Read-Me

Brief overview of project working:

Part1: Instance1Application.java

Instance1-0.0.1-SNAPSHOT.jar

1. Program will start by configuring the aws credentials which need to are entered in the file already.
2. First, the program will access the s3 bucket and pass the images one by one to Rekognition to do object detection. While in process it simultaneously will check whether the label is "Car" and confidence > 90%.
3. The sqs JMS connection is made. (queue is created through java).
4. The images which satisfies the condition will be pushed to sqs fifo queue.

Part2: CloudComputingApplication.java

CloudComputing-2-0.0.1-SNAPSHOT.jar

1. The program will connect to the queue (which will be existing as instance 1 ran first).
2. Mylistener class will retrieve the indexes (fifo manner).
3. The image indexes which is retrieved from queue will be fetched from s3 bucket and passed to text recognition simultaneously. The output is printed to the output.txt file.

Both the programs work **parallelly.** As soon as image comes to queue from instance 1, instance 2 fetches it and perform text recognition and output is stored in output.txt file.

If instance 2 is started first and queue is not created, then it will create a queue and wait for instance 1 to start (not for longer time). As soon as instance 1 starts, instance 2 starts fetching.

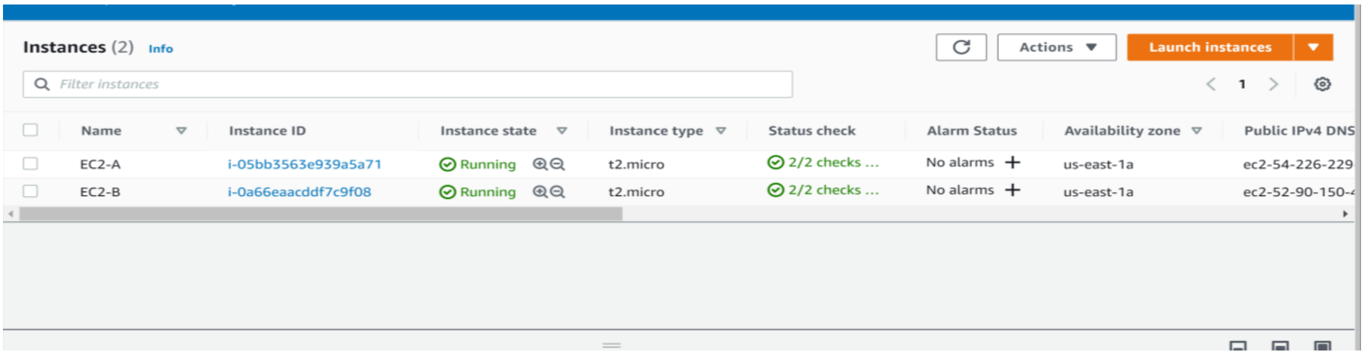
Execution of Programming Assignment step by step:

Starting by creating the .jar files from both java applications respective of instances.

- .jars are form using maven command through command line.

1. Create Instances

Creating two instances on AWS console and applied the IAM roles (which has full access to s3, sqs, recognition).

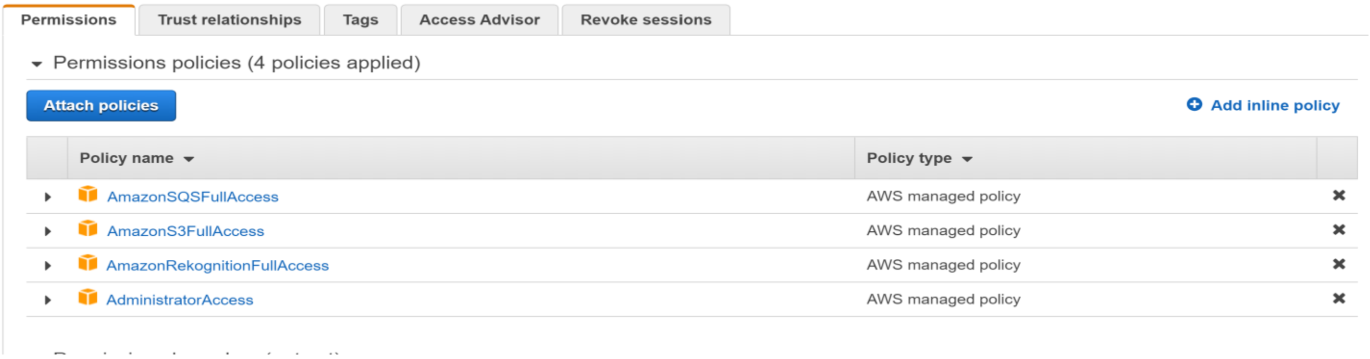


Instances (2) Info

	Name	Instance ID	Instance state	Instance type	Status check	Alarm Status	Availability zone	Public IPv4 DNS
□	EC2-A	i-05bb3563e939a5a71	Running	t2.micro	2/2 checks ...	No alarms	us-east-1a	ec2-54-226-229
□	EC2-B	i-0a66eaacddf7c9f08	Running	t2.micro	2/2 checks ...	No alarms	us-east-1a	ec2-52-90-150-

Download key pair.

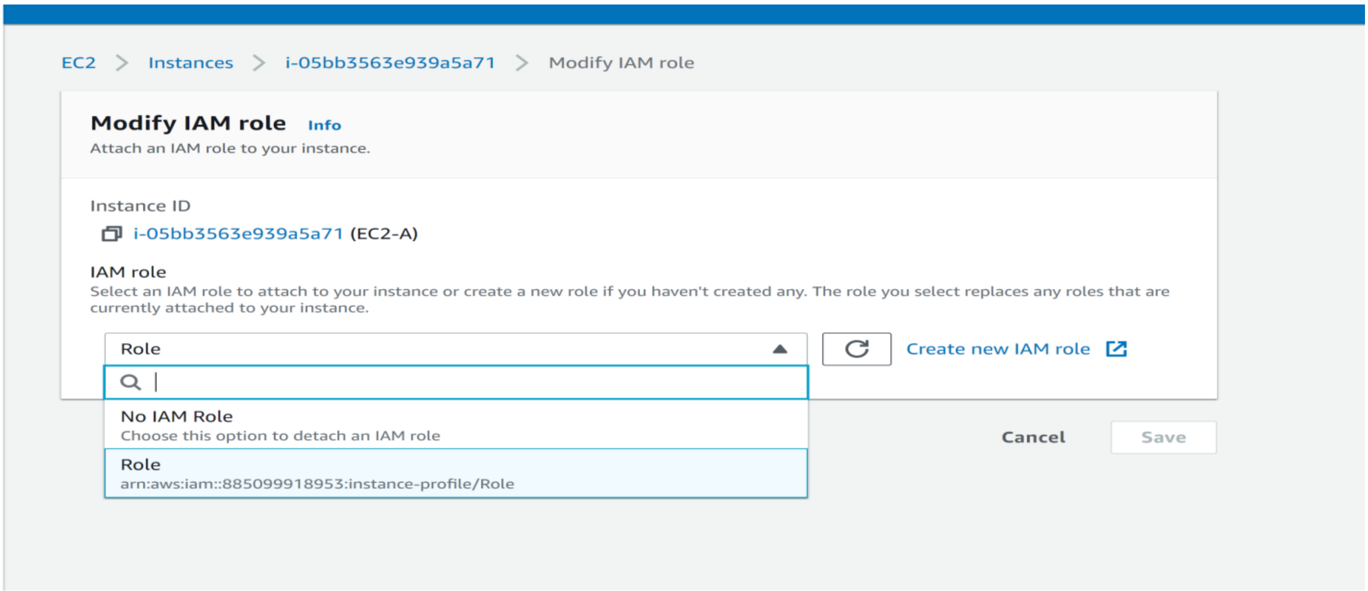
Adding the policies to IAM role:



Permissions policies (4 policies applied)

Policy name	Policy type
AmazonSQSFullAccess	AWS managed policy
AmazonS3FullAccess	AWS managed policy
AmazonRekognitionFullAccess	AWS managed policy
AdministratorAccess	AWS managed policy

Attaching the role to both of instances for successful communication.



Modify IAM role Info

Attach an IAM role to your instance.

Instance ID

i-05bb3563e939a5a71 (EC2-A)

IAM role

Select an IAM role to attach to your instance or create a new role if you haven't created any. The role you select replaces any roles that are currently attached to your instance.

No IAM Role

Choose this option to detach an IAM role

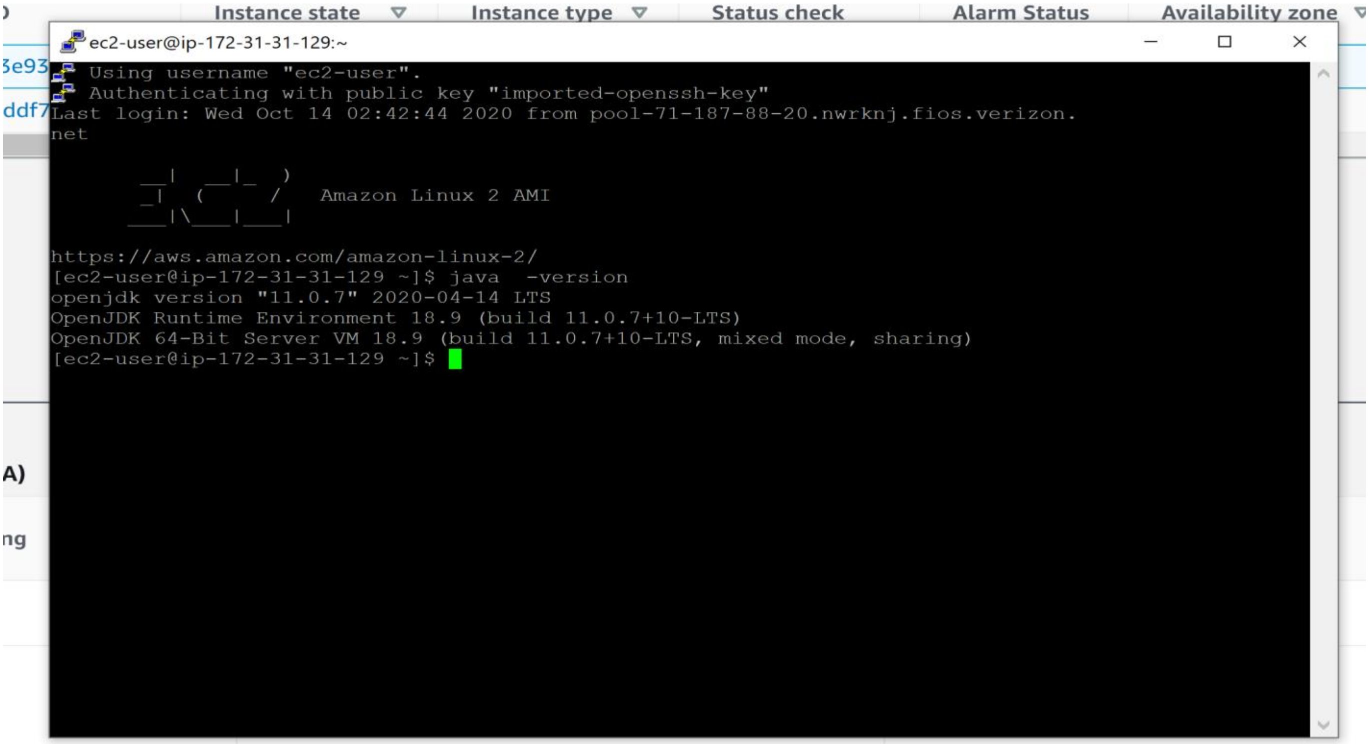
Role

arn:aws:iam::885099918953:instance-profile/Role

2. Connect to instances through putty.

(my application and putty uses jdk 11 version)

Instance1:



```
Using username "ec2-user".
Authenticating with public key "imported-openssh-key"
Last login: Wed Oct 14 02:42:44 2020 from pool-71-187-88-20.nwrknj.fios.verizon.
net

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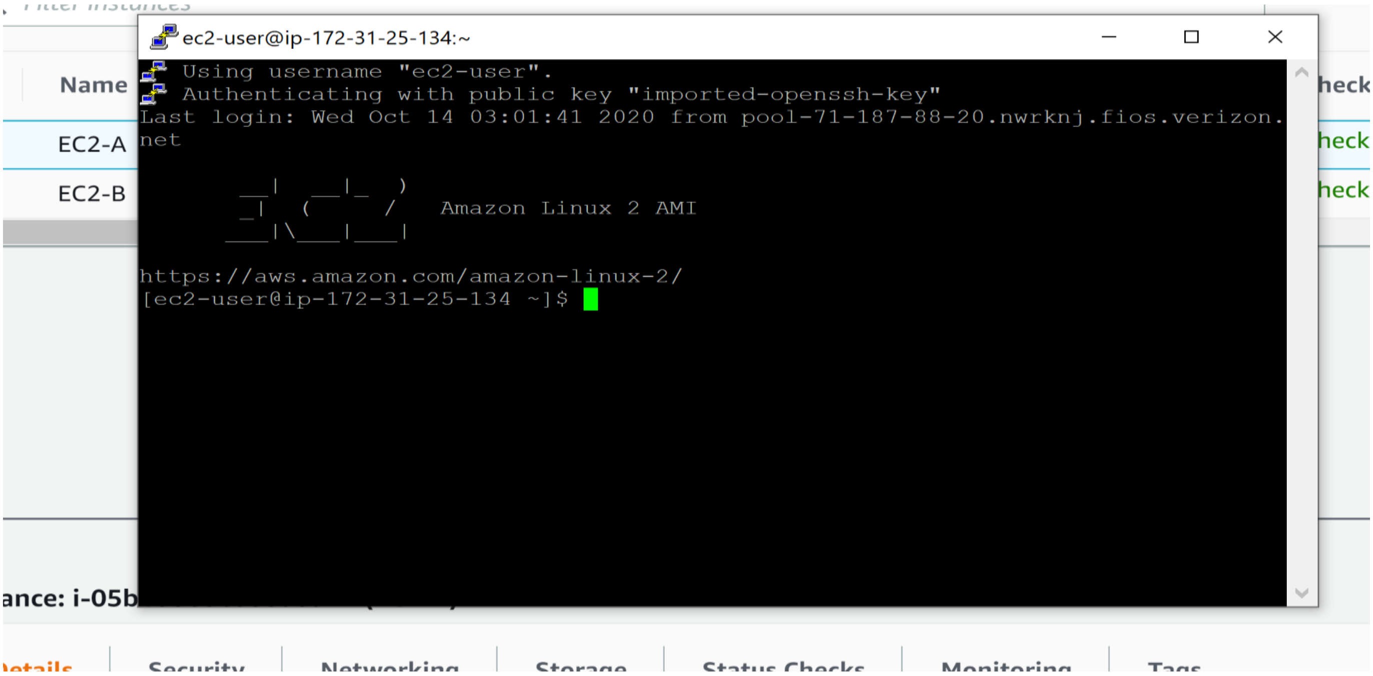
https://aws.amazon.com/amazon-linux-2/
[ec2-user@ip-172-31-31-129 ~]$ java  -version
openjdk version "11.0.7" 2020-04-14 LTS
OpenJDK Runtime Environment 18.9 (build 11.0.7+10-LTS)
OpenJDK 64-Bit Server VM 18.9 (build 11.0.7+10-LTS, mixed mode, sharing)
[ec2-user@ip-172-31-31-129 ~]$
```

Instance 2:



```
Using username "ec2-user".
Authenticating with public key "imported-openssh-key"
Last login: Wed Oct 14 03:01:41 2020 from pool-71-187-88-20.nwrknj.fios.verizon.
net

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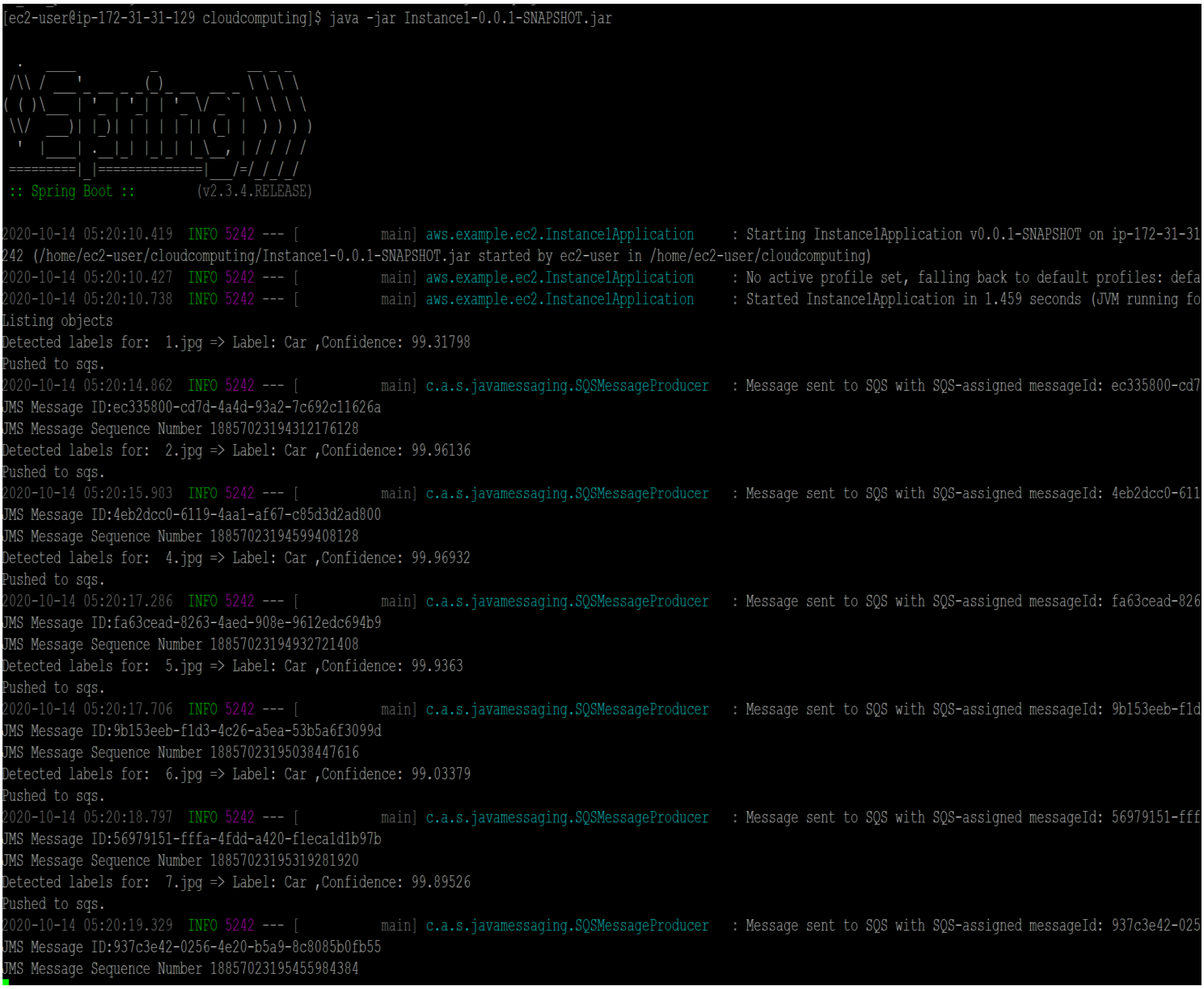
https://aws.amazon.com/amazon-linux-2/
[ec2-user@ip-172-31-25-134 ~]$
```

3. Uploading respective jar files in both of the instances using WinSCP.

Scenario 1: Running instance 1 first

4. Running jar file on instance 1.



```
[ec2-user@ip-172-31-31-129 cloudcomputing]$ java -jar Instance1-0.0.1-SNAPSHOT.jar

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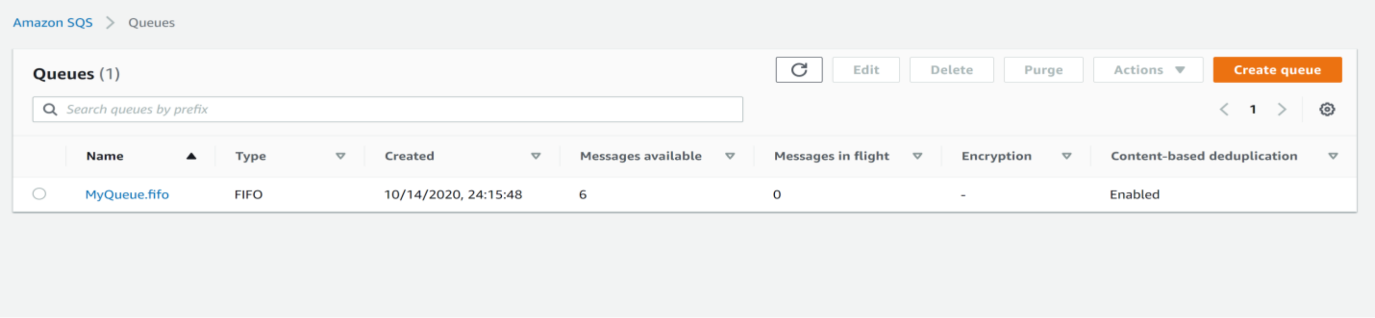
 :: Spring Boot ::        (v2.3.4.RELEASE)

2020-10-14 05:20:10.419  INFO 5242 --- [           main] aws.example.ec2.Instance1Application     : Starting Instance1Application v0.0.1-SNAPSHOT on ip-172-31-31
242 (/home/ec2-user/cloudcomputing/Instance1-0.0.1-SNAPSHOT.jar started by ec2-user in /home/ec2-user/cloudcomputing)
2020-10-14 05:20:10.427  INFO 5242 --- [           main] aws.example.ec2.Instance1Application     : No active profile set, falling back to default profiles: defa
2020-10-14 05:20:10.738  INFO 5242 --- [           main] aws.example.ec2.Instance1Application     : Started Instance1Application in 1.459 seconds (JVM running fo
Listing objects
Detected labels for:  1.jpg => Label: Car ,Confidence: 99.31798
Pushed to sqs.
2020-10-14 05:20:14.862  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: ec335800-cd7
JMS Message ID:ec335800-cd7d-4a4d-93a2-7c692c11626a
JMS Message Sequence Number 18857023194312176128
Detected labels for:  2.jpg => Label: Car ,Confidence: 99.96136
Pushed to sqs.
2020-10-14 05:20:15.983  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: 4eb2dcc0-611
JMS Message ID:4eb2dcc0-6119-4aa1-af67-c85d3d2ad800
JMS Message Sequence Number 18857023194599408128
Detected labels for:  4.jpg => Label: Car ,Confidence: 99.96932
Pushed to sqs.
2020-10-14 05:20:17.286  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: fa63cead-826
JMS Message ID:fa63cead-8263-4aed-908e-9612edc694b9
JMS Message Sequence Number 18857023194932721408
Detected labels for:  5.jpg => Label: Car ,Confidence: 99.9363
Pushed to sqs.
2020-10-14 05:20:17.706  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: 9b153eeb-f1d
JMS Message ID:9b153eeb-f1d3-4c26-a5ea-53b5a6f3099d
JMS Message Sequence Number 18857023195038447616
Detected labels for:  6.jpg => Label: Car ,Confidence: 99.03379
Pushed to sqs.
2020-10-14 05:20:18.797  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: 56979151-fff
JMS Message ID:56979151-fffa-4fdd-a420-f1eca1d1b97b
JMS Message Sequence Number 18857023195319281920
Detected labels for:  7.jpg => Label: Car ,Confidence: 99.89526
Pushed to sqs.
2020-10-14 05:20:19.329  INFO 5242 --- [           main] c.a.s.javamessaging.SQSMessageProducer   : Message sent to SQS with SQS-assigned messageId: 937c3e42-025
JMS Message ID:937c3e42-0256-4e20-b5a9-8c8085b0fb55
JMS Message Sequence Number 18857023195455984384
```

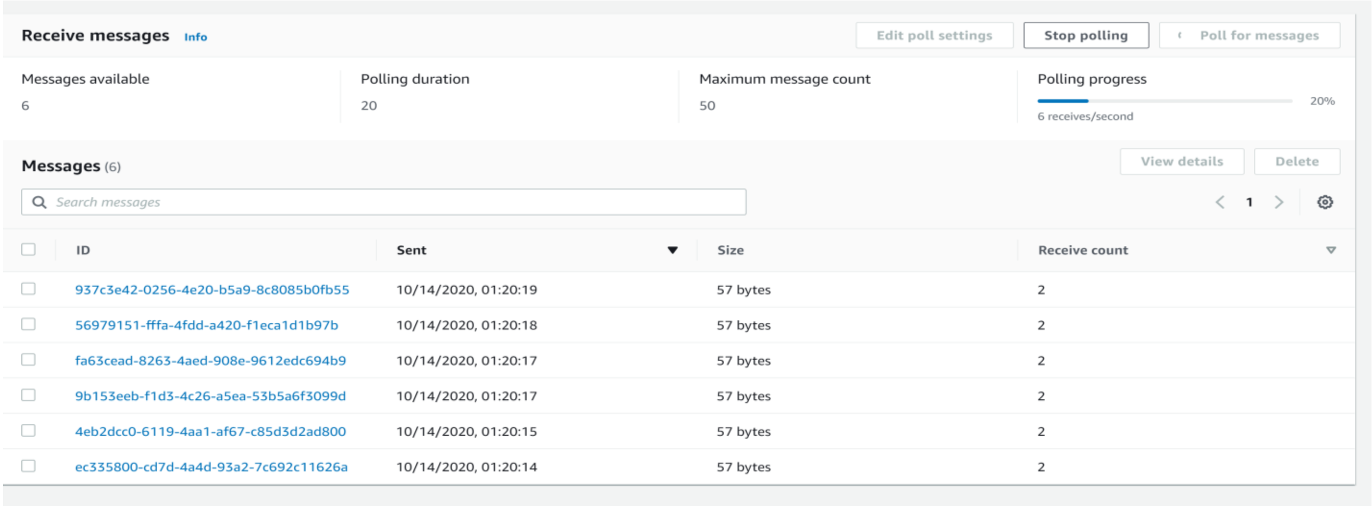
The output is the images which has label “Car” and confidence >90.
Only 6 images satisfies out of 10.

The snapshot of queue created by instance 1, and it has 6 messages which are indexes of 6 images.



Queues (1)

	Name ▲	Type	Created	Messages available	Messages in flight	Encryption	Content-based deduplication
○	MyQueue.fifo	FIFO	10/14/2020, 24:15:48	6	0	-	Enabled



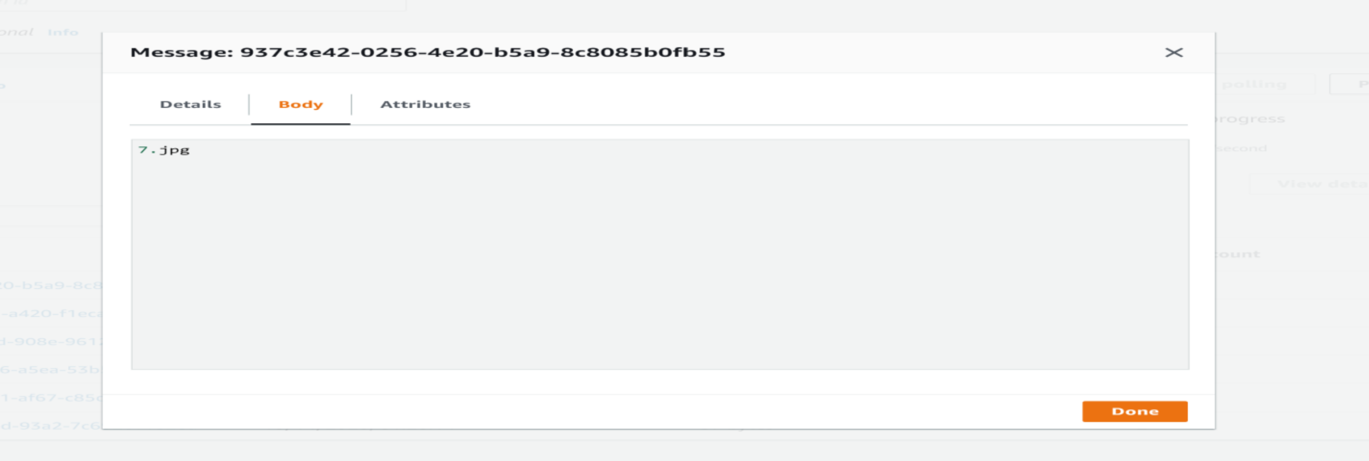
Receive messages

Messages available	Polling duration	Maximum message count	Polling progress
6	20	50	20% 6 receives/second

Messages (6)

	ID	Sent	Size	Receive count
□	937c3e42-0256-4e20-b5a9-8c8085b0fb55	10/14/2020, 01:20:19	57 bytes	2
□	56979151-fffa-4fdd-a420-f1eca1d1b97b	10/14/2020, 01:20:18	57 bytes	2
□	fa63cead-8263-4aed-908e-9612edc694b9	10/14/2020, 01:20:17	57 bytes	2
□	9b153eeb-f1d3-4c26-a5ea-53b5a6f3099d	10/14/2020, 01:20:17	57 bytes	2
□	4eb2dcc0-6119-4aa1-af67-c85d3d2ad800	10/14/2020, 01:20:15	57 bytes	2
□	ec335800-cd7d-4a4d-93a2-7c692c11626a	10/14/2020, 01:20:14	57 bytes	2

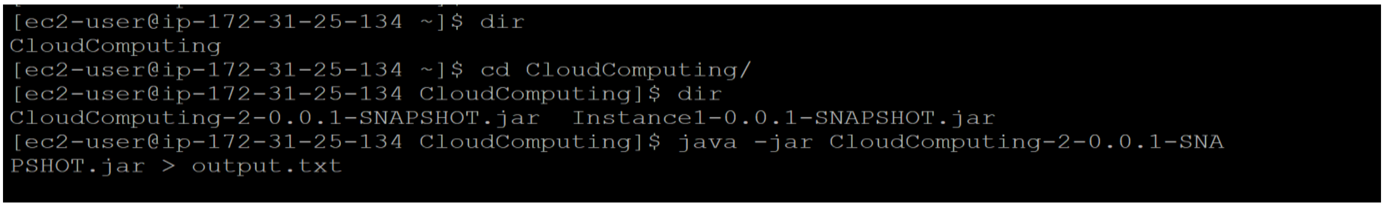
One of the queue message body :



Message: 937c3e42-0256-4e20-b5a9-8c8085b0fb55

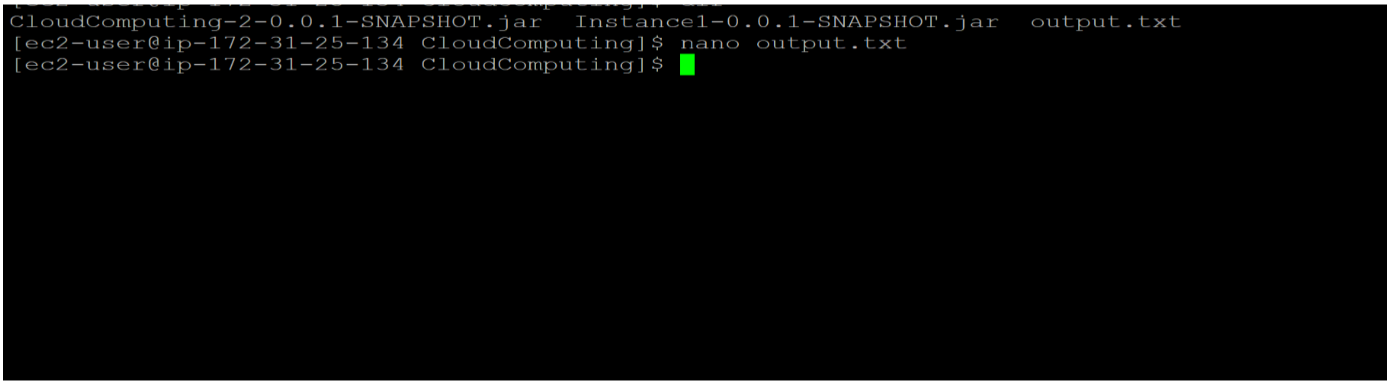
```
7.jpg
```

5.Running jar file on instance 2 and output saved to output.txt :



```
[ec2-user@ip-172-31-25-134 ~]$ dir
CloudComputing
[ec2-user@ip-172-31-25-134 ~]$ cd CloudComputing/
[ec2-user@ip-172-31-25-134 CloudComputing]$ dir
CloudComputing-2-0.0.1-SNAPSHOT.jar  Instance1-0.0.1-SNAPSHOT.jar
[ec2-user@ip-172-31-25-134 CloudComputing]$ java -jar CloudComputing-2-0.0.1-SNA
PSHOT.jar > output.txt
```

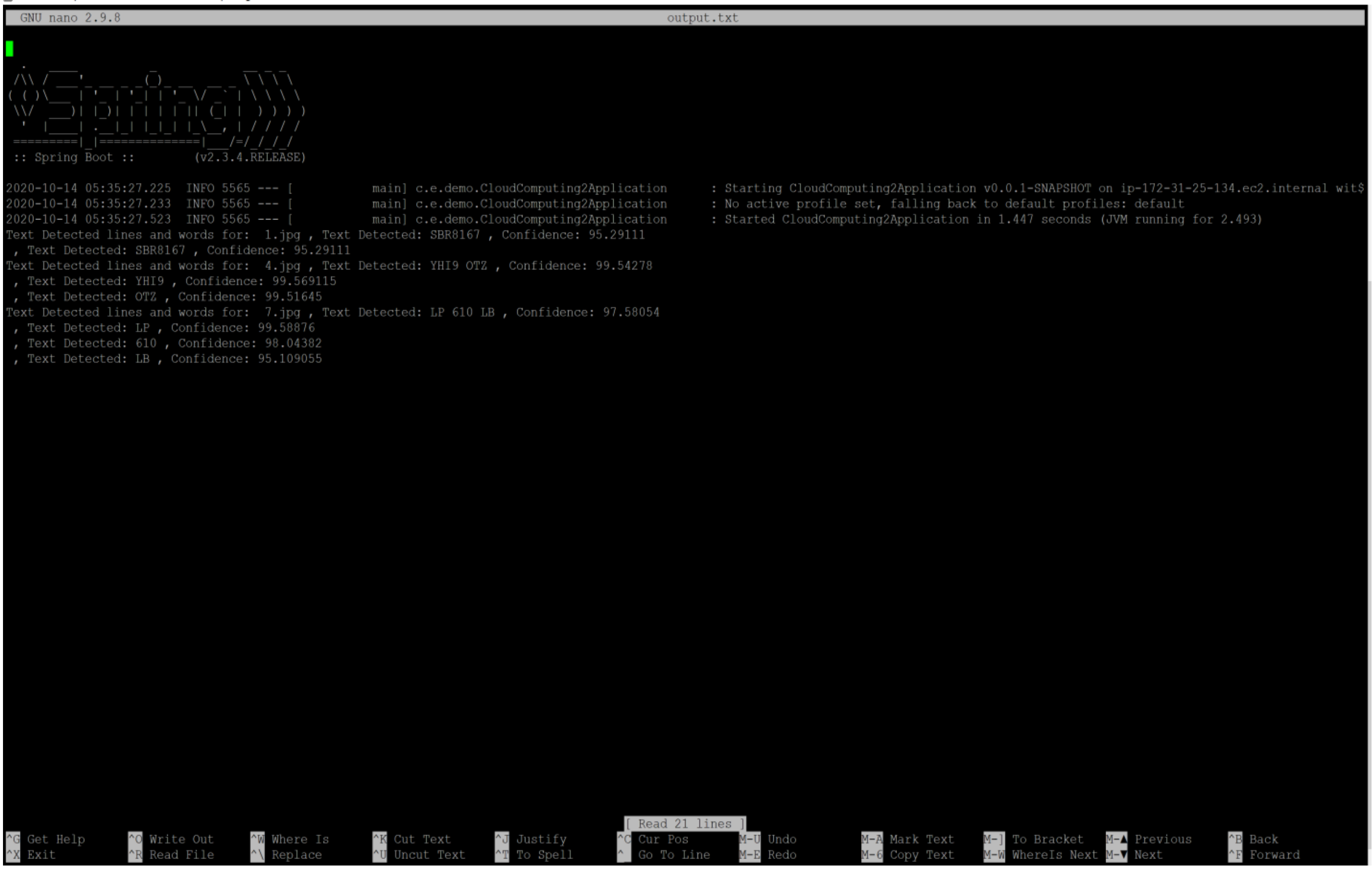
Opening output.txt:



```
CloudComputing-2-0.0.1-SNAPSHOT.jar  Instance1-0.0.1-SNAPSHOT.jar  output.txt
[ec2-user@ip-172-31-25-134 CloudComputing]$ nano output.txt
[ec2-user@ip-172-31-25-134 CloudComputing]$
```

output.txt :

It will only contain images which had label car, confidence >90 and text.



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 :: Spring Boot ::        (v2.3.4.RELEASE)

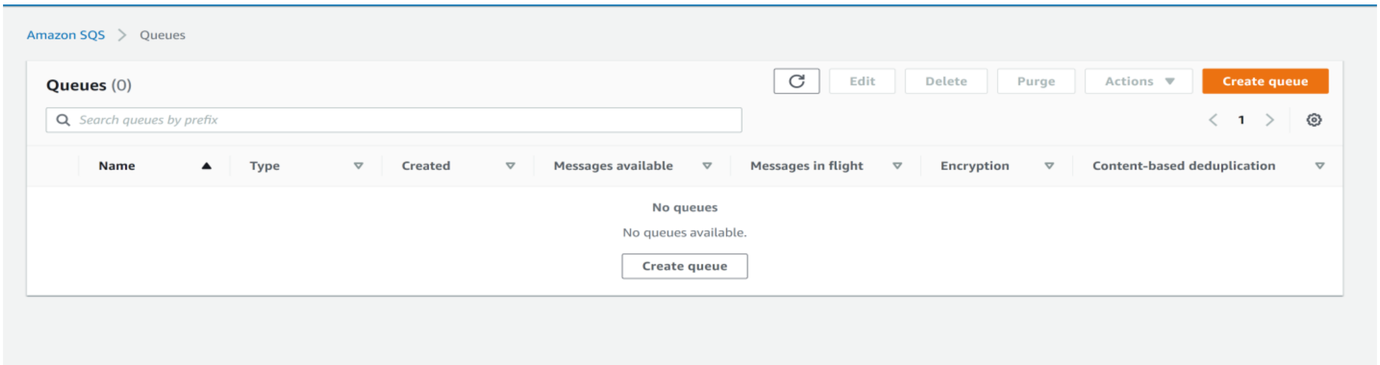
2020-10-14 05:35:27.225  INFO 5565 --- [           main] c.e.demo.CloudComputing2Application      : Starting CloudComputing2Application v0.0.1-SNAPSHOT on ip-172-31-25-134.ec2.internal wit$
2020-10-14 05:35:27.233  INFO 5565 --- [           main] c.e.demo.CloudComputing2Application      : No active profile set, falling back to default profiles: default
2020-10-14 05:35:27.523  INFO 5565 --- [           main] c.e.demo.CloudComputing2Application      : Started CloudComputing2Application in 1.447 seconds (JVM running for 2.493)
Text Detected lines and words for:  1.jpg , Text Detected: SBR8167 , Confidence: 95.29111
 , Text Detected: SBR8167 , Confidence: 95.29111
Text Detected lines and words for:  4.jpg , Text Detected: YHI9 OTZ , Confidence: 99.54278
 , Text Detected: YHI9 , Confidence: 99.569115
 , Text Detected: OTZ , Confidence: 99.51645
Text Detected lines and words for:  7.jpg , Text Detected: LP 610 LB , Confidence: 97.58054
 , Text Detected: LP , Confidence: 99.58876
 , Text Detected: 610 , Confidence: 98.04382
 , Text Detected: LB , Confidence: 95.109055
```

Since all the messages are fetched, the queue is empty.

Scenario 2: Starting the instance 2 first.

- The queue formation is in instance 1 with a condition that if it queue not created then create it.
- For fresh start for scenario2, the queue will not exist, so instance 2 will create an empty queue and wait for message to come.
- Upon starting instance 1, since the queue (empty) is already present, it will not create queue and directly start sending messages.

No queue is present before starting instance 2 first.



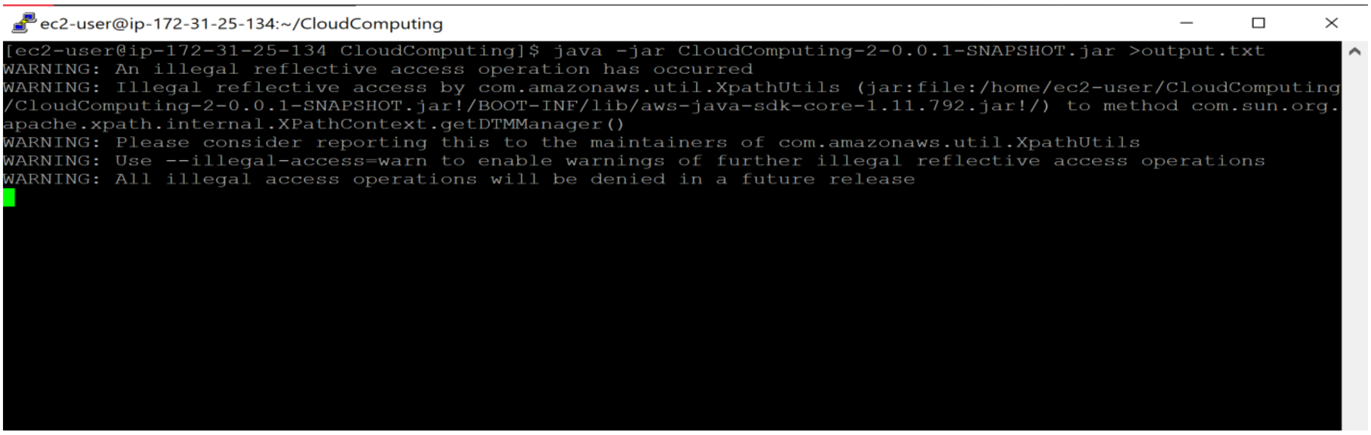
Name	Type	Created	Messages available	Messages in flight	Encryption	Content-based deduplication

No queues

No queues available.

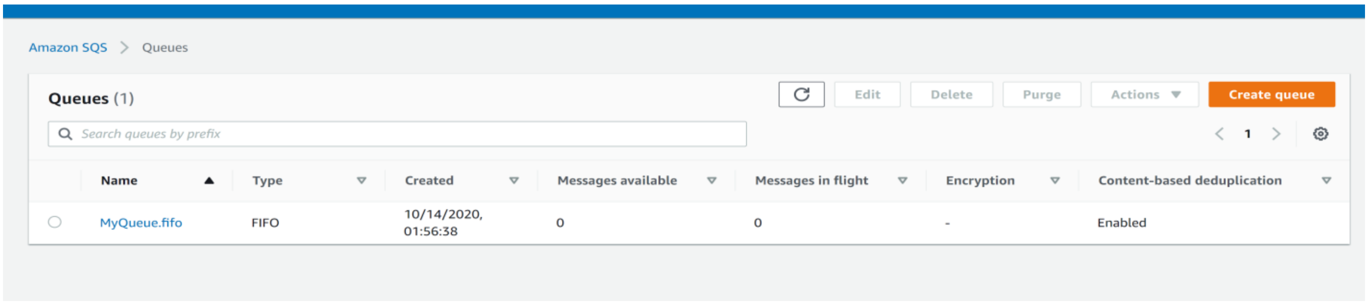
Running jar on instance 2 first:

The output will be stored in output.txt.
Since, queue is not present, it is throwing warning.



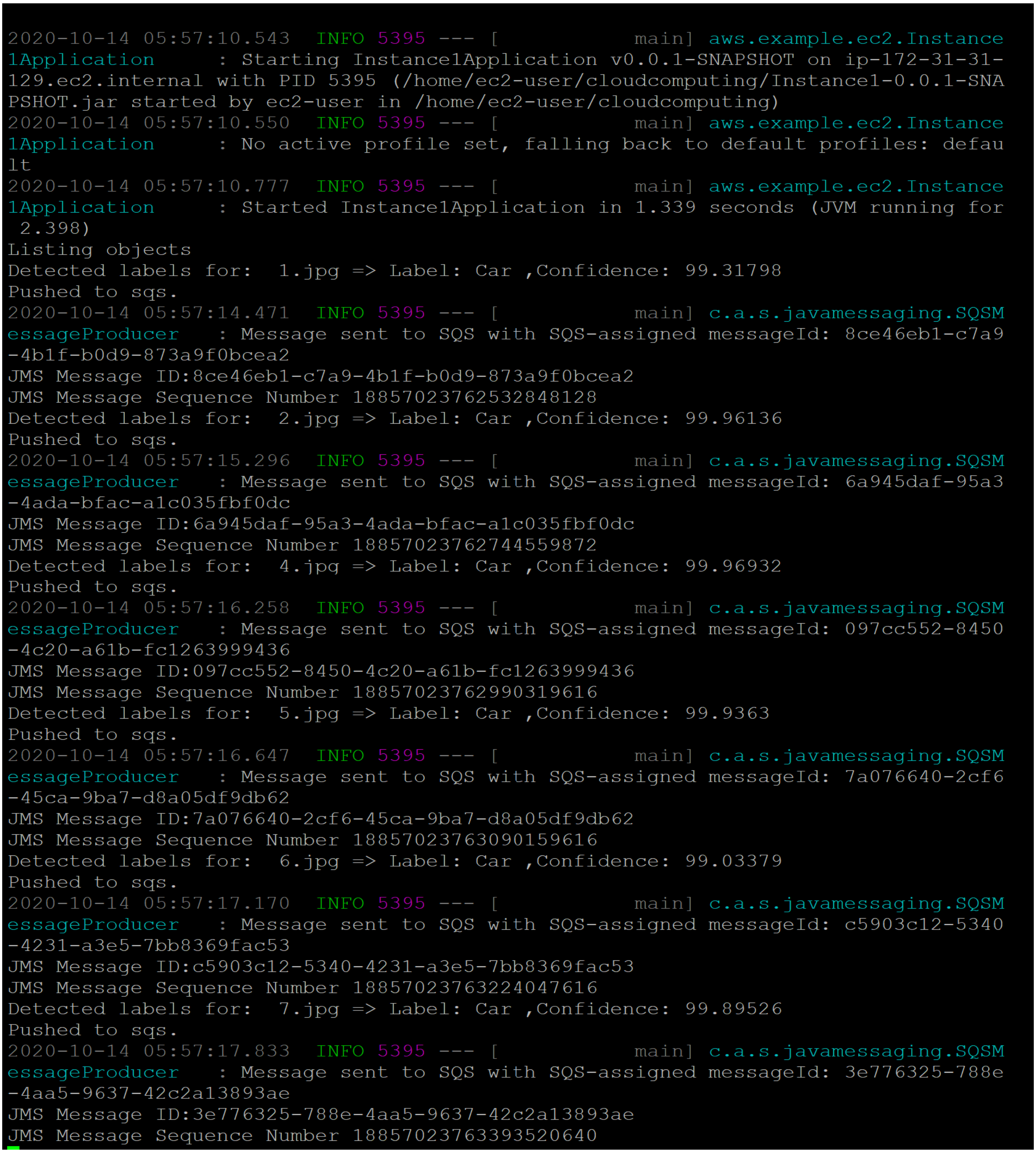
```
[ec2-user@ip-172-31-25-134 CloudComputing]$ java -jar CloudComputing-2-0.0.1-SNAPSHOT.jar >output.txt
WARNING: An illegal reflective access operation has occurred
WARNING: Illegal reflective access by com.amazonaws.util.XpathUtils (jar:file:/home/ec2-user/CloudComputing
/CloudComputing-2-0.0.1-SNAPSHOT.jar!/BOOT-INF/lib/aws-java-sdk-core-1.11.792.jar!/) to method com.sun.org.
apache.xpath.internal.XPathContext.getDTMManager()
WARNING: Please consider reporting this to the maintainers of com.amazonaws.util.XpathUtils
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
WARNING: All illegal access operations will be denied in a future release
```

The below queue is formed after running instance 2 by instance 2 as it was not present.
It is empty because instance 1 is not yet started.



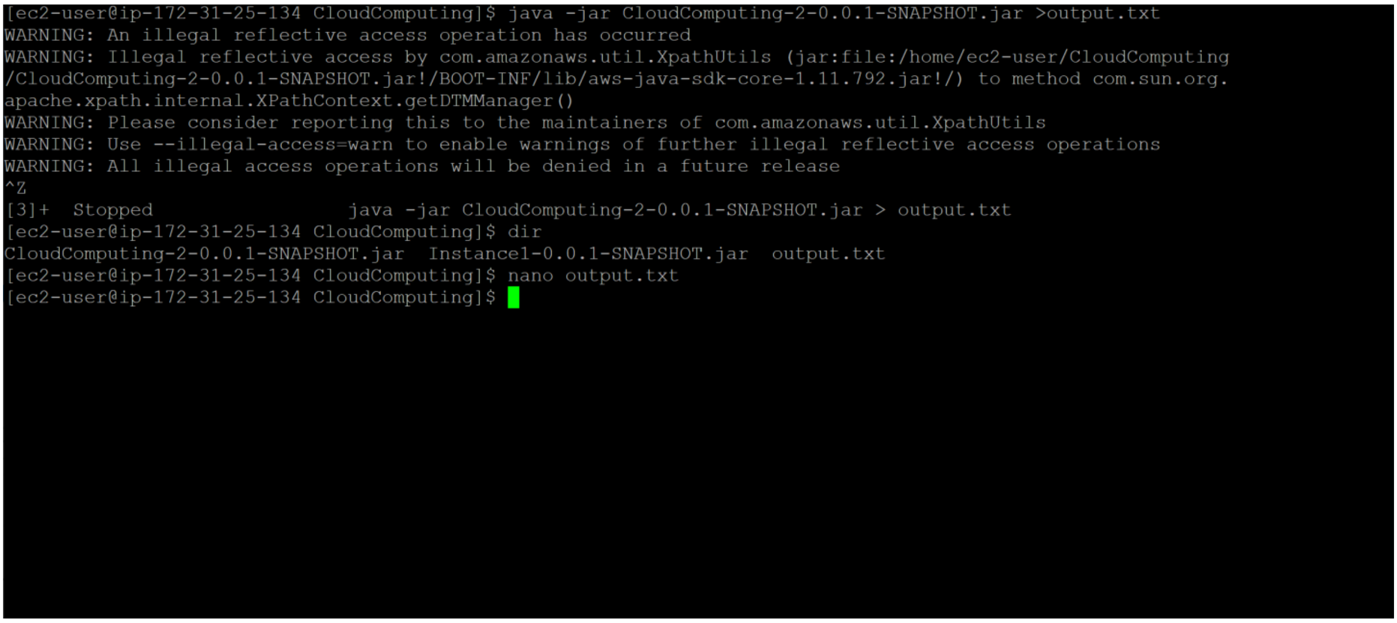
	Name	Type	Created	Messages available	Messages in flight	Encryption	Content-based deduplication
○	MyQueue.fifo	FIFO	10/14/2020, 01:56:38	0	0	-	Enabled

Running jar on instance 1:



```
2020-10-14 05:57:10.543  INFO 5395 --- [           main] aws.example.ec2.Instance
1Application      : Starting Instance1Application v0.0.1-SNAPSHOT on ip-172-31-31-
129.ec2.internal with PID 5395 (/home/ec2-user/cloudcomputing/Instance1-0.0.1-SNA
PSHOT.jar started by ec2-user in /home/ec2-user/cloudcomputing)
2020-10-14 05:57:10.550  INFO 5395 --- [           main] aws.example.ec2.Instance
1Application      : No active profile set, falling back to default profiles: defau
lt
2020-10-14 05:57:10.777  INFO 5395 --- [           main] aws.example.ec2.Instance
1Application      : Started Instance1Application in 1.339 seconds (JVM running for
 2.398)
Listing objects
Detected labels for:  1.jpg => Label: Car ,Confidence: 99.31798
Pushed to sqs.
2020-10-14 05:57:14.471  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: 8ce46eb1-c7a9
-4b1f-b0d9-873a9f0bcea2
JMS Message ID:8ce46eb1-c7a9-4b1f-b0d9-873a9f0bcea2
JMS Message Sequence Number 18857023762532848128
Detected labels for:  2.jpg => Label: Car ,Confidence: 99.96136
Pushed to sqs.
2020-10-14 05:57:15.296  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: 6a945daf-95a3
-4ada-bfac-a1c035fbf0dc
JMS Message ID:6a945daf-95a3-4ada-bfac-a1c035fbf0dc
JMS Message Sequence Number 18857023762744559872
Detected labels for:  4.jpg => Label: Car ,Confidence: 99.96932
Pushed to sqs.
2020-10-14 05:57:16.258  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: 097cc552-8450
-4c20-a61b-fc1263999436
JMS Message ID:097cc552-8450-4c20-a61b-fc1263999436
JMS Message Sequence Number 18857023762990319616
Detected labels for:  5.jpg => Label: Car ,Confidence: 99.9363
Pushed to sqs.
2020-10-14 05:57:16.647  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: 7a076640-2cf6
-45ca-9ba7-d8a05df9db62
JMS Message ID:7a076640-2cf6-45ca-9ba7-d8a05df9db62
JMS Message Sequence Number 18857023763090159616
Detected labels for:  6.jpg => Label: Car ,Confidence: 99.03379
Pushed to sqs.
2020-10-14 05:57:17.170  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: c5903c12-5340
-4231-a3e5-7bb8369fac53
JMS Message ID:c5903c12-5340-4231-a3e5-7bb8369fac53
JMS Message Sequence Number 18857023763224047616
Detected labels for:  7.jpg => Label: Car ,Confidence: 99.89526
Pushed to sqs.
2020-10-14 05:57:17.833  INFO 5395 --- [           main] c.a.s.javamessaging.SQSM
essageProducer    : Message sent to SQS with SQS-assigned messageId: 3e776325-788e
-4aa5-9637-42c2a13893ae
JMS Message ID:3e776325-788e-4aa5-9637-42c2a13893ae
JMS Message Sequence Number 18857023763393520640
```

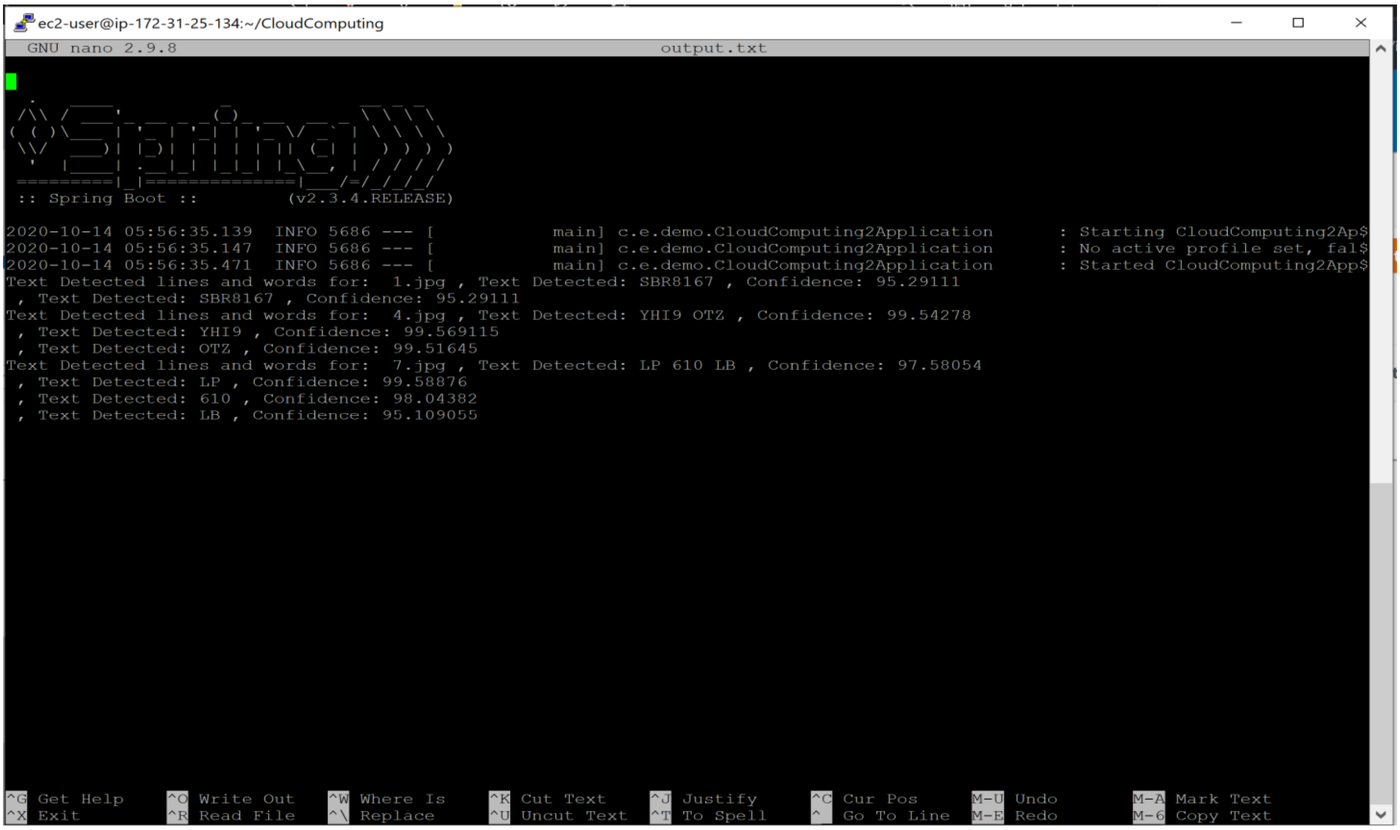
output.txt is created in instance 2:



```
[ec2-user@ip-172-31-25-134 CloudComputing]$ java -jar CloudComputing-2-0.0.1-SNAPSHOT.jar >output.txt
WARNING: An illegal reflective access operation has occurred
WARNING: Illegal reflective access by com.amazonaws.util.XpathUtils (jar:file:/home/ec2-user/CloudComputing
/CloudComputing-2-0.0.1-SNAPSHOT.jar!/BOOT-INF/lib/aws-java-sdk-core-1.11.792.jar!/) to method com.sun.org.
apache.xpath.internal.XPathContext.getDTMManager()
WARNING: Please consider reporting this to the maintainers of com.amazonaws.util.XpathUtils
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
WARNING: All illegal access operations will be denied in a future release
^Z
[3]+  Stopped                 java -jar CloudComputing-2-0.0.1-SNAPSHOT.jar > output.txt
[ec2-user@ip-172-31-25-134 CloudComputing]$ dir
CloudComputing-2-0.0.1-SNAPSHOT.jar  Instance1-0.0.1-SNAPSHOT.jar  output.txt
[ec2-user@ip-172-31-25-134 CloudComputing]$ nano output.txt
[ec2-user@ip-172-31-25-134 CloudComputing]$
```

Opening output.txt:

It will only contain images which had label car, confidence >90 and text.



```
  GNU nano 2.9.8                                    output.txt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 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.3.4.RELEASE)

2020-10-14 05:56:35.139  INFO 5686 --- [           main] c.e.demo.CloudComputing2Application      : Starting CloudComputing2Ap$
2020-10-14 05:56:35.147  INFO 5686 --- [           main] c.e.demo.CloudComputing2Application      : No active profile set, fal$
2020-10-14 05:56:35.471  INFO 5686 --- [           main] c.e.demo.CloudComputing2Application      : Started CloudComputing2App$
Text Detected lines and words for:  1.jpg , Text Detected: SBR8167 , Confidence: 95.29111
 , Text Detected: SBR8167 , Confidence: 95.29111
Text Detected lines and words for:  4.jpg , Text Detected: YHI9 OTZ , Confidence: 99.54278
 , Text Detected: YHI9 , Confidence: 99.569115
 , Text Detected: OTZ , Confidence: 99.51645
Text Detected lines and words for:  7.jpg , Text Detected: LP 610 LB , Confidence: 97.58054
 , Text Detected: LP , Confidence: 99.58876
 , Text Detected: 610 , Confidence: 98.04382
 , Text Detected: LB , Confidence: 95.109055

^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 Spell    ^_ Go To Line  M-E Redo       M-6 Copy Text
```