GROUP A PROJECT - INTELLIGENT DOCUMENT PROCESSING WITH AWS AI SERVICES.

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Contents

INTRODUCTION

Imagine a world where your documents could understand themselves, extracting key information and automating tasks that once required hours of manual labor. This is the power of Intelligent Document Processing (IDP).

IDP harnesses the capabilities of artificial intelligence and machine learning to analyze and understand unstructured or semi-structured documents. By automating the process of extracting data and information, IDP can significantly improve efficiency, reduce errors, and provide valuable insights.

Key benefits of IDP include:

- **Enhanced Productivity**: Streamline operations and reduce manual labor.
- **Improved Accuracy:** Minimize errors and ensure data quality.
- **Faster Decision-Making:** Gain valuable insights from your documents to make informed decisions.
- **Cost Savings:** Reduce operational costs associated with manual data processing.

IDP applications span various industries, including but not limited to:

- **Financial Services:** Processing invoices, contracts, and insurance claims.
- **Healthcare: Analyzing**: medical records, prescriptions, and insurance claims.
- **Legal:** Extracting information from legal documents like contracts and court filings.
- **Human Resources:** Processing resumes, job applications, and employee records.

- **Customer Service:** Automating customer support tasks.

By embracing IDP, businesses can unlock the potential of their documents and drive innovation.
Intelligent Document Processing (IDP) uses AI to automate document processing. This boosts efficiency, accuracy, and decision-making. It's revolutionizing how businesses handle document-intensive tasks

AWS SERVICES USED:

AMAZON TEXTRACT: Amazon Textract is a machine learning service that uses optical character recognition (OCR) to automatically extract text, handwriting, and data from scanned documents, forms, and tables. It's a powerful tool for automating document-intensive processes and extracting valuable information from unstructured data.

AMAZON COMPREHEND: Amazon Comprehend is an NLP service that extracts information from unstructured text. It identifies entities, sentiment, and topics, and can redact sensitive data. It's fully managed and can process millions of documents quickly.

AMAZON AUGMENTED AI (A2I): Amazon Augmented AI (A2I) streamlines the process of adding human review to IDP workflows. It integrates with Textract and Comprehend, automating tasks like document preparation and review assignment. This frees up developers to focus on building the core logic of their applications.

AMAZON SAGEMAKER: A fully managed machine learning platform that provides developers with all the tools they need to build, train, deploy, and manage machine learning models. It simplifies the process of machine learning, making it accessible to a wider range of developers.

AMAZON S3 BUCKET: An S3 bucket is a storage unit in Amazon Simple Storage Service (S3) that can store and retrieve any amount of data, from any place, at any time. It's designed for storing and retrieving any amount of data, from any place, at any time.

AMAZON IAM: is a fundamental service in AWS that controls who can access and what they can do within your AWS account. It's like the gatekeeper of your AWS environment, ensuring that only authorized users and resources have the necessary permissions.

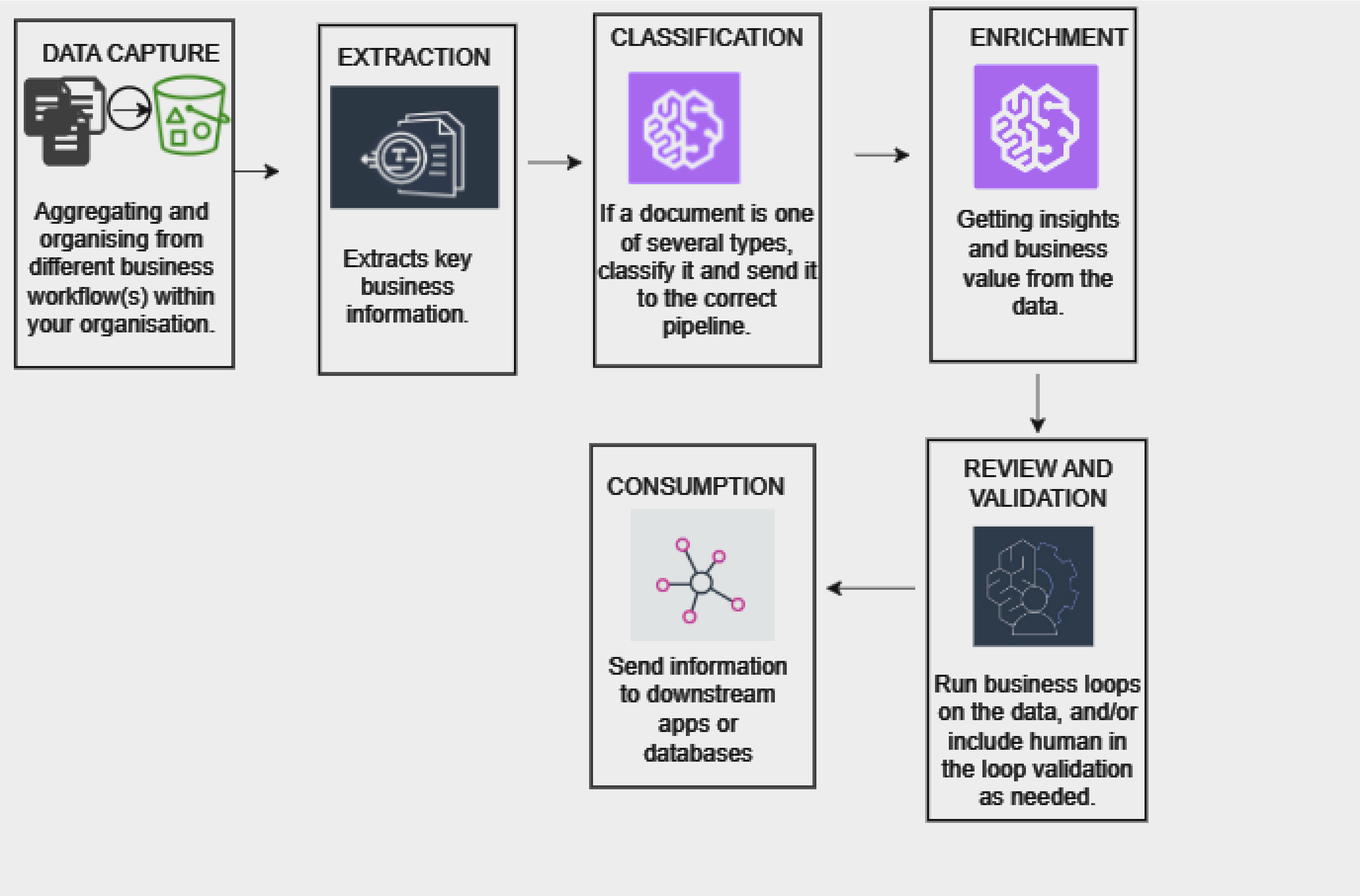
CLOUDFORMATION: A powerful tool that lets you define and manage your AWS infrastructure using a simple declarative language. It automates the provisioning, updating, and deletion of resources, making it easier to deploy and manage your applications on AWS.

AMAZON QUICK SIGHT: A cloud-based business intelligence (BI) service from AWS that empowers businesses to make data-driven decisions. It offers a user-friendly interface for creating interactive dashboards, analyzing data, and uncovering valuable insights.

SYSTEM ARCHITECTURE

The architecture diagram below shows the stages of an Intelligent Document Processing workflow. It starts with a data capture stage to securely store, aggregate different types (pdf, jpeg, png, tiff), formats, and layouts of documents. The next stage is classification, this is where you categorize your documents (for example categories such as contracts, claim forms, invoices, receipts and so on) followed by document extraction. In the extraction stage, you can extract meaningful business information from your documents. This extracted data is often used to gather insights via data analysis or sent to downstream systems such as databases or transactional systems. The following stage is enrichment, at this stage documents can be enriched by redacting PII data, custom business term extraction, and so on. Finally, in the review/verification stage you can include a human workforce for document reviews to ensure the outcome is accurate

INTELLIGENT DOCUMENT PROCESSING WORKFLOW



DATA CAPTURE

Aggregating and organising from different business workflow(s) within your organisation.

EXTRACTION

Extracts key business information.

CLASSIFICATION

If a document is one of several types, classify it and send it to the correct pipeline.

ENRICHMENT

Getting insights and business value from the data.

REVIEW AND VALIDATION

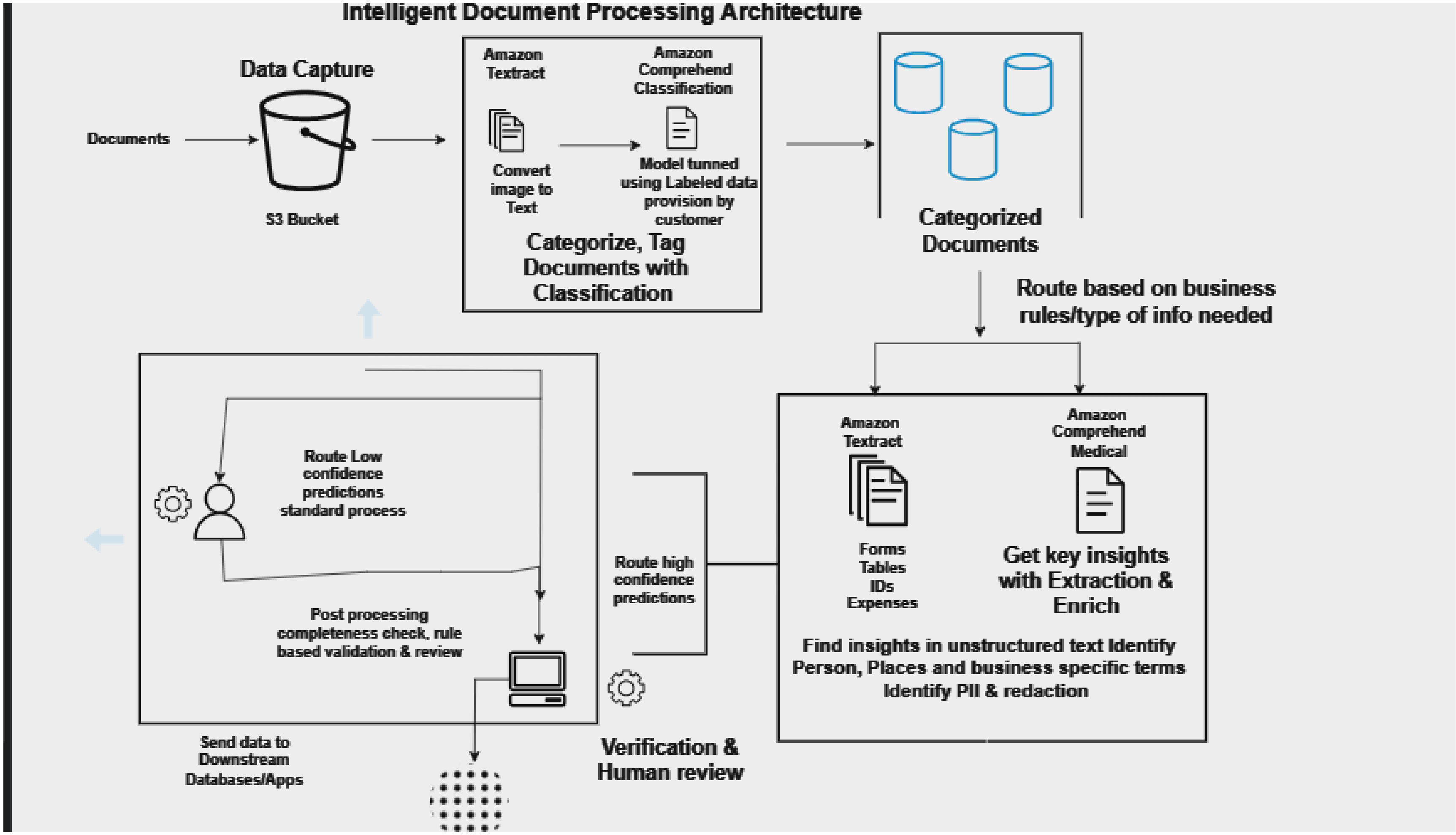
Run business loops on the data, and/or include human in the loop validation as needed.

CONSUMPTION

Send information to downstream apps or databases

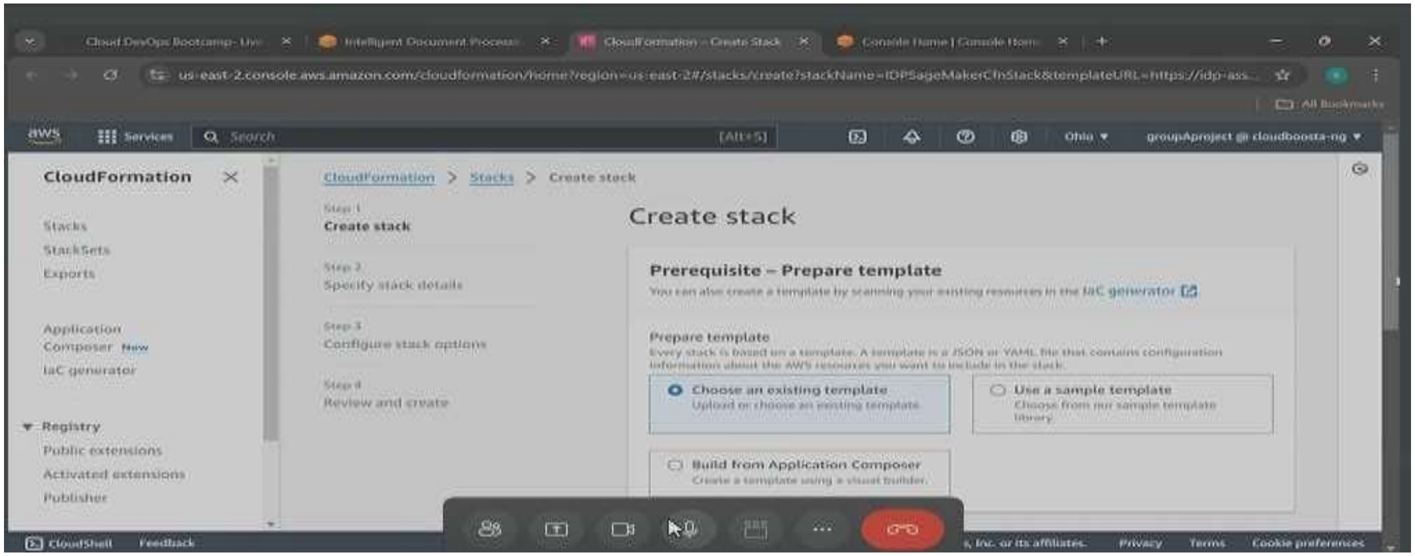
Data Governance- Security and Policies

- **IAM Roles and Policies:** Use granular permissions and MFA.
- **Data Encryption:** Encrypt data at rest and in transit.
- **Access Control:** Use ACLs and security groups.
- **Data Loss Prevention:** Implement DLP measures.
- **Logging and Monitoring:** Track activity and detect anomalies.
- **Vulnerability Management:** Scan for vulnerabilities and apply patches.
- **Incident Response:** Have a plan and conduct regular drills.
- **Compliance:** Ensure compliance with relevant regulations of third-party services.


Intelligent Document Processing Architecture
Data Capture
Documents
S3 Bucket
Amazon Textract
Amazon Comprehend Classification
Convert image to Text
Model tunned using Labeled data provision by customer
Categorize, Tag Documents with Classification
Categorized Documents
Route based on business rules/type of info needed
Amazon Textract
Amazon Comprehend Medical
Forms
Tables
IDs
Expenses
Get key insights with Extraction & Enrich
Find insights in unstructured text Identify Person, Places and business specific terms Identify PII & redaction
Route high confidence predictions
Route Low confidence predictions standard process
Post processing completeness check, rule based validation & review
Send data to Downstream Databases/Apps
Verification & Human review

GETTING STARTED

1. Creation of stack via CloudFormation.



us-east-2.console.aws.amazon.com/cloudformation/home?region=us-east-2#/stacks/create?stackName=IDPSageMakerCfnStack&templateURL=https://idp-ass...

CloudFormation > Stacks > Create stack

Step 1
Create stack

Step 2
Specify stack details

Step 3
Configure stack options

Step 4
Review and create

Create stack

Prerequisite – Prepare template

You can also create a template by scanning your existing resources in the IaC generator

Prepare template

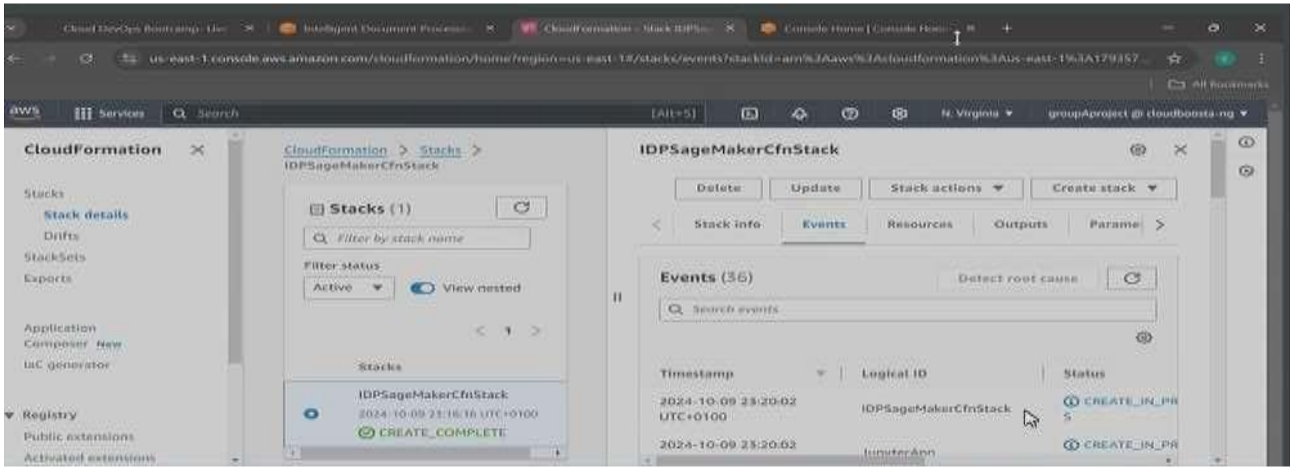
Every stack is based on a template. A template is a JSON or YAML file that contains configuration information about the AWS resources you want to include in the stack.

● Choose an existing template
Upload or choose an existing template.

○ Use a sample template
Choose from our sample template library.

○ Build from Application Composer
Create a template using a visual builder.

2. Ensure that the stack is created successfully.



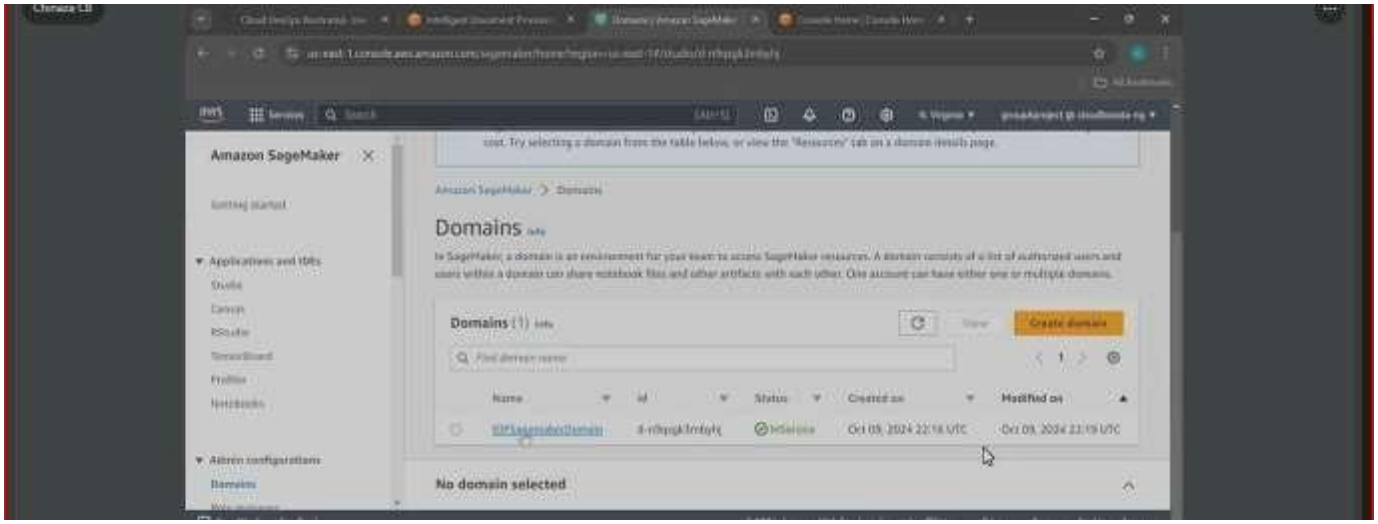
Stacks (1)

IDPSageMakerCfnStack
2024-10-09 23:16:16 UTC+0100
CREATE_COMPLETE

Events (36)

Timestamp	Logical ID	Status
2024-10-09 23:20:02 UTC+0100	IDPSageMakerCfnStack	CREATE_IN_PR S
2024-10-09 23:20:02	JupyterApp	CREATE_IN_PR

3. On Amazon SageMaker, Domain is created automatically



Domains Info

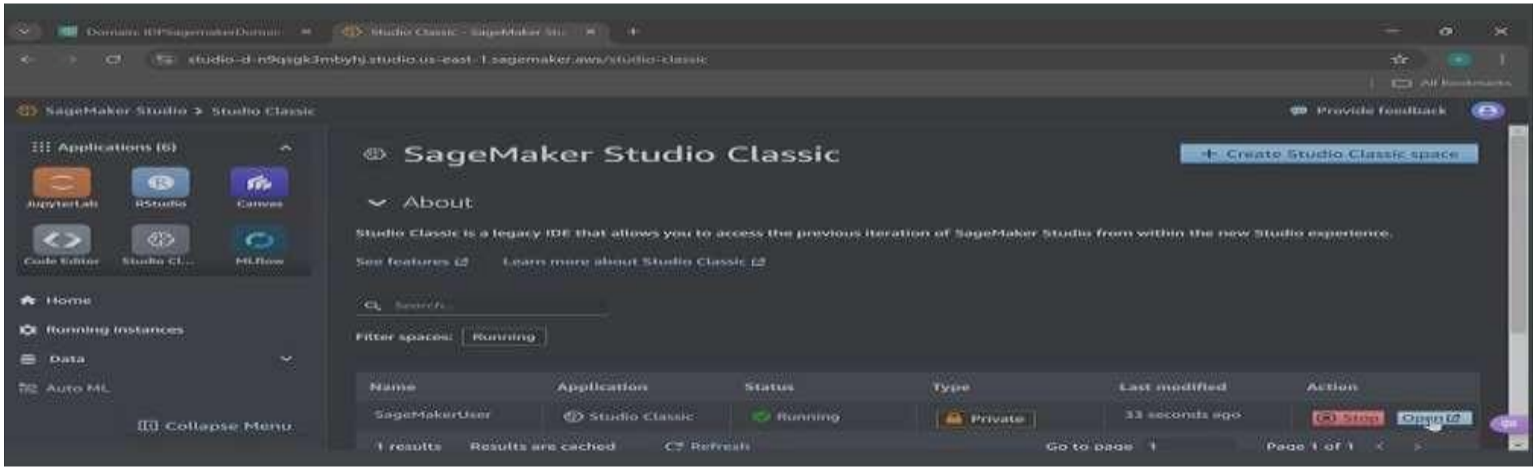
In SageMaker, a domain is an environment for your team to access SageMaker resources. A domain consists of a list of authorized users and users within a domain can share notebook files and other artifacts with each other. One account can have either one or multiple domains.

Domains (1) Info

Name	Id	Status	Created on	Modified on
IDPSagemakerDomain	d-r[illegible]	InService	Oct 09, 2024 22:18 UTC	Oct 09, 2024 22:19 UTC

No domain selected

4. The studio is launched via the domain, then we can access our notebooks to run the script.



SageMaker Studio Classic

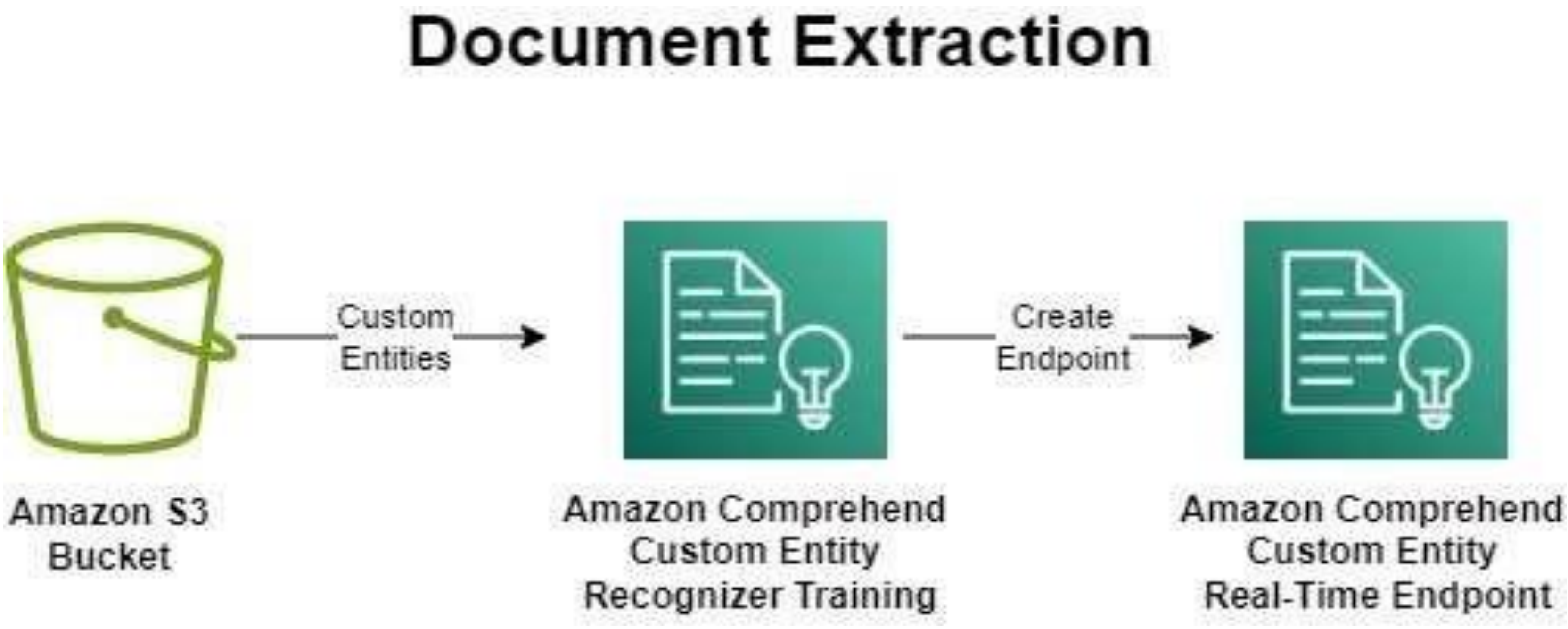
Studio Classic is a legacy IDE that allows you to access the previous iteration of SageMaker Studio from within the new Studio experience.

See features · Learn more about Studio Classic

Filter spaces: Running

Name	Application	Status	Type	Last modified	Action
SageMakerUser	Studio Classic	Running	Private	33 seconds ago	Stop Open

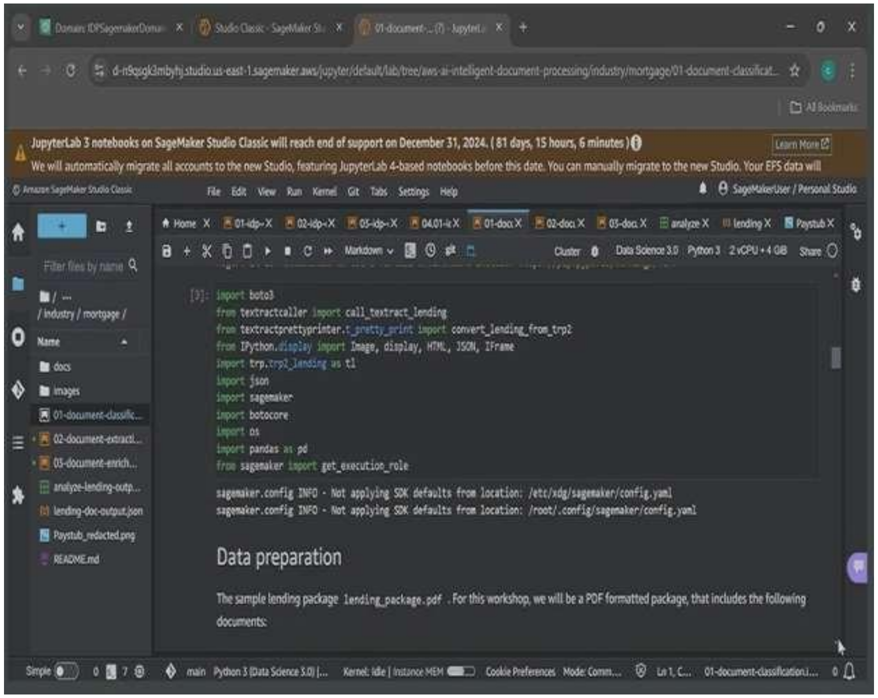
1 results · Results are cached · Go to page 1 · Page 1 of 1


Document Extraction
Amazon S3 Bucket
Custom Entities
Amazon Comprehend Custom Entity Recognizer Training
Create Endpoint
Amazon Comprehend Custom Entity Real-Time Endpoint

DOCUMENT EXTRACTION ARCHITECTURE.

DOCUMENT EXTRACTION

- Setup Notebook By Deploying Cloud formation Stacks On Amazon Sagemaker.
- The Data Was Prepared and Uploaded Into An S3 Bucket.
- Amazon Textract’s “detect_document_text” API to extract the raw text information for all the documents in S3 bucket.



d-n9qsgk3mbyhj.studio.us-east-1.sagemaker.aws/jupyter/default/lab/tree/aws-ai-intelligent-document-processing/industry/mortgage/01-document-classificat...

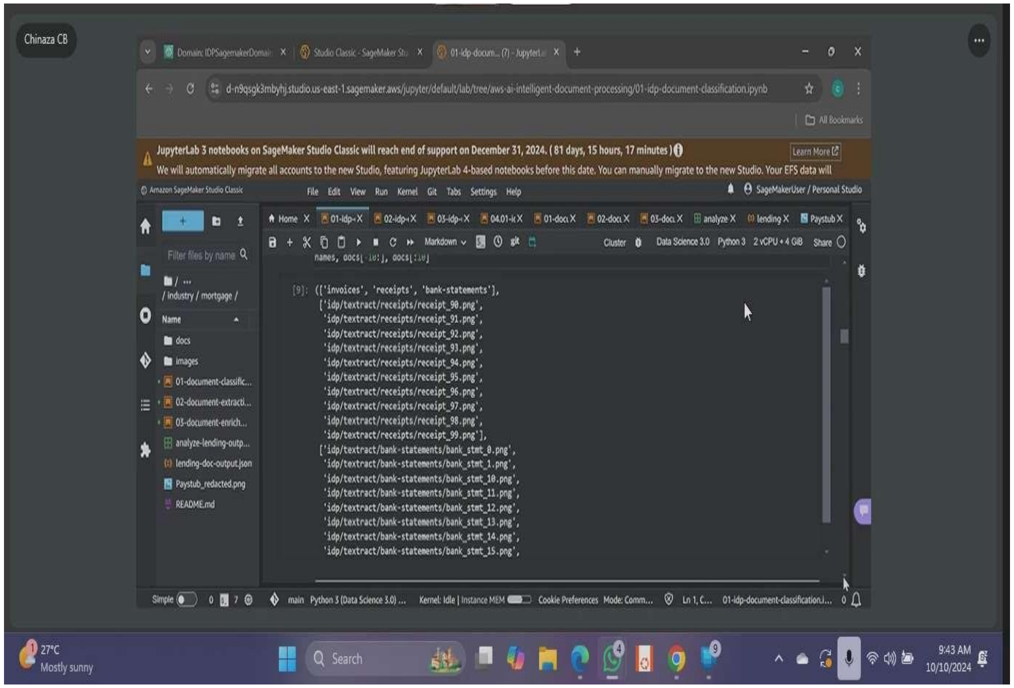
JupyterLab 3 notebooks on SageMaker Studio Classic will reach end of support on December 31, 2024. (81 days, 15 hours, 6 minutes)

We will automatically migrate all accounts to the new Studio, featuring JupyterLab 4-based notebooks before this date. You can manually migrate to the new Studio. Your EFS data will

```
[3]: import boto3
     from textractcaller import call_textract_lending
     from textractprettyprinter.t_pretty_print import convert_lending_from_trp2
     from IPython.display import Image, display, HTML, JSON, IFrame
     import trp.trp2_lending as tl
     import json
     import sagemaker
     import botocore
     import os
     import pandas as pd
     from sagemaker import get_execution_role

sagemaker.config INFO - Not applying SDK defaults from location: /etc/xdg/sagemaker/config.yaml
sagemaker.config INFO - Not applying SDK defaults from location: /root/.config/sagemaker/config.yaml
```

Data preparation

The sample lending package `lending_package.pdf` . For this workshop, we will be a PDF formatted package, that includes the following documents:



d-n9qsgk3mbyhj.studio.us-east-1.sagemaker.aws/jupyter/default/lab/tree/aws-ai-intelligent-document-processing/01-idp-document-classification.ipynb

JupyterLab 3 notebooks on SageMaker Studio Classic will reach end of support on December 31, 2024. (81 days, 15 hours, 17 minutes)

We will automatically migrate all accounts to the new Studio, featuring JupyterLab 4-based notebooks before this date. You can manually migrate to the new Studio. Your EFS data will

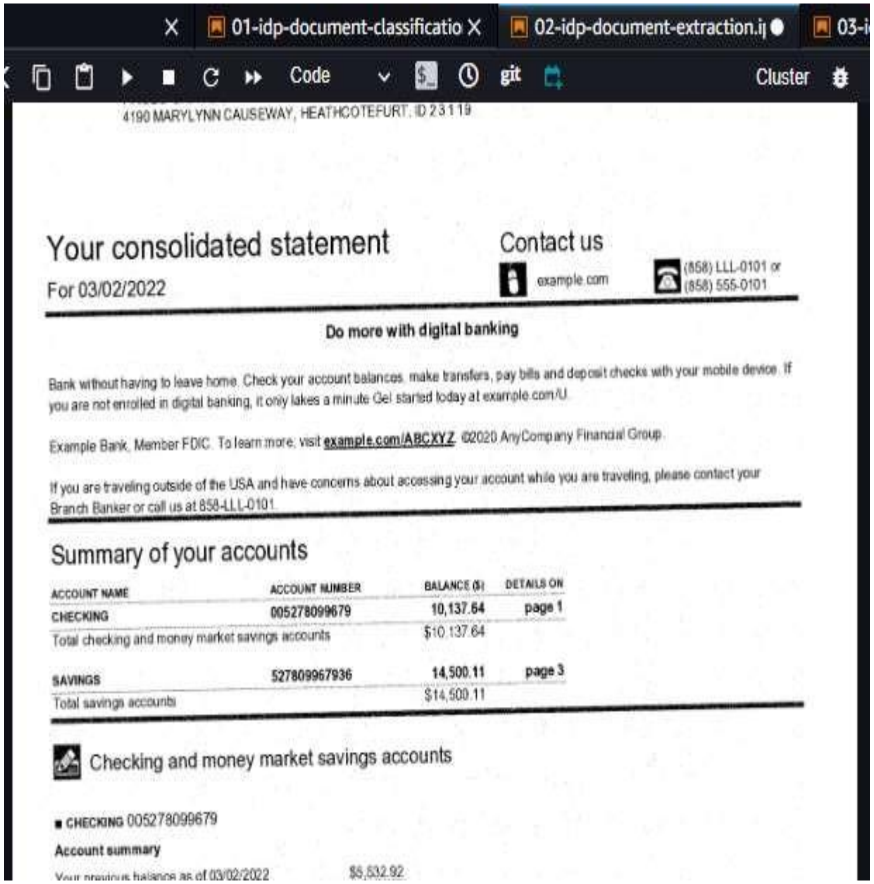
```
names, docs[-10:], docs[:10]

[9]: (['invoices', 'receipts', 'bank-statements'],
      ['idp/textract/receipts/receipt_90.png',
       'idp/textract/receipts/receipt_91.png',
       'idp/textract/receipts/receipt_92.png',
       'idp/textract/receipts/receipt_93.png',
       'idp/textract/receipts/receipt_94.png',
       'idp/textract/receipts/receipt_95.png',
       'idp/textract/receipts/receipt_96.png',
       'idp/textract/receipts/receipt_97.png',
       'idp/textract/receipts/receipt_98.png',
       'idp/textract/receipts/receipt_99.png'],
      ['idp/textract/bank-statements/bank_stmt_0.png',
       'idp/textract/bank-statements/bank_stmt_1.png',
       'idp/textract/bank-statements/bank_stmt_10.png',
       'idp/textract/bank-statements/bank_stmt_11.png',
       'idp/textract/bank-statements/bank_stmt_12.png',
       'idp/textract/bank-statements/bank_stmt_13.png',
       'idp/textract/bank-statements/bank_stmt_14.png',
       'idp/textract/bank-statements/bank_stmt_15.png',
```

DOCUMENTS EXTRACTED VIA AMAZON TEXTRACT’S “DETECT_DOCUMENT_TEXT” API

Below are some of the Kinds of data that was extracted:

- Unstructured Data Extraction
- Semi-Structured Data Extraction
- Structured Data Extraction
- Extraction with Textract Queries
- Signature Detection
- Invoices and Receipts Extraction
- Identity Documents Extraction

EXTRACTING TABLE FROM A STRUCTURED DATA



4190 MARYLYNN CAUSEWAY, HEATHCOTEFURT, ID 23119

Your consolidated statement

For 03/02/2022

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(858) 555-0101

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Summary of your accounts

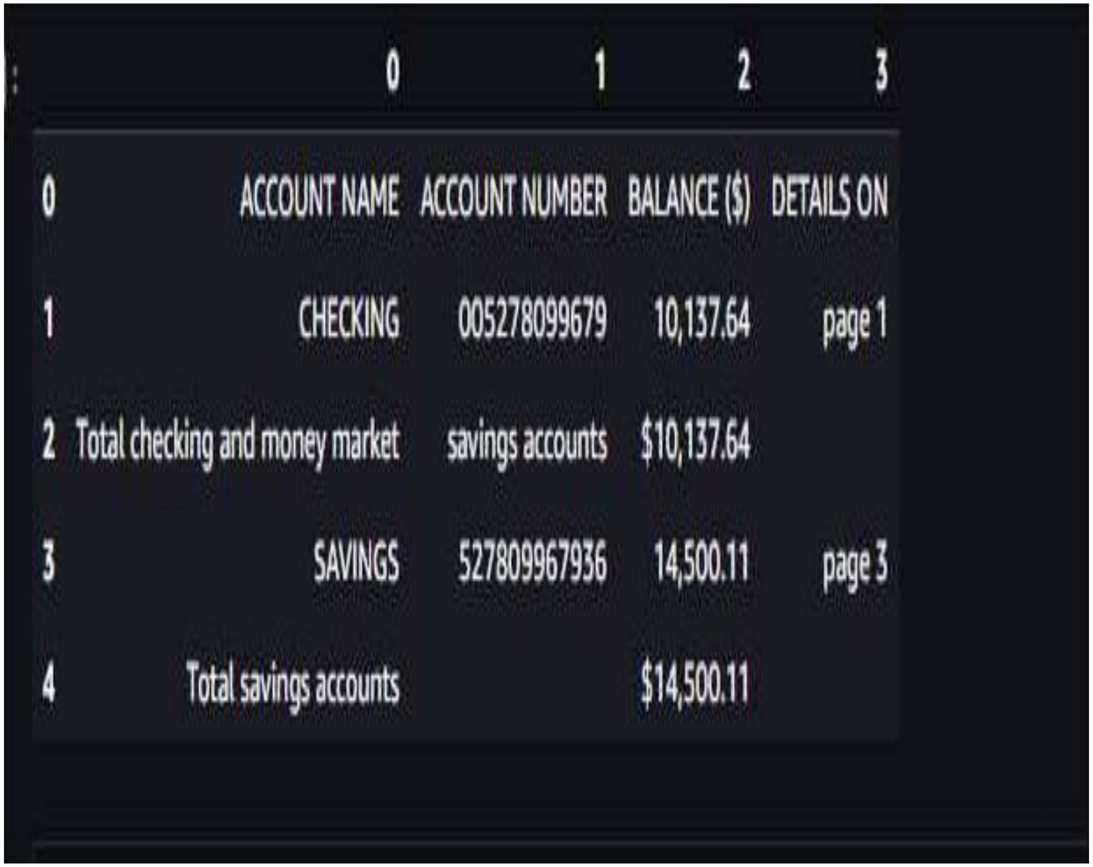
ACCOUNT NAME	ACCOUNT NUMBER	BALANCE ($)	DETAILS ON
CHECKING	005278099679	10,137.64	page 1
Total checking and money market savings accounts		$10,137.64	
SAVINGS	527809967936	14,500.11	page 3
Total savings accounts		$14,500.11	

Checking and money market savings accounts

■ CHECKING 005278099679

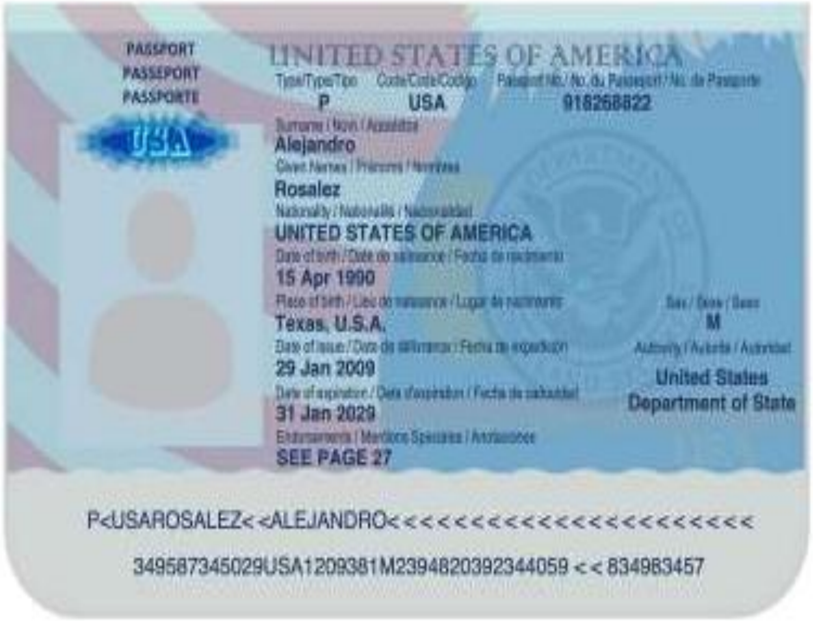
Account summary

Your previous balance as of 03/02/2022 $5,532.92



	0	1	2	3
0	ACCOUNT NAME	ACCOUNT NUMBER	BALANCE ($)	DETAILS ON
1	CHECKING	005278099679	10,137.64	page 1
2	Total checking and money market	savings accounts	$10,137.64	
3	SAVINGS	527809967936	14,500.11	page 3
4	Total savings accounts		$14,500.11	

IDENTITY DOCUMENT EXTRACTION

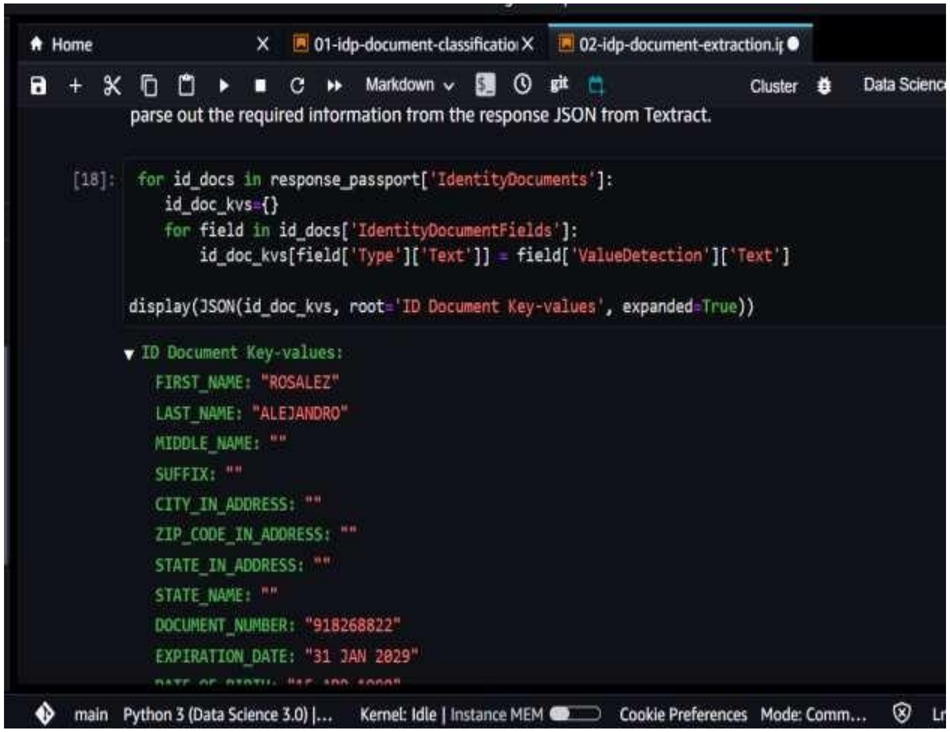


PASSPORT
PASSEPORT
PASSPORTE

UNITED STATES OF AMERICA

Type/Type/Tipo: P
Code/Code/Codigo: USA
Passport No./No. du Passeport/No. de Pasaporte: 918268822
Surname / Nom / Apellidos: Alejandro
Given Names / Prénoms / Nombres: Rosalez
Nationality / Nationalité / Nacionalidad: UNITED STATES OF AMERICA
Date of birth / Date de naissance / Fecha de nacimiento: 15 Apr 1990
Place of birth / Lieu de naissance / Lugar de nacimiento: Texas, U.S.A.
Sex / Sexe / Sexo: M
Date of issue / Date de délivrance / Fecha de expedición: 29 Jan 2009
Authority / Autorité / Autoridad: United States Department of State
Date of expiration / Date d'expiration / Fecha de caducidad: 31 Jan 2029
Endorsements / Mentions Spéciales / Anotaciones: SEE PAGE 27

```
P<USAROSALEZ<<ALEJANDRO<<<<<<<<<<<<<<<<<<<<<<<<<
349587345029USA1209381M239482039234405<<834983457
```


Home
01-idp-document-classificatio
02-idp-document-extraction.i
Markdown
git
Cluster
Data Scienc
main
Python 3 (Data Science 3.0) |...
Kernel: Idle | Instance MEM
Cookie Preferences
Mode: Comm...
Ln

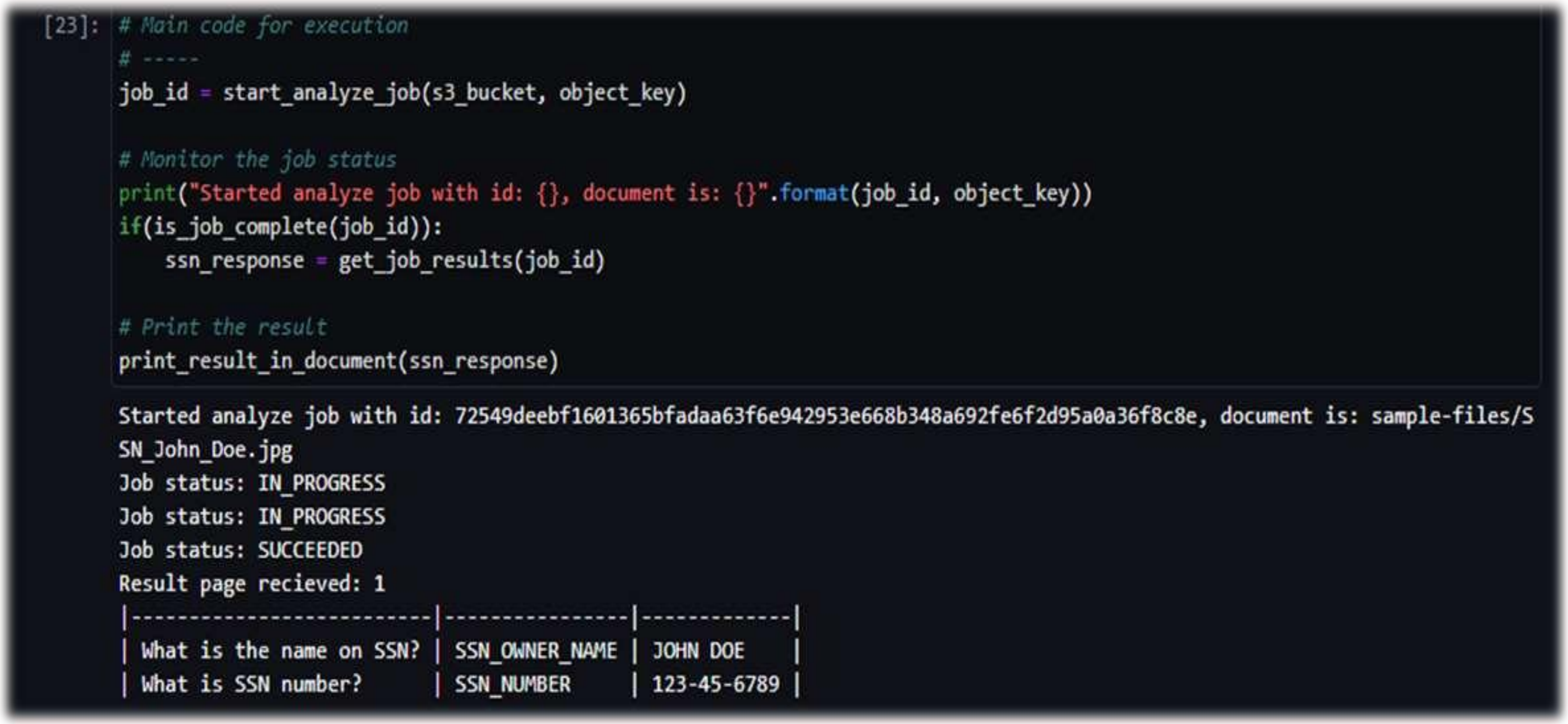
parse out the required information from the response JSON from Textract.

```
[18]: for id_docs in response_passport['IdentityDocuments']:
          id_doc_kvs={}
          for field in id_docs['IdentityDocumentFields']:
              id_doc_kvs[field['Type']['Text']] = field['ValueDetection']['Text']

      display(JSON(id_doc_kvs, root='ID Document Key-values', expanded=True))
```

```
▼ ID Document Key-values:
    FIRST_NAME: "ROSALEZ"
    LAST_NAME: "ALEJANDRO"
    MIDDLE_NAME: ""
    SUFFIX: ""
    CITY_IN_ADDRESS: ""
    ZIP_CODE_IN_ADDRESS: ""
    STATE_IN_ADDRESS: ""
    STATE_NAME: ""
    DOCUMENT_NUMBER: "918268822"
    EXPIRATION_DATE: "31 JAN 2029"
    DATE_OF_BIRTH: "15 APR 1990"
```

EXTRACTION WITH TEXTRACT QUERIES.



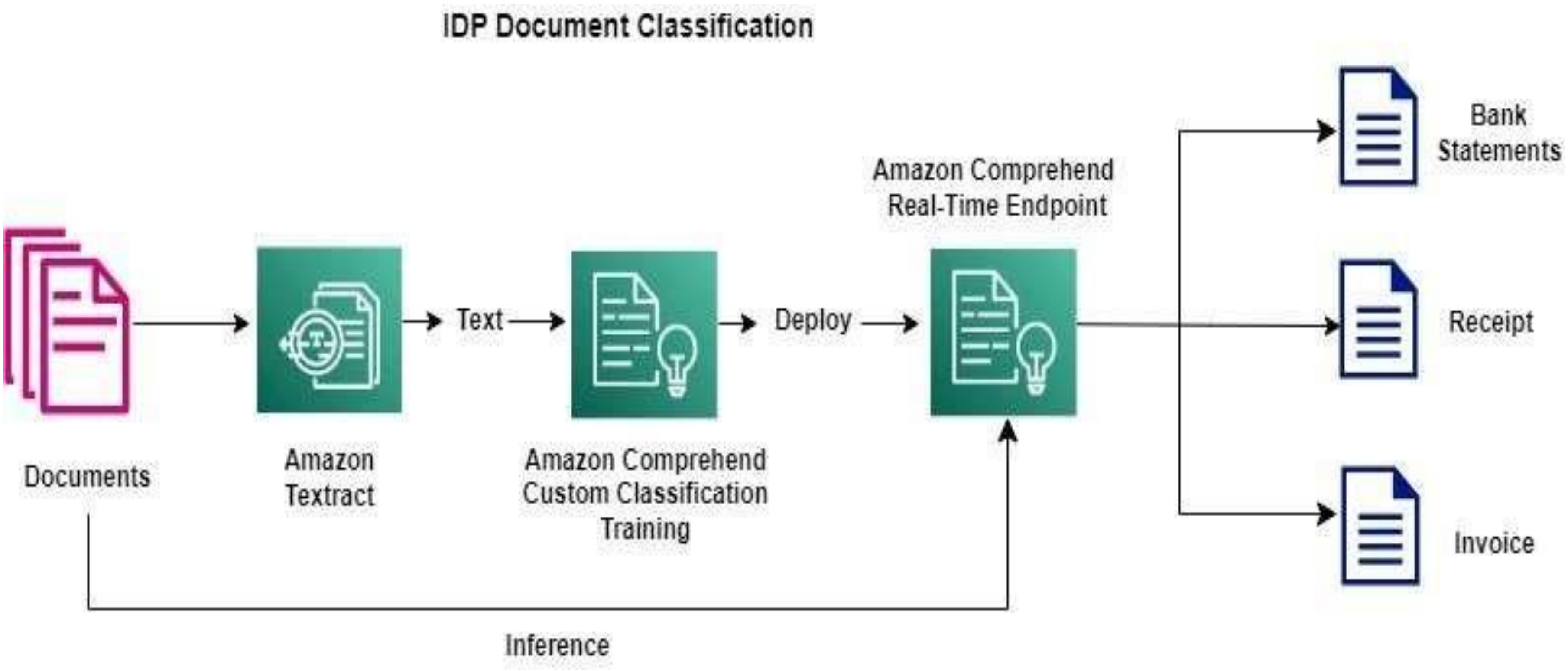
```
[23]: # Main code for execution
      # -----
      job_id = start_analyze_job(s3_bucket, object_key)

      # Monitor the job status
      print("Started analyze job with id: {}, document is: {}".format(job_id, object_key))
      if(is_job_complete(job_id)):
          ssn_response = get_job_results(job_id)

      # Print the result
      print_result_in_document(ssn_response)
```

```
Started analyze job with id: 72549deebf1601365bfadaa63f6e942953e668b348a692fe6f2d95a0a36f8c8e, document is: sample-files/S
SN_John_Doe.jpg
Job status: IN_PROGRESS
Job status: IN_PROGRESS
Job status: SUCCEEDED
Result page recieved: 1
|-------------------------|---------------|------------|
| What is the name on SSN? | SSN_OWNER_NAME | JOHN DOE    |
| What is SSN number?      | SSN_NUMBER     | 123-45-6789 |
```

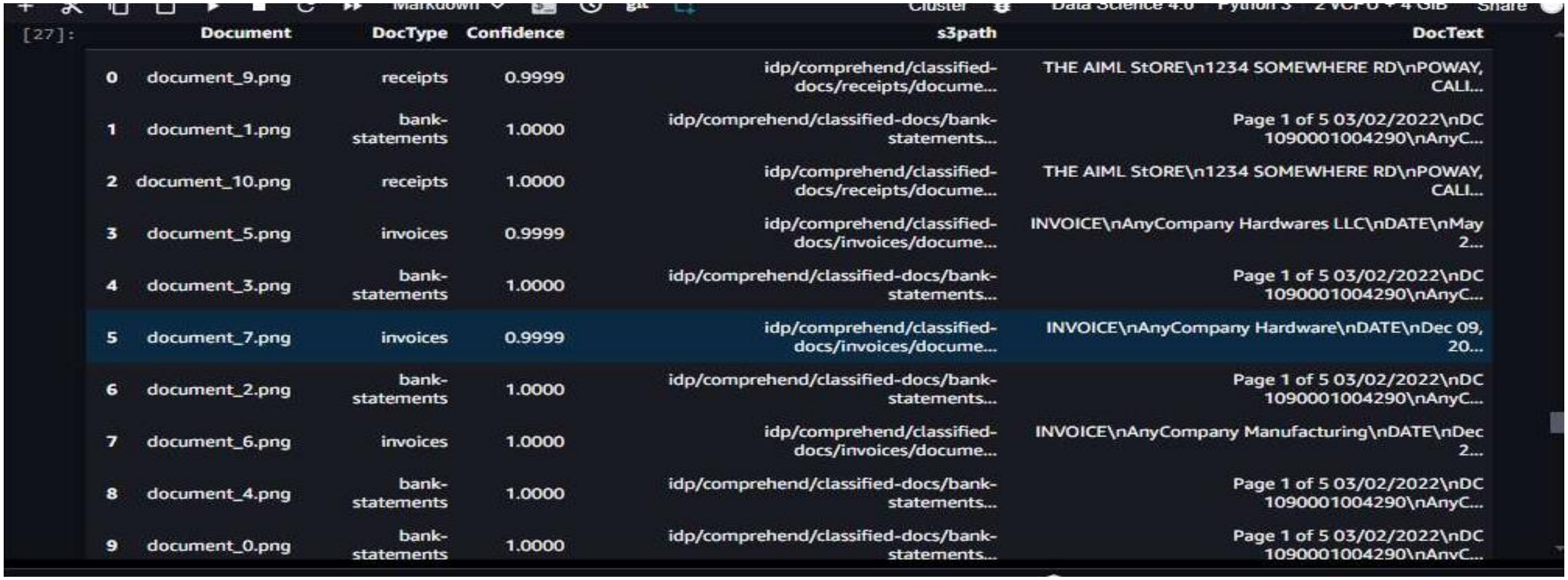
DOCUMENT CLASSIFICATION ARCHITECTURE


IDP Document Classification
Documents
Amazon Textract
Text
Amazon Comprehend Custom Classification Training
Deploy
Amazon Comprehend Real-Time Endpoint
Bank Statements
Receipt
Invoice
Inference

DOCUMENT CLASSIFICATION

- Prepare a CSV training dataset for AmazonComprehend custom classifier training.
- This data is written into a csv file and uploaded into an s3 bucket and be used as training data.
- We trained a custom classifier using Amazon Comprehend's Custom Classification feature andthe labeled data CSV file we created.
- We used Amazon Comprehend's custom classification modelto classify sample documents asynchronously using the start_document_classification_job API.
- We specified DocumentReadAction and used Amazon Textract's DETECT_DOCUMENT_TEXT option. This enabled Amazon Comprehend to automatically extract textand classify it.

- The next step is to use the Amazon Comprehend real-time endpoint to classify these documents.

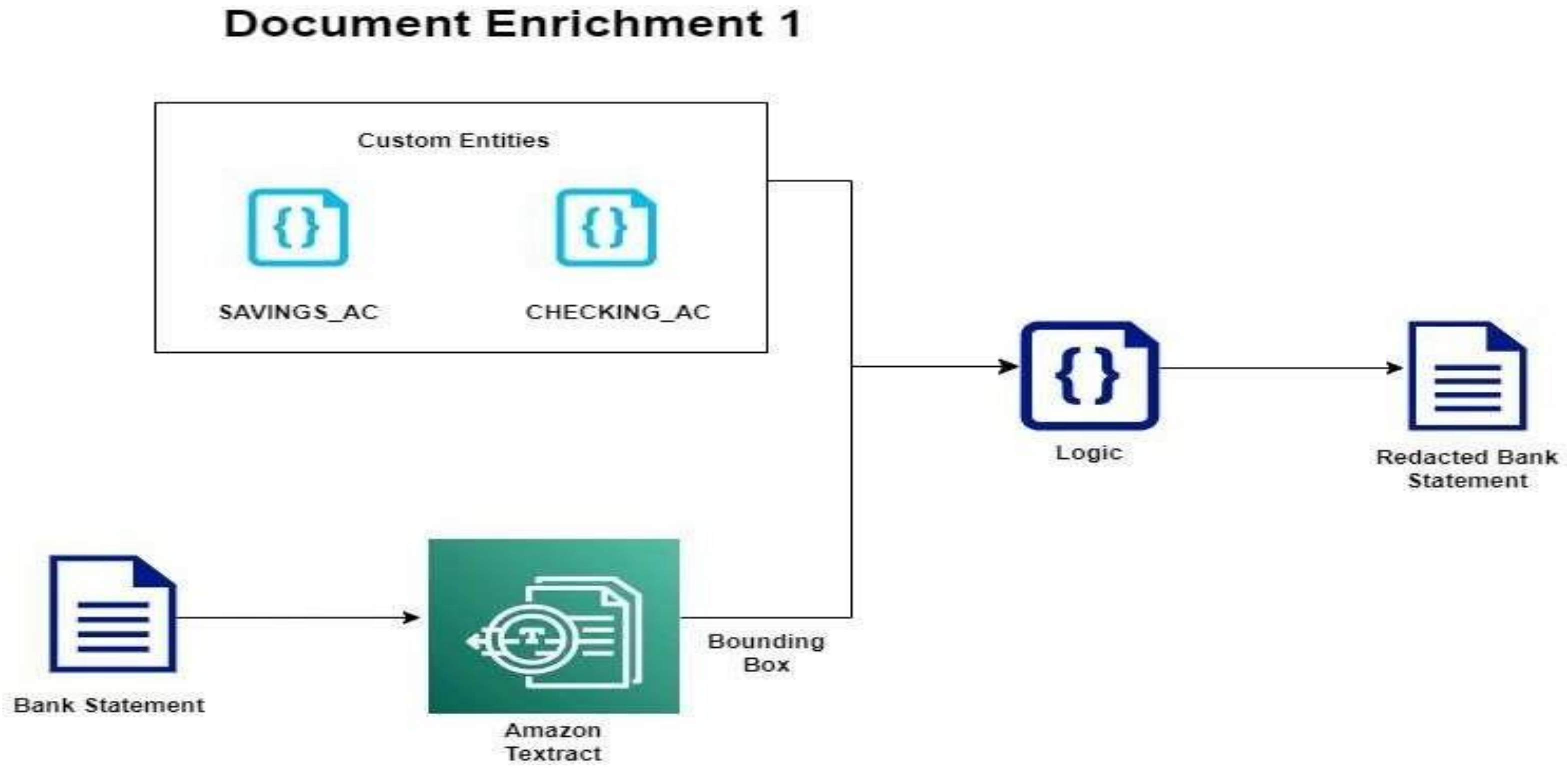


[27]:

	Document	DocType	Confidence	s3path	DocText
0	document_9.png	receipts	0.9999	idp/comprehend/classified-docs/receipts/docume...	THE AIML StORE\n1234 SOMEWHERE RD\nPOWAY, CALI...
1	document_1.png	bank-statements	1.0000	idp/comprehend/classified-docs/bank-statements...	Page 1 of 5 03/02/2022\nDC 1090001004290\nAnyC...
2	document_10.png	receipts	1.0000	idp/comprehend/classified-docs/receipts/docume...	THE AIML StORE\n1234 SOMEWHERE RD\nPOWAY, CALI...
3	document_5.png	invoices	0.9999	idp/comprehend/classified-docs/invoices/docume...	INVOICE\nAnyCompany Hardwares LLC\nDATE\nMay 2...
4	document_3.png	bank-statements	1.0000	idp/comprehend/classified-docs/bank-statements...	Page 1 of 5 03/02/2022\nDC 1090001004290\nAnyC...
5	document_7.png	invoices	0.9999	idp/comprehend/classified-docs/invoices/docume...	INVOICE\nAnyCompany Hardware\nDATE\nDec 09, 20...
6	document_2.png	bank-statements	1.0000	idp/comprehend/classified-docs/bank-statements...	Page 1 of 5 03/02/2022\nDC 1090001004290\nAnyC...
7	document_6.png	invoices	1.0000	idp/comprehend/classified-docs/invoices/docume...	INVOICE\nAnyCompany Manufacturing\nDATE\nDec 2...
8	document_4.png	bank-statements	1.0000	idp/comprehend/classified-docs/bank-statements...	Page 1 of 5 03/02/2022\nDC 1090001004290\nAnyC...
9	document_0.png	bank-statements	1.0000	idp/comprehend/classified-docs/bank-statements...	Page 1 of 5 03/02/2022\nDC 1090001004290\nAnyC...

DOCUMENT CLASSIFIED USING AMAZON COMPREHEND CUSTOM CLASSIFICATION MODEL

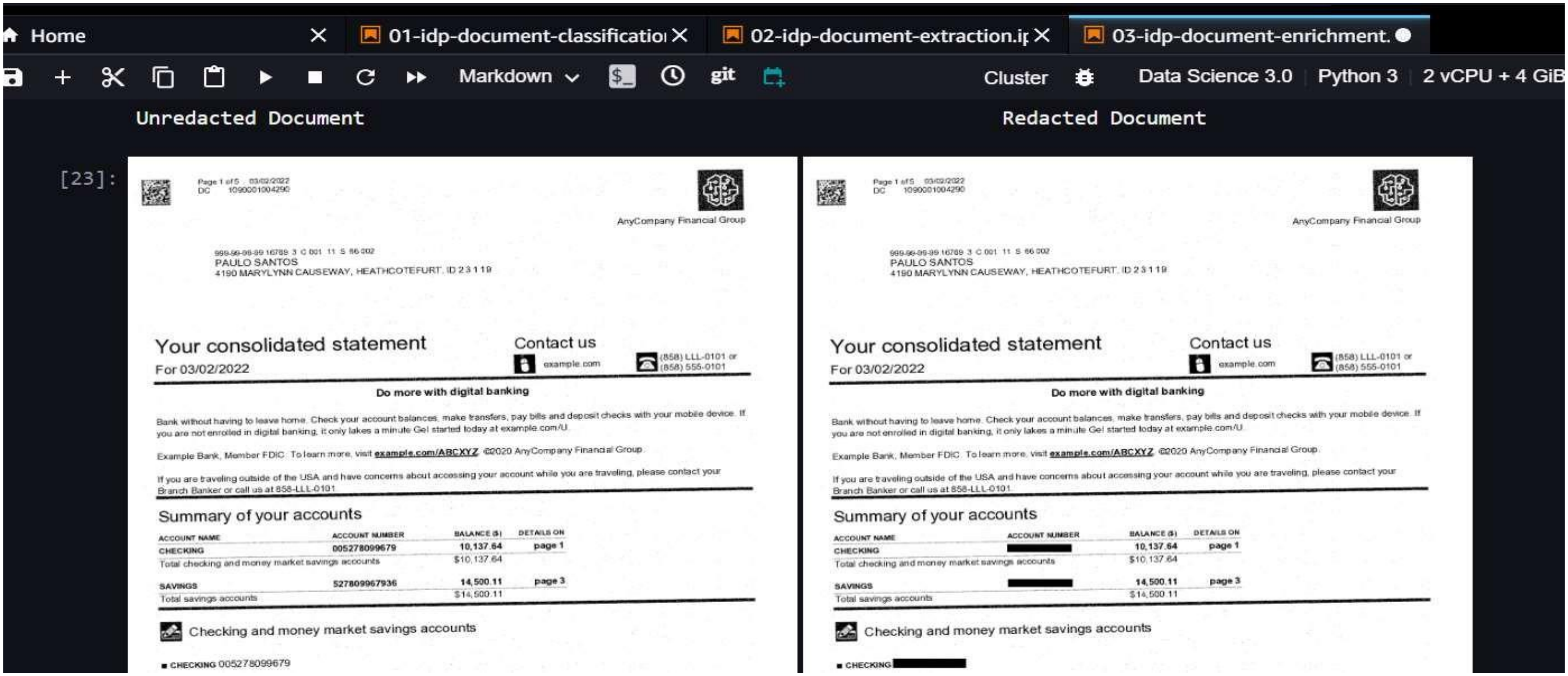
IDP DOCUMENT ENRICHMENT ARCHITECTURE



We picked a bank statement from our list of documents, then got the S3 location of the document and then perform the actions below:

- Used Amazon Textract to get the geometry information i.e. the bounding boxes, of all the lines in the document.

- Used the extracted text above to identify the entities CHECKING_AC and SAVINGS_AC, using Comprehend custom entity recognizer.
- Found the bounding box for the CHECKING_AC and SAVINGS_AC words from the Textract Response.
- Used the bounding box geometry to annotate the document and redact the customer's name and address.


Home
01-idp-document-classificatio
02-idp-document-extraction.i
03-idp-document-enrichment.
Markdown
git
Cluster
Data Science 3.0
Python 3
2 vCPU + 4 GiB
[23]:

Unredacted Document

Page 1 of 5 03/02/2022
DC 1090001004290

AnyCompany Financial Group

999-99-09-99 16789 3 C 001 11 S 86 002
PAULO SANTOS
4190 MARYLYNN CAUSEWAY, HEATHCOTEFURT, ID 23119

Your consolidated statement
For 03/02/2022

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(858) 555-0101

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Example Bank, Member FDIC. To learn more, visit **example.com/ABCXYZ**. ©2020 AnyCompany Financial Group.

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Summary of your accounts

ACCOUNT NAME	ACCOUNT NUMBER	BALANCE ($)	DETAILS ON
CHECKING	005278099679	10,137.64	page 1
Total checking and money market savings accounts		$10,137.64	
SAVINGS	527809967936	14,500.11	page 3
Total savings accounts		$14,500.11	

Checking and money market savings accounts

■ CHECKING 005278099679

Redacted Document

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DC 1090001004290

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999-99-09-99 16789 3 C 001 11 S 86 002
PAULO SANTOS
4190 MARYLYNN CAUSEWAY, HEATHCOTEFURT, ID 23119

Your consolidated statement
For 03/02/2022

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If you are traveling outside of the USA and have concerns about accessing your account while you are traveling, please contact your Branch Banker or call us at 858-LLL-0101

Summary of your accounts

ACCOUNT NAME	ACCOUNT NUMBER	BALANCE ($)	DETAILS ON
CHECKING	[redacted]	10,137.64	page 1
Total checking and money market savings accounts		$10,137.64	
SAVINGS	[redacted]	14,500.11	page 3
Total savings accounts		$14,500.11	

Checking and money market savings accounts

■ CHECKING [redacted]

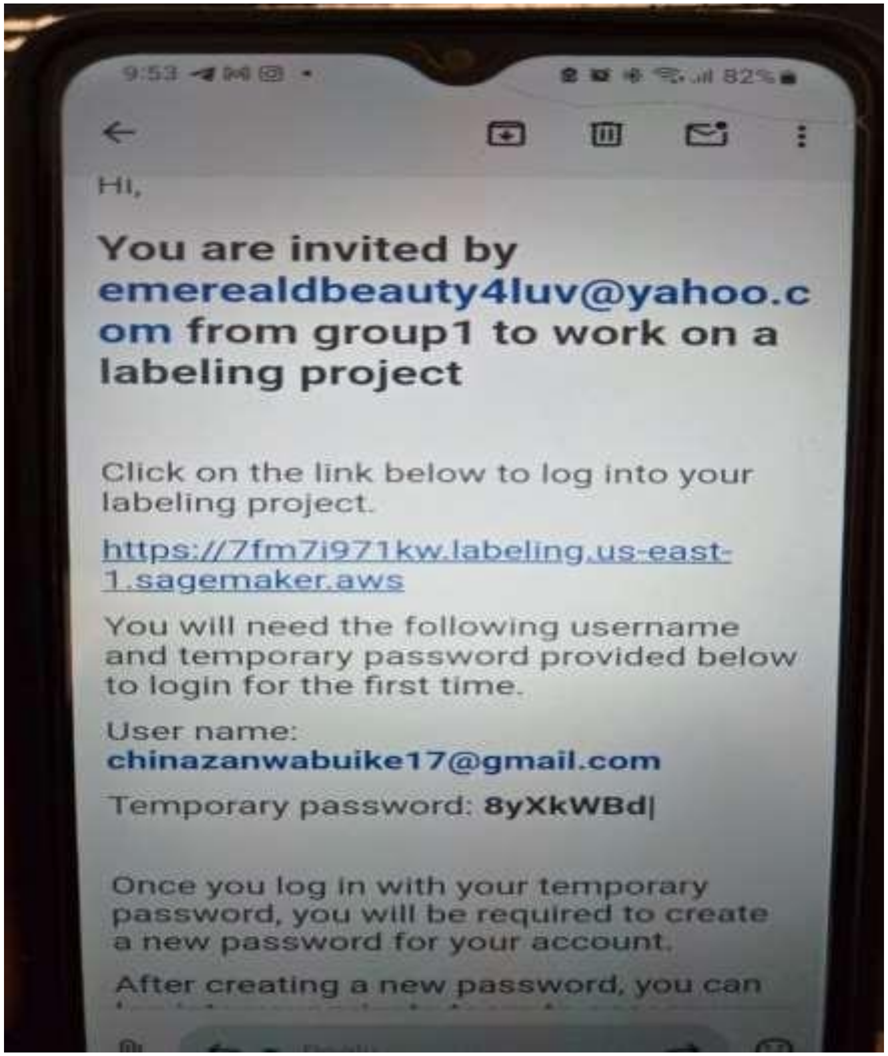
The Customer's Name and Address Has Been Redacted.

DOCUMENT REVIEW AND VERIFICATION (AMAZON AUGUMENTED AI)

To incorporate Amazon A2I into human review workflows, we needed the following resources:

- Worker task template
- Human review workflow
- Human loop

- We used an amazon s3 bucket to store data for A2I workers.
- We created a human review workflow via Augmented AIG which is found in the left panel of the amazon Sagemaker console.
- We then set up the A2I Workflow definition, while calling Amazon Textract's Analyze Document API including the A2I paramters in the HumanLoopConfig and Provided the A2I workflow ARN to be used by Amazon Textract.
- We logged into the labelling/human review portal after we had received an email with a link to the Labeling/human review portal with details on how to login and a portal URL



Hi,

You are invited by emerealdbeauty4luv@yahoo.com from group1 to work on a labeling project

Click on the link below to log into your labeling project.

https://7fm7i971kw.labeling.us-east-1.sagemaker.aws

You will need the following username and temporary password provided below to login for the first time.

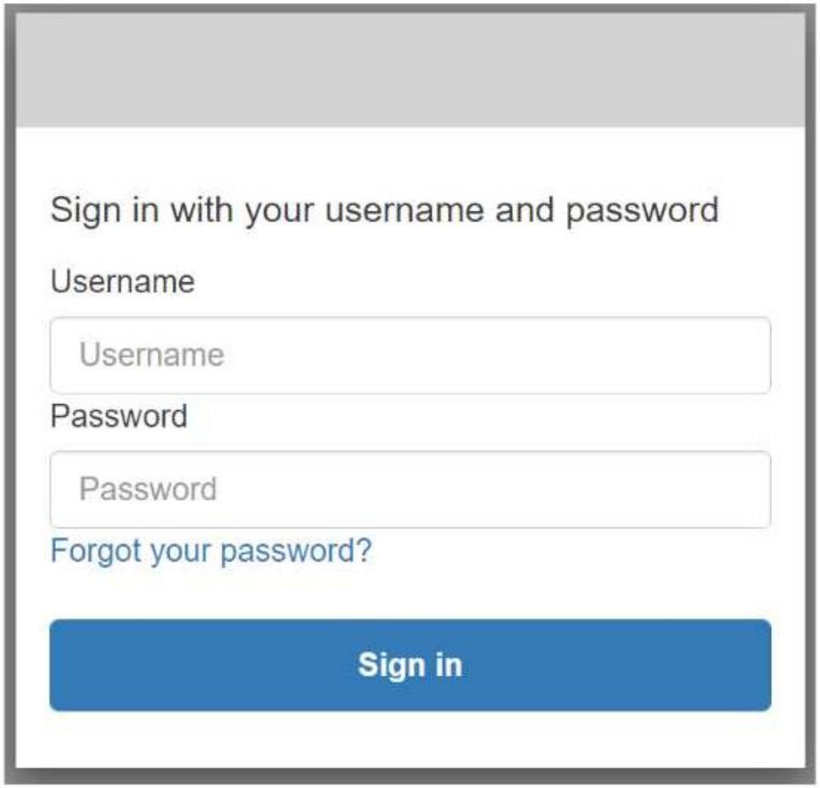
User name:
chinazanwabuike17@gmail.com

Temporary password: **8yXkWBd**

Once you log in with your temporary password, you will be required to create a new password for your account.

After creating a new password, you can

An Email invite to login into the human review portal.

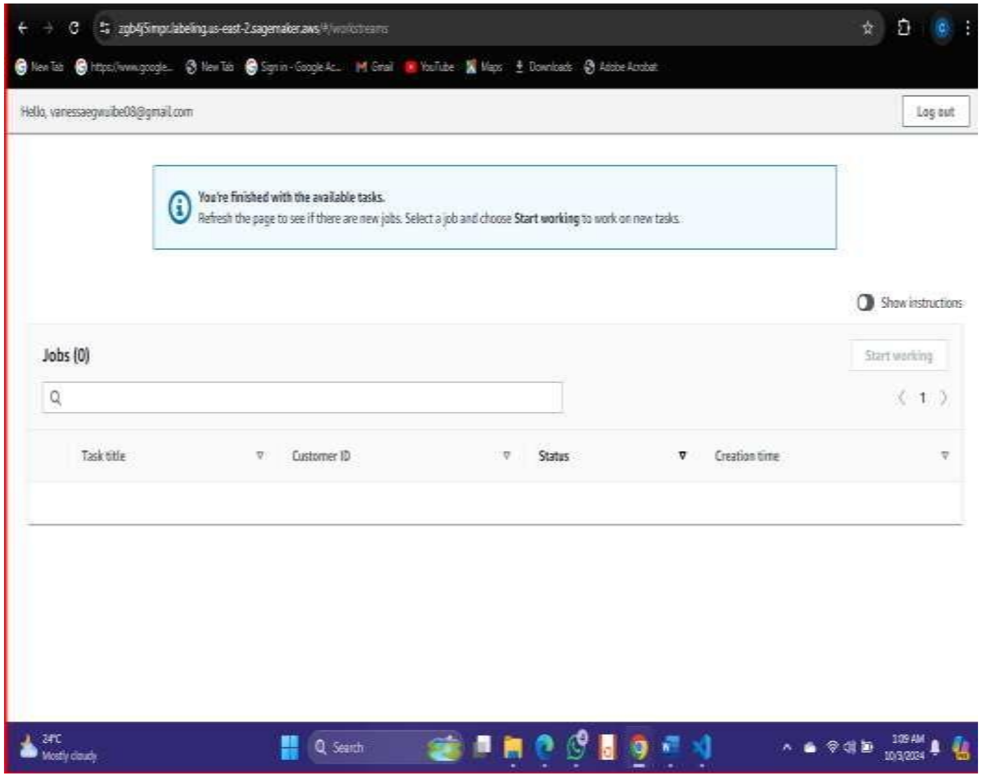


Sign in with your username and password

Username

Password

LOG IN INTO HUMAN REVIEW PORTAL



Hello, vanessaegwuibe08@gmail.com

You're finished with the available tasks.
Refresh the page to see if there are new jobs. Select a job and choose **Start working** to work on new tasks.

Jobs (0)

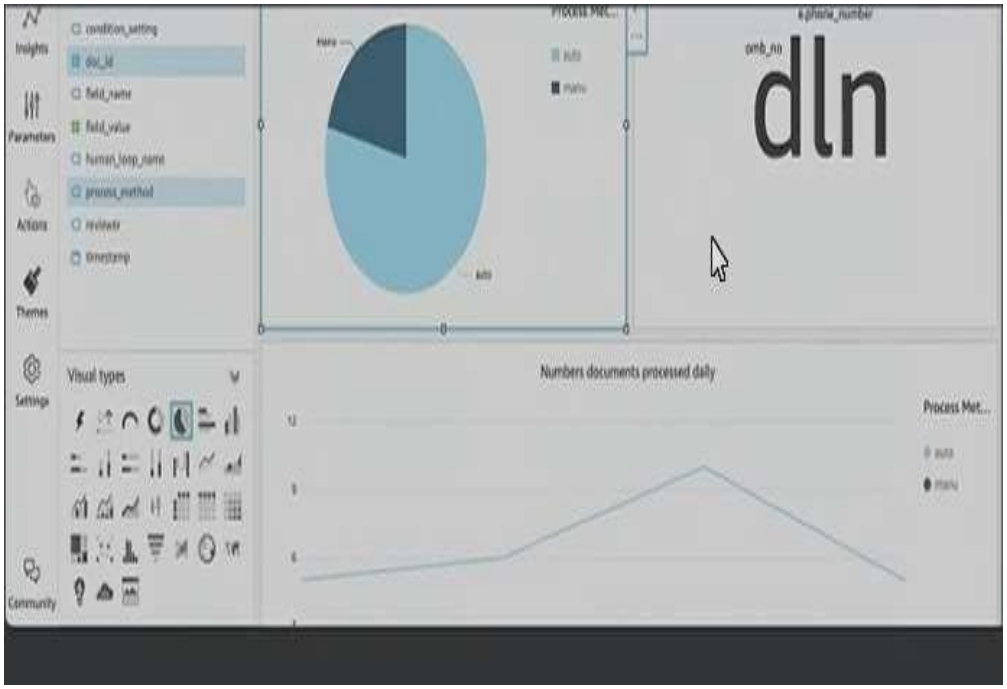
Task title	Customer ID	Status	Creation time

HUMAN REVIEW AFTER TASK IS DONE

DATA VISUALIZATION

The data was then visualized usingQUICKSIGHT, which is one of the services offered by AWS as a visualization tool.

- In this project, we used Pie Chart, and Line Chart for visualization.



CHALLENGES

Below are some of the Challenges we faced while deploying the project:

- Outdated Codes
- Ran out of financial resources
- Using same region by multiple users
- Time Constraints
- Unfamiliar Territory