CS- 643861 Cloud Computing.

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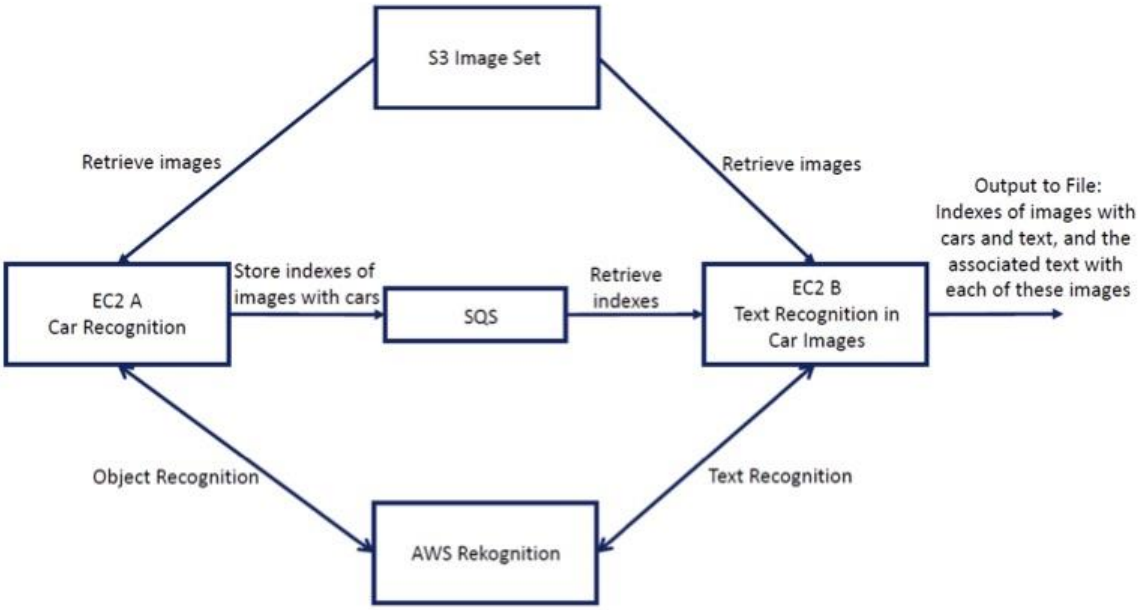
Programming Assignment 1: AWS Image Recognition Pipeline

This project consists of two main Python applications running on separate AWS EC2 instances. The first application (EC2 Instance A) is responsible for detecting cars in images using AWS Rekognition. If a car is detected with a confidence level above 90%, the image index is sent to an AWS SQS queue. The second application (EC2 Instance B) reads these image indices from the SQS queue, retrieves the corresponding images, and uses AWS Rekognition to perform text recognition.



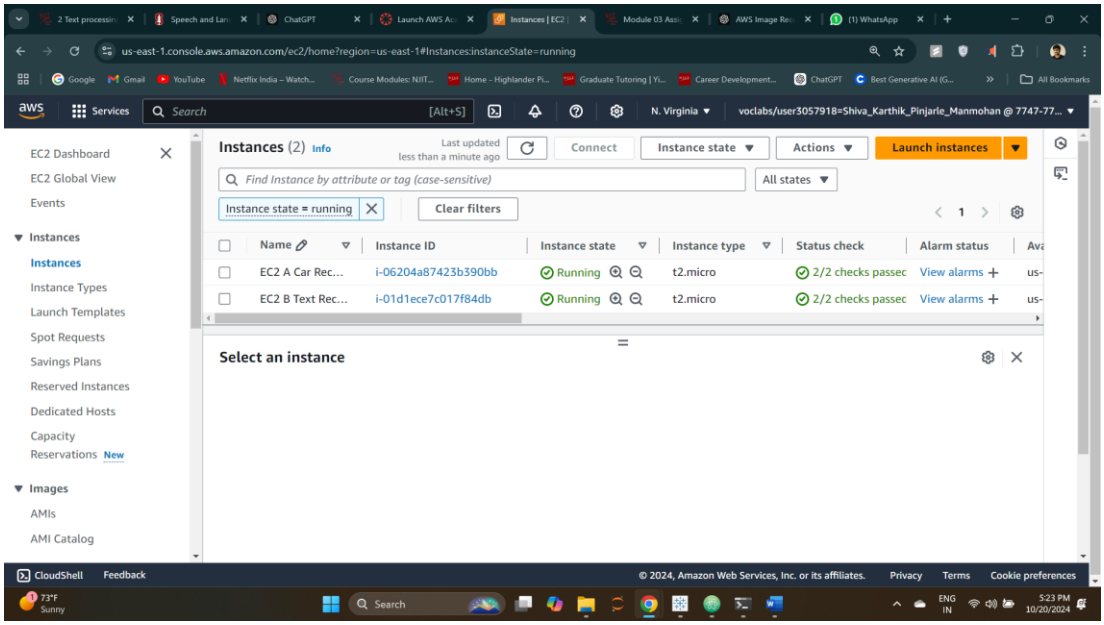
Requirements

- AWS Account
- Python 3.8 or later
- Boto3
- AWS CLI configured with appropriate permissions

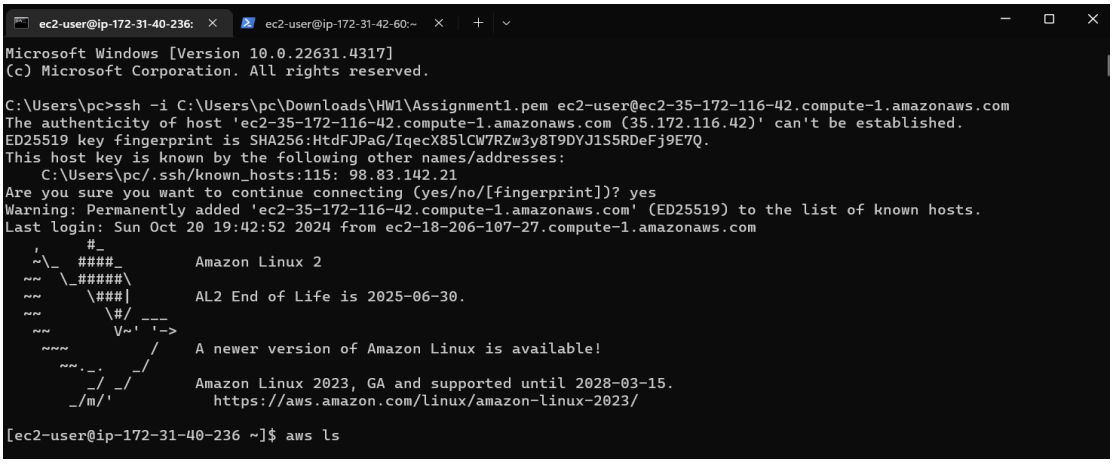
Setup

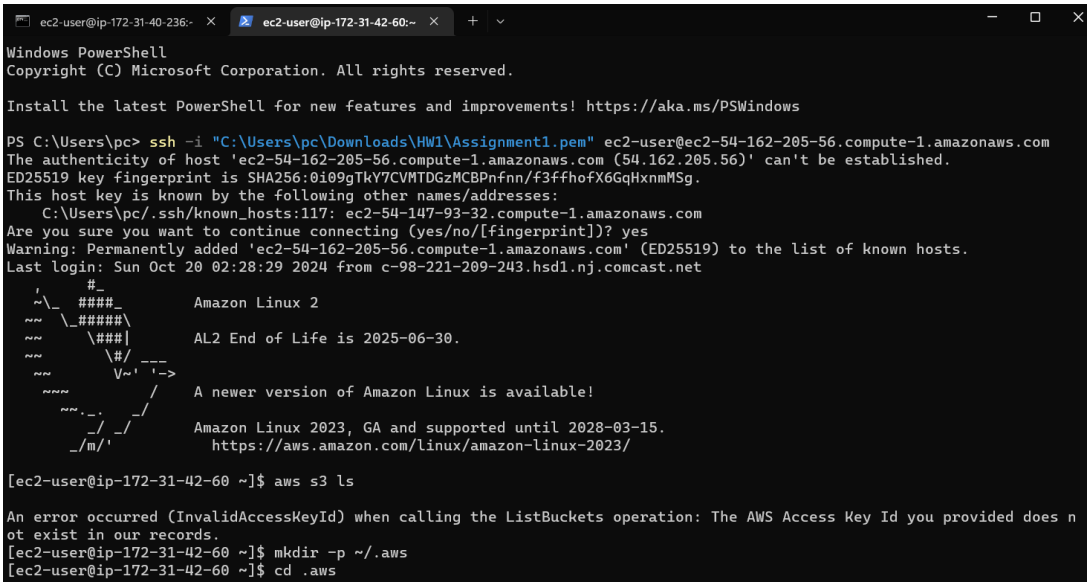
AWS Services Setup

1. **Amazon EC2 Instances:**
    - Create two Car/Text Recognition instances.
    - You should use the same .pem key for both instances.
    - You must configure the Security Group well to prevent any attacks. In the Security Group
    - tab, there is a column called "Source" which tells from which IP address this instance can be accessed: you should select "MYIP" from the drop box. You should open just three ports: SSH, HTTP, HTTPS.
    - For this assignment, the free tier instances are more than enough (this will incur no cost).



- Connected to the command prompt using **ssh -i <filename>.pem ec2-user@<public-ip>**





- We have created a directory with the configuration commands and keys. (AWS Configure)
  1. mkdir -p ~/.aws

2. cd .aws
3. nano ~/.aws/credentials
4. Copy and paste the credentials

- Follow the same thing for the second instance.

```
[ec2-user@ip-172-31-42-60 ~]$ mkdir -p ~/.aws
[ec2-user@ip-172-31-42-60 ~]$ cd .aws
[ec2-user@ip-172-31-42-60 .aws]$ ls
config  credentials
[ec2-user@ip-172-31-42-60 .aws]$ nano ~/.aws/credentials
[ec2-user@ip-172-31-42-60 .aws]$ cd
[ec2-user@ip-172-31-42-60 ~]$ aws s3 ls
2024-10-20 03:48:59 s3bucket9542
```

2. Amazon S3:

- Create an S3 bucket named s3bucket9542 and upload your image files (e.g., 1.jpg, 2.jpg, ...).

3. Amazon SQS:

- Create an SQS queue named "Queue_name" that stores the output messages from the first instance so that the second instance can process them using python code.

4. Install Boto3 and AWS CLI:

- I am using Python for this assignment, where I have installed boto3 in both instances using these commands:
  1. **pip3 install boto3**
  2. **pip3 install awscli**
- After installing these packages, we need to add Python code in both instances using the nano editor **nano (file_name).py.**

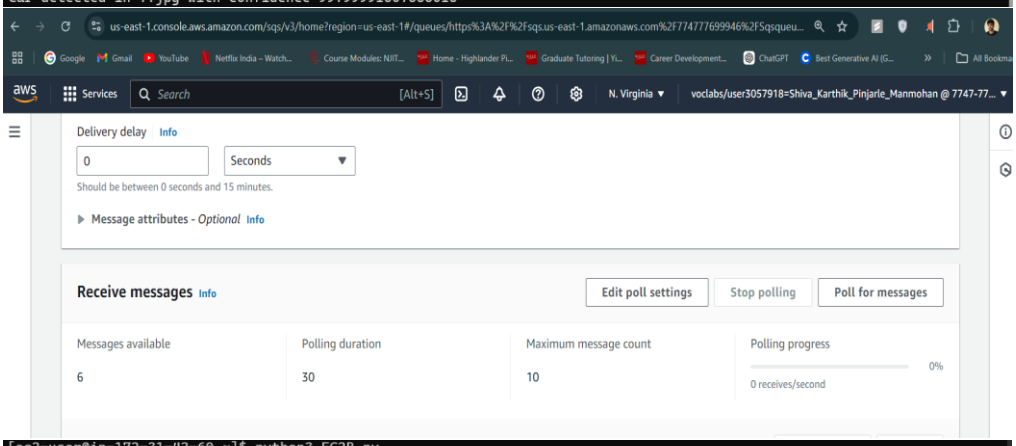
```
ec2-user@ip-172-31-40-236:   ec2-user@ip-172-31-42-60:~
  GNU nano 2.9.8                                   EC2A.py

import boto3

def detect_cars_and_send_to_sqs(bucket_name, image_keys, queue_url):
    rekognition_client = boto3.client('rekognition')
    sqs_client = boto3.client('sqs')

    for image_key in image_keys:
        response = rekognition_client.detect_labels(
            Image={
                'S3Object': {
                    'Bucket': bucket_name,
                    'Name': image_key
                }
            },
            MaxLabels=10,
            MinConfidence=75
        )

        # Check if 'Car' is detected and confidence > 90%
        for label in response['Labels']:
            if label['Name'] == 'Car' and label['Confidence'] > 90:
                print(f"Car detected in {image_key} with confidence {label['Confidence']}")
                # Send the image key to SQS
                sqs_client.send_message(
                    QueueUrl=queue_url,
                                        [ Read 35 lines ]
^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos   M-U Undo   M-A Mark Text
^X Exit       ^R Read File   ^\ Replace    ^U Uncut Text ^T To Linter  ^_ Go To Line M-E Redo  M-6 Copy Text
```

```
ec2-user@ip-172-31-40-236:~   ec2-user@ip-172-31-42-60:~
  GNU nano 2.9.8                                   EC2B.py

import boto3

def receive_messages_and_detect_text(bucket_name, queue_url):
    rekognition_client = boto3.client('rekognition')
    sqs_client = boto3.client('sqs')

    empty_responses = 0  # Counter for empty responses

    while True:
        messages = sqs_client.receive_message(
            QueueUrl=queue_url,
            MaxNumberOfMessages=1,
            WaitTimeSeconds=20
        )

        if 'Messages' not in messages:
            print("No messages in queue. Waiting...")
            empty_responses += 1
            if empty_responses >= 10:  # Stop after 10 empty responses
                print("No new messages for a while. Stopping.")
                break
            continue

        empty_responses = 0  # Reset counter if a message is found

                                                [ Read 51 lines ]
^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos   M-U Undo   M-A Mark Text
^X Exit       ^R Read File   ^\ Replace    ^U Uncut Text ^T To Linter  ^_ Go To Line M-E Redo   M-6 Copy Text
```

- Run the Python code in both instances using this command **python3 (file_name).py.** Here, I have used two Python codes for the two instances. (EC2A.py and EC2B.py).

5. Outputs:

```
[ec2-user@ip-172-31-40-236 ~]$ python3 EC2A.py
/home/ec2-user/.local/lib/python3.7/site-packages/boto3/compat.py:82: PythonDeprecationWarning: Boto3 will no longer sup
port Python 3.7 starting December 13, 2023. To continue receiving service updates, bug fixes, and security updates pleas
e upgrade to Python 3.8 or later. More information can be found here: https://aws.amazon.com/blogs/developer/python-supp
ort-policy-updates-for-aws-sdks-and-tools/
  warnings.warn(warning, PythonDeprecationWarning)
Car detected in 1.jpg with confidence 99.94896697998047
Car detected in 2.jpg with confidence 99.703125
Car detected in 4.jpg with confidence 99.48165130615234
Car detected in 5.jpg with confidence 99.52181243896484
Car detected in 6.jpg with confidence 98.75323486328125
Car detected in 7.jpg with confidence 99.99991607666016
```




```
[ec2-user@ip-172-31-42-60 ~]$ python3 EC2B.py
/home/ec2-user/.local/lib/python3.7/site-packages/boto3/compat.py:82: PythonDeprecationWarning: Boto3 will no longer sup
port Python 3.7 starting December 13, 2023. To continue receiving service updates, bug fixes, and security updates pleas
e upgrade to Python 3.8 or later. More information can be found here: https://aws.amazon.com/blogs/developer/python-supp
ort-policy-updates-for-aws-sdks-and-tools/
  warnings.warn(warning, PythonDeprecationWarning)
No messages in queue. Waiting...
Detected texts for 1.jpg:
$ BR8167
$
BR8167
Detected texts for 2.jpg:
Detected texts for 4.jpg:
YHI9 OTZ
YHI9
OTZ
Detected texts for 5.jpg:
Detected texts for 6.jpg:
Detected texts for 7.jpg:
Lamborghini
LP 610 LB
BO
BWW
Lamborghini
LP
610 LB
BO
BWW
```