

# Week 12: Building Predictive Analytics for AWS IoT

SageMaker Canvas is to generate accurate machine learning predictions — no code required.

## 1. Create an AWS IAM role

<https://console.aws.amazon.com/iam/home?region=us-east-1>

The image shows three screenshots of the AWS IAM console interface for creating a new role.

**First Screenshot: Roles Page**

- Header: AWS Services, Search, [Alt+S], Global.
- Left sidebar: Identity and Access Management (IAM), Search IAM, Dashboard, Access management (User groups, Users, Roles, Policies, Identity providers, Account settings).
- Main content: IAM > Roles. Roles (20) info. An IAM role is an identity you can create that has specific permissions with credentials that are valid for short durations. Roles can be assumed by entities that you trust.
- Buttons: Refresh, Delete, **Create role** (highlighted with a red box).
- Table of existing roles:

Role name	Trusted entities
AmazonSageMaker-ExecutionRole-20221205112768	AWS Service: sagemaker
AmazonSageMakerCanvasForecastRole-167026833559	AWS Service: forecast
AmazonSageMakerCanvasForecastRole-1670275411548	AWS Service: forecast

**Second Screenshot: Name, review, and create**

- Header: AWS Services, Search, [Alt+S], Global.
- Left sidebar: IAM > Roles > Create role. Steps: Step 1 Select trusted entity, Step 2 Add permissions, Step 3 **Name, review, and create**.
- Main content: Name, review, and create. Role details.
- Form fields:

  - Role name: **ml-test** (highlighted with a red box). This role. Maximum 64 characters. Use alphanumeric and "+", "@", "\_" characters.
  - Description: Add a short explanation for this role. Allows SageMaker notebook instances, training jobs, and models to access S3, ECR, and CloudWatch on your behalf. Maximum 1000 characters. Use alphanumeric and "+", "@", "\_" characters.

**Third Screenshot: Select trusted entity**

- Header: AWS Services, Search, [Alt+S], Global.
- Left sidebar: IAM > Roles > Create role. Steps: Step 1 **Select trusted entity**, Step 2 Add permissions, Step 3 Name, review, and create.
- Main content: Select trusted entity info. Trusted entity type.
- Form fields:

  - Trusted entity type: **AWS service** (highlighted with a red box). Allow AWS services like EC2, Lambda, or others to perform actions in this account.
  - Other options: AWS account, Web identity, SAML 2.0 federation, Custom trust policy.
  - Use case: Allow an AWS service like EC2, Lambda, or others to perform actions in this account.
  - Common use cases: EC2, Lambda.
  - Use cases for other AWS services: SageMaker (selected), SageMaker - Execution (selected).

- Buttons: Cancel, **Next** (highlighted with a red box).

Add necessary permissions policies for the role:

**ml-test** Delete

Allows SageMaker notebook instances, training jobs, and models to access S3, ECR, and CloudWatch on your behalf.

**Summary** Edit

Creation date  
December 05, 2022, 13:38 (UTC-08:00)

ARN  
arn:aws:iam::032108903651:role/ml-test

Last activity  
53 minutes ago

Maximum session duration  
1 hour

**Permissions** | Trust relationships | Tags | Access Advisor | Revoke sessions

**Permissions policies (3)** Info

You can attach up to 10 managed policies.

Filter policies by property or policy name and press enter. < 1 > ⚙

+ **Policy name** ↗ **Type** **Description**

<input type="checkbox"/>	<b>AmazonS3FullAccess</b>	AWS managed	Provides full access to all buckets via the AWS Management Console.
<input type="checkbox"/>	<b>AmazonSageMakerFullAccess</b>	AWS managed	Provides full access to Amazon SageMaker via the AWS Management Console and SDK. Also provides ...
<input type="checkbox"/>	<b>AmazonSageMakerCanvasFullAcc...</b>	AWS managed	Provides full access to Amazon SageMaker Canvas resources and operations. The policy also provides ...

You will need the **role ARN** information later when you create SageMaker Domain to launch Canvas.

## 2. Create an AWS S3 bucket

<https://s3.console.aws.amazon.com/s3/home?region=us-east-1>

The bucket is used to store the training data for SageMaker Canvas.

**aws** **Services**  [Alt+S]

**Amazon S3** > **Buckets** > **Create bucket**

### Create bucket Info

Buckets are containers for data stored in S3. [Learn more](#)

**General configuration**

Bucket name

Bucket name must be globally unique and must not contain spaces or uppercase letters. [See rules for bucket naming](#)

AWS Region

Copy settings from existing bucket - *optional*  
Only the bucket settings in the following configuration are copied.

**Object Ownership** Info

Control ownership of objects written to this bucket from other AWS accounts and the use of access control lists (ACLs). Object ownership determines who can specify access to objects.

☐

**Block all public access**  
Turning this setting on is the same as turning on all four settings below. Each of the following settings are independent of one another.

☐

**Block public access to buckets and objects granted through *new* access control lists (ACLs)**  
S3 will block public access permissions applied to newly added buckets or objects, and prevent the creation of new public access ACLs for existing buckets and objects. This setting doesn't change any existing permissions that allow public access to S3 resources using ACLs.

☐


**Block public access to buckets and objects granted through *any* access control lists (ACLs)**  
S3 will ignore all ACLs that grant public access to buckets and objects.

☐

**Block public access to buckets and objects granted through *new* public bucket or access point policies**  
S3 will block new bucket and access point policies that grant public access to buckets and objects. This setting doesn't change any existing policies that allow public access to S3 resources.

☐

**Block public and cross-account access to buckets and objects through *any* public bucket or access point policies**  
S3 will ignore public and cross-account access for buckets or access points with policies that grant public access to buckets and objects.



**Turning off block all public access might result in this bucket and the objects within becoming public**  
AWS recommends that you turn on block all public access, unless public access is required for specific and verified use cases such as static website hosting.

☒

I acknowledge that the current settings might result in this bucket and the objects within becoming public.

**Bucket Versioning**  
Versioning is a means of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your Amazon S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. [Learn more](#)

Bucket Versioning  
☐ Disable  
☒ Enable

**Tags (0) - optional**  
You can use bucket tags to track storage costs and organize buckets. [Learn more](#)

No tags associated with this bucket.  

Add tag

**Default encryption**  
Automatically encrypt new objects stored in this bucket. [Learn more](#)

Server-side encryption  
☒ Disable  
☐ Enable

After you create it successfully, you would see the bucket in the bucket list as below:

Amazon S3 > Buckets

**Account snapshot**  
Storage lens provides visibility into storage usage and activity trends. [Learn more](#)

[View Storage Lens dashboard](#)

**Buckets (7)** [Info](#)  
Buckets are containers for data stored in S3. [Learn more](#)

[Refresh](#) [Copy ARN](#) [Empty](#) [Delete](#) [Create bucket](#)

	Name	AWS Region	Access	Creation date
<input type="radio"/>	mybucket-ml-sensor-data	US West (Oregon) us-west-2	Objects can be public	December 5, 2022, 14:20:21 (UTC-08:00)
<input type="radio"/>	mydata02	US East (N. Virginia) us-east-1	Objects can be public	December 5, 2022, 14:50:51 (UTC-08:00)

Upload the training data file into this bucket.

Typically, the training data comes from real sensor statistics which contains “temperature”, “humidity” and “watering or not” information.

Here, I manually created **.csv** file (Note: AWS SageMaker Canvas requires that the input file must contains **more than 150 rows** at least for building a model)

File snippet:

1	Temperature	Humidity	Watering
2	30	30	WATERING
3	35	32	WATERING
4	30	25	WATERING
5	25	40	WATERING
6	24	30	WATERING
7	23	20	WATERING
8	20	10	WATERING
9	19	19	WATERING
10	24	20	WATERING
11	23	19	WATERING
12	21	22	WATERING
13	20	21	WATERING
14	21	22	NOWATERING
15	19	24	NOWATERING
16	30	25	NOWATERING
17	23	60	NOWATERING
18	24	65	NOWATERING
19	24	65	NOWATERING
20	25	70	NOWATERING
21	24	75	NOWATERING

Amazon S3

Buckets  
Access Points  
Object Lambda Access Points  
Multi-Region Access Points  
Batch Operations  
Access analyzer for S3

Block Public Access settings for this account

Storage Lens

Amazon S3 > Buckets > mydata02

**mydata02** [Info](#)

[Objects](#) [Properties](#) [Permissions](#) [Metrics](#) [Management](#) [Access Points](#)

**Objects (1)**  
Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 Inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

[Refresh](#) [Copy S3 URI](#) [Copy URL](#) [Download](#) [Open](#) [Delete](#) [Actions](#) [Create folder](#) [Upload](#)

[Show versions](#)

Amazon S3 > Buckets > mydata02 > Upload

Upload [Info](#)

Add the files and folders you want to upload to S3. To upload a file larger than 160GB, use the AWS CLI, AWS SDK or Amazon S3 REST API. [Learn more](#)

Drag and drop files and folders you want to upload here, or choose **Add files**, or **Add folders**.

Files and folders (0)

Remove **Add files** Add folder

All files and folders in this table will be uploaded.

< 1 >

	Name	Folder	Type	Size
No files or folders				
You have not chosen any files or folders to upload.				

Amazon S3 > Buckets > mydata02

mydata02 [Info](#)

[Objects](#) | [Properties](#) | [Permissions](#) | [Metrics](#) | [Management](#) | [Access Points](#)

Objects (1)

Objects are the fundamental entities stored in Amazon S3. You can use [Amazon S3 Inventory](#) to get a list of all objects in your bucket. For others to access your objects, you'll need to explicitly grant them permissions. [Learn more](#)

Show versions

< 1 >

	Name	Type	Last modified	Size	Storage class
<input type="checkbox"/>	mydata.csv	csv	December 5, 2022, 15:41:40 (UTC-08:00)	4.2 KB	Standard

3. Go to this website [Amazon SageMaker](https://aws.amazon.com/sagemaker/), set up Canvas.
  - a> Create a domain

aws Services Search [Alt+S]

## Setup SageMaker Domain

Use SageMaker Domain as the central store to manage the configuration of SageMaker for your organization.

### Quick setup (1 min)

Let Amazon SageMaker configure your account, and set up permissions for your SageMaker Domain.

- ✓ Public internet access, and standard encryption
- ✓ SageMaker Studio integration
- ✓ Shareable SageMaker Studio Notebooks
- ✓ SageMaker Canvas
- ✓ IAM Authentication

Perfect for single user domains and first time users looking to get started with SageMaker.

### Domain name

Name  
Domain name should be unique across the AWS account.

ml-test

### User profile

Name  
default-1670275989129  
The name can have up to 63 characters. Valid characters: A-Z, a-z, 0-9, and - (hyphen)

Execution role  
The default execution role for both users and spaces in the domain. The execution role must have the [AmazonSageMakerFullAccess](#) policy attached.

Enter a custom IAM role: ARN

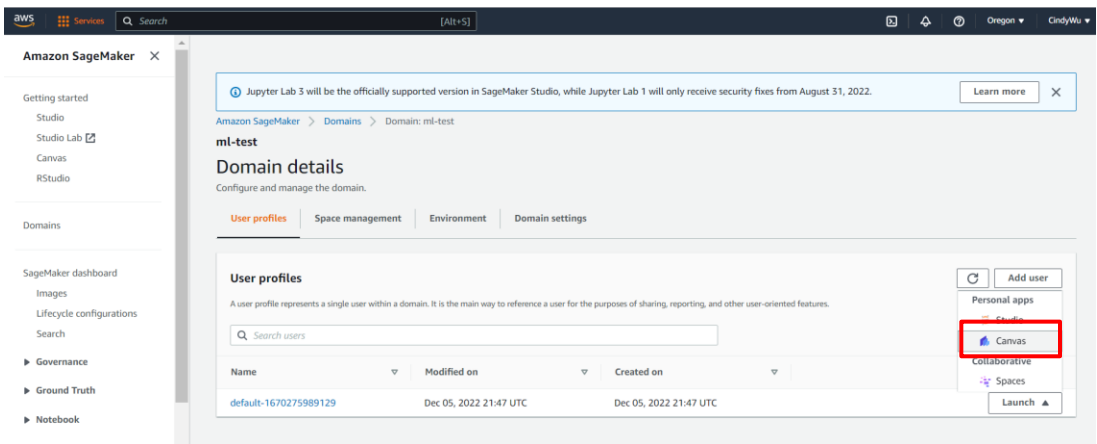
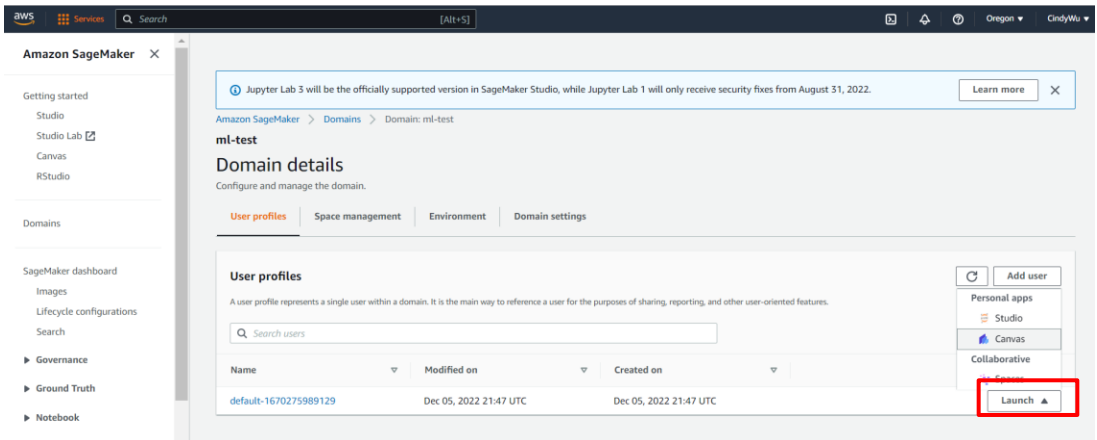
Custom IAM role ARN  
arn:aws:iam::032108903651:role/ml-test

Create role using the role creation wizard

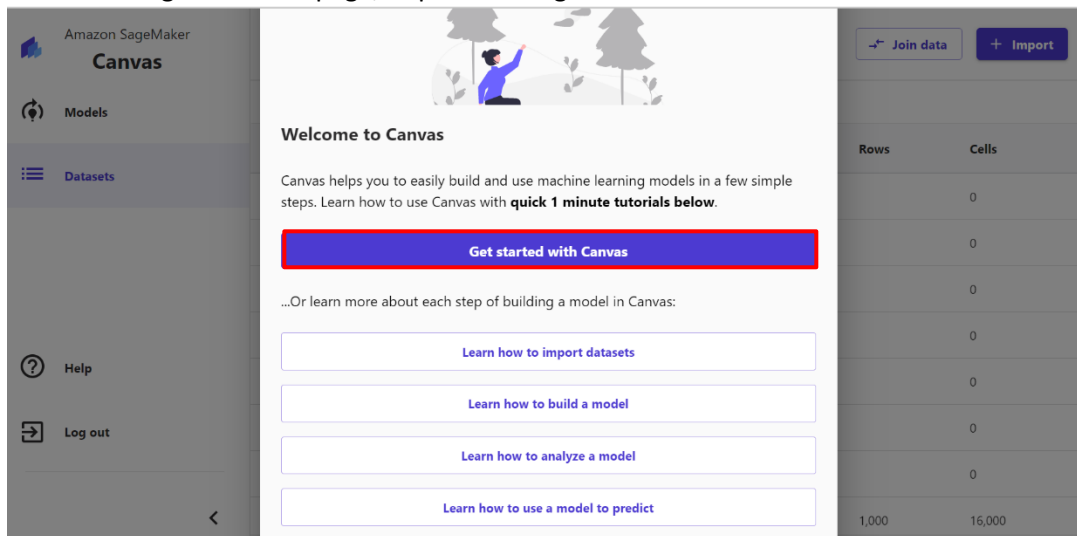
☒ Enable SageMaker Canvas permissions [Info](#)  
Enable SageMaker Canvas permissions to attach the [AmazonSageMakerCanvasFullAccess](#) policy to the default execution role. This also enables time series forecasting in Canvas and creates the AmazonSagemakerCanvasForecastRole and attaches the [AmazonSagemakerCanvasForecastRolePolicy](#) policy to the role.

Cancel Submit

## b> Launch Canvas



## c> After entering the canvas page, Import training data



Amazon SageMaker Canvas

Models

Datasets

### Datasets

Search: dataset

Join data Import

Name	Source	Columns	Rows	Cells
<input type="checkbox"/> canvas-sample-housing.csv	S3	10	1,000	10,000
<input type="checkbox"/> canvas-sample-sales-forecasting.csv	S3	5	1,000	5,000
<input type="checkbox"/> canvas-sample-loans-part-1.csv	S3	19	1,000	19,000

Amazon SageMaker Canvas

Models

Datasets

### Datasets

Search: Dataset

Join data Import

1 selected Create a model Delete

Name	Source	Columns	Rows	Cells	Created	Status
<input checked="" type="checkbox"/> mydata(1).csv	S3	3	252	756	12/05/2022 3:43 PM	Ready

d> Create a model

Amazon SageMaker Canvas

Models

Datasets

### Datasets

Search: Dataset

Join data Import

1 selected Create a model Delete

Name	Source	Columns	Rows	Cells
<input checked="" type="checkbox"/> mydata.csv	S3	3	21	63

Amazon SageMaker Canvas

Models

Datasets

### Models

Search models New model

#### Create new model

Model name

sensor-data-ml-model

Use only letters, numbers, and underscores up to 32 characters.

Cancel Create



Enter target column, select Watering

The screenshot shows the 'Build' tab of the SageMaker Canvas interface for a model named 'sensorDataModel'. The interface includes a top navigation bar with 'V1' and 'Draft' status, and buttons for 'Add version' and 'Share'. Below the navigation bar, there are four tabs: 'Select', 'Build' (active), 'Analyze', and 'Predict'. A blue banner at the top of the main content area says 'Validate your data' with a subtext 'It might take several minutes, depending on the dataset size.' and a 'Validate data' button. The main content area is divided into three sections. The first section, 'Select a column to predict', has a 'Target column' dropdown set to 'Watering' and a 'Value distribution' bar chart showing 'WATERING' and 'NOWATERING'. The second section, 'Model type', shows '2 category prediction' and 'Your model classifies Watering into two categories.' with a 'Change type' link. The third section contains a 'Quick build' button (highlighted with a red rectangle) and a 'Preview model' button.

e> Quick build a training model

The screenshot shows the 'Analyze' tab of the SageMaker Canvas interface for a model named 'myModel'. The interface includes a top navigation bar with 'V1' and 'Draft' status, and buttons for 'Add version' and 'Share'. Below the navigation bar, there are four tabs: 'Select', 'Build', 'Analyze' (active), and 'Predict'. The main content area is titled 'Model overview' with a subtext 'Your model is being created. Quick build usually takes 2–15 minutes. You can now leave this view.' Below this, there is a large light gray area with an illustration of a person at a laptop. To the left of the illustration, there are three columns of information: 'Expected build time' (2-15 minutes), 'Build type' (Quick build), and 'Detailed progress' (Generating column impact).

The screenshot shows the 'Analyze' tab of the SageMaker Canvas interface for a model named 'myModel'. The interface includes a top navigation bar with 'V1' and 'Ready' status, and buttons for 'Add version' and 'Share'. Below the navigation bar, there are four tabs: 'Select', 'Build', 'Analyze' (active), and 'Predict'. The main content area is titled 'Model status' and displays '88.235%' with a subtext 'The model predicts the correct Watering 88.235% of the time.' A 'Predict' button (highlighted with a red rectangle) is located in the top right corner. Below the model status, there are two sections. The first section, 'Column impact', has a search bar and a list of columns: 'Humidity' (91.129%) and 'Temperature' (8.871%). The second section, 'Impact of Humidity on prediction of Watering', contains a scatter plot with 'WATERING' on the y-axis and 'Humidity' on the x-axis. The plot shows a positive correlation between humidity and the prediction of watering.

f> Prediction

Select “single prediction”.

Change the value as you want to test, then click update, you will see the prediction result.

**myModel** V1 Ready Add version Share

Select Build Analyze **Predict**

**Predict target values**

Batch prediction **Single prediction**

Modify values to predict Watering in real time.

Filter columns

Column	Feature importance	Value
Humidity	98.739%	18
Temperature	1.261%	24

**Watering Prediction** Copy

## WATERING

Average prediction

WATERING 99.432%

NOWATERING 0.568%

**myModel** V1 Ready Add version Share

Select Build Analyze **Predict**

Batch prediction **Single prediction**

Modify values to predict Watering in real time.

Filter columns

Column	Feature importance	Value
Humidity	96.424%	60
Temperature	3.576%	24

**Watering Prediction** Copy

You made 1 change to your sections. Update for a new prediction and feature importance metrics.

**Update**

## WATERING

Average prediction

WATERING 99.432%

**myModel** V1 Ready Add version Share

Select Build Analyze **Predict**

**Predict target values**

Batch prediction **Single prediction**

Modify values to predict Watering in real time.

Filter columns

Column	Feature importance	Value
Humidity	96.006%	60
Temperature	3.994%	24

**Watering Prediction** Copy

## NOWATERING

New prediction  
Average prediction

WATERING 0.86%

NOWATERING 99.14%

Done!!!