entitled "**Image Recognition using AWS"** by **Prerna Banswani (5) Kalpana Gurnani(21) Varsha Makhija(43)** is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

Examiners

1……
(Internal Examiner Name & Sign)

2……

(External Examiner name & Sign)

Date:

Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

(Signature)

(Prerna Banswani Roll No:5)

(Signature)

(Kalpana Gurnani Roll No:21)

(Signature)

(Varsha Makhija Roll No:43)

Date:

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Contents:

Abstract

Image classification is a rapidly growing field, with a wide range of applications in various industries such as healthcare, agriculture, and retail where accurate categorization of images can significantly enhance decision-making processes and operational efficiency. Cloud computing has emerged as a fundamental technology for image classification, offering scalability, reliability, and cost-effectiveness. In this project, we propose a cloud-based image classification system using Amazon Web Services (AWS) to address the challenges associated with storing, managing, and classifying large volumes of images. In this project, we propose a cloud-based image classification system using Amazon web services. The system will leverage Amazon Web Services to perform image analysis and classification, while S3 bucket Storage will be used for storing image.The system will be scalable, secure, and reliable, enabling users to store, manage, and classify large volumes of image in the cloud. The proposed system will have numerous benefits, including reducing storage costs, improving the accuracy of image classification, and increasing the efficiency of data management. The project will involve designing and developing the system using various Amazon services, testing and optimizing the system performance, and evaluating the system's effectiveness in real-world scenarios. The results of this project will be useful for organizations that deal with large volumes of image data and need an efficient and scalable way to manage and classify their data in the cloud.

1.Introduction

1.1 Introduction

In today's digital age, the volume and complexity of data being generated are growing rapidly. This trend has led to an increasing demand for cloud-based solutions that can store, manage, and process data efficiently and reliably. Amazon Web Services (AWS) offers a wide range of services that enable organizations to develop and deploy cloud-based solutions quickly and cost-effectively.

In this project, our aim is to develop a cloud-based image classification system using AWS. We will utilize AWS S3 (Simple Storage Service) for storing images, Amazon Rekognition service for analyzing images, and React for the frontend. This system will allow users to upload images to the S3 bucket, where they will be stored securely. The Rekognition service will then analyze these images to identify objects, scenes, and faces, providing valuable insights into the content of the images. By leveraging AWS services, we can ensure that our image classification system is scalable, reliable, and cost-effective. AWS provides a robust infrastructure that can handle large volumes of data and process it quickly, making it an ideal choice for our project. Additionally, by using React for the frontend, we can create a user-friendly interface that allows users to interact with the system easily.

Overall, this project will demonstrate the capabilities of AWS in handling image data and showcase the power of cloud-based solutions in managing and processing data in today's digital age.

1.2 Motivation

Image classification is a critical task in various industries, including healthcare, retail, and agriculture. However, managing and processing large volumes of image data can be challenging, requiring significant storage and computational resources. Cloud-based solutions offer a scalable, secure, and cost-effective way to store and process image data, enabling organizations to focus on their core business operations rather than managing IT infrastructure. Cloud-based solutions offer a scalable, secure, and cost-effective way to store and process image data, enabling organizations to focus on their core business operations rather than managing IT infrastructure. AWS provides a comprehensive set of services that can be used to develop and deploy cloud-based image classification systems quickly and easily.

1.3 Problem Statement & Objectives

The objective of this project is to develop a cloud-based image classification system that can effectively store, manage, and classify large volumes of image data. The system will leverage S3 bucket for storage, Amazon Rekognition service to analyze images and React for Frontend. The project aims to address the challenges associated with managing and processing large volumes of image data by developing an efficient and scalable cloud-based solution that can be easily integrated into existing business workflows.

2.Literature Survey

2.1 Survey of Existing System and Limitations

Ref	Title	Summary	Methodology	Limitations
1	Cloud Strategies for Image Recognition	The paper presents two cloud strategies for image recognition, comparing out-of-the-box services with AWS framework service using a case study on labor safety, concluding that both can recognize helmets with a trade-off between construction time and assertiveness.	The methodology involves a comparison between out-of-the-box services and the framework service from Amazon Web Services (AWS) using a case study for labor safety in the field.	Limited generalizability due to a single case study, focus on specific object recognition, trade-off may not be universally applicable
2	A Technical Report on Image Classification using AWS	The paper presents the development of an elastic web application for image classification using AWS, highlighting successful implementation but also performance issues that need improvement.	The methodology in the study involves utilizing AWS resources like EC2, SQS, and S3 to create a two-tier infrastructure for image classification, with scaling based on incoming image volume.	The limitations of the study include issues identified in the evaluation metrics of response time, boot time, and accuracy that need to be addressed for improved performance.
3	Proposed Face Detection Classification Model Based on Amazon Web Services Cloud (AWS)	The paper proposes a face detection classification model based on AWS cloud to classify faces into permission and non-permission classes using real data collected from cameras, aiming to reduce computing time without compromising accuracy and utilizing deep learning methods for facial recognition. The system is designed to distinguish between individuals with permission and without permission to enter a building using AWS cloud services and RGB images of 100x100 pixels.	The methodology involves using a CNN cloud-based system, IoT services, Haar cascade, and MTCNN detectors on AWS EC2, with reported validation accuracy and execution times.	Utilizing AWS cloud services for deploying the model may incur significant costs, especially if the model requires high computational resources or frequent data transfers. The cost-effectiveness of the model needs to be carefully evaluated, considering both the performance and the associated costs.

2.2 Mini Project Contribution

In this mini-project, we aim to address the challenges related to managing and classifying large volumes of image data by leveraging Amazon Web Services (AWS) cloud-based technologies. Drawing insights from existing literature, we recognize the importance of several key areas: comparative analysis, performance optimization, innovative model development, scalable infrastructure design, user interface enhancement, security and compliance implementation, and documentation and deployment. Our approach will involve a systematic step-by-step process, beginning with a comprehensive understanding of current cloud strategies for image recognition and their limitations. We will then proceed to develop a comparative analysis framework considering factors such as implementation complexity, performance metrics, scalability, and cost-effectiveness. To optimize performance, we will fine-tune parameters, optimize algorithms, and explore alternative AWS services to improve response time, accuracy, and resource utilization. Building on existing models, we will explore innovative approaches for facial recognition using AWS cloud services, experimenting with different deep learning architectures and data integration methods. Our scalable infrastructure design will include workflows, selecting appropriate AWS services, and optimizing resource allocation for dynamic scalability. We will focus on enhancing the user interface, using React or similar technologies, to improve user experience and accessibility. Security and compliance will be prioritized through robust measures such as encryption, access control, identity management, and compliance with data protection regulations. Finally, we will ensure the system's usability and accessibility by providing comprehensive documentation and deployment guides. Through this systematic

approach, we aim to contribute to the advancement of cloud-based image classification systems using AWS technologies.

3 Proposed System

3.1 Introduction

The proposed system aims to address the challenges associated with managing and classifying large volumes of image data by leveraging cloud-based technologies provided by Amazon Web Services (AWS). With the increasing demand for efficient image classification systems across various industries such as healthcare, agriculture, and retail, there is a need for scalable, secure, and reliable solutions that can handle the complexities of image analysis and classification.The system will primarily utilize AWS services, including Amazon S3 for storing images and Amazon Rekognition for analyzing and classifying images. Additionally, React will be used for developing the frontend interface, providing users with an intuitive and interactive platform to interact with the system.

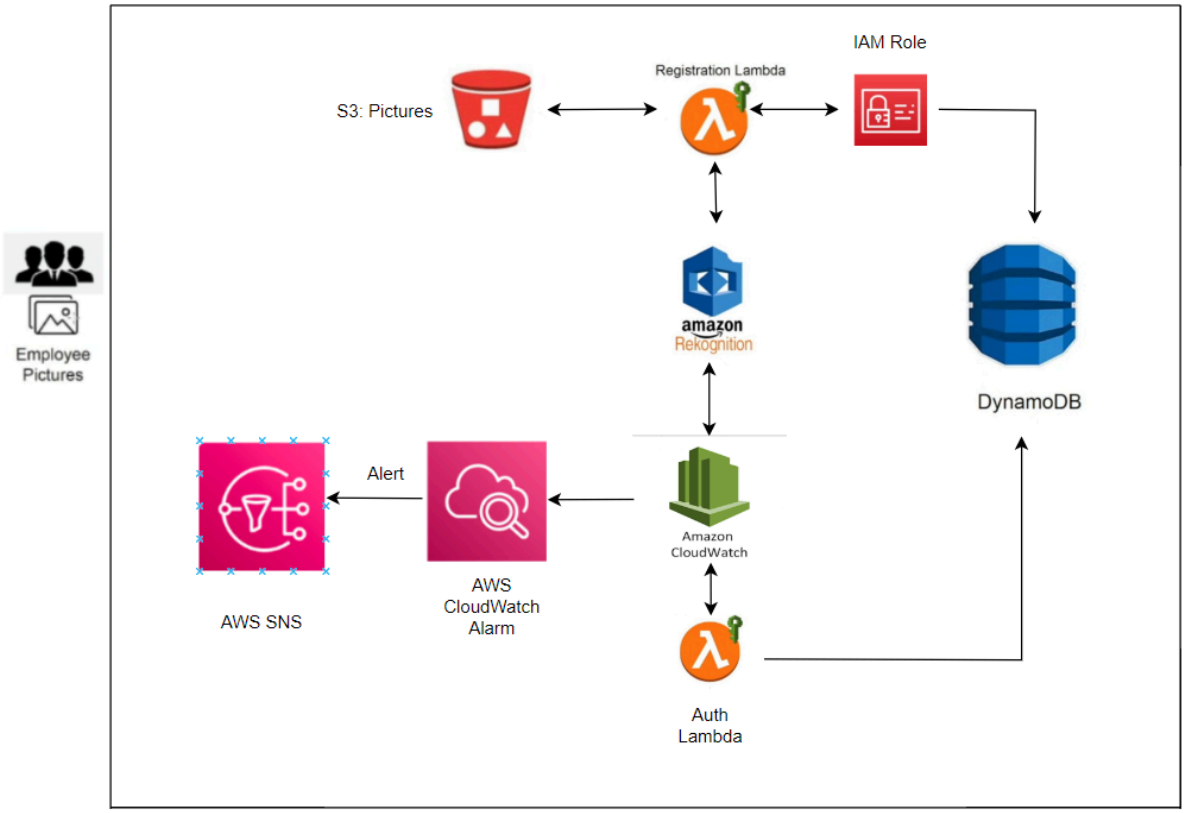
By harnessing the power of AWS's cloud infrastructure, the proposed system will offer several advantages over traditional on-premises solutions, including:

- Scalability: AWS provides on-demand scalability, allowing the system to dynamically adjust resources based on workload fluctuations. This ensures that the system can handle varying volumes of image data without compromising performance.
- Cost-effectiveness: By utilizing AWS's pay-as-you-go pricing model, organizations can avoid upfront infrastructure costs and only pay for the resources they consume. This helps in reducing overall operational expenses associated with managing and maintaining on-premises infrastructure.

- Security: AWS offers robust security features and compliance certifications, ensuring that sensitive image data is protected from unauthorized access and data breaches. This includes encryption mechanisms, access control policies, and monitoring tools to detect and respond to security threats proactively.
- Reliability: With AWS's global infrastructure, the proposed system will benefit from high availability and fault tolerance. This minimizes downtime and ensures uninterrupted access to image data and classification services, even in the event of hardware failures or network disruptions.

Overall, the proposed cloud-based image classification system offers a comprehensive solution for organizations looking to streamline their image management and classification workflows. By leveraging the scalability, cost-effectiveness, security, and reliability of AWS, the system will enable users to store, manage, and classify large volumes of image data efficiently and effectively.

3.2 Architecture / Framework



3.3 Algorithm and Process Design

- AWS configure: It is used to set up the AWS Command Line Interface (CLI) with the necessary credentials, including the Access Key ID and Secret Access Key, to enable communication with AWS services programmatically.

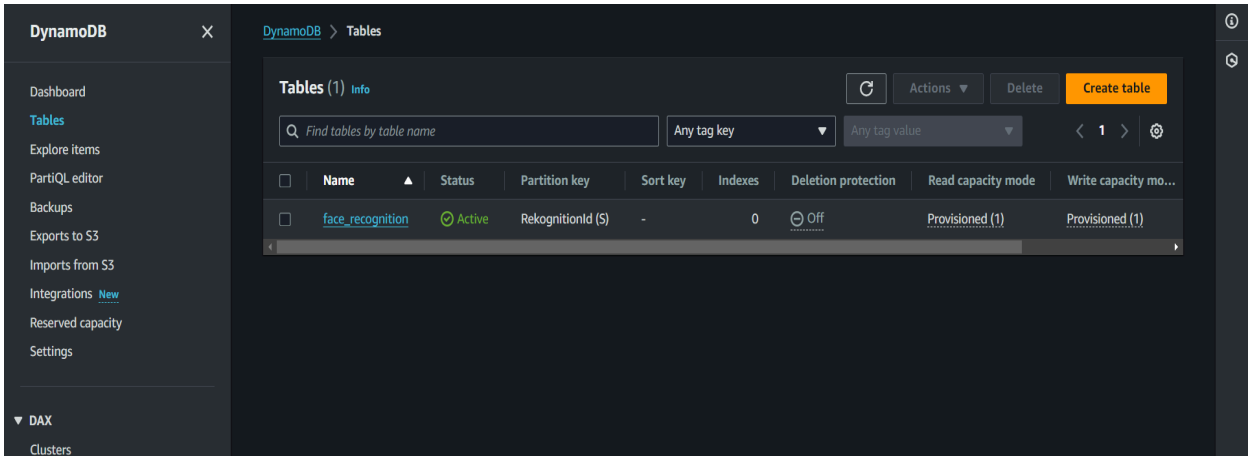
```
PS D:\> aws configure
AWS Access Key ID [****************C2XM]: AKIA2UC3FLETG4DBC2XM
AWS Secret Access Key [****************q3ij]: hD7xbc7WVp0XH8CMPP6t5me+dH23B5luBWBlq3
Default region name [None]: us-east-1
Default output format [None]:
```

- Create collection in amazon rekognition.

```
PS D:\> aws rekognition create-collection --collection-id famouspersons --region us-east-1
{
    "StatusCode": 200,
    "CollectionArn": "aws:rekognition:us-east-1:730335631654:collection/famouspersons",
    "FaceModelVersion": "7.0"
}
```

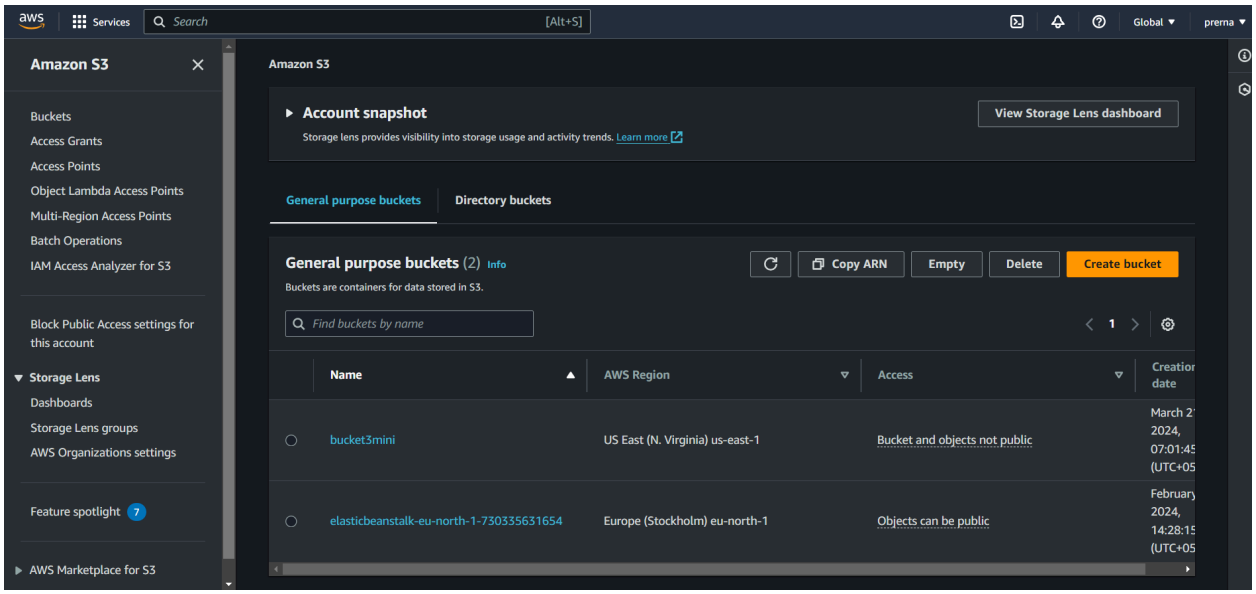
- Create a table in on aws dynamodb so that lambda function will be able to store the faceprint and the corresponding name of that person.

```
PS D:\> aws dynamodb create-table --table-name face_recognition --attribute-definitions AttributeName=RekognitionId,AttributeType=S --key-schema AttributeName=RekognitionId
,KeyType=HASH --provisioned-throughput ReadCapacityUnits=1,WriteCapacityUnits=1 --region us-east-1
{
    "TableDescription": {
        "AttributeDefinitions": [
            {
                "AttributeName": "RekognitionId",
                "AttributeType": "S"
            }
        ],
        "TableName": "face_recognition",
        "KeySchema": [
            {
                "AttributeName": "RekognitionId",
                "KeyType": "HASH"
            }
        ],
        "TableStatus": "CREATING",
        "CreationDateTime": "2024-03-21T06:58:55.849000+05:30",
        "ProvisionedThroughput": {
            "NumberOfDecreasesToday": 0,
            "ReadCapacityUnits": 1,
            "WriteCapacityUnits": 1
        },
        "TableSizeBytes": 0,
        "ItemCount": 0,
        "TableArn": "arn:aws:dynamodb:us-east-1:730335631654:table/face_recognition",
        "TableId": "6172f22c-4676-42b6-b2e9-5a10e3f8a5df",
        "DeletionProtectionEnabled": false
    }
}
```

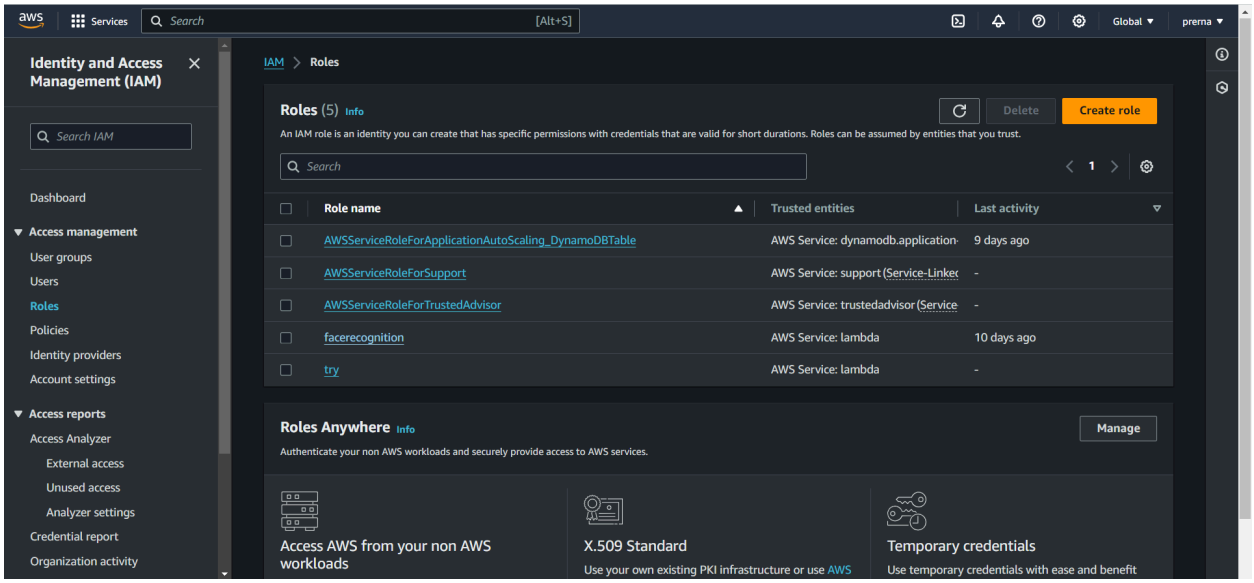


- Create S3 bucket where the images will be stored.

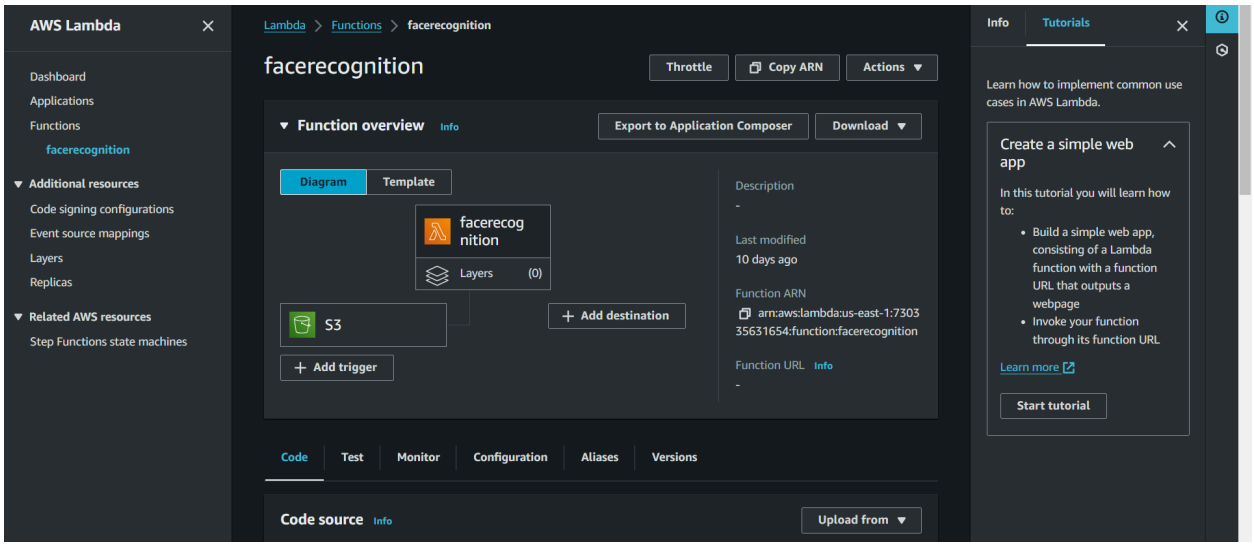
```
PS D:\> aws s3 mb s3://bucket3mini
make_bucket: bucket3mini
PS D:\> _
```



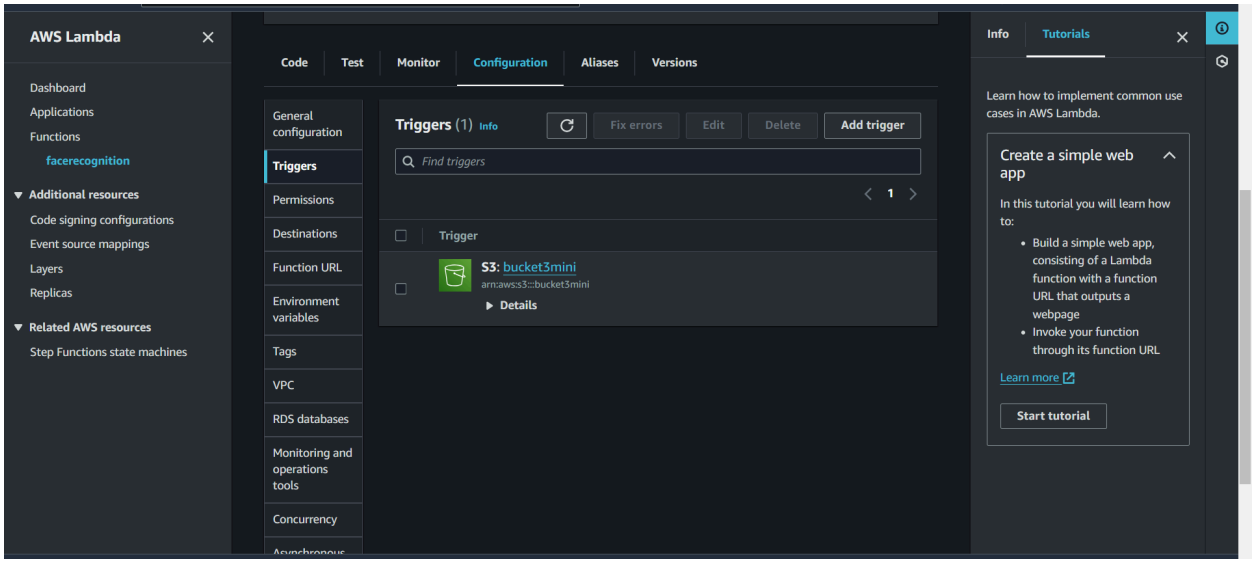
- Create Iam role for lambda function to access the dynamodb.



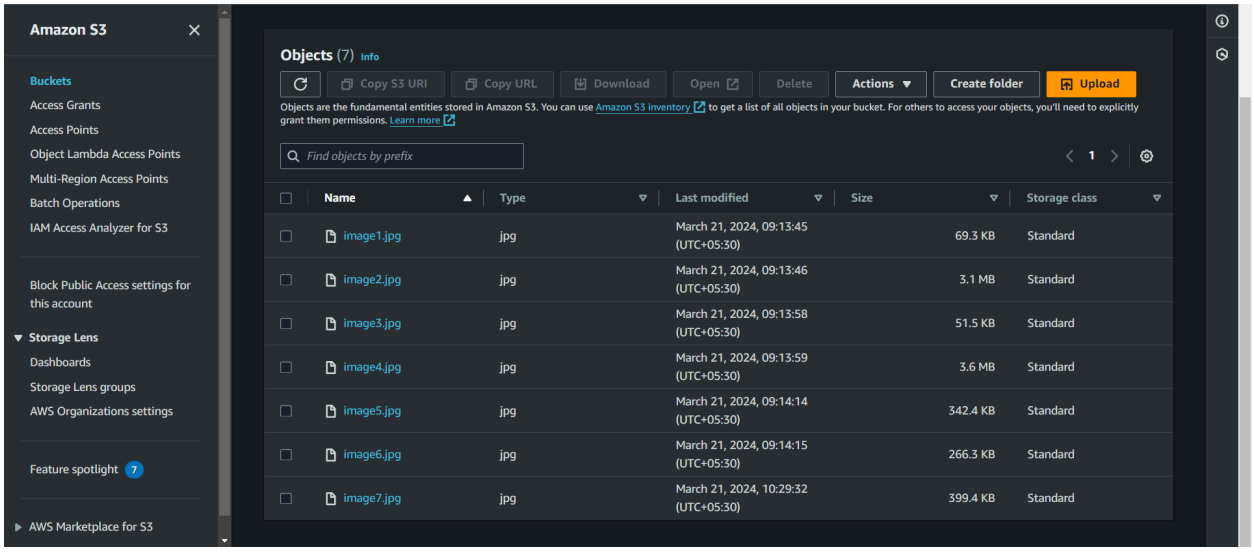
- Create a Lambda function.



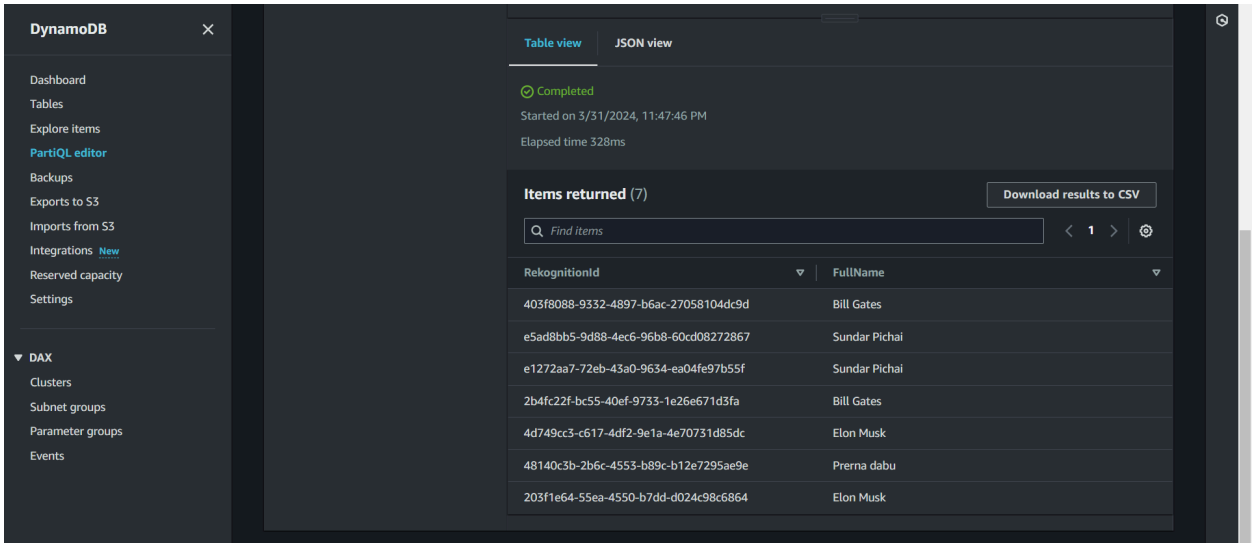
- Add trigger.



- This step where code is written to put the images in S3 bucket.



- Index will be populated in dynamodb with faceprint and the persons name



In conclusion, the outlined steps provide a structured approach to implementing a robust cloud-based image classification system leveraging Amazon Web Services. By configuring the AWS CLI, setting up S3 buckets, integrating Amazon Rekognition for image analysis, and developing a user-friendly frontend with React, organizations can streamline image management and classification workflows effectively. Through rigorous testing, optimization, and evaluation, the system ensures not only scalability and reliability but also cost-effectiveness and security. This comprehensive solution empowers businesses across various industries to efficiently handle large volumes of image data, ultimately enhancing productivity and decision-making processes.

3.4 AWS and other software specifications

In the proposed cloud-based image classification system, several AWS services are utilized to create a robust and scalable architecture. Here's an overview of the key AWS services used:

- **Amazon S3 (Simple Storage Service)**:

  Amazon S3 is used as the primary storage solution for storing the image dataset securely in the cloud. It provides highly scalable object storage with high availability and durability.

- **AWS Lambda:**

  AWS Lambda is a serverless compute service that executes code in response to events. It is utilized for serverless image processing tasks, such as triggering image analysis and classification workflows.

- **Amazon Rekognition**:

  Amazon Rekognition is a deep learning-based image and video analysis service that can identify objects, people, text, scenes, and activities in images and videos.

  Rekognition is integrated into the system to perform image analysis and classification tasks on the images stored in S3 buckets.

- **Amazon DynamoDB**:

  Amazon DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability.

  DynamoDB can be used to store metadata associated with the image dataset, such as image IDs, labels, and analysis results.

- **IAM (Identity and Access Management) Role**:

IAM roles are used to define permissions for AWS resources and control access to AWS services and resources securely.

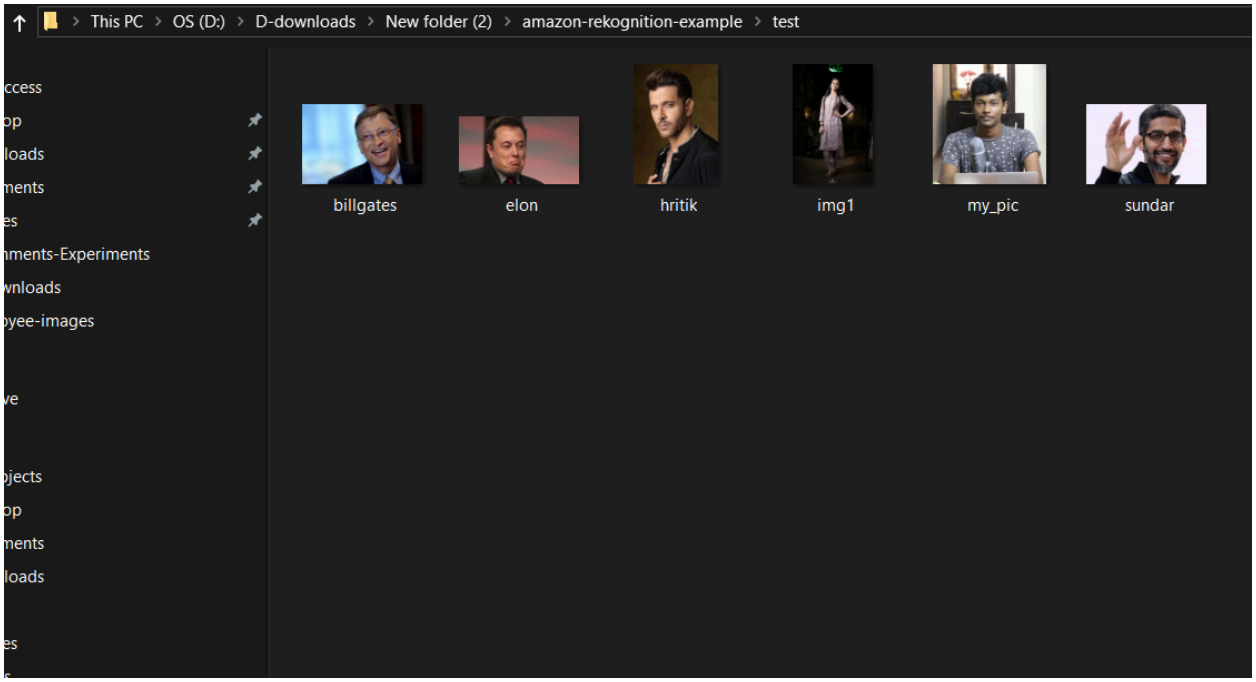
An IAM role is created and attached to AWS Lambda functions to grant them the necessary permissions to access S3 buckets, invoke Rekognition APIs, and interact with other AWS services.

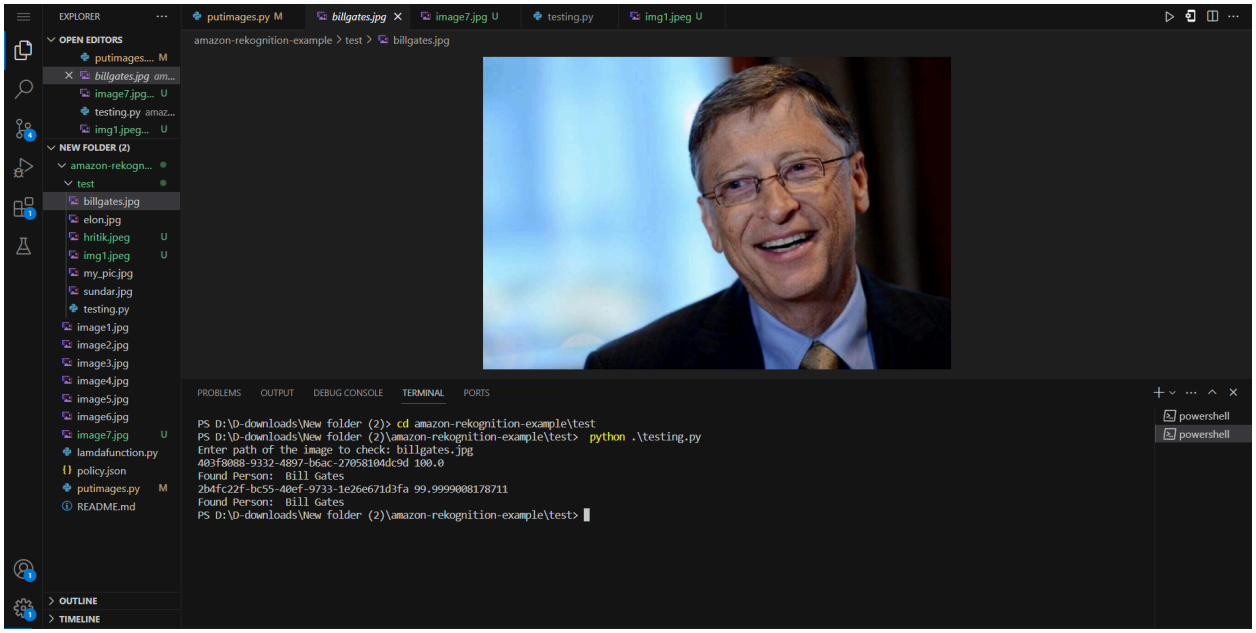
IAM roles help enforce the principle of least privilege, ensuring that Lambda functions only have access to the resources they need to perform their tasks.

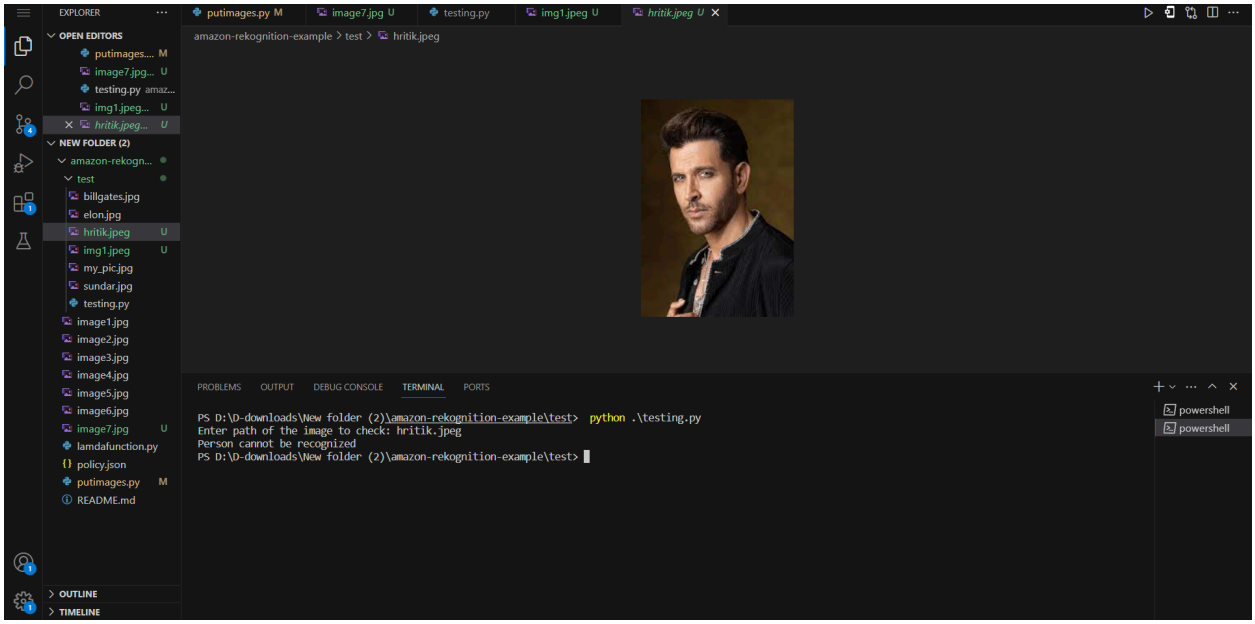
3.5 Experiment and Results

In this project, we utilized Amazon S3 (Simple Storage Service), Amazon Machine Learning, AWS Service, and Amazon Rekognition to create an intelligent cloud storage system for image classification. Our goal was to develop a machine learning model that could accurately classify images stored in Amazon S3 buckets.

Output screenshots of the preprocessing steps are shown:


This PC
OS (D:)
D-downloads
New folder (2)
amazon-rekognition-example
test
billgates
elon
hritik
img1
my_pic
sundar


EXPLORER
OPEN EDITORS
NEW FOLDER (2)
billgates.jpg
elon.jpg
hritik.jpeg
img1.jpeg
my_pic.jpg
sundar.jpg
testing.py
image1.jpg
image2.jpg
image3.jpg
image4.jpg
image5.jpg
image6.jpg
image7.jpg
lamdafunction.py
policy.json
putimages.py
README.md
putimages.py M
billgates.jpg
image7.jpg U
testing.py
img1.jpeg U
amazon-rekognition-example > test > billgates.jpg
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS D:\D-downloads\New folder (2)> cd amazon-rekognition-example\test
PS D:\D-downloads\New folder (2)\amazon-rekognition-example\test> python .\testing.py
Enter path of the image to check: billgates.jpg
403f8088-9332-4897-b6ac-27058104dc9d 100.0
Found Person: Bill Gates
2b4fc22f-bc55-40ef-9733-1e26e671d3fa 99.9999008178711
Found Person: Bill Gates
PS D:\D-downloads\New folder (2)\amazon-rekognition-example\test>
powershell
powershell
OUTLINE
TIMELINE


EXPLORER
putimages.py M
image7.jpg U
testing.py
img1.jpeg U
hritik.jpeg U
amazon-rekognition-example > test > hritik.jpeg
OPEN EDITORS
putimages.... M
image7.jpg... U
testing.py amaz...
img1.jpeg... U
hritik.jpeg... U
NEW FOLDER (2)
amazon-rekogn...
test
billgates.jpg
elon.jpg
hritik.jpeg U
img1.jpeg U
my_pic.jpg
sundar.jpg
testing.py
image1.jpg
image2.jpg
image3.jpg
image4.jpg
image5.jpg
image6.jpg
image7.jpg U
lamdafunction.py
policy.json
putimages.py M
README.md
OUTLINE
TIMELINE
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
PS D:\D-downloads\New folder (2)\amazon-rekognition-example\test> python .\testing.py
Enter path of the image to check: hritik.jpeg
Person cannot be recognized
PS D:\D-downloads\New folder (2)\amazon-rekognition-example\test>
powershell
powershell

3.6 Conclusion

In conclusion, the project successfully leveraged various AWS services such as Amazon S3, Amazon Machine Learning to develop an intelligent cloud storage system for image classification. By utilizing these services, we were able to create a scalable, efficient, and accurate solution for managing and classifying large volumes of image data stored in Amazon S3 buckets. The integration of machine learning capabilities allowed us to build a model capable of accurately classifying images, enhancing the functionality and value of the cloud storage system. Additionally, deploying the frontend on AWS web services ensured seamless accessibility and reliability for end-users.

Overall, the project demonstrates the effectiveness of utilizing AWS services to address complex data management and analysis tasks, showcasing the potential for leveraging cloud computing resources to solve real-world challenges in image classification and beyond.