

Object Detection Using AWS

Project Team

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Abstract

Currently, there are many domains in which object detection is being used. For instance, auto-driving cars, video surveillance, crowd counting, face detection, anomaly detection and many more. Recently, cloud computing has also become a hot topic in the computer world. Many companies and individuals are using cloud platforms to set up and run their infrastructure with low cost and very good scalability. To combine these two rapidly growing domains, the given project will be useful to learn and develop a real time object detection system using Amazon Web Services cloud platform. Results have been shown in JSON file with object confidence.

Keywords: *Aws account, Aws S3, React, Aws CloudWatch, Aws Rekognition, Aws Lambda, Aws Dynamo Db, OpenCV, Boto3*

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1 INTRODUCTION

Web frameworks are used to design and develop amazing and attractive websites. Websites are the medium for interaction between systems and users. Recent surveys found that React.js is one of the most widely used web frameworks. Object detection is the technique of Computer Vision which allows us to detect and locate any object from those images and videos. Due to the high demand for cost-effective, efficient, scalable, and secure infrastructure to be established, many companies are adopting cloud technologies and platforms to fulfill their requirements. Combining all these three booming aspects, the project aims to design and develop the object detection system using the services which is provided by Amazon Web Services (AWS) platform.

1.1 Cloud Computing

Cloud computing is a technology which is used to work with the resources using internet. It is completely work with safe internet so we can access it virtually from anywhere. It contains data centers and servers which is used to store the data and retrieve. Nowadays, various cloud service provider like Amazon web services, Microsoft Azure, Google cloud, Oracle cloud and many more. It is more secure, reliable, flexible.

1.2 Object Detection

Object detection is being used in various fields like auto pilot cars, video surveillance, facial expressions detection, anomaly detection, face detection, and many more. Object detection is a boon that is introduced in this technological world under computer vision. With the help of this technique, there are numerous applications can be designed and developed for the betterment of humankind. One of the main parts of this project is object detection using AI rekognition service of AWS.

1.3 Web Application

To interact with the system, developer build specific bridge which connects to the users. This bridge is fulfilled by the web and mobile applications. For smaller applications and personal use, one-page web apps are the favorite instead of mobile apps. There are many web languages available to design, develop and maintain the web apps like HTML, CSS, Python, Java, JavaScript, and many others. According to recent surveys, it has been identified that JavaScript is the most preferred language to develop web apps. One of the most widely used frameworks, React.js is based on JavaScript itself. To develop the front-end for the users to upload images for testing and training, React.js is used for this project. User can take picture directly from this web page.

2 SUGGESTED IMPROVEMENT

- If you get an exact image twice (duplicate) then your system should not make another Rekognition call, and should be able to handle it (and still show results). So think how you can implement it in your project
- Images should not be saved in S3 bucket after getting processed. It should be deleted. But still point 1 should work

3 LITERATURE REVIEW

Paper discussed about the object detection techniques and methods. This study used various kind of images like rotate, shaded, mirror and some more. It will provide output without train the model from Rekognition.[14] How object can be detected from static images but cluttered scenes. Moreover, motion-based extension to enhance the performance of the detection algorithm over video sequences.[13] Representation affects detection performance by considering several alternate representations including pixels and principal components.[12]

How deep convolutional neural network(CNN) is used to find the small object from the images. Major research work on four areas like face detection, aerial imagery, segmentation and generic object detection. Faster R-CNN perform best compare to YOLOv3 and SSD.[10] Develop serverless full-stack application by using React for front-end with GraphQL and AppSync based back-end generated by AWS Amplify framework through its CLI tools.[11]

4 PROPOSED METHOD

Main purpose of this project is to identify the objects from the input images. Below diagram shows the workflow of this project model in which we use Amazon S3 bucket, Aws lambda, Amazon CloudWatch, DynamoDB, Amazon Rekognition and for the frontend build the webpage on React.js which is used to capture the images.

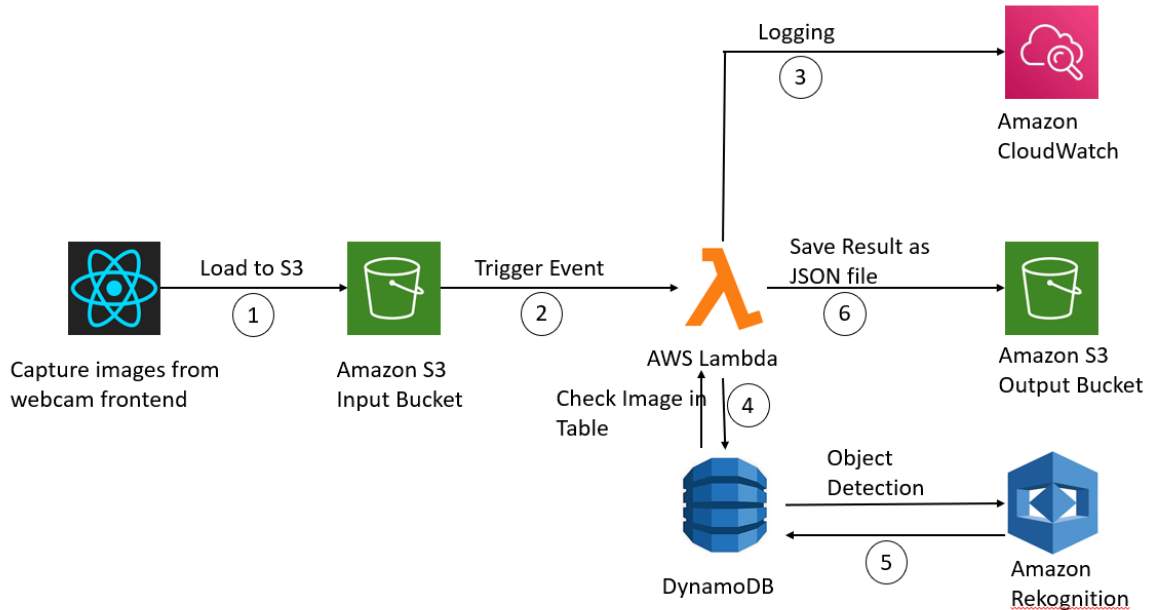


Figure 1: Work flow of the System

According to the above flow chart, users capture the images from the front web-page with their label and then it will be store into the S3 bucket with their given label. At the same time, Aws Lambda function trigger and check into DynamoDB table. If the image

is unique then it will call the Amazon Rekognition console and provide the object name with their confidence. All logs can be able to watch from CloudWatch and that file is stored into output S3 bucket.

4.1 Services

4.1.1 React.js

It is used to build frontend of the web application which is based on the UI components and JavaScript library. In this project, webpage is created on Javascript which is used to capture the real time images. This page contain dataset name (Parent folder) and label name(image name).

Here Aws Amplify plays an important role. This library connect S3 bucket with the React web page and capture images are uploaded in S3 bucket directly using this amplify and store image with that assign label.[\[11\]](#)

4.1.2 Amazon S3 Bucket

S3 is basically known as Simple Storage Services which provides scalability, data availability, security, and performance. Here the role of S3 bucket is to store captured images in particular that dataset name with their label. S3 provides access analyzer, ACLS, ownership, privacy, speed, high scale image storage and many more things.

Let's talk about the output bucket in S3. After calling Amazon Rekognition by lambda, it will store the output JSON format file into the output S3 bucket which is handled by the Aws Lambda function.

4.1.3 AWS Lambda

AWS Lambda is a server-less, event-driven compute service. Lambda function is used to communicate with other console in AWS. It is event-driven server-less system which can compute the administration of the compute resources, including server and operat-

ing system maintenance, capacity provisioning and automatic scaling, and logging. It is compatible with file processing, stream processing, Web application, IoT backends and mobile backends.

In this project, Lambda function trigger whenever input bucket get some images. This lambda function connects with DynamoDb, Amazon Rekognition. Lambda handle all the backend system like read image, store into DynamoDb and call Rekognition.

4.1.4 DynamoDB

Amazon DynamoDB is a fully managed NoSQL database service that provides fast and predictable performance with seamless scalability. It is used to create data in a table form. From DynamoDB, users can easily retrieve the data anytime. Basically, Lambda function store the images which is not inserted before in DynamoDB table and check for every new uploaded image. If same image upload two or more time then it won't insert into DynamoDB table.

4.1.5 Amazon Rekognition

Amazon Rekognition is the SaaS which used to train the model from images and videos. It has their pre-trained algorithm too. However, Algorithm is implemented on Deep learning base. This service is known for machine learning model with low cost and easily integrate with other services.

Lambda directed images to Amazon Rekognition and from algorithm model, it generates label and confidence from those images. By the use of this service, users can identify any objects from images and videos.

4.1.6 CloudWatch

Amazon CloudWatch logs to monitor, store and access the logs files. Users can easily watch the logs, search them and identify the errors from that log also. For this project, logs is useful to see if the rekognition call it again or not for the same images. Moreover,

it shows the label name and their confidence in CloudWatch too. Identify the issue and resolve the errors from watch logs.

5 RESULTS

Result is different for each and every captured images. Because it gives label name with their confidence. Moreover, we found that for each and individual image confidence for every label always more than 95 percent.

6 CONCLUSION

This project can be useful in real world. Everyone knows object detection is necessary for automation industry. This project is just a demo for the use of various AWS services and how it can be helpful in large number of images and videos. Users only interact with the front end and capture image and give image name. However, in backend, as we mentioned several Aws services interact with each other. Lambda especially use for serverless and event driven system which handles everything. Users can then download the JSON output file from S3 bucket and analyze that image. We succeed in first improvement suggestion and we tried for the second suggestion but we didn't get that one.

7 FUTURE SCOPE

Here, Output files are stored into S3 bucket in JSON format. However, this file can be shown directly into the web-page and in a table form. This can be implemented in future of this project.

References

- [1] URL: <https://docs.aws.amazon.com/AmazonS3/latest/userguide/Welcome.html>.
- [2] URL: <https://aws-amplify.github.io/docs/cli/init#amplify-init>.
- [3] URL: <https://docs.aws.amazon.com/rekognition/latest/dg/what-is.html>.
- [4] URL: <https://towardsdatascience.com/how-to-create-an-object-detection-solution-with-aws-and-python-8b20690686c5>.
- [5] URL: <https://github.com/gabehollombe-aws/webcam-s3-uploader>.
- [6] URL: <https://docs.aws.amazon.com/amazondynamodb/latest/developerguide/Introduction.html>.
- [7] URL: <https://hackernoon.com/image-analysis-using-aws-rekognition-via-lambda-function-hvq3uvy>.
- [8] URL: <https://docs.aws.amazon.com/lambda/latest/dg/welcome.html>.
- [9] URL: <https://docs.aws.amazon.com/AmazonCloudWatch/latest/logs/WhatIsCloudWatchLogs.html>.
- [10] Yang Liu et al. "A survey and performance evaluation of deep learning methods for small object detection". In: *Expert Systems with Applications* 172 (2021), p. 114602. ISSN: 0957-4174. DOI: <https://doi.org/10.1016/j.eswa.2021.114602>. URL: <https://www.sciencedirect.com/science/article/pii/S0957417421000439>.

- [11] Neupane and Khem Raj. “Serverless full-stack web application development guidelines with AWS Amplify framework”. In: (2022). URL: <https://www.theseus.fi/handle/10024/752390>.
- [12] C. Papageorgiou and T. Poggio. “A Trainable System for Object Detection”. In: *International Journal of Computer Vision* 38 (2000), pp. 15–33. DOI: <https://doi.org/10.1023/A:1008162616689>.
- [13] C.P. Papageorgiou, M. Oren, and T. Poggio. “Sixth International Conference on Computer Vision (IEEE Cat. No.98CH36271)”. In: (1998), pp. 555–562. DOI: [10.1109/ICCV.1998.710772](https://doi.org/10.1109/ICCV.1998.710772).
- [14] Vivek Sharma. “Object Detection and Recognition using Amazon Rekognition with Boto3”. In: *2022 6th International Conference on Trends in Electronics and Informatics (ICOEI)* (2022), pp. 727–732. DOI: <https://doi.org/10.1109/ICOEI53556.2022.9776884>.