Learning Tutorial

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TABLE OF CONTENTS

INTRODUCTION 1

SAGEMAKER OVERVIEW 2

SageMaker Applications 3
- SageMaker Studio 3
- SageMaker Canvas 3
- SageMaker RStudio 4
- SageMaker Studio Lab 4

SageMaker Features 5
- Ground Truth 5
- Notebook 5
- Processing and Training 5
- Inference 7
- Edge Manager 7
- Augmented AI 7
- AWS Marketplace 8

MANAGE BILLING 9

Monitor Resources 10

AWS Billing Console 12
- AWS Billing Dashboard 12
- AWS Free Tier 13
- AWS Bills 14

SET UP AMAZON SAGEMAKER 16

Create an AWS Account 16
Create an IAM Administrator 17
SageMaker Domain Quick Setup 19

SAGEMAKER APPLICATIONS 20

Studio App 20
Create a Notebook 21
Shut Down Resources 22
Canvas App 23
RStudio App 27

GIT REPOSITORIES 28

AWS DEMOSTRATIONS 29

predict customer churn rate With XGBboost 29
Build Data Pipeline 35

CONTACT AWS SUPPORT 38

AWS MARKETPLACE 39

BUY and SELL Algorithms 41
Buy and Sell Data 42

ANNEX – SUPPORT IMAGES 44

Figures: Create an AWS Account 44
Figures: Create an IAM Administrator 49
Figures: SageMaker Domain Quick Setup 54
Figures: Contact AWS Support 56
Figures: Git Repositories 58

INTRODUCTION

In 2006, Amazon Web Services (AWS) began offering IT infrastructure services to businesses in the form of web services, also known as cloud computing.

With the Cloud, businesses no longer need to plan for and procure servers and other IT infrastructure weeks or months in advance. Instead, they can instantly spin up hundreds or thousands of servers in minutes and deliver results faster.

Today, Amazon Web Services provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers hundreds of thousands of businesses in 190 countries around the world. With data center locations in the U.S., Europe, Brazil, Singapore, Japan, and Australia, customers across all industries are taking advantage of the following benefits.

Amazon SageMaker is a service, provided inside the Amazon Web Services ecosystem, that enables data scientists and developers to build, train, and deploy machine learning models at any scale quickly and easily.

This document is a hands-on guide to start using Amazon SageMaker from the beginning, providing contextual information and step-by-step guides.

SAGEMAKER OVERVIEW

Amazon SageMaker is a fully managed machine learning service to build and train machine learning models and deploy them into a production-ready hosted environment.

It provides an integrated Jupyter authoring notebook instance to easily access your data sources for exploration and analysis. It also provides common machine learning algorithms that run efficiently against extremely large data in a distributed environment.

SageMaker provides a comprehensive list of environments and features, some of them with duplicated functions and unclear pricing and use metrics. Here is an image of SageMaker home page.

The SageMaker environment is constituted by a set of applications and a group of features.

SAGEMAKER APPLICATIONS

These applications are grouped under the category named Control panel, and they are:

SAGEMAKER STUDIO

An integrated machine learning environment where you can build, train, deploy, and analyze your models all in the same application.

Amazon SageMaker Studio is a web-based, integrated development environment (IDE) for machine learning that lets you build, train, debug, deploy, and monitor your machine learning models. You can perform the following tasks:

- *Write and execute code in Jupyter notebooks*
- *Build and train machine learning models*
- *Deploy the models and monitor the performance of their predictions*
- *Track and debug the machine learning experiments*

This application is not inside the Free Tier, so just doing one-click Amazon starts billing you by the time you use it.

SAGEMAKER CANVAS

Amazon SageMaker Canvas allows you to use machine learning to generate predictions without coding.

You can import data from one or more sources, build a predictive model, train the model, and evaluate performance.

SAGEMAKER RSTUDIO

With RStudio on Amazon SageMaker, you can launch RStudio, and use RStudio on-demand cloud compute resources.

RStudio is an integrated development environment for R, with a console, syntax-highlighting editor that supports direct code execution, and tools for plotting, history, debugging and workspace management. Amazon SageMaker supports RStudio as a fully-managed integrated development environment (IDE) integrated with Amazon SageMaker Domain.

To use an RStudio license with Amazon SageMaker, you must first have a valid RStudio license registered with AWS License Manager. Subscriptions to RStudio Workbench on AWS Marketplace automatically trigger license creation with AWS License Manager. For that reason, we couldn't explore this application.

SAGEMAKER STUDIO LAB

Amazon SageMaker Studio Lab is a free machine learning (ML) development environment that provides the compute, storage (up to 15GB), and security for anyone to learn and experiment with ML.

With a valid email address, you don't need to configure infrastructure or manage identity and access or even sign up for an AWS account.

SageMaker Studio Lab accelerates model building through GitHub integration, and it comes preconfigured with the most popular ML tools, frameworks, and libraries to get you started immediately. SageMaker Studio Lab automatically saves your work, so you don't need to restart between sessions.

However, your registration is not automatic. You submit your personal information and get on a waiting list until Amazon gives you access or not.

SAGEMAKER FEATURES

GROUND TRUTH

Amazon SageMaker Ground Truth is a data labeling service that deliver annotations. Using Ground Truth, data scientists and business managers, such as data operations managers and program managers, can create training datasets without having to build labeling applications and manage labeling workforces on their own.

When you upload the data, Ground Truth sets up the data labeling workflows and operates them on your behalf. Ground Truth does not support PHI, PCI or FedRAMP certified data, and you should not provide this data to Ground Truth.

NOTEBOOK

An Amazon SageMaker notebook instance is a machine learning (ML) compute instance running the Jupyter Notebook App. SageMaker manages creating the instance and related resources.

Use Jupyter notebooks in your notebook instance to prepare and process data, write code to train models, deploy models to SageMaker hosting, and test or validate your models.

SageMaker also provides sample notebooks that contain complete code walkthroughs. These walkthroughs show how to use SageMaker to perform common machine learning tasks.

PROCESSING AND TRAINING

To analyze data and evaluate machine learning models on Amazon SageMaker, use Amazon SageMaker Processing. With Processing, you can use a simplified, managed experience on SageMaker to run your

data processing workloads, such as feature engineering, data validation, model evaluation, and model interpretation. You can also use the Amazon SageMaker Processing APIs during the experimentation phase and after the code is deployed in production to evaluate performance.

The preceding diagram shows how Amazon SageMaker spins up a Processing job. Amazon SageMaker takes your script, copies your data from Amazon Simple Storage Service (Amazon S3), and then pulls a processing container.

The processing container image can either be an Amazon SageMaker built-in image or a custom image that you provide. The underlying infrastructure for a Processing job is fully managed by Amazon SageMaker. Cluster resources are provisioned for the duration of your job, and cleaned up when a job completes. The output of the Processing job is stored in the Amazon S3 bucket you specified.

While you SageMaker is processing fully manage by AWS, you are being changing for use AWS resources, like instances, virtual private clouds (VPC) and File Systems. Using SageMaker is as easy as using Google Collab with the difference that Amazon charge you for recourses you used without knowing.

INFERENCE

Using Inference, you can accelerate the process by allowing you to attach fractional GPUs to any SageMaker instance. You can select the client instance to run your application and attach an Elastic Inference accelerator to use the right amount of GPU acceleration for your inference needs.

EDGE MANAGER

Many machines learning (ML) use cases require running ML models on a fleet of edge devices, which allows you to get predictions in real-time, preserves the privacy of the end users and lowers the cost of network connectivity.

With SageMaker Edge Manager, you can optimize, run, monitor, and update machine learning models across fleets of devices at the edge.

AUGMENTED AI

When you use AI applications such as Amazon Rekognition, Amazon Textract, or your custom machine learning (ML) models, you can use Amazon Augmented AI to get human reviews of low-confidence predictions or random prediction samples.

Amazon Augmented AI (Amazon A2I) is a service that facilitates workflows for human revision across different roles inside the organization.

AWS MARKETPLACE

Amazon SageMaker integrates with AWS Marketplace, enabling developers to charge other SageMaker users for the use of their algorithms and model packages.

AWS Marketplace is a curated digital catalogue that makes it easy for customers to find, buy, deploy, and manage third-party software and services that customers need to build solutions and run their businesses.

AWS Marketplace includes thousands of software listings in popular categories, such as security, networking, storage, machine learning, business intelligence, database, and DevOps.

It simplifies software licensing and procurement with flexible pricing options and multiple deployment methods.

MANAGE BILLING

Billing and cost management is a critical concept for Amazon SageMaker because when you start using SageMaker, the truth is that you begin using a Cloud Computing environment with a set of applications named SageMaker. Thus, you will be billed for the Cloud Computing resources that SageMaker.

In other words, Amazon manages its offering as a Platform as a Service (PaaS) and not as a Software as a Service (SaaS) like GoogleCollab.

Said that, and before we proceed with the billing explanation, it is crucial to accept that SageMaker is a service designed for enterprises and not for persons because to manage this service properly, it is required to involve different roles like infrastructure admin, network admin, identity and access management admin, and security admin.

To understand the billing method, the architecture's key components must be reviewed in that context.

Regarding billing, these are the essential components that should be managed and monitored to avoid unexpected costs:

Amazon Simple Storage Service (S3): S3 buckets are used as a data store for training models and SageMaker model artifacts.

Virtual Private Cloud (VPC): It is the environment that is created to host the SageMaker services. While you are using SageMaker, VPCs are automatically created without notice.

Instances: An instance can be a server, a database, or another component required to execute SageMaker services. The instances are created while you are activating and using services.

Regions: Finally, it is also important to know that AWS has Cloud Services in several regions around the world and while you use SageMaker you could create and activate instances in different regions.

You can close your web browser when you finish working, but these instances keep running without your notice.

MONITOR RESOURCES

You can view your AWS resources such as Instances, VPCs, Subnets, Security Groups, Volumes across AWS Regions.

Global View provides visibility to all your resources in a single pane of glass across AWS regions. It helps monitor resource counts, notice abnormalities sooner rather than later, and find stray resources.

Global View can be accessed from the EC2 and VPC Consoles. It provides the ability to search across resources by resource ID or tag values. You can filter resources by regions or resource type. Once a resource is located, you can access the existing management screens of the selected resource in the right region.

This capability is currently available for 5 resources: Instances, VPCs, Subnets, Security Groups, Volumes. in all AWS Regions except Amazon Web Services China (Beijing) Region, Amazon Web Services China (Ningxia) Region and AWS GovCloud (US).

When you access to Global View you will see something similar to this image:

When you finish working, before living your computer, first you must get in this service to monitor your instances, VPCs and Volumes. Letting working only the components you want to keep working. Amazon billing is mainly related to these components.

AWS BILLING CONSOLE

The AWS Bills page provides a monthly view of your chargeable costs. For monthly billing periods that have not yet closed, the Bills page will display the most recent estimated charges based on services metered to date. Invoices are generated when a monthly billing period closes, or when subscriptions or one-time purchases are made.

For users of AWS Organizations, users logged into the management account can view consolidated charges for all member accounts, with account-level detail available on the “Charges by account” tab.

The AWS Bills page provides details of AWS-provided services as well as purchases made through AWS Marketplace.

AWS BILLING DASHBOARD

The AWS Billing console Dashboard provides an overview of your AWS costs and other key metrics. Use the Dashboard for a high-level view of your AWS spending, identify your highest cost service and Region, and view trends over previous months. You can customize which data is displayed in which order by choosing the gear icon.

AWS FREE TIER

The AWS Free Tier allows you to explore and try out AWS services free of charge up to specified limits for each service. The Free Tier comprises three different types of offerings, a 12-month Free Tier, an Always Free offer, and short-term trials.

Services with a 12-month Free Tier allow customers to use the product for free up to specified limits for one year from when the account was created.

Services with an Always Free offer allow customers to use the product for free up to specified limits as long as they are an AWS customer.

Services with a short-term trial are free to use for a specified period of time or up to a one-time limit depending on the service selected.

Details on the limits and services provided for free are detailed in each card on the Free Tier page. If your application use exceeds the free tier limits, you simply pay standard, pay-as-you-go service rates (

You can monitor the use of your free tier inside the billing section, here is an screenshot of this section.

AWS Billing > AWS Free Tier

AWS Free Tier Info

Summary (9)

Find service name

Service	AWS Free Tier usage limit	Current usage	Forecasted usage	MTD actual usage %	MTD forecasted usage %
Amazon SageMaker	$0.00 per hour up to 750 hours per month	348 Hrs	514 Hrs	46.43%	68.53%
Amazon Simple Storage Service	2,000 Put, Copy, Post or List Requests of Amazon S3	312 Requests	461 Requests	15.60%	23.03%
Amazon Simple Storage Service	20,000 Get Requests of Amazon S3	656 Requests	968 Requests	3.28%	4.84%
AWS Key Management Service	20,000 free requests per month for AWS Key Management Service	162 Requests	239 Requests	0.81%	1.20%
AmazonCloudWatch	5 GB of Log Data Ingestion for Amazon Cloudwatch	0 GB	0 GB	0.09%	0.13%
AmazonCloudWatch	1,000,000 API requests for Amazon Cloudwatch	825 Requests	1,218 Requests	0.08%	0.12%
AmazonCloudWatch	5 GB of Log Data Archive for Amazon Cloudwatch	0 GB-Mo	0 GB-Mo	0.02%	0.03%
Amazon Simple Storage Service	5 GB of Amazon S3 standard storage	0 GB-Mo	0 GB-Mo	0.01%	0.01%
Amazon Elastic File System	5 GB per month of Amazon EFS capacity	0 GB-Mo	0 GB-Mo	0.00%	0.01%

It is essential to know that although you do not cross the limits of your free tier, you could still be charged for using other services out of this tier. For example, if you start a Jupiter notebook inside the SageMaker Studio, you will be billed because it is out of the free tier.

AWS BILLS

You can use the **Bills** page in your AWS Billing console to see your monthly chargeable costs, along with details of your AWS services and purchases made through AWS Marketplace.

Invoices are generated when a monthly billing period closes (marked as **Issued** billing status), or when subscriptions or one-time purchases are made. For monthly billing periods that haven't closed (marked as **Pending** billing status), this page shows the most recent estimated charges based on your AWS services metered to date.

Bills

Date: July 2022 | Download CSV | Print

Estimated Total	20.95 CAD	$16.10

Your invoiced total will be displayed once an invoice is issued.

Details — Collapse All

AWS Service Charges		**$16.10**
CloudWatch		**$0.00**
US West (Oregon)		**$0.00**
Amazon CloudWatch		$0.00
$0.00 per metric-month - first 10 metrics	0.087 Metrics	$0.00
$0.00 per request - first 1,000,000 requests	825.000 Requests	$0.00
AmazonCloudWatch PutLogEvents		$0.00
First 5GB per month of log data ingested is free.	0.005 GB	$0.00
AmazonCloudWatch USW2-TimedStorage-ByteHrs		$0.00
First 5GB-mo per month of logs storage is free.	0.001 GB-Mo	$0.00
Data Transfer		**$0.00**
US East (N. Virginia)		**$0.00**
AWS Data Transfer USE1-USW2-AWS-In-Bytes		$0.00
$0.00 per GB - US East (Northern Virginia) data transfer from US West (Oregon)	0.000000140 GB	$0.00
AWS Data Transfer USE1-USW2-AWS-Out-Bytes		$0.00
$0.02 per GB - US East (Northern Virginia) data transfer to US West (Oregon)	0.000003 GB	$0.00
Elastic File System		**$0.00**
US West (Oregon)		**$0.00**
Amazon Elastic File System Standard Storage Class		$0.00
USD $0.00 per GB-Mo for Standard storage under the monthly global free tier	0.000234 GB-Mo	$0.00
Key Management Service		**$0.00**
US West (Oregon)		**$0.00**
AWS Key Management Service us-west-2-KMS-Requests		$0.00
$0.00 per request - Monthly Global Free Tier for KMS requests	162.000 Requests	$0.00
SageMaker		**$14.37**
US West (Oregon)		**$14.37**
Amazon SageMaker CreateVolume-Gp2		$0.07
$0.14 per GB-Mo of Endpoint ML storage	0.513 GB-Mo	$0.07
Amazon SageMaker RunInstance		$14.30
$0 per hour upto 750 hours per month	348.189 Hrs	$0.00
$0.00 for Notebk:ml.t3.medium per hour under monthly free tier	0.480 Hrs	$0.00
$1.125 per Hosting ml.p2.xlarge hour in US West (Oregon)	12.714 Hrs	$14.30
Service Catalog		**$0.00**
US West (Oregon)		**$0.00**
AWS Service Catalog USW2-AR-App-API-Calls		$0.00
$0.00 per API Calls for AppRegisty Application API-Calls in US West (Oregon)	1.000 API Calls	$0.00
AWS Service Catalog USW2-SC-API-Calls		$0.00
$0.00 per API Calls for SC-API-Calls in US West (Oregon) - Free Tier	36.000 API Calls	$0.00
Simple Storage Service		**$0.00**
US East (N. Virginia)		**$0.00**
Amazon Simple Storage Service Requests-Tier1		$0.00
$0.00 per request - PUT, COPY, POST, or LIST requests under the monthly global free tier	29.000 Requests	$0.00
Amazon Simple Storage Service Requests-Tier2		$0.00
$0.00 per request - GET and all other requests under the monthly global free tier	22.000 Requests	$0.00
US West (Oregon)		**$0.00**
Amazon Simple Storage Service USW2-Requests-Tier1		$0.00
$0.00 per request - PUT, COPY, POST, or LIST requests under the monthly global free tier	283.000 Requests	$0.00
Amazon Simple Storage Service USW2-Requests-Tier2		$0.00
$0.00 per request - GET and all other requests under the monthly global free tier	634.000 Requests	$0.00
Amazon Simple Storage Service USW2-TimedStorage-ByteHrs		$0.00
$0.000 per GB - storage under the monthly global free tier	0.000411 GB-Mo	$0.00
Taxes		
Canada Tax to be collected		**$1.73**

SET UP AMAZON SAGEMAKER

CREATE AN AWS ACCOUNT

When you sign up for Amazon Web Services (AWS), your AWS account is automatically signed up for all AWS services, including SageMaker. You are going to be charged only for the services that you use.

Follow these steps:

1. *Open https://portal.aws.amazon.com/billing/signup, confirm your email and select a password.*
2. *Complete the required information.*
3. *Confirm your identity by SMS or phone call*
4. *Select the support plan*

Write down your AWS account ID and remember your password because you'll need it for the following tasks.

Click here to see figures about this procedure

CREATE AN IAM ADMINISTRATOR

When you create an AWS account, you get a single sign-in identity that has full access to all of the AWS services and resources in the account. This identity is called the AWS account *root user*.

We strongly recommend that you *not* use the root user for everyday tasks, even the administrative ones. Instead, adhere to the Create Individual IAM Users, an AWS Identity and Access Management (IAM) administrator user. Then securely lock away the root user credentials and use them to perform only a few account and service management tasks.

To create an administrator user, follow these steps:

1. *Sign in to the IAM console (https://console.aws.amazon.com/iam/) as the account owner by choosing Root user and entering your AWS account email address. On the next page, enter your password.*
2. *Enable access to billing data for the IAM admin user that you will create as follows:*
    a. *On the navigation bar, choose your account name, and then choose Account.*
    b. *Next to IAM User and Role Access to Billing Information, choose Edit. You must be signed in as the root user for this section to be displayed on the account page.*
    c. *Select the check box to Activate IAM Access and choose Update.*
    d. *On the navigation bar, choose Services and then IAM to return to the IAM console.*
3. *In the navigation pane, choose Users and then choose Add users.*
4. *On the Details page, do the following:*

   a. *For User name, type Administrator.*
   b. *Select the check box for AWS Management Console access, select Custom password, and then type your new password in the text box.*
   c. *Choose Next: Permissions.*

5. *On the Permissions page, do the following:*
   a. *Choose Add user to group.*
   b. *Choose Create group.*
   c. *In the Create group dialog box, for Group name type Administrators.*
   d. *Select the check box for the AdministratorAccess policy.*
   e. *Choose Create group.*
6. *Back on the page with the list of user groups, select the check box for your new user group. Choose Refresh if you don't see the new user group in the list.*
7. *Choose Next: Tags.*
8. *Choose Next: Review. Verify the user group memberships to be added to the new user. When you are ready to proceed, choose Create user.*
9. *On the Complete page, you can download a .csv file with login information for the user, or send email with login instructions to the user.*

You can use this same process to create more user groups and users and to give your users access to your AWS account resources.

Click here to see figures about this procedure

SAGEMAKER DOMAIN QUICK SETUP

This topic describes how to onboard to Amazon SageMaker Domain using the **Quick setup** procedure, which uses AWS Identity and Access Management (IAM) authentication.

To onboard to the Domain using Quick setup

1. *Open the SageMaker console.*
2. *Choose ControlPanel at the top left of the page.*
3. *On the Setup SageMaker Domain page, choose Quick setup.*
4. *Under User profile, for Name keep the default name or create a new name. The name can be up to 63 characters. Valid characters: A-Z, a-z, 0-9, and - (hyphen).*
5. *Choose Create a new role, the Create an IAM role dialog opens:*
6. *For S3 buckets you specify, specify additional S3 buckets that users of your notebooks can access.*
7. *If you don't want to add access to more buckets, choose None.*
8. *Choose Submit.*
9. *Choose Save and continue.*
10. *From Launch app, select Studio. The Amazon SageMaker Studio loading page displays.*
11. *When Studio opens, you can start using it.*

Click here to see figures about this procedure

SAGEMAKER APPLICATIONS

STUDIO APP

Amazon SageMaker Studio extends the JupyterLab interface. Previous users of JupyterLab will notice the similarity in the user interface, including the workspace. The following image shows SageMaker Studio with the file browser open and the Studio Launcher displayed.

At the top of the screen is the menu bar. At the left of the screen is the left sidebar which contains icons to open file browsers, resource browsers, and tools. At the right of the screen is the right sidebar, which displays contextual property settings when open. At the bottom of the screen is the status bar.

Above the Settings icon, there's a button to provide feedback about your experiences with SageMaker Studio.

To the left of the Feedback button, there's the notification icon. Choose the icon to view notifications from Studio, such as new Studio versions and new SageMaker features.

The main work area is divided horizontally into two panes. The left pane is the file and resource browser. The right pane contains one or more tabs for resources such as notebooks, terminals, metrics, and graphs.

CREATE A NOTEBOOK

When you create a notebook or open a non-shared notebook in Studio for the first time, you must select a SageMaker image and kernel for the notebook. SageMaker launches the notebook on a default instance of a type based on the chosen SageMaker image.

For CPU-based images, the default instance type is ml.t3.medium (available as part of the AWS Free Tier). For GPU based images, the default instance type is ml.g4dn.xlarge (not available as part of the AWS Free Tier).

You can have only one instance of each instance type. Each instance can have multiple SageMaker images running on it. Each SageMaker image can run multiple kernels or terminal instances.

Billing occurs per instance and starts when the first instance of a given instance type is launched. *If you want to create or open a notebook without the risk of incurring charges, open the notebook from the File menu and choose No Kernel from the Select Kernel dialogue.* You can read and edit a notebook without a kernel, but you can't run cells.

Billing ends when the SageMaker image for the instance is shut down.

SHUT DOWN RESOURCES

You can reach the Running Terminals and Kernels pane on the left side of Amazon SageMaker Studio. The Running Terminals and Kernels pane consists of four sections. Each section lists all the resources of that type. You can shut down each resource individually or shut down all the resources in a section at the same time.

When you choose to shut down all resources in a section, the following occurs:

RUNNING INSTANCES/RUNNING APPS: All instances, apps, notebooks, kernel sessions, consoles/shells, and image terminals are shut down. System terminals aren't shut down.

IMPORTANT: When you shut down the Studio notebook instances, any additional resources, such as SageMaker endpoints, Amazon EMR

clusters, and Amazon S3 buckets created from Studio are not deleted. *And you must delete those resources to stop accrual of charges.*

KERNEL SESSIONS: All kernels, notebooks and consoles/shells are shut down.

TERMINAL SESSIONS: All image terminals and system terminals are shut down.

CANVAS APP

Amazon SageMaker Canvas provides a visual point-and-click interface that allows generating ML predictions independently, without having to write code. This app connects, access, and combines data, and creates unified datasets

Here is an image of the application:

You can import datasets from Local files, Amazon S3, Amazon Redshift, and Snowflake.

The following image shows how the interface is to upload local files.

The most powerful and mature functionality of canvas is the one that allows you to load data from different sources, transform, clean, join and format the data. In other words, it lets you realize the data wrangling with a point-and-click tool. Here are some screenshots of this tool in action.

Join Datasets
Datasets
+ Import Data
Search
sales-data-May2020.csv
sales-data-May2020.csv
DatasetB.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
Autosaved 8/9/21 at 11:34 AM
Drag and drop datasets to join
No result to preview
Close
Save joined data

Join Datasets
Datasets
+ Import Data
Search
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
{datasetname}.csv
{datasetname}.csv
Join Preview
Sample
Show dropped columns
Sold
Price
Age
Discount
Fabric
Age
2 categories
12 categories
4 categories
22 categories
Yes
29.99
Southwest
23
Yes
Yes
Previewing first 100 rows
Close
Save joined data

Join Datasets
Datasets
+ Import Data
Search
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
{datasetname}.csv
{datasetname}.csv
Join
Inner
Left
Right
Full
{Left Data Set}
{Right Data Set}
Key
Key
Key
Key
Key
Key
+ Add Key
Save Changes
Join Preview
Sample
Show dropped columns
{selecteddataset2}.csv
Sold
ABC
Price
ABC
Age
{selecteddataset1}.csv
Age
ABC
2 categories
2
200.99
12 categories
1
4
4 categories
22 categories
Yes
29.99
Southwest
23
Yes
Yes
Previewing first 100 rows
Close
Save joined data

Join Datasets
Datasets
+ Import Data
Search
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
sales-data-May2020.csv
{datasetname}.csv
{datasetname}.csv
Join
Inner
Left
Right
Full
{Left Data Set}
datasetname3
P
Key
{datasetname}.csv
Product
{datasetname1}.csv
Product ID
Unit Price
Product ID
Price Per Unit
Save Changes
Join Preview
Sample
Show dropped columns
{selecteddataset2}.csv
Sold
ABC
Price
ABC
Age
{selecteddataset1}.csv
Fabric
ABC
Age
ABC
2 categories
2
200.99
12 categories
4
4 categories
22 categories
Yes
29.99
Southwest
23
Yes
Yes
Previewing first 100 rows
Close
Save joined data

RSTUDIO APP

RStudio is a paid product and requires that each user is licensed. Licenses for RStudio on Amazon SageMaker may be obtained from RStudio PBC directly, or by purchasing a subscription to RStudio Workbench on AWS Marketplace. For existing customers of RStudio Workbench Enterprise, licenses are issued at no additional cost.

To use an RStudio license with Amazon SageMaker, you must first have a valid RStudio license registered with AWS License Manager.

Subscriptions to RStudio Workbench on AWS Marketplace automatically trigger license creation with AWS License Manager.

GIT REPOSITORIES

Git is a connection to GitHub. After setting it up, it can link specific GitHub to the notebook instance.

Follow these steps:

1. *Select Git repositories*
2. *Fill the Amazon SageMaker repository name and Git Respostory URL*
3. *Press Add repository*

Click here to see figures about this procedure

AWS DEMOSTRATIONS

PREDICT CUSTOMER CHURN RATE WITH XGBBOOST

Amazon SageMaker Notebook is similar to the Jupyter notebook. To use the Notebook, we must establish a notebook instance.

Below are the steps to create a notebook instance

1. *Press Create notebook instance in Notebook instances page*
2. *Enter the notebook instance name, choose the notebook instance type. In our example, we choose ml.t3.medium to operate the notebook.*
3. *Press Create notebook instance*
4. *Wait a few minutes, the status of the instances will change to in-service*
5. *Press start Open, then open JupyterLab to start the jupyter notebook*

aws
Services
Search for services, features, blogs, docs, and more
[Option+S]
Console Home
IAM
Amazon SageMaker
AWS Budgets
EC2
Resource Groups & Tag Editor
VPC
AWS Cost Explorer
Amazon SageMaker > Notebook instances > Create notebook instance
Create notebook instance
Amazon SageMaker provides pre-built fully managed notebook instances that run Jupyter notebooks. The notebook instances include example code for common model training and hosting exercises. Learn more
Notebook instance settings
Notebook instance name
NotebookCPSC
Maximum of 63 alphanumeric characters. Can include hyphens (-), but not spaces. Must be unique within your account in an AWS Region.
Notebook instance type
ml.t3.medium
Elastic Inference Learn more
none
Platform identifier Learn more
Amazon Linux 2, Jupyter Lab 1
Additional configuration
Permissions and encryption
IAM role
Notebook instances require permissions to call other services including SageMaker and S3. Choose a role or let us create a role with the AmazonSageMakerFullAccess IAM policy attached.
AmazonSageMakerServiceCatalogProductsUseRole
Root access - optional
Enable - Give users root access to the notebook
Disable - Don't give users root access to the notebook
Lifecycle configurations always have root access
Encryption key - optional
Encrypt your notebook data. Choose an existing KMS key or enter a key's ARN.
No Custom Encryption
Network - optional
Git repositories - optional
Tags - optional
Cancel
Create notebook instance

After opening the notebook instances, we use the resources from AWS official GitHub as a demonstration.

(Source: https://github.com/aws/amazon-sagemaker-examples/blob/main/introduction_to_applying_machine_learning/xgboost_customer_churn/xgboost_customer_churn_outputs.ipynb)

Throughout this exercise, this machine learning model uses below 15 columns from State to CustServ Calls of data to predict the churn rate of the customers. Churn implies if the customers will leave the company over a particular time.

By modern standards, it's a relatively small dataset, with only 5,000 records, where each record uses 21 attributes to describe the profile of a customer of an unknown US mobile operator. The attributes are:

- `State` : the US state in which the customer resides, indicated by a two-letter abbreviation; for example, OH or NJ
- `Account Length` : the number of days that this account has been active
- `Area Code` : the three-digit area code of the corresponding customer's phone number
- `Phone` : the remaining seven-digit phone number
- `Int'l Plan` : whether the customer has an international calling plan: yes/no
- `VMail Plan` : whether the customer has a voice mail feature: yes/no
- `VMail Message` : the average number of voice mail messages per month
- `Day Mins` : the total number of calling minutes used during the day
- `Day Calls` : the total number of calls placed during the day
- `Day Charge` : the billed cost of daytime calls
- `Eve Mins, Eve Calls, Eve Charge` : the billed cost for calls placed during the evening
- `Night Mins` , `Night Calls` , `Night Charge` : the billed cost for calls placed during nighttime
- `Intl Mins` , `Intl Calls` , `Intl Charge` : the billed cost for international calls
- `CustServ Calls` : the number of calls placed to Customer Service
- `Churn?` : whether the customer left the service: true/false

This notebook has used the XGBoost to increase the speed of the algorithms.

Train

Moving onto training, first we'll need to specify the locations of the XGBoost algorithm containers.

In [17]:
```
container = sagemaker.image_uris.retrieve("xgboost", sess.boto_region_name, "1.5-1")
display(container)
```

```
'433757028032.dkr.ecr.us-west-2.amazonaws.com/xgboost:latest'
```

Then, because we're training with the CSV file format, we'll create `TrainingInput`s that our training function can use as a pointer to the files in S3.

In [18]:
```
s3_input_train = TrainingInput(
    s3_data="s3://{}/{}/train".format(bucket, prefix), content_type="csv"
)
s3_input_validation = TrainingInput(
    s3_data="s3://{}/{}/validation/".format(bucket, prefix), content_type="csv"
)
```

Now, we can specify a few parameters like what type of training instances we'd like to use and how many, as well as our XGBoost hyperparameters. A few key hyperparameters are:

- `max_depth` controls how deep each tree within the algorithm can be built. Deeper trees can lead to better fit, but are more computationally expensive and can lead to overfitting. There is typically some trade-off in model performance that needs to be explored between numerous shallow trees and a smaller number of deeper trees.
- `subsample` controls sampling of the training data. This technique can help reduce overfitting, but setting it too low can also starve the model of data.
- `num_round` controls the number of boosting rounds. This is essentially the subsequent models that are trained using the residuals of previous iterations. Again, more rounds should produce a better fit on the training data, but can be computationally expensive or lead to overfitting.
- `eta` controls how aggressive each round of boosting is. Larger values lead to more conservative boosting.
- `gamma` controls how aggressively trees are grown. Larger values lead to more conservative models.

More detail on XGBoost's hyper-parameters can be found on their GitHub page.

In [19]:
```
sess = sagemaker.Session()

xgb = sagemaker.estimator.Estimator(
    container,
    role,
    instance_count=1,
    instance_type="ml.m4.xlarge",
    output_path="s3://{}/{}/output".format(bucket, prefix),
    sagemaker_session=sess,
)
xgb.set_hyperparameters(
    max_depth=5,
    eta=0.2,
    gamma=4,
    min_child_weight=6,
    subsample=0.8,
    verbosity=0,
    objective="binary:logistic",
    num_round=100,
)
```

After the model is developed, it is put into an endpoint. Appointed users can use it to make real-time predictions.

Host

Now that we've trained the algorithm, let's create a model and deploy it to a hosted endpoint.

In [20]:
```
xgb_predictor = xgb.deploy(
    initial_instance_count=1, instance_type="ml.m4.xlarge", serializer=CSVSerializer()
)
```

When running the notebook, it is important to clean up. For example, the below code is eliminating the endpoint. This will stop the AWS from charging the account.

(Optional) Clean-up

If you're ready to be done with this notebook, please run the cell below. This will remove the hosted endpoint you created and avoid any charges from a stray instance being left on.

In [28]:
```
xgb_predictor.delete_endpoint()
```

Moreover, the jupyter notebook has to be stopped to avoid charges too. Select the needed instances, and press action "stop" to stop the notebook instances. When you see the below screen, it confirms that the notebook instance is shut down.

After running all the code, the training job, model, and endpoints will appear in the SageMaker as well.

Amazon SageMaker > Models
Models
Create endpoint
Create endpoint configuration
Actions
Create model
Search models
Name
ARN
Creation time
sagemaker-xgboost-2022-06-23-22-04-31-426
arn:aws:sagemaker:us-east-1:084256606738:model/sagemaker-xgboost-2022-06-23-22-04-31-426
Jun 23, 2022 22:04 UTC
Notebook
Notebook instances
Git repositories
Processing
Processing jobs
Training
Algorithms
Training jobs
Hyperparameter tuning jobs
Inference
Compilation jobs
Marketplace model packages
Models
Endpoint configurations
Endpoints
Batch transform jobs
Edge Manager
Augmented AI
AWS Marketplace

us-east-1.console.aws.amazon.com/sagemaker/home?region=us-east-1#/endpoints
Amazon SageMaker > Endpoints
Endpoints
Update endpoint
Actions
Create endpoint
Search endpoints
Name
ARN
Creation time
Status
Last updated
xgboost-churn-endpoint
arn:aws:sagemaker:us-east-1:084256606738:endpoint/xgboost-churn-endpoint
Jul 06, 2022 04:32 UTC
InService
Jul 06, 2022 04:35 UTC
Notebook
Processing
Processing jobs
Training
Algorithms
Training jobs
Hyperparameter tuning jobs
Inference
Compilation jobs
Marketplace model packages
Models
Endpoint configurations
Endpoints
Batch transform jobs
Edge Manager
Get started
Edge packaging jobs
Edge device fleets
Edge devices
Augmented AI
AWS Marketplace

BUILD DATA PIPELINE

This Jupyter notebook demonstrates the implementation of the pipeline. After setting up the pipeline, the model could be processed with any datasets.

(Source: https://github.com/aws/amazon-sagemaker-examples/ blob/main/sagemaker-pipelines/nlp/amazon_comprehend_sagemaker_pipeline/sm_pipeline_with_comprehend.ipynb)

Repeat the same step as above; after creating and starting the instance for this project, the jupyter notebook is ready to run.

Before running the notebook, we have to set-up the execution role, the IAM role, the trust policy and the inline policy.

After executing the code, the pipeline is set up. The pipeline can do classification on your own dataset afterwards.

In [ ]:
```
# Custom Lambda Step
function_name = "DEMO-sagemaker-lambda-step-endpoint-test"

# Lambda helper class can be used to create the Lambda function
endpoint_lambda = Lambda(
    function_name=function_name,
    execution_role_arn=lambda_role,
    script="test_comprehend_lambda.py",
    handler="test_comprehend_lambda.lambda_handler",
)

test_endpoint = LambdaStep(
    name="LambdaStep",
    lambda_func=endpoint_lambda,
    inputs={
        "endpoint_arn_path": step_deploy_model.properties.ProcessingOutputConfig.Outputs[
            "endpoint_arn"
        ].S3Output.S3Uri,
        "text": example_text,
    },
)
```

In [ ]:
```
step_deploy_model.properties.ProcessingOutputConfig.Outputs["endpoint_arn"].S3Output.S3Uri
```

In [ ]:
```
from sagemaker.workflow.pipeline import Pipeline

pipeline_name = "DEMO-ComprehendPipeline"
pipeline = Pipeline(
    name=pipeline_name,
    parameters=[
        processing_instance_count,
        input_train,
        input_test,
        model_output,
    ],
    steps=[preprocess, comprehend_train_and_eval, step_cond, test_endpoint],
)
```

It is prominent to clean up the endpoint and Lambda function. Also, we should stop running the notebook instance. Otherwise, the charges will accumulate.

Clean up

Note: the Comprehend Classifier endpoint will incur charges, but the Lambda function and IAM role will not incur costs if not deleted (if the Lambda function isn't invoked).

In [ ]:

```
import re
import json
from s3path import S3Path


def get_comprehend_endpoint_arn(execution):
    sagemaker_client = boto3.client("sagemaker")
    step_response = [
        step for step in execution.list_steps() if step["StepName"] == "ComprehendDeploy"
    ][0]
    deploy_job_arn = step_response["Metadata"]["ProcessingJob"]["Arn"]
    deploy_job_name = re.split(":|/", deploy_job_arn)[-1]
    job_response = sagemaker_client.describe_processing_job(ProcessingJobName=deploy_job_name)
    job_path = (
        job_response["ProcessingOutputConfig"]["Outputs"][0]["S3Output"]["S3Uri"]
        + "/endpoint_arn.txt"
    )
    with S3Path.from_uri(job_path).open() as f:
        comprehend_arn = f.read()

    return comprehend_arn
```

In [ ]:

```
# Delete Comprehend endpoint
comprehend_client = boto3.client("comprehend")
comprehend_client.delete_endpoint(EndpointArn=get_comprehend_endpoint_arn(execution))

# Delete Lambda function
lambda_client = boto3.client("lambda")
lambda_client.delete_function(FunctionName=function_name)

# Delete IAM role
iam_helper.delete_lambda_role(lambda_role_name)

# Delete SageMaker Pipeline
pipeline.delete()
```

CONTACT AWS SUPPORT

In general, AWS divides the enquiries into 5 types. For an individual account, it is more common to reach the "technical support", "billing or account support", or "login or access support".

If you have login your AWS account, you can contact support by the following steps.

1. *Open the AWS Support console and select Create case*
2. *Select the needed enquiry type, enter the needed information and click the next step*
3. *Enter additional information and attach a print screen if needed*
4. *There are three ways offered to contact the support: web, phone or live chat. Select and press submit, then you are going to reach the support.*

   Click here to see figures about this procedure

AWS MARKETPLACE

AWS Marketplace enables developers to charge other SageMaker users for using their algorithms and model packages.

AWS Marketplace is a curated digital catalogue that makes it easy for customers to find, buy, deploy, and manage third-party software and services that customers need to build solutions and run their businesses.

AWS Marketplace includes thousands of software listings in popular categories, such as security, networking, storage, machine learning, business intelligence, database, and DevOps.

It simplifies software licensing and procurement with flexible pricing options and multiple deployment methods.

Here is a how the marketplace looks:

aws marketplace

About | Categories | Delivery Methods | Solutions | AWS IQ | Resources | Your Saved List | Partners | Sell in AWS Mar

quantiphi

License Plate Detection and Recognition

By: Quantiphi Latest Version: 3.0

Automatic Detection & Recognition of Vehicle License Plate from an image using Deep Learning ML Models

Continue to Subscribe

Save to List

Overview | Pricing | Usage | Support | Reviews

Product Overview

License Plate Recognition is one of the techniques used for vehicle identification purposes. The sole intention of this product is to find the most efficient way to recognize the number plate information from the digital image . This process involves detecting a vehicle, localizing the license plate and then segmenting & recognizing the characters from the license plate.

Key Data

Version	3.0 Usage Instructions Release Notes
By	Quantiphi
Categories	Object Detection-Image Segmentation/Pixel Labeling Classification-Image
Type	Model Package
Fulfillment Methods	Amazon SageMaker

Highlights

- Vehicle Detection Model: Accepts images of any size. Uses gluoncv-model-zoo-detection Object Detection Network as a black box, merges the outputs related to vehicles (cars & buses) & ignores other classes.
- License Plate OCR: The character segmentation and recognition over the rectified license plate is performed using a custom code using the open-cv library followed by a model trained for image classification for classification of the segmented characters.
- We evaluated the system in terms of the percentage of correctly recognized license plates, considered correct if all characters were correctly recognized. The inference time is highly dependent on the number of vehicles detected in a single image. The avg response time for a single image single vehicle inference on the compute optimized ml.c5.2xlarge instance with 8vCPUs & 16GB Memory is approximately 3.25 secs. Our models are currently configured to use only CPU for inference & our future versions will have GPU inference capability enabled to further optimize the latency.

Not quite sure what you're looking for? AWS Marketplace can help you find the right solution for your use case. Contact us

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quantiphi

License Plate Detection and Recognition

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Pricing Information

Use this tool to estimate the software and infrastructure costs based your configuration choices. Your usage and costs might be different from this estimate. They will be reflected on your monthly AWS billing reports.

Estimating your costs

Choose your region and launch option to see the pricing details. Then, modify the estimated price by choosing different instance types.

Version: 3.0

Region: US East (N. Virginia)

Software Pricing

Model Realtime Inference	$0.00/hr running on ml.m4.xlarge
Model Batch Transform	$0.00/hr running on ml.m4.xlarge

Infrastructure Pricing

SageMaker Realtime Inference	$0.24/host/hr running on ml.m4.xlarge
SageMaker Batch Transform	$0.24/host/hr running on ml.m4.xlarge

Model Realtime Inference

For model deployment as Real-time endpoint in Amazon SageMaker, the software is priced based on hourly pricing that can vary by instance type. Additional infrastructure cost, taxes or fees may apply.

InstanceType	Realtime Inference/hr
ml.m4.4xlarge	$0.00
ml.m5.4xlarge	$0.00
ml.m4.16xlarge	$0.00
ml.m5.2xlarge	$0.00
ml.m4.2xlarge	$0.00
ml.c5.2xlarge	$0.00
ml.c4.2xlarge	$0.00
ml.m4.10xlarge	$0.00
ml.c4.xlarge	$0.00

BUY AND SELL ALGORITHMS

You can buy algorithms that have two logical components: training and inference. You can use the training component to create training jobs in SageMaker and build a machine learning model.

SageMaker saves the model artifacts generated by the algorithm during training to an Amazon S3 bucket.

You can use the inference component with the model artifacts generated during a training job to create a deployable model in their SageMaker account.

BUY AND SELL DATA

With AWS Data Exchange, you can buy third-party data files, tables, and APIs from a portfolio of third-party data sets.

As an AWS service, AWS Data Exchange is secure and compliant, integrated with AWS and third-party tools and services, and offers consolidated billing and subscription management.

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About | Categories | Delivery Methods | Solutions | AWS IQ | Resources | Your Saved List | Partners | Sell in AWS Marketplac

TransUnion - US - Small Business - Complete Data Set (Trial)

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Provided By: TransUnion

TransUnion's US Small Business Complete data set includes all data from the Industry, Financial Health, and Employee Metrics and Staffing data sets. TransUnion's business data covers 25 million unique businesses from over 70 data sources. Data is anonymized and updated quarterly. It is then aggregated at the ZIP+4 level. Use this data for modeling, market analysis, and business planning. This trial data set includes data for Savannah, Georgia.

Product offers | Overview | Data sets | Usage | Support

Product offers

The following offers are available for this product. Choose an offer to view the pricing and access duration options for the offer. Select an offer and continue to subscribe. Your subscription begins on the date that your request is approved by the provider. Additional taxes or fees might apply.

Public offer

Payment schedule: Upfront payment | Offer auto-renewal: Supported

$0 for 1 month

Overview

TransUnion's Small Business Complete Data Set includes all data from the Industry, Financial Health, and Employee Metrics and Staffing data sets:

- Employment Title - Owner
- Employment Title - Executive
- Employment Title - President
- Employment Title - Chief Level Executive
- Employment Title - Other
- Number of Employees - Less Than 2
- Number of Employees - 5 - 9
- Number of Employees - 10 - 49
- Number of Employees - 50 - 100
- Number of Employees - Greater Than 100
- Business Growth - Growing Business
- Business Growth - Mature Business
- Years In Business - Less Than 2
- Years In Business - 2 - 5
- Years In Business - 6 - 10
- Years In Business - Greater Than 10
- Annual Sales Revenue - $0 - $250,000
- Annual Sales Revenue - $250,001 - $500,000
- Annual Sales Revenue - $500,001 - $1,000,000
- Annual Sales Revenue - $1,000,001 - $3,000,000
- Annual Sales Revenue - $3,000,001 - $10,000,000
- Annual Sales Revenue - $10,000,000+
- Industry Classification - Agriculture
- Industry Classification - Business / Professional Services
- Industry Classification - Construction
- Industry Classification - Communication
- Industry Classification - Financial Services
- Industry Classification - Government
- Industry Classification - Healthcare Services
- Industry Classification - Manufacturing
- Industry Classification - Mining
- Industry Classification - Non Profit Services
- Industry Classification - Personal Services
- Industry Classification - Retail
- Industry Classification - Social Services
- Industry Classification - Transportation
- Industry Classification - Wholesale

ANNEX – SUPPORT IMAGES

FIGURES: CREATE AN AWS ACCOUNT

Figure 1: Create an AWS Account

Figure 2: Create an AWS Account

Figure 3: Create an AWS Account

Figure 4: Create an AWS Account

Figure 5: Create an AWS Account

Click here to go back

FIGURES: CREATE AN IAM ADMINISTRATOR

Figure 6: Create an IAM Admin

Figure 7: Create an IAM Admin

IAM User and Role Access to Billing Information

Edit

Use the **Activate IAM Access** setting to allow IAM users and roles access to pages of the Billing and Cost Management console. This setting alone doesn't grant IAM users and roles the necessary permissions for these console pages. In addition to activating IAM access, you must also attach the required IAM policies to those users or roles. For more information, see Granting access to your billing information and tools.

If this setting is deactivated, then IAM users and roles in this account can't access the Billing and Cost Management console pages, even if they have administrator access or the required IAM policies.

The **Activate IAM Access** setting does not control access to:

- The console pages for AWS Cost Anomaly Detection, Savings Plans overview, Savings Plans inventory, Purchase Savings Plans, and Savings Plan cart
- The Cost Management view in the AWS Console Mobile Application
- The Billing and Cost Management SDK APIs (AWS Cost Explorer, AWS Budgets, and AWS Cost and Usage Report APIs)
- The Customer Carbon Footprint Tool on the Cost & Usage Reports console page

IAM user/role access to billing information is deactivated.

Reserved Instance Marketplace Settings

The Reserved Instance Marketplace gives you the flexibility to sell the remaining full months on your Reserved Instances. Manage your Reserved Instance Marketplace disbursement and tax information using options below.

Manage Seller and Bank Account Information

You can update your business name and bank account information so we can disburse funds to the appropriate location.

Manage Tax Settings

Change your tax information so that your 1099K or W-88EN is generated appropriately. Setting this information up also allows you to sell more than 200 transactions or $20,000 in Reserved Instances.

Account Contract Information

Edit

If this account is being used to service public sector customer, please provide the contract details in the fields below.

Is this account being used to service a public sector customer?

End User Organization Name: None

Contract Name: None

Contract Number: None

Task or Purchase Order Number: None

Figure 8: Create an IAM Admin

IAM User and Role Access to Billing Information

Use the **Activate IAM Access** setting to allow IAM users and roles access to pages of the Billing and Cost Management console. This setting alone doesn't grant IAM users and roles the necessary permissions for these console pages. In addition to activating IAM access, you must also attach the required IAM policies to those users or roles. For more information, see Granting access to your billing information and tools.

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- The Billing and Cost Management SDK APIs (AWS Cost Explorer, AWS Budgets, and AWS Cost and Usage Report APIs)
- The Customer Carbon Footprint Tool on the Cost & Usage Reports console page

Activate IAM Access

Update Cancel

Figure 9: Create an IAM Admin

Figure 10: Create an IAM Admin

Figure 11: Create an IAM Admin

Figure 12: Create an IAM Admin

Figure 13: Create an IAM Admin

Figure 14: Create an IAM Admin

Figure 15: Create an IAM Admin

Click here to go back

FIGURES: SAGEMAKER DOMAIN QUICK SETUP

Figure 16: SageMaker Domain Quick Setup

Figure 17: SageMaker Domain Quick Setup

Figure 18: SageMaker Domain Quick Setup

Click here to go back

FIGURES: CONTACT AWS SUPPORT

Figure 19: Contact AWS Support

Figure 20: Contact AWS Support

Figure 21: Contact AWS Support

Click here to go back

FIGURES: GIT REPOSITORIES

Figure 22: Git Repositories

Figure 23: Git Repositories

Figure 24: Git Repositories

Click here to go back