

Queen's

Master of Management in Artificial Intelligence

MMAI 844
Agile Project Management for AI

Dr. Tracy Jenkin

AWS Comprehend: Tutorial and Training
July 11, 2020

Team Adelaide:

Francis Bello
Tiancheng Qu
Alexander Bakus
Mamta Gupta
Amit Kumar
Gunpreet Singh
Keerthi Sukhavasi

Section 1

AWS Comprehend: Tutorial and Training (PaaS)



Amazon Comprehend

AWS Comprehend: Tutorial and Training (PaaS)

Prof. Tracy Jenkin
MMAI844 - Agile Project Management for AI

Team Adelaide
MMAI2020
Smith School of Business
Queen's University

Adelaide 2020 MMAI

This training material was made for Prof. Tracy Jenkin and students of MMAI taking up Agile Project Management for AI.



Amazon Comprehend

A transcribed copy of this presentation is available for download from:
https://github.com/adelaide-mmai2020/mmai844/blob/master/aws_comprehend_tutorial.pdf

An online video of this training material is available at:
<https://youtu.be/Zf7sxXnXtHg>

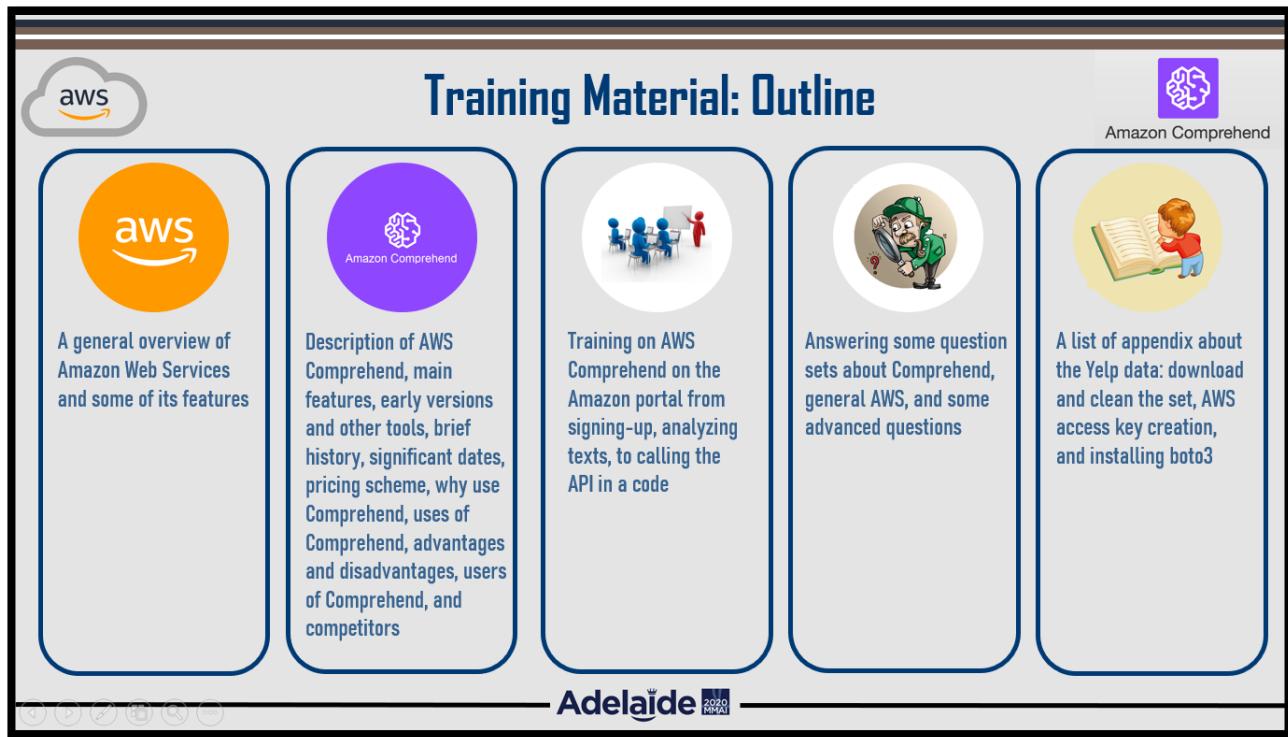
For support, please email Team Adelaide at:
group-teamadelaide@queensu.ca

Adelaide 2020
MMAI

For technical support, please send us an email at:
group-teamadelaide@queensu.ca

An online video of this training material is available on YouTube:
<https://youtu.be/Zf7sxXnXtHg>

A copy of this training material can also be downloaded from:
https://github.com/adelaide-mmai2020/mmai844/blob/master/aws_comprehend_tutorial.pdf



The slide is titled "Training Material: Outline" in a large blue font at the top center. In the top left corner is the AWS logo, and in the top right corner is the Amazon Comprehend logo. Below the title are five rounded rectangular boxes, each containing an icon and a brief description of a training module:

- AWS Overview:** A yellow circle with the AWS logo. Description: "A general overview of Amazon Web Services and some of its features".
- Amazon Comprehend Description:** A purple circle with a brain icon. Description: "Description of AWS Comprehend, main features, early versions and other tools, brief history, significant dates, pricing scheme, why use Comprehend, uses of Comprehend, advantages and disadvantages, users of Comprehend, and competitors".
- Training on Amazon Portal:** A white circle with three stylized human figures. Description: "Training on AWS Comprehend on the Amazon portal from signing-up, analyzing texts, to calling the API in a code".
- Trivia Questions:** A grey circle with a cartoon character holding a magnifying glass over a question mark. Description: "Answering some question sets about Comprehend, general AWS, and some advanced questions".
- Appendix:** A yellow circle with a boy reading a book. Description: "A list of appendix about the Yelp data: download and clean the set, AWS access key creation, and installing boto3".

At the bottom left, there are small icons for navigation: back, forward, search, and others. At the bottom center is the text "Adelaide 2020 MM&AI".

The training material is outlined as follows:

Part –

- A general overview of AWS and some of its features.
- A description of AWS Comprehend – description, features, early versions and other tools, etc.
- Training on AWS Comprehend on Amazon portal from signing-up, analyzing texts, to calling the API in a code.
- Trivia questions about Comprehend, general AWS, and some advanced questions.
- Appendix about the Yelp data, AWS access key creation, and installing boto3.

Part A: Amazon Web Services



AWS Amazon Web Services



Amazon Comprehend



What is AWS?



Cloud-based platform



Provides pre-built services



Helps with workloads



Saves time and money

Features of AWS



Mobile friendly access

- AWS Mobile Hub
- AWS Mobile SDK



Serverless Cloud Functions



Databases



Storage



Security and Compliance



Marketplace



Adelaide 2020 MMAT

What is AWS?

- Amazon's cloud-based platform used for building solutions for businesses using inter-connected web services.
- Provides a variety of pre-built services which can benefit businesses to build their custom cloud-based solutions.
- Helps companies with a wide variety of workloads such as game development, data processing, warehousing, achieve, development and many more.
- Provides a feature which allows you to choose servers according to your choice which ultimately saves time and money.

Features of AWS:

- Mobile Friendly Access
 - AWS Mobile Hub
 - For Android and IOS
 - Supports and guides towards the suitable and compatible feature for any app
 - AWS Mobile SDK
 - Supports Android, IOS, Web, React Native, Unity and many more
 - This feature allows app to directly access AWS such as DynamoDB, S3 and Lambda
- Serverless Cloud Functions

- Allows developers to deliver a great experience to their users by providing a back-end code at once to them that responds to their code
 - Amazon API and Amazon Gateway help users run, scale, patch and administer their codes
- Databases
 - All the database service is managed by AWS
 - Relational database – transactional purposes
 - Non-relational database – internet scale applications
 - Data Warehouse – analytics
 - In-memory Data Store – caching & real-time workloads
 - Graph Database – application with highly connected data
- Storage
 - Economical, flexible and easy to use
 - Can be used independently as well as combined to meet any requirement
- Security and Compliance
 - Provides maximum data security
 - Allows customers to scale and innovate
 - Provides security at the protocol and port access level
- Marketplace
 - An online store where a customer can immediately search for the suitable software for his/her business
 - Provides a one-click deployment of the software

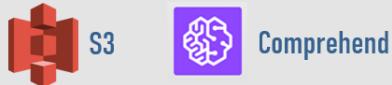


AWS Amazon Web Services, cont.



Amazon Comprehend

Some Popular AWS Services



and many more...



Let's not forget about IAM... it's the key!

Adelaide 2020 MM&AI

Some Popular AWS Services

S3

AWS offers a wonderful service called Amazon Simple Storage Service or Amazon S3 to store and retrieve data from the cloud. S3 allows the user to store, upload, retrieve large files up to 5 TB from the cloud. It is a scalable, low-cost and high-speed web-based service designed for archival and online backup of application programs and data.

Comprehend

Amazon Comprehend is a natural language processing (NLP) service that uses machine learning to find insights and relationships in text. It uses machine learning to help you uncover the insights and relationships in your unstructured data. The service identifies the language of the text; extracts key phrases, places, people, brands, or events; understands how positive or negative the text is; analyzes text using tokenization and parts of speech; and automatically organizes a collection of text files by topic.

In this training literature, we would be learning about:

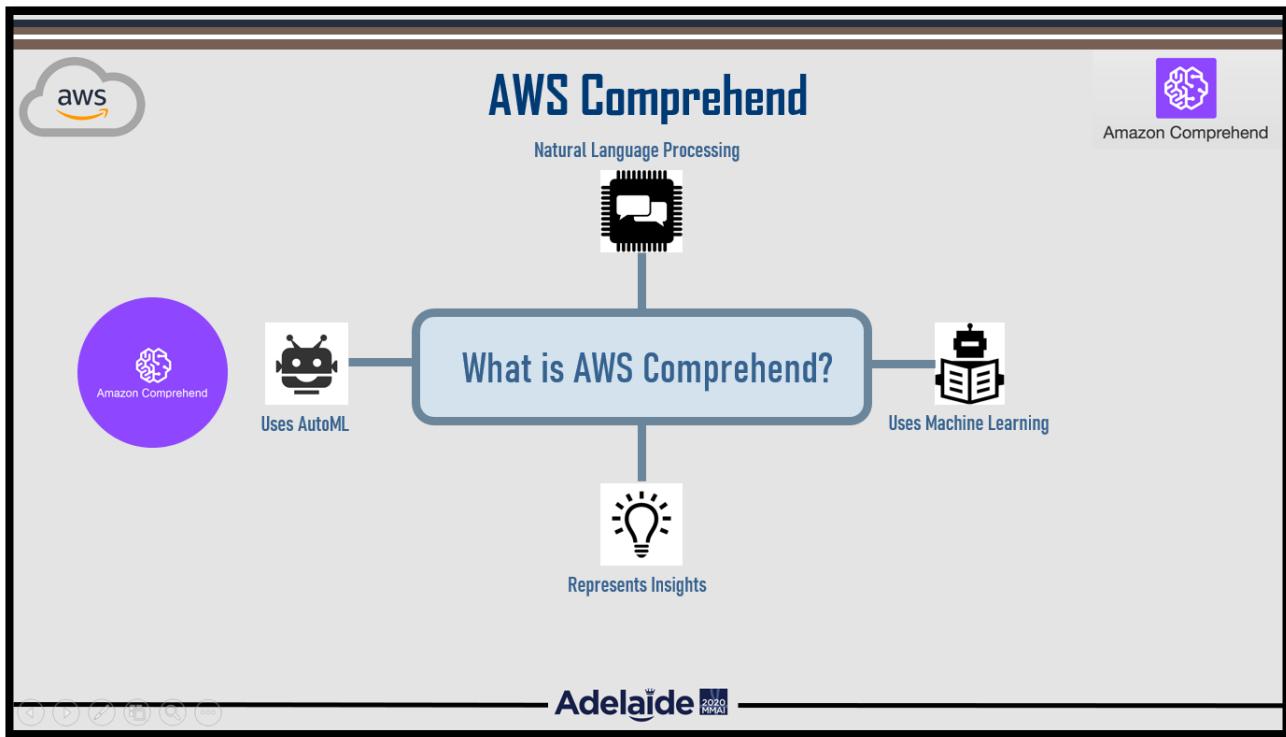
- how to perform sentiment analysis using the AWS Comprehend console
- as well as how to call the AWS Comprehend API in Python/Jupyter codes to perform
 - dominant language detection
 - named entities detection
 - key phrases detection
 - sentiment analysis

- syntax detection

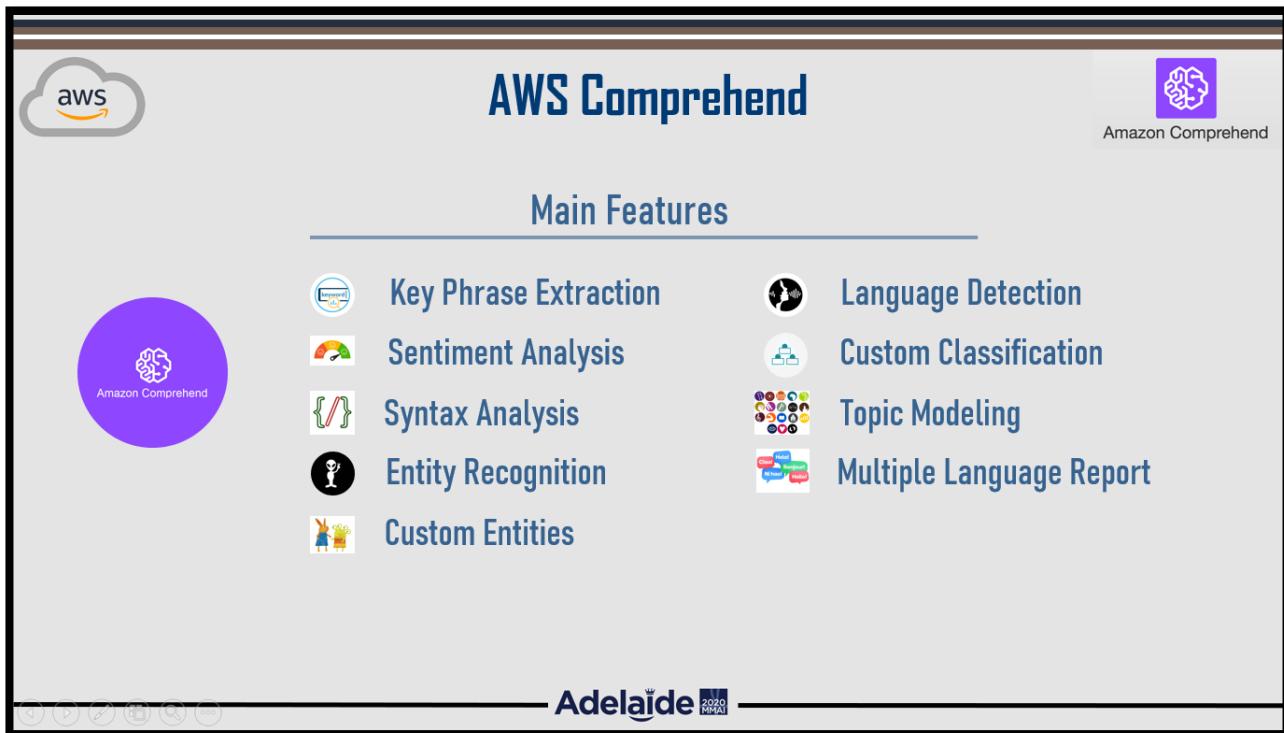
IAM

- Enables to manage access to AWS services and resources securely.
- Using IAM, users can create and manage AWS other users and groups, and use permissions to allow and deny their access to AWS resources.
- IAM is a feature of AWS account offered at no additional charge.
- IAM permissions allows and denies user access to AWS resources.
- IAM is a feature of your AWS account offered at no additional charge.

Part B: AWS Comprehend



Amazon Comprehend is a natural language processing (NLP) service that uses machine learning to find insights and relationships in text. Amazon Comprehend uses machine learning to help you uncover the insights and relationships in your unstructured data like Customer emails, support tickets, product reviews, social media, advertising copy etc. This can be used to represent insights into customer sentiment that can be put to work for your business. The service identifies the language of the text; extracts key phrases, places, people, brands, or events; understands how positive or negative the text is; analyzes text using tokenization and parts of speech; and automatically organizes a collection of text files by topic. You can also use AutoML capabilities in Amazon Comprehend to build a custom set of entities or text classification models that are tailored uniquely to your organization's needs.



The slide is titled "AWS Comprehend Main Features". It features the AWS logo and the Amazon Comprehend logo. On the left, there is a purple circular icon with a brain and the text "Amazon Comprehend". The main content area lists seven features with corresponding icons:

	Key Phrase Extraction		Language Detection
	Sentiment Analysis		Custom Classification
	Syntax Analysis		Topic Modeling
	Entity Recognition		Multiple Language Report
	Custom Entities		

At the bottom, there is a navigation bar with icons for back, forward, search, and other controls, followed by the text "Adelaide 2020 MM&AI".

Main features of the service are:

Keyphrase Extraction: The Key Phrase extraction API returns the key phrases or talking points and a confidence score to support that this is a key phrase.

Sentiment Analysis: The Sentiment Analysis API returns the overall sentiment of a text (Positive, Negative, Neutral, or Mixed).

Syntax Analysis: The Amazon Comprehend Syntax API enables customers to analyze text using tokenization and Parts of Speech (PoS) and identify word boundaries and labels like nouns and adjectives within the text.

Entity Recognition: The Entity Recognition API returns the named entities ("People," "Places," "Locations," etc.) that are automatically categorized based on the provided text.

Custom Entities: Custom Entities allows you to customize Amazon Comprehend to identify terms that are specific to your domain. Using AutoML, Comprehend will learn from a small private index of examples (for example, a list of policy numbers and text in which they are used), and then train a private, custom model to recognize these terms in any other block of text. There are no servers to manage, and no algorithms to master.

Language Detection: The Language Detection API automatically identifies text written in over 100 languages and returns the dominant language with a confidence score to support that a language is dominant.

Custom Classification: The Custom Classification API enables you to easily build custom text classification models using your business-specific labels without learning ML.

Topic Modeling: Topic Modeling identifies relevant terms or topics from a collection of documents stored in Amazon S3. It will identify the most common topics in the collection and organize them in groups and then map which documents belong to which topic.

Multiple language support: Amazon Comprehend can perform text analysis on English, French, German, Italian, Portuguese, and Spanish texts. This lets you build applications that can detect text in multiple languages, convert the text to English, French, German, Italian, Portuguese, and Spanish with Amazon Translate, and then use Amazon Comprehend to perform text analysis.

AWS Comprehend, cont.

Why use the platform?

- Easy to use
- Helps uncover insights & relationships
- Supports general & industry-specific texts
- Fully managed service

Advantages

- Easy to use
- Low cost & affordable
- Seamless integration with other AWS
- Highly scalable
- Customizable

Uses of the platform

- Customer Analytics
- Search engines
- Content recommendation
- Customer support ticket handling
- Medical cohort analysis

Disadvantages

- Relatively new
- Not a complete AI solution
- Output files are zipped
- Models are too generic
- Billing and usage are not transparent

Adelaide 2020 NNAI

Why use the platform?

- Easy to use NLP platform, minimal to no machine learning experience needed.
- Helps uncover the insights and relationships in unstructured data by identifying things such as:
 - The language of text,
 - Extracts key phrases, places, people, brands or events
 - Positive or negative sentiment, etc.
- Supports general and industry specific text such as email to complex medical information.
- Fully managed service therefore no servers to provision and no machine learning models to build, train, or deploy. Pay only the services used and there is no minimum fees.

Uses of the Platform

- Customer analytics – to analyze customer interactions in the form of support emails, social media posts, online comments, etc. and discover what factors drive positive and negative experiences.
- Search engines – provide better search experience by enabling it to index key phrases, entities, and sentiment. It helps focus the search on the intent and the context of the articles rather than generic keywords.

- Content recommendation – organize and categorize documents by topic for easier discovery, and then personalize content recommendations for readers by recommending other related articles.
- Customer support ticket handling – improve overall customer satisfaction by using custom classification to automatically categorize inbound customers support documents, such as feedback forms, support tickets, and product reviews. Then use custom entities to automatically extract relevant information like loyalty tiers to quickly route documents the team best equipped to solve the customer problem.
- Medical cohort analysis – understand and identify complex medical information found in unstructured text to help make indexing and searching easier and recruit patients to the appropriate clinical trial in a fraction of time.

Advantages

- AWS Comprehend is easy to use as it enables you to build text analysis capabilities such as language detection, sentiment analysis, topic modeling etc. into your applications with a simple API.
- AWS Comprehend is a low cost and affordable service. You only pay for the documents analyzed with no minimum fees or upfront charges.
- AWS Comprehend is designed to seamlessly integrate with other AWS Services such as Amazon S3, AWS Lambda, AWS KMS and so on.
- AWS Comprehend is a highly scalable service as it can analyze millions of documents across a variety of use cases such as customer support tickets, product reviews, social media, medical records and more.
- AWS Comprehend can be customized to suit your business needs with very little Machine Learning experience as it only requires labels and a small set of training examples.

Disadvantages

- Relatively new, as such the interface is missing the rich functionality that practitioners on NLP are accustomed to, and may leave users feeling that more can be done if only the tools were present. Great for starting but missing the depth of already well-known platforms.
- AWS Comprehend is not a complete AI solution, and requires a more DIY set up pace. Works well if you have clearly defined Text Analysis needs, but has limited capabilities to explore options with undefined purpose.
- The outputs from AWS Comprehend are produced in zip files, which need to be extracted and processed further for consumption.

- For Advanced users, the models are too generic, so if working with specific data, the results will leave much to be desired. The model selection is also limited, so if more are needed, the service cannot be relied on, and data teams have to go back to building their own and then deploying them themselves.
- The platform billing and consumption usage is not transparent, so it is difficult to estimate and forecast the monthly cost of using the platform full time.

Part C: Training on AWS Comprehend



Training on AWS Comprehend



Amazon Comprehend



Part 1: Set Up an AWS Account and Create an Administrator User

- A. Sign Up for AWS: Create a New AWS Account
- B. Create an IAM User: Create an Administrator User and Group

Part 2: Set Up an S3 Storage Space: Creating an S3 Bucket

Part 3: Getting Started Using the Amazon Comprehend Console

- A. Know the Different Sections of Comprehend Console
- B. Creating and Using Custom Classifiers
 - i. Creating a Custom Classifier
 - ii. Running an Asynchronous Custom Classification Job
- C. Create a Sentiment Analysis Task Using the Console

Part 4: Getting Started Using AWS Comprehend API

- A. Detecting the Dominant Language
- B. Detecting the Named Entities
- C. Detecting Key Phrases
- D. Detecting Sentiment
- E. Detecting Syntax

Adelaide 2020 MHAI

We have divided this AWS Comprehend tutorial into 4 parts:

Part 1: Set Up an AWS Account and Create an Administrator User

- A. Sign Up for AWS: Create a New AWS Account
- B. Create an IAM User: Create an Administrator User and Group

Part 2: Set Up an S3 Storage Space: Creating an S3 Bucket

Part 3: Getting Started Using the Amazon Comprehend Console

- A. Know the Different Sections of Comprehend Console
- B. Creating and Using Custom Classifiers
 - i. Creating a Custom Classifier
 - ii. Running an Asynchronous Custom Classification Job
- C. Create a Sentiment Analysis Task Using the Console

Part 4: Getting Started Using AWS Comprehend API

- A. Detecting the Dominant Language
- B. Detecting the Named Entities
- C. Detecting Key Phrases
- D. Detecting Sentiment
- E. Detecting Syntax

Part 1: Set Up an AWS Account and Create an Administrator User



Part 1: Set Up an AWS Account and Create an Administrator User



Amazon Comprehend

Learning Objective:

A. Sign Up for AWS: Create a New AWS Account



Adelaide 2020 MHAI

Sign Up for AWS

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

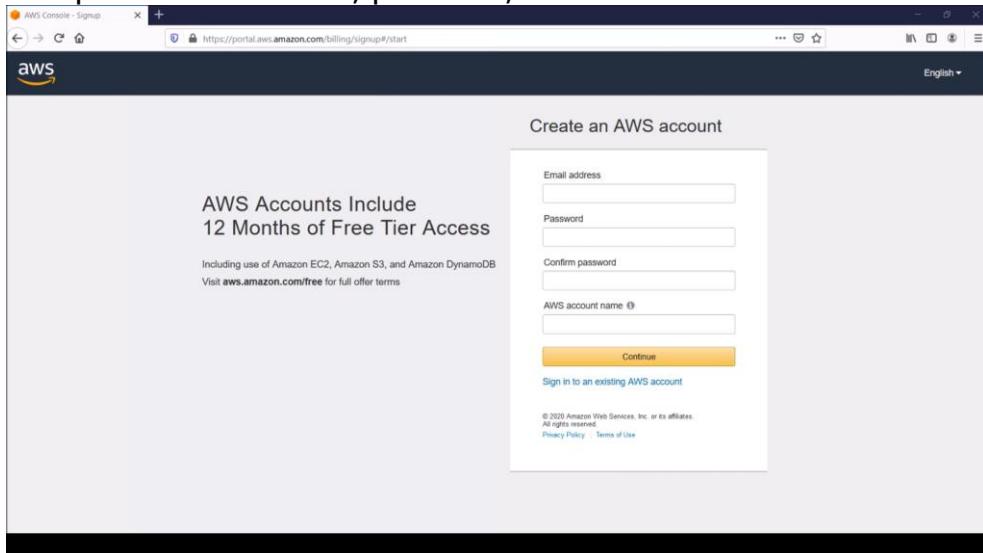
With Amazon Comprehend, you pay only for the resources that you use. If you are a new AWS customer, you can get started with Amazon Comprehend for free.

If you already have an AWS account, skip to the next section.

To create an AWS account

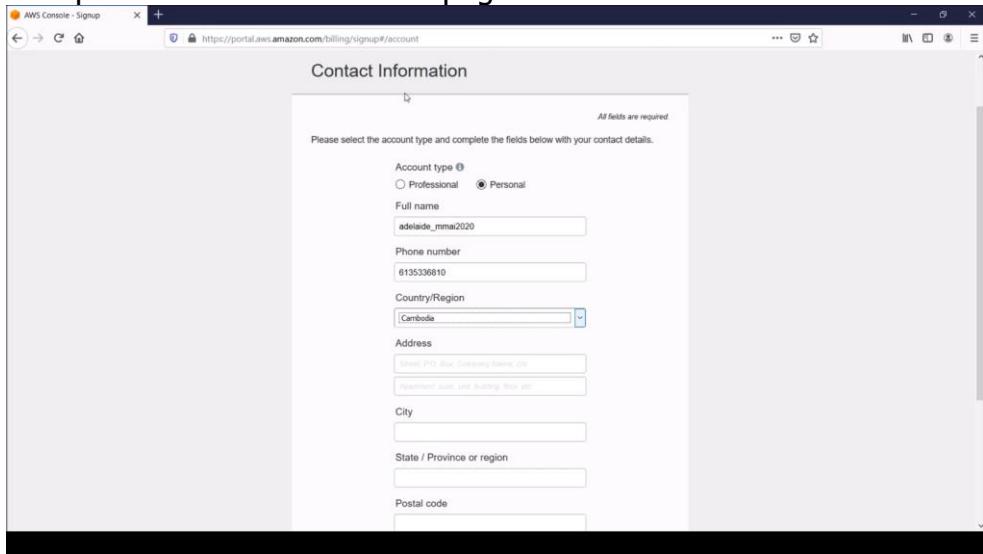
1. Open <https://portal.aws.amazon.com/billing/signup>
2. Follow the online instructions.

- a. Fill-up the email address, password, AWS account name.



The screenshot shows the 'Create an AWS account' page. At the top, there's a promotional message: 'AWS Accounts Include 12 Months of Free Tier Access' (including use of Amazon EC2, Amazon S3, and Amazon DynamoDB) with a link to 'aws.amazon.com/free'. Below this is a form with fields for 'Email address', 'Password', 'Confirm password', and 'AWS account name'. A 'Continue' button is at the bottom right, and a 'Sign in to an existing AWS account' link is just above it. The URL in the browser is https://portal.aws.amazon.com/billing/signup#/start.

- b. Fill-up the contact information page.



The screenshot shows the 'Contact Information' page. It starts with a note: 'Please select the account type and complete the fields below with your contact details.' There are two radio buttons for 'Account type': 'Professional' (unchecked) and 'Personal' (checked). Below this are fields for 'Full name' (containing 'adelaide_rrma2020'), 'Phone number' (containing '6135336810'), 'Country/Region' (set to 'Cambodia'), and an 'Address' section with two dropdown menus ('Street/P.O. Box, Company Name etc.' and 'Apartment suite unit Building Block etc.') and fields for 'City', 'State / Province or region', and 'Postal code'. The URL in the browser is https://portal.aws.amazon.com/billing/signup#/account.

c. Fill-up the billing information page.

The screenshot shows the 'Payment Information' step of the AWS sign-up process. It includes a note about a \$1 charge for verification, a field for the credit/debit card number, logos for VISA, MasterCard, and American Express, a dropdown for the expiration date (set to 06/2020), a field for the cardholder's name, and a section for the billing address with a radio button for 'Use my contact address' (selected) and an input field containing '74 Union Street, Kingston ON K7L3N6 CA'. There is also an option to 'Use a new address'.

d. Fill-up the identity confirmation page.

The screenshot shows the 'Confirm your identity' step. It asks users to verify their phone number by choosing between 'Text message (SMS)' (selected) and 'Voice call'. It includes a dropdown for the country/region code ('Canada (+1)'), a field for the cell phone number ('1'), and a security check section featuring a CAPTCHA image with the characters '85e 23 7' and a text input field for re-typing it. A 'Send SMS' button is at the bottom.

Part of the sign-up procedure involves receiving a phone call and entering a verification code on the phone keypad.

Record your AWS account ID.

- Now it's your turn! Let's apply what we've just learned about AWS Comprehend.



Part 1: Set Up an AWS Account and Create an Administrator User



Amazon Comprehend

Learning Objective:

B. Create an IAM User: Create an Administrator User and Group



Adelaide 2020 MHAI

Create an IAM User

Services in AWS, such as Amazon Comprehend, require that you provide credentials when you access them. This allows the service to determine whether you have permissions to access the service's resources.

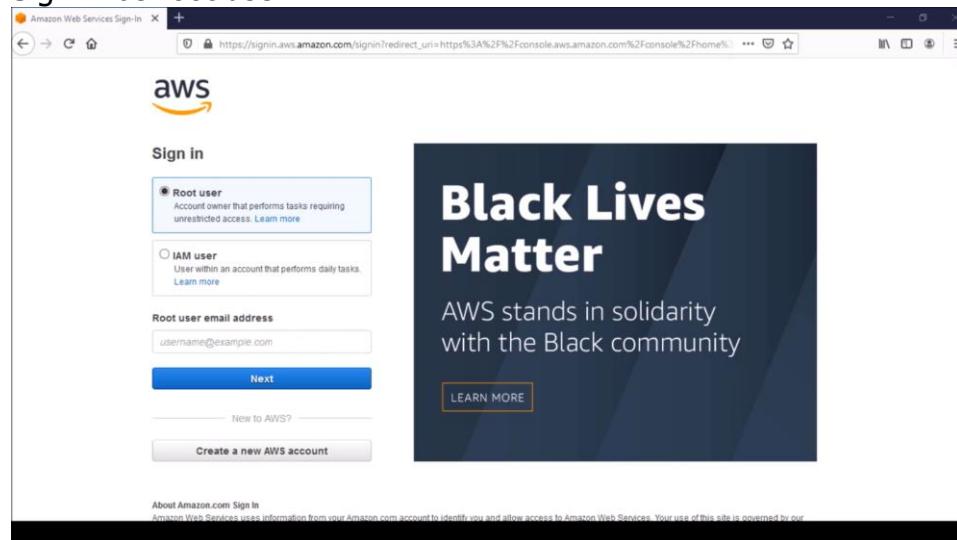
It is strongly recommended that you access AWS using AWS Identity and Access Management (IAM), not the credentials for your AWS account. To use IAM to access AWS, create an IAM user, add the user to an IAM group with administrative permissions, and then grant administrative permissions to the IAM user. You can then access AWS using a special URL and the IAM user's credentials.

The Getting Started we need a user with administrator privileges, "administrator".

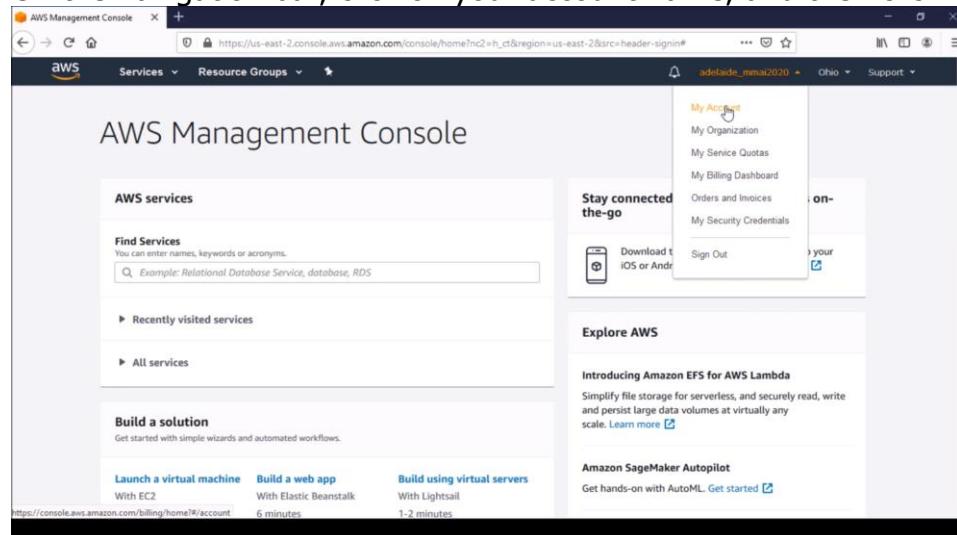
To create an administrator user and sign in to the console

1. Create an administrator user called "administrator" in your AWS account.

a. Sign in as root user.



b. On the navigation bar, click on your account name, and then click My Account.



- c. Scroll down to IAM User and Role Access to Billing Information, click Activate IAM Access, click Update.

IAM User and Role Access to Billing Information

You can give IAM users and federated users with roles permissions to access billing information. This includes access to Account Settings, Payment Methods, and Report pages. You control which users and roles can see billing information by creating IAM policies. For more information, see [Controlling Access to Your Billing Information](#).

Activate IAM Access

Update **Cancel**

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-8BEN is generated appropriately. Setting this information up also allows you to sell more than 200 transactions or \$20,000 in Reserved Instances.

- d. Scroll back up to the navigation bar, click Services, type IAM to return to the IAM Dashboard, click IAM.

History

Billing

IAM

Console Home

S3

Amazon Comprehend

Services ▾ Resource Groups ▾

Search: iam

IAM Manage access to AWS resources

EC2	Amazon Managed Blockchain	Athena	Alexa for Business
Lightsail		EMR	Amazon Chime
Lambda	Satellite	CloudSearch	WorkMail
Batch	Ground Station	Elasticsearch Service	Amazon Honeycode
Elastic Beanstalk		Kinesis	
Serverless Application Repository		QuickSight	
AWS Outposts		Data Pipeline	
EC2 Image Builder	Quantum Technologies	AWS Data Exchange	
	Amazon Braket	AWS Glue	
		AWS Lake Formation	
		MSK	
			End User Computing
			WorkSpaces
			AppStream 2.0
			WorkDocs
			WorkLink
			Internet Of Things
			IoT Core
			FreeRTOS
			IoT 1-Click
			IoT Analytics

Group A-Z

Storage

S3

EFS

Fsx

S3 Glacier

Storage Gateway

AWS Backup

Management & Governance

AWS Organizations

CloudWatch

AWS Auto Scaling

CloudFormation

CloudTrail

Config

Security, Identity, & Compliance

IAM

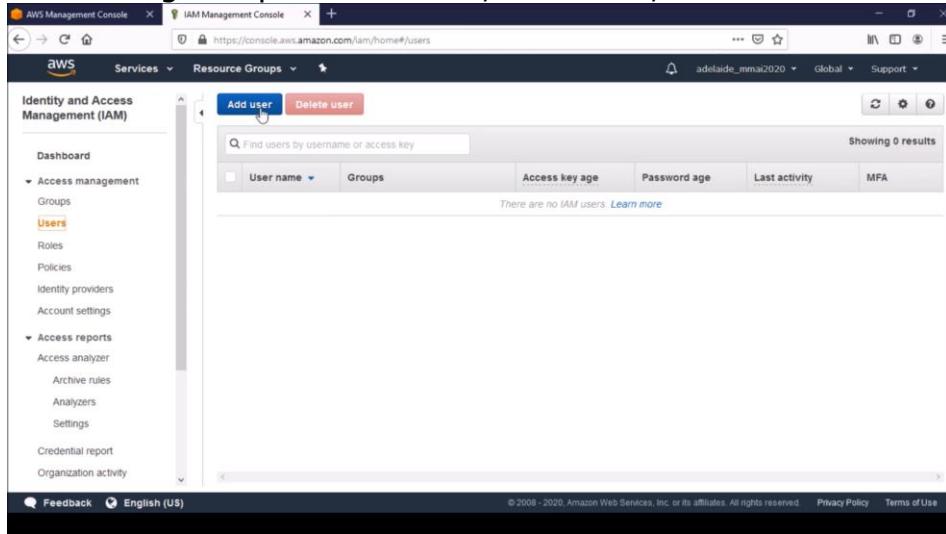
Resource Access Manager

Cognito

close

<https://console.aws.amazon.com/iam/home>

- e. In the navigation pane on the left, click Users, click Add user.



- f. On the details page, type “Administrator” for the User name, check AWS Management Console access, select Custom password and supply a password, uncheck the User must create a new password at next sign-in option, click Next: Permissions.

Select AWS access type
Select how these users will access AWS. Access keys and autogenerated passwords are provided in the last step. Learn more

Access type* **Programmatic access**
Enables an **access key ID** and **secret access key** for the AWS API, CLI, SDK, and other development tools.

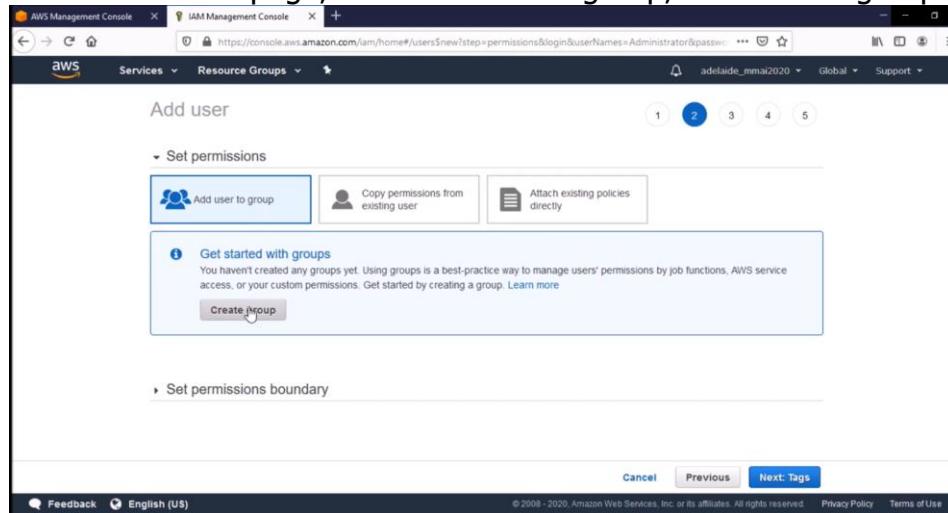
AWS Management Console access
Enables a **password** that allows users to sign-in to the AWS Management Console.

Console password* Autogenerated password Custom password

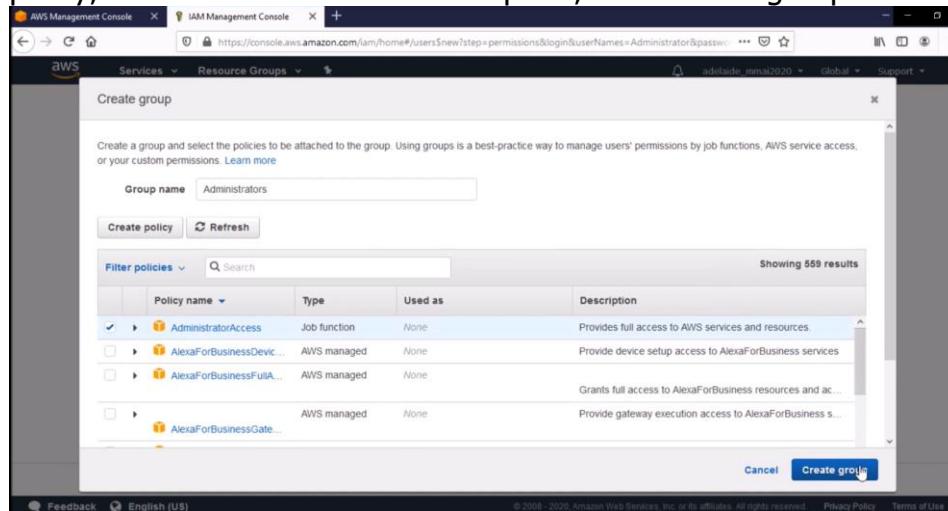
Require password reset User must create a new password at next sign-in
Users automatically get the [IAMUserChangePassword](#) policy to allow them to change their own password.

* Required Cancel Next: Permissions

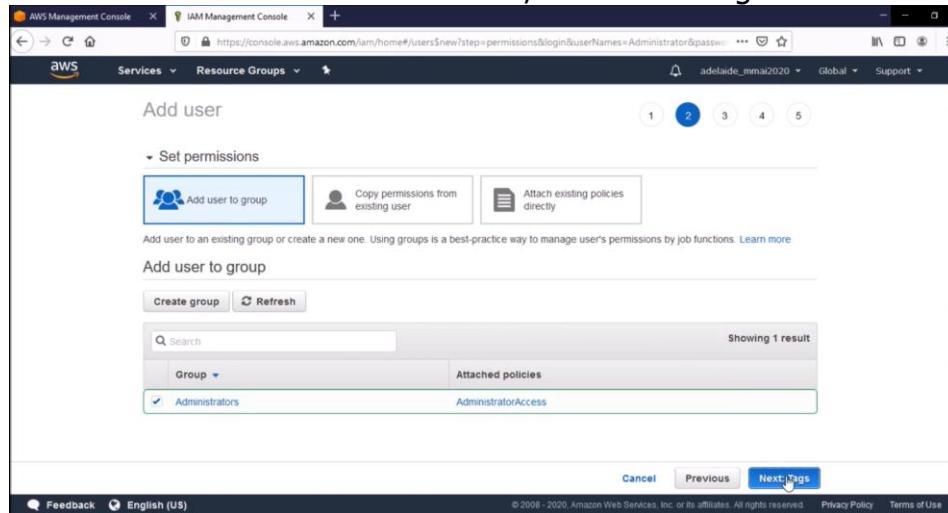
- g. On the Add user page, click Add user to group, click Create group.



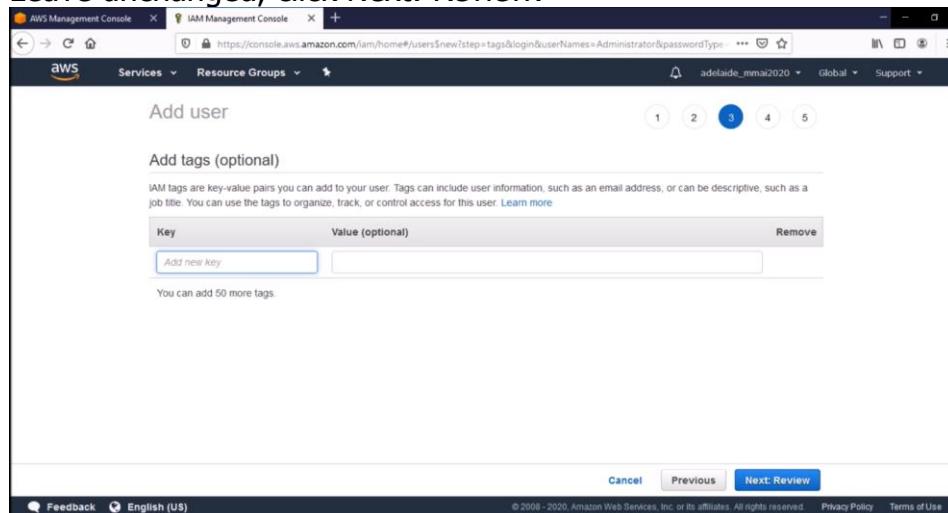
- h. On the Create group dialog box, type Administrators for Group name, under policy, check AdministratorAccess option, click Create group.



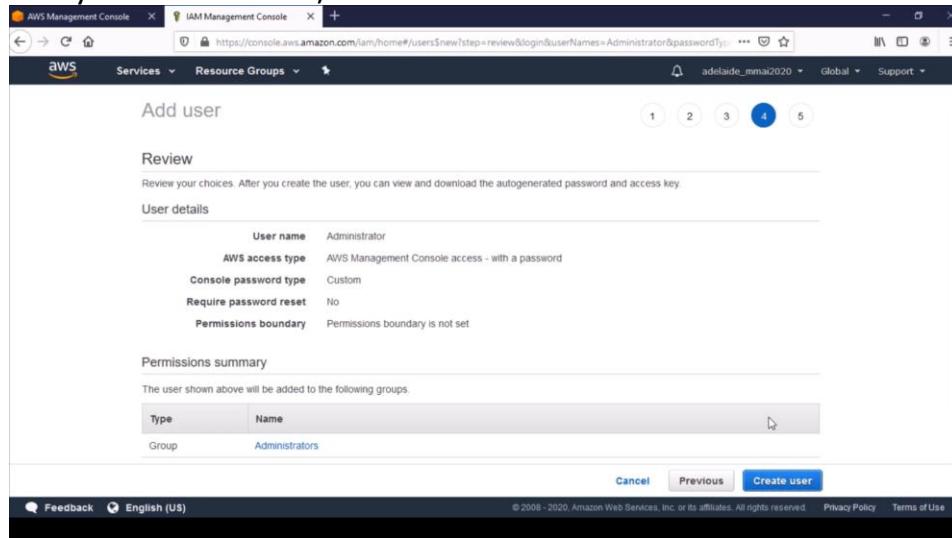
- i. Make sure Administrators is checked, click Next: Tags.



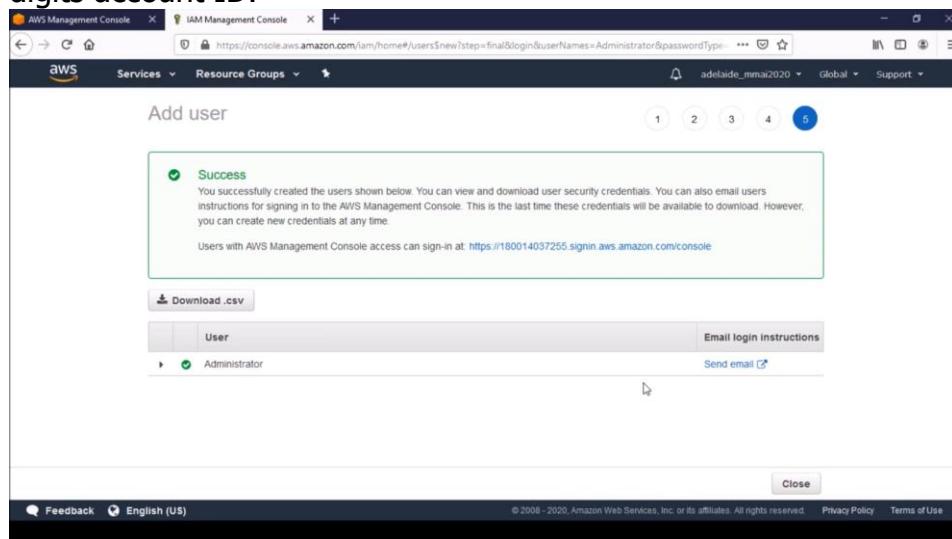
- j. Leave unchanged, click Next: Review.



- k. Verify the information, click Create user.

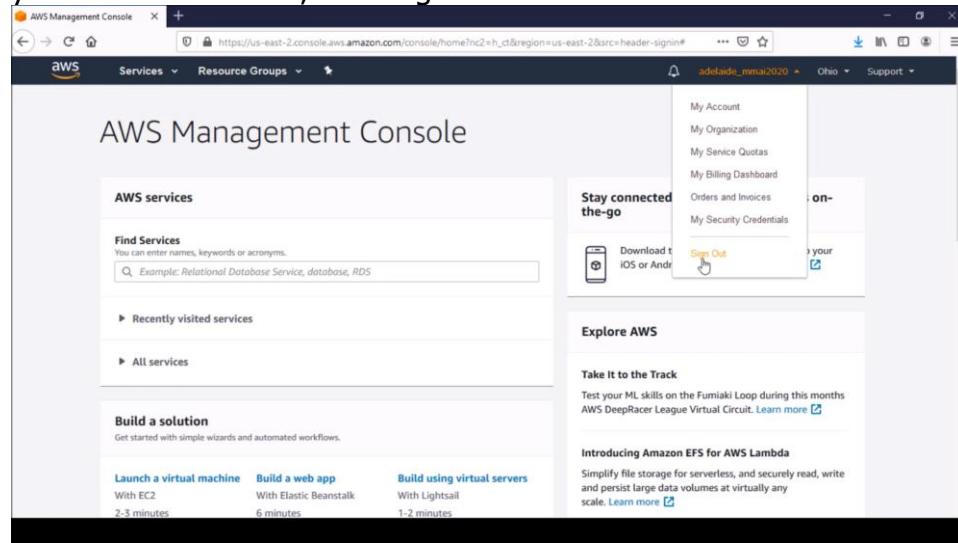


- l. User will be created, click Close. Download the CSV file that contains your 12 digits account ID.

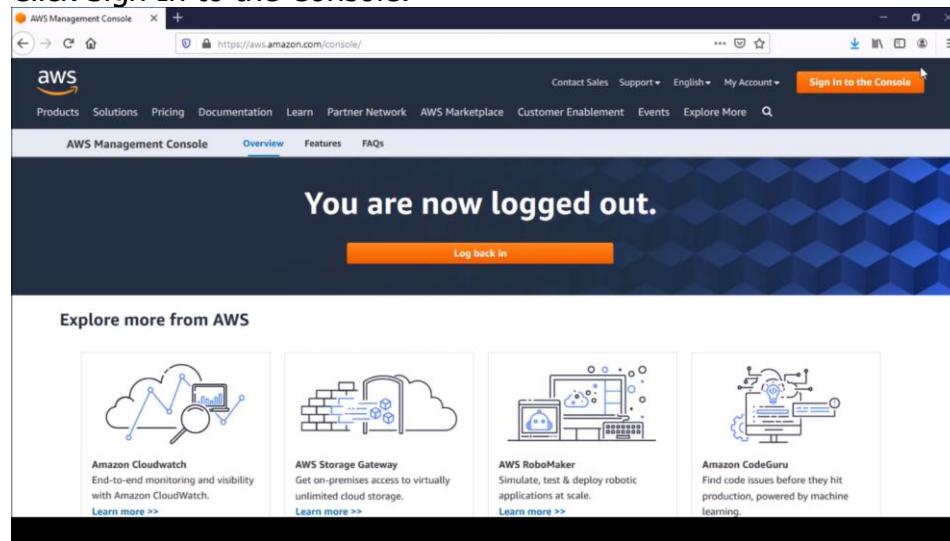


2. Sign in to the AWS Management Console using a special URL.

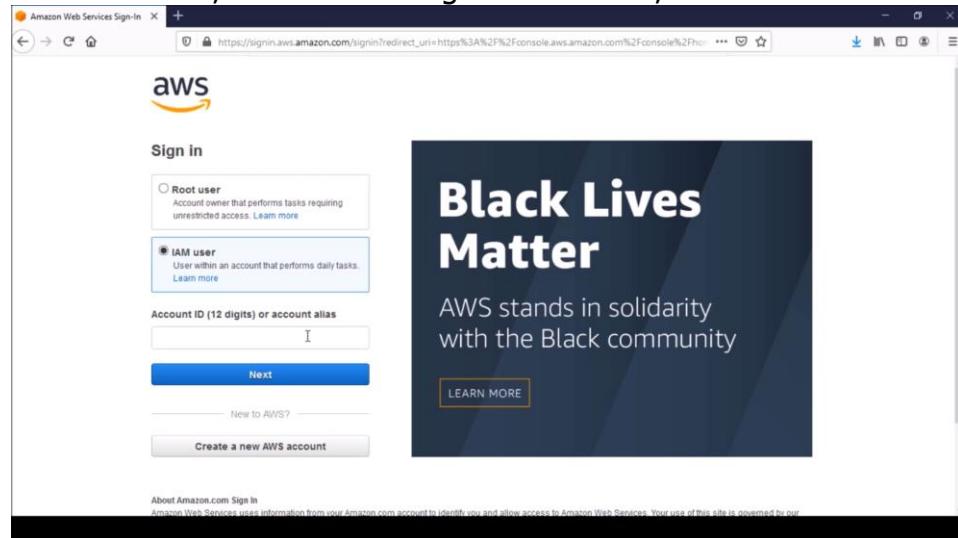
- a. As the root user, sign out from the console. On the navigation bar, click on your root user name, click Sign Out.



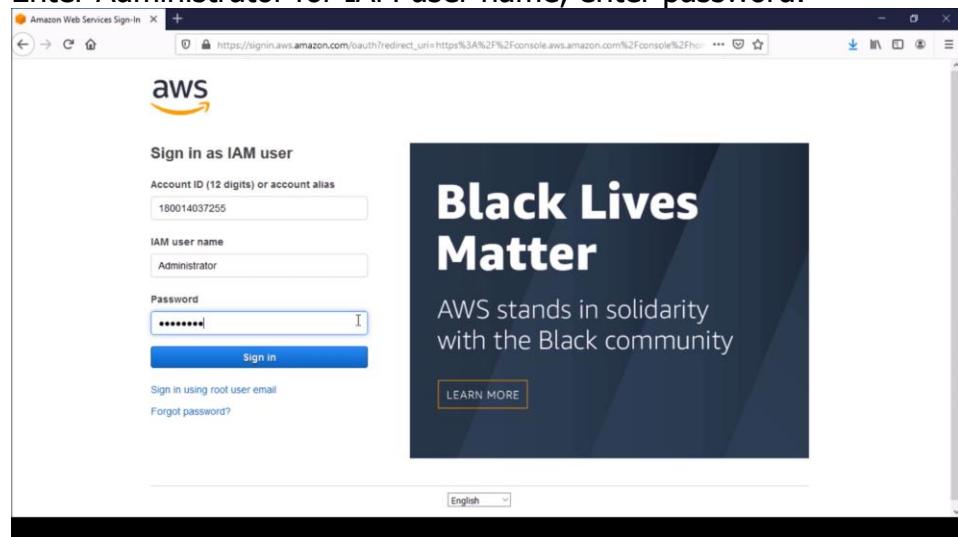
- b. Click Sign In to the Console.



- c. Click IAM user, enter the 12 digits account ID, click Next.



- d. Enter Administrator for IAM user name, enter password.



3. Now it's your turn! Let's apply what we've just learned about AWS Comprehend.

Part 2: Set Up an S3 Storage Space

Creating an S3 Bucket



Part 2: Set Up an S3 Storage Space



Amazon Comprehend

Learning Objective:

Creating an S3 Bucket



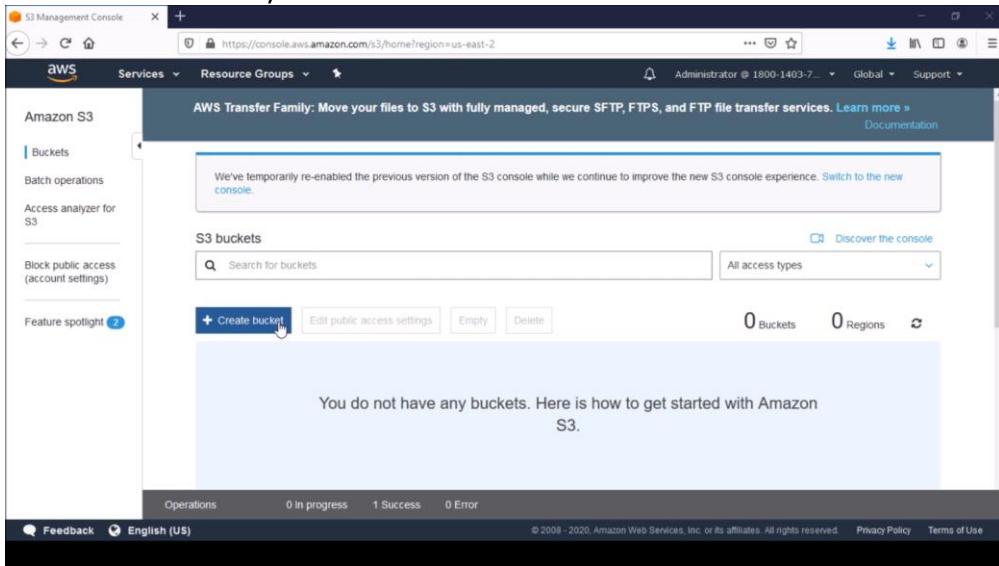
Adelaide 2020

Create an S3 Bucket

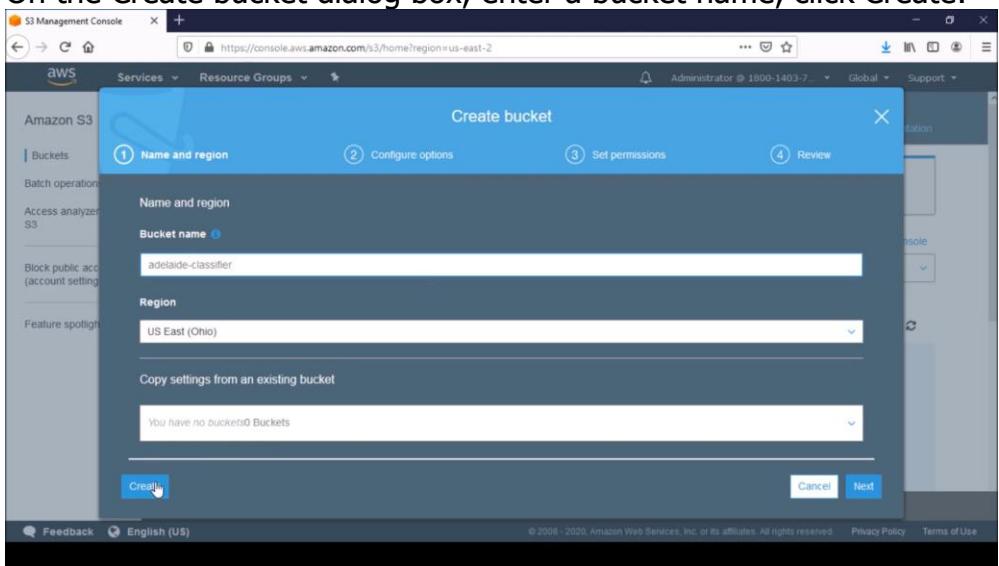
1. On the AWS Management Console, search S3, click S3 Scalable Storage in the Cloud.

The screenshot shows the AWS Management Console homepage. In the top navigation bar, there is a search bar with the text 's3'. Below the search bar, the results are displayed under the heading 'AWS services'. The first result listed is 'S3 Scalable Storage in the Cloud'. To the right of the search results, there is a sidebar with the title 'Explore AWS' and sections for 'Host Static Web Apps in Minutes' and 'Amazon DocumentDB (with MongoDB compatibility)'. At the bottom of the sidebar, there is a link to 'Build a solution'.

2. On the S3 Console, click Create bucket.



3. On the Create bucket dialog box, enter a bucket name, click Create.



4. Click on the newly created bucket.

The screenshot shows the AWS S3 Management Console. On the left sidebar, under 'Amazon S3', there is a 'Buckets' section. In the main area, there is a banner at the top stating 'AWS Transfer Family: Move your files to S3 with fully managed, secure SFTP, FTPS, and FTP file transfer services.' Below this, there is a search bar labeled 'Search for buckets' and a dropdown menu set to 'All access types'. A table displays one bucket:

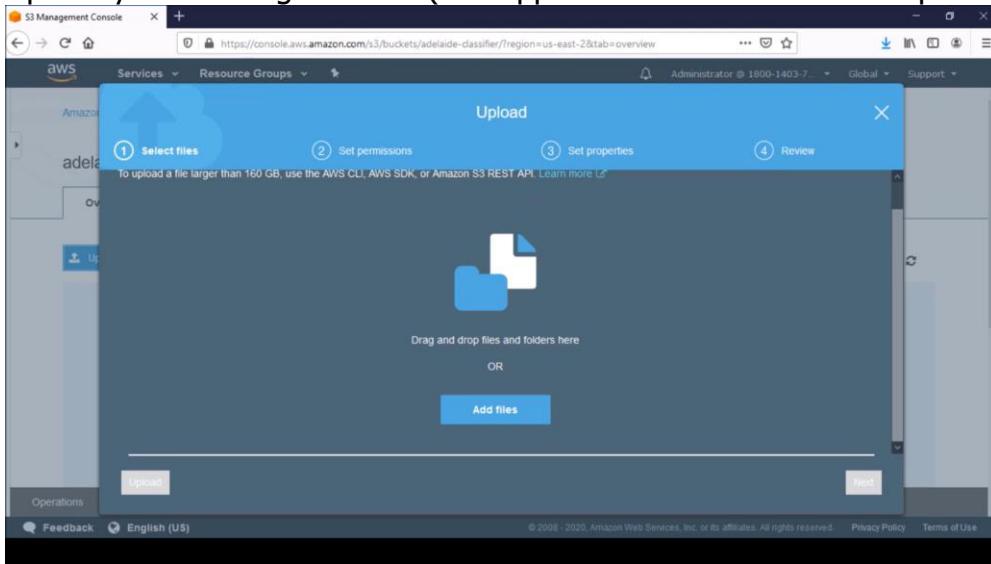
Bucket name	Access	Region	Date created
adelaide-classifier	Bucket and objects not public	US East (Ohio)	Jun 28, 2020 4:25:47 PM GMT-0400

At the bottom of the page, there is a footer with links for 'Feedback', 'English (US)', and copyright information: '© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use'.

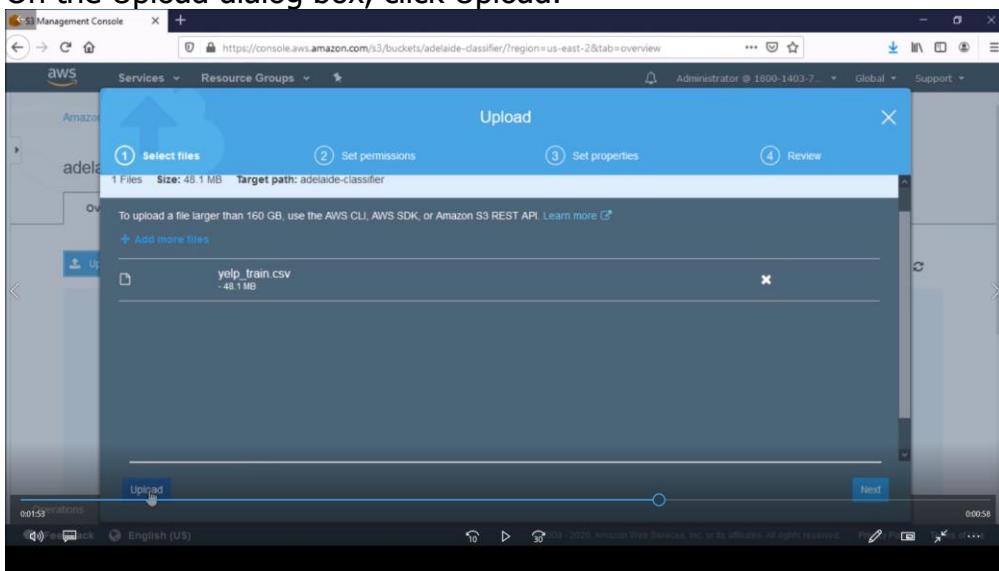
5. Inside the bucket, click Upload.

The screenshot shows the AWS S3 bucket overview page for 'adelaide-classifier'. At the top, there is a breadcrumb navigation: 'Amazon S3 > adelaide-classifier'. Below this, there is a toolbar with tabs: 'Overview' (which is selected), 'Properties', 'Permissions', 'Management', and 'Access points'. The main content area has a heading 'adelaide-classifier' and a message 'This bucket is empty. Upload new objects to get started.' Below this message, there are three icons: a glass with a pencil, two people, and a database. At the bottom of the page, there is a footer with links for 'Feedback', 'English (US)', and copyright information: '© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use'.

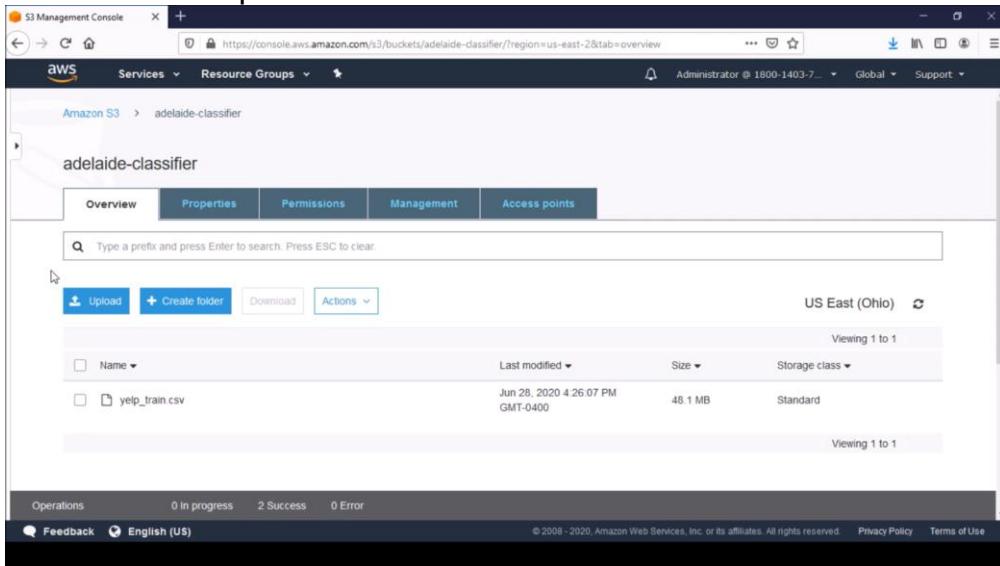
6. Upload your training data set (see Appendix I: Download the Yelp Dataset).



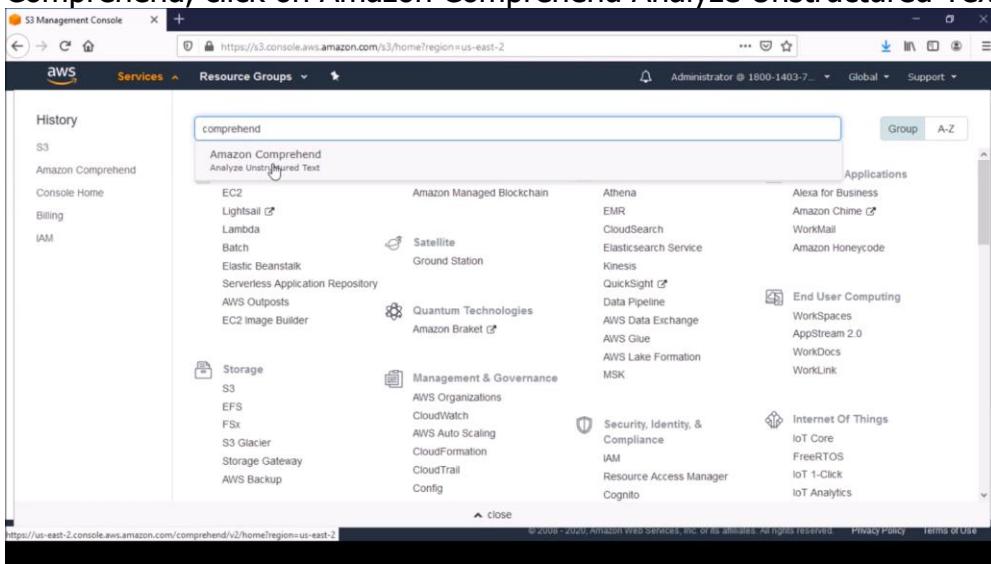
7. On the Upload dialog box, click Upload.



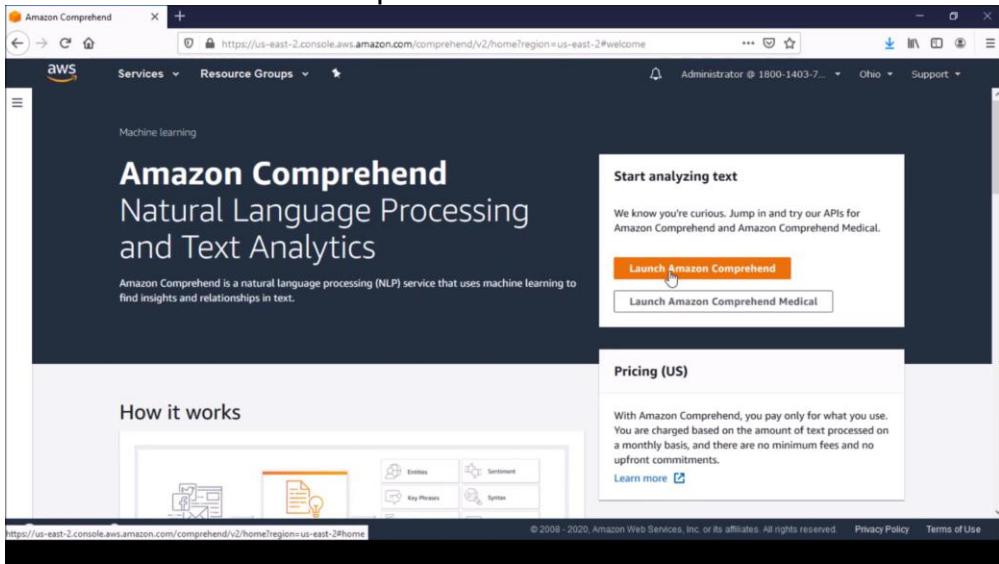
8. The file will be uploaded.



9. Go back to the Comprehend console. On the navigation bar, click Services, type Comprehend, click on Amazon Comprehend Analyze Unstructured Text.



10. Click Launch Amazon Comprehend.



11. Now it's your turn! Let's apply what we've just learned about AWS Comprehend.

Part 3: Getting Started Using the AWS Comprehend Console

Part 3: Getting Started Using the Amazon Comprehend Console

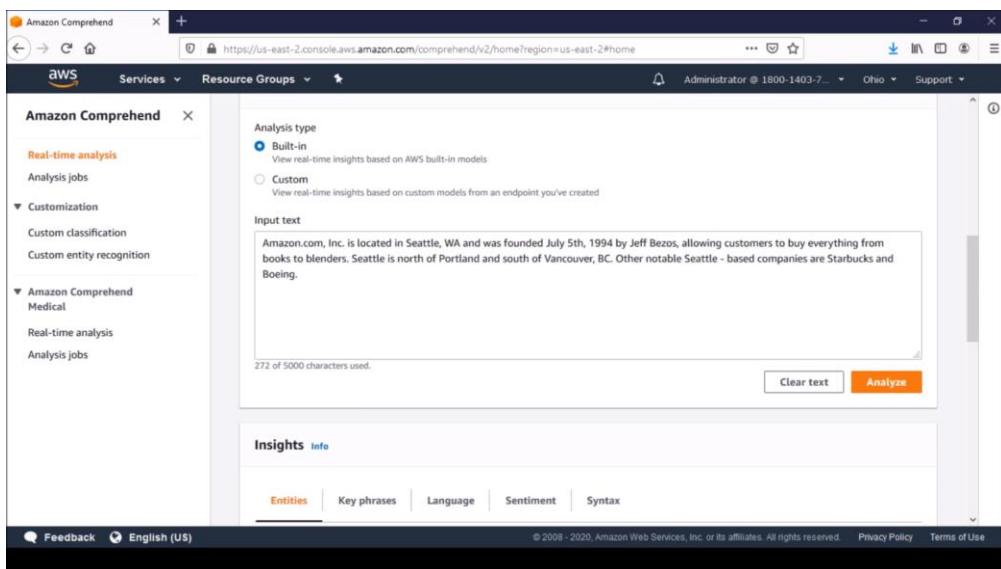
Learning Objective:

A. Know the Different Sections of Comprehend Console

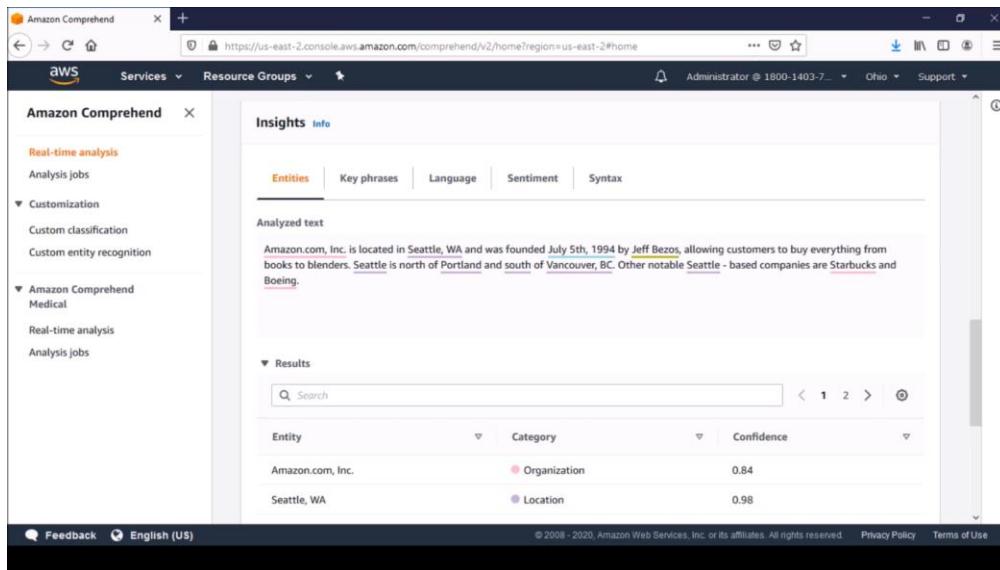
Know the Different Sections of AWS Comprehend Console

The Amazon Comprehend console enables you to analyze the contents of documents up to 1,000 characters long. The results are shown in the console so that you can review the analysis.

You can replace the sample text with your own text either in English or one of the other languages supported by Amazon Comprehend and then choose Analyze to get an analysis of your text.



Entity Types Tab



The screenshot shows the AWS Comprehend Insights interface. On the left, a sidebar lists various analysis options like Real-time analysis, Analysis jobs, Customization, and Amazon Comprehend Medical. The main pane displays an analyzed text snippet and a results table.

Analyzed text:

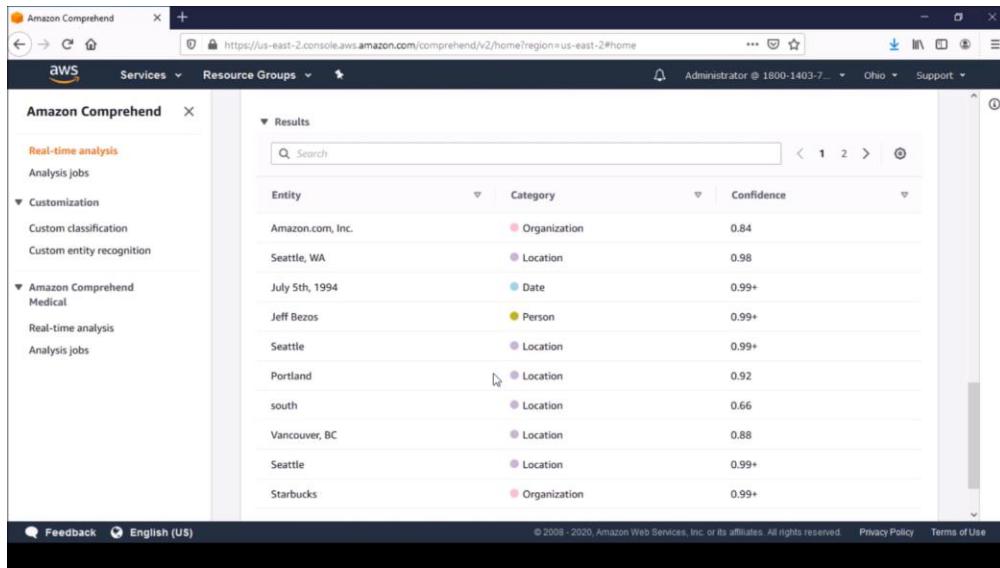
Amazon.com, Inc. is located in Seattle, WA and was founded July 5th, 1994 by Jeff Bezos, allowing customers to buy everything from books to blenders. Seattle is north of Portland and south of Vancouver, BC. Other notable Seattle - based companies are Starbucks and Boeing.

Results:

Entity	Category	Confidence
Amazon.com, Inc.	Organization	0.84
Seattle, WA	Location	0.98

The text is color-coded to indicate different entity types such as organizations, locations, dates, and persons.

Below the text being analyzed, the Results pane shows more information about the text. Each entry shows the entity, its category, and the level of confidence AWS Comprehend has in this analysis.

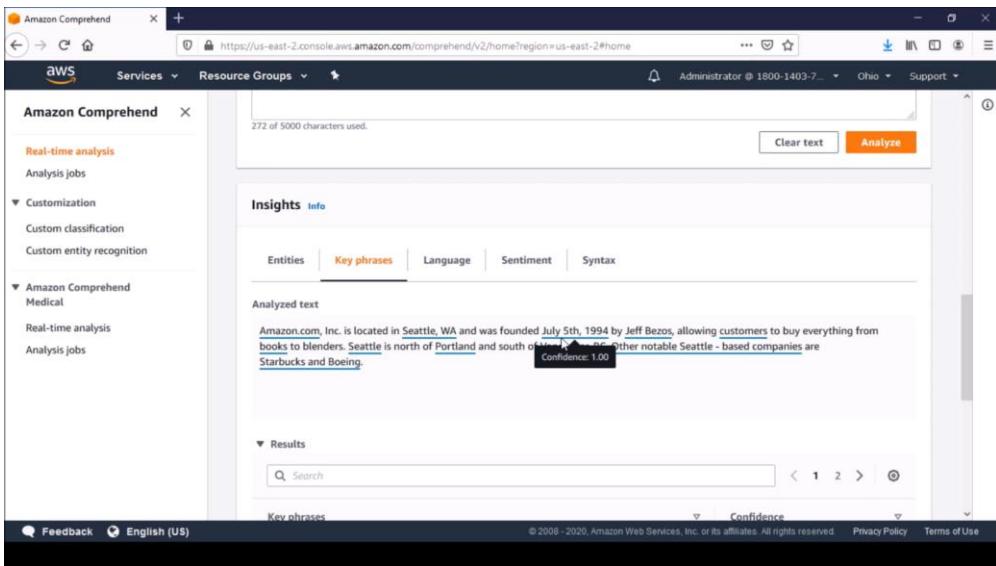


This screenshot shows the same AWS Comprehend Insights interface as above, but with more entities listed in the results table. The entities are color-coded according to their type: pink for organizations, purple for locations, teal for dates, yellow for persons, and light blue for other entities.

Results:

Entity	Category	Confidence
Amazon.com, Inc.	Organization	0.84
Seattle, WA	Location	0.98
July 5th, 1994	Date	0.99+
Jeff Bezos	Person	0.99+
Seattle	Location	0.99+
Portland	Location	0.92
south	Location	0.66
Vancouver, BC	Location	0.88
Seattle	Location	0.99+
Starbucks	Organization	0.99+

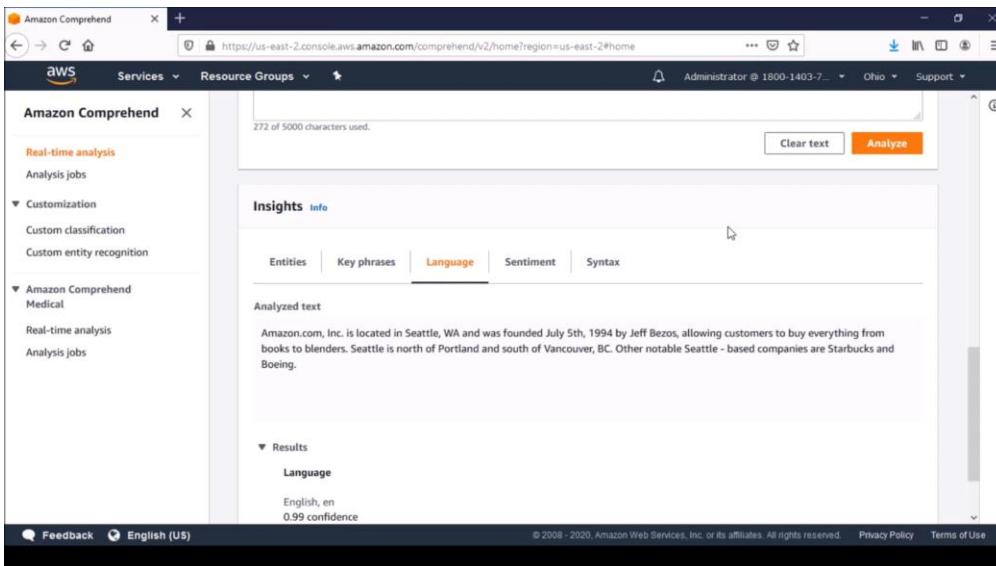
Key Phrases Tab



The screenshot shows the AWS Comprehend service in the AWS Management Console. On the left, the navigation pane includes 'Real-time analysis', 'Analysis jobs', 'Customization', 'Amazon Comprehend Medical', and 'Amazon Comprehend'. The main area has a text input field with '272 of 5000 characters used.' and a 'Clear text' button. Below it is the 'Insights' section with tabs for 'Entities', 'Key phrases' (which is selected), 'Language', 'Sentiment', and 'Syntax'. Under 'Analyzed text', the input text is: 'Amazon.com, Inc. is located in Seattle, WA and was founded July 5th, 1994 by Jeff Bezos, allowing customers to buy everything from books to blenders. Seattle is north of Portland and south of Vancouver, BC. Other notable Seattle - based companies are Starbucks and Boeing.' A confidence score of 'Confidence: 1.00' is shown. The 'Results' section below shows a search bar and a table with columns for 'Key phrases', 'Confidence', and other metrics. At the bottom, there are links for 'Feedback', 'English (US)', and legal notices.

The Key phrases tab lists key noun phrases that Amazon Comprehend detected in the input text and the associated confidence level.

Language Tab



This screenshot is identical to the one above, but the 'Language' tab is selected in the 'Insights' section. The analyzed text remains the same. In the 'Results' section, the table now shows the dominant language as 'English, en' with a '0.99 confidence' level.

The Language tab shows the dominant language of the text and AWS Comprehend's level of confidence that it's detected the dominant language correctly. Amazon Comprehend can recognize 100 languages.

Sentiment Tab

The screenshot shows the AWS Comprehend Insights interface. On the left, there's a navigation sidebar with sections like 'Real-time analysis', 'Customization', and 'Amazon Comprehend Medical'. The main area is titled 'Insights' with tabs for 'Entities', 'Key phrases', 'Language', 'Sentiment' (which is selected), and 'Syntax'. Below the tabs, there's a section for 'Analyzed text' containing a sample sentence: 'Amazon.com, Inc. is located in Seattle, WA and was founded July 5th, 1994 by Jeff Bezos, allowing customers to buy everything from books to blenders. Seattle is north of Portland and south of Vancouver, BC. Other notable Seattle - based companies are Starbucks and Boeing.' Under the 'Results' section, the 'Sentiment' tab displays four categories: Neutral (0.99 confidence), Positive (0.00 confidence), Negative (0.00 confidence), and Mixed (0.00 confidence). At the bottom, there are links for 'Feedback', 'English (US)', and 'Privacy Policy'.

The Sentiment tab shows the overall emotional sentiment of the text. Sentiment can be rated neutral, positive, negative, or mixed. In this case, each emotional sentiment has a confidence rating, providing an estimate by AWS Comprehend for that sentiment being dominant.

Syntax Tab

This screenshot shows the 'Syntax' tab in the AWS Comprehend Insights interface. The layout is similar to the Sentiment tab, with the same sidebar and tabs at the top. The analyzed text is the same as in the previous screenshot. Under the 'Results' section, there's a search bar and a table showing parts of speech and their confidence scores. The table includes columns for 'Word', 'Part of speech', and 'Confidence'. The data shown is:

Word	Part of speech	Confidence
Amazon.com	Proper noun	0.88
,	Punctuation	0.99+
Inc.	Proper noun	0.00

The Syntax tab shows a breakdown of each element in the text, along with its part of speech and the associated confidence score.



Part 3: Getting Started Using the Amazon Comprehend Console



Amazon Comprehend

Learning Objective:

B. Creating and Using Custom Classifiers

i. Creating a Custom Classifier

Adelaide 2020 MHAI

You can create and train custom classifiers using the console, and then run asynchronous classification jobs to analyze your documents. You can also use the same custom model and add an endpoint to it to run custom classification requests to gain real-time (synchronous) insights about your text.

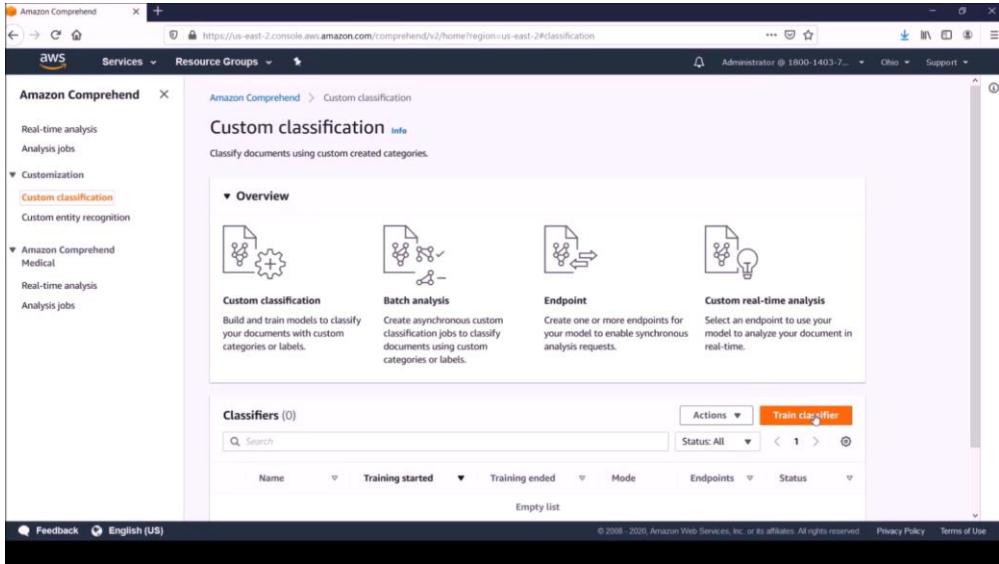
Create a Custom Classifier

1. On the AWS Comprehend Console, from the left menu, choose Customization and then choose Custom Classification.

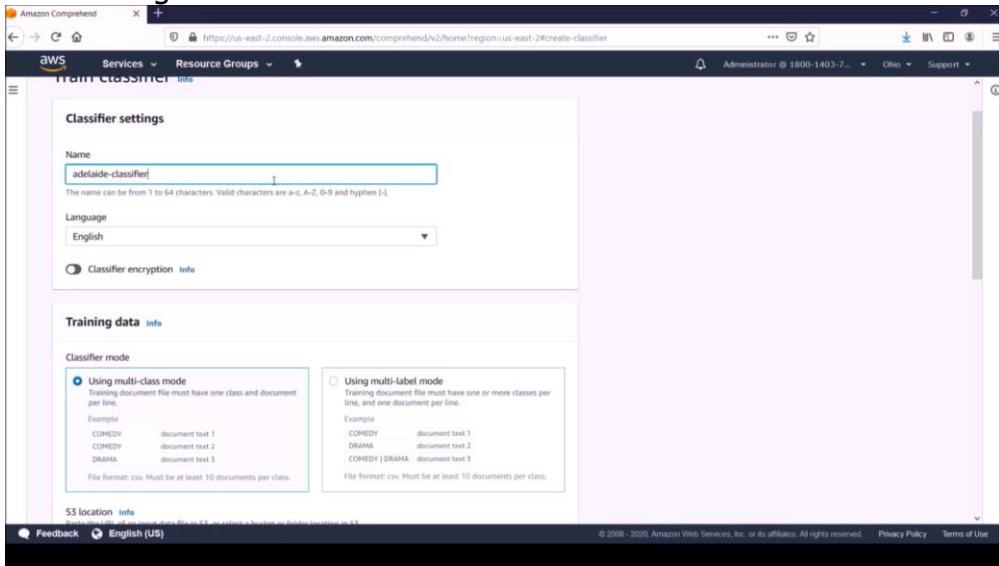
The screenshot shows the AWS Comprehend console interface. The left sidebar has a tree view with 'Amazon Comprehend' selected, under which 'Customization' is expanded, showing 'Custom classification'. The main content area is titled 'Real-time analysis' and contains the following sections:

- Learn more**: A link to learn about using Amazon Comprehend in an Elasticsearch Service domain.
- Real-time analysis**: A brief description of what real-time analysis is and how it works.
- Overview**: Two cards:
 - Real-time analysis with built-in models**: Describes using built-in models for real-time analysis.
 - Custom real-time analysis with endpoint**: Describes creating a custom endpoint for real-time analysis.
- Input text**: A section for inputting text for analysis.
- Analysis type**: A section for selecting the type of analysis.

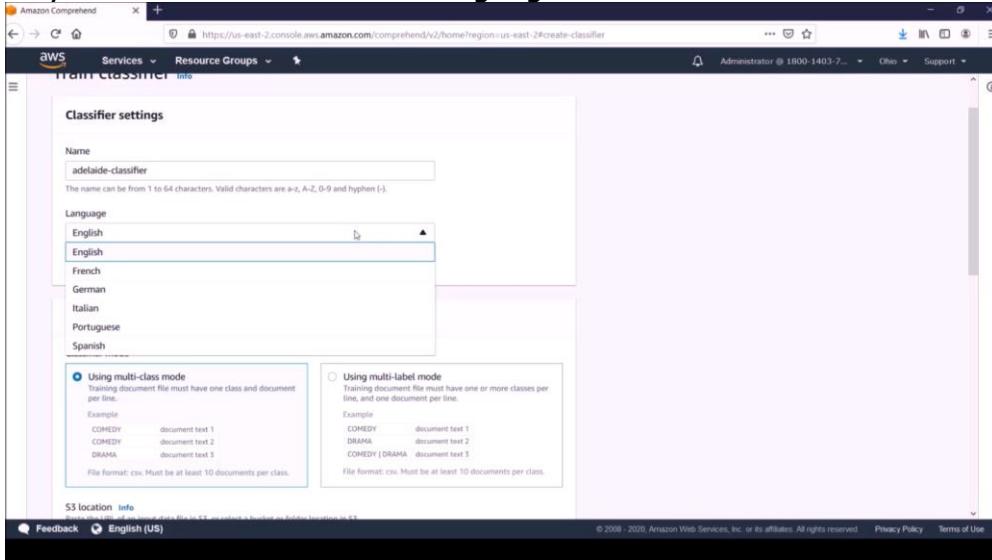
2. Click Train Classifier.



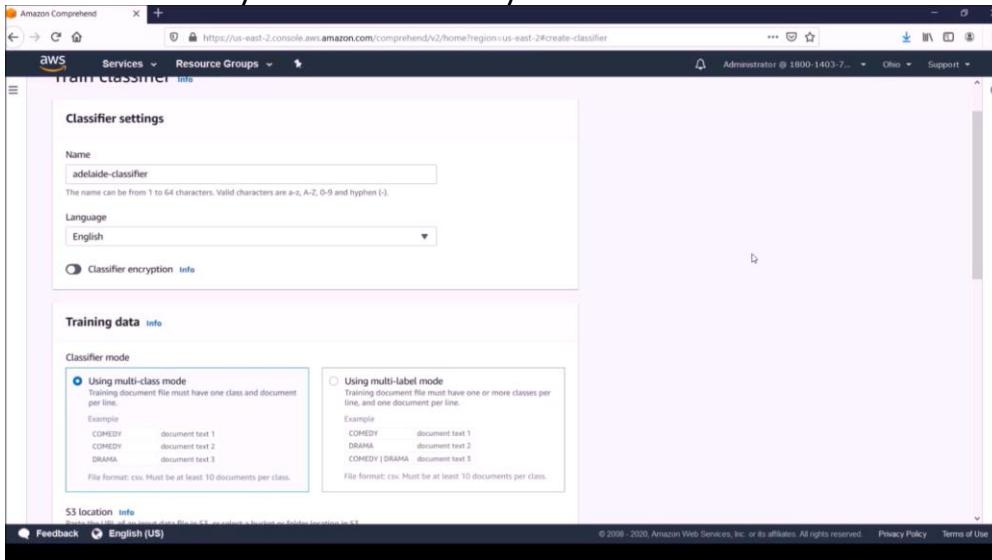
3. Give the classifier a name. The name must be unique within your account and current Region.



- Select the language of the training documents. You can train a document classifier using any of the languages that work with AWS Comprehend. However, you can only train the classifier in one language.

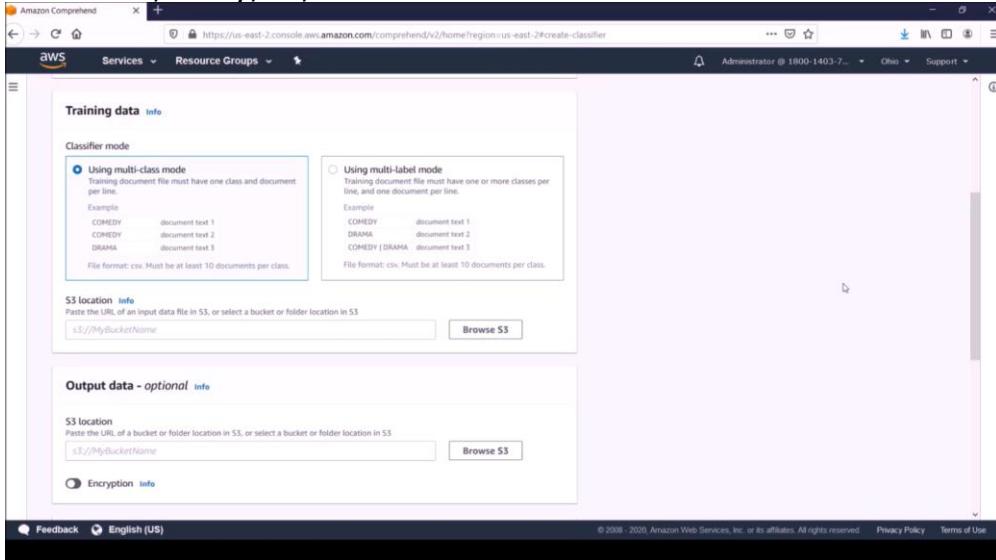


- If you want to encrypt the data in the storage volume while your training job is being processed, choose Classifier encryption and then choose whether to use a KMS key associated with your current account, or one from another account.
 - If you are using a key associated with the current account, choose the key ID for KMS key ID.
 - If you are using a key associated with a different account, enter the ARN for the key ID under KMS key ARN.

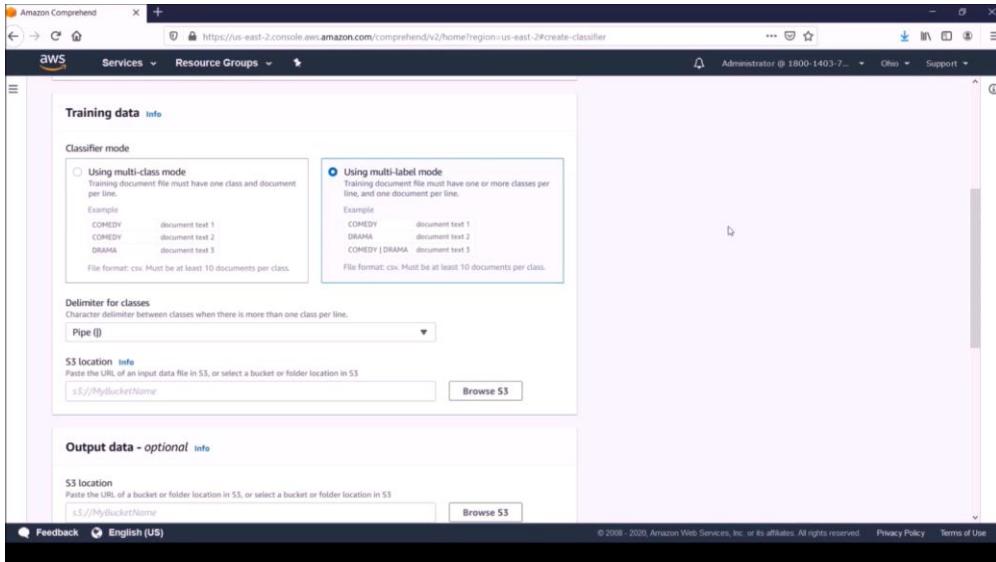


- Under Training data, choose which classifier mode to use.
 - Multi-class mode:** Choose this option if the categories you are assigning to documents are mutually exclusive and you are training your classifier to assign one and only one label to each document.

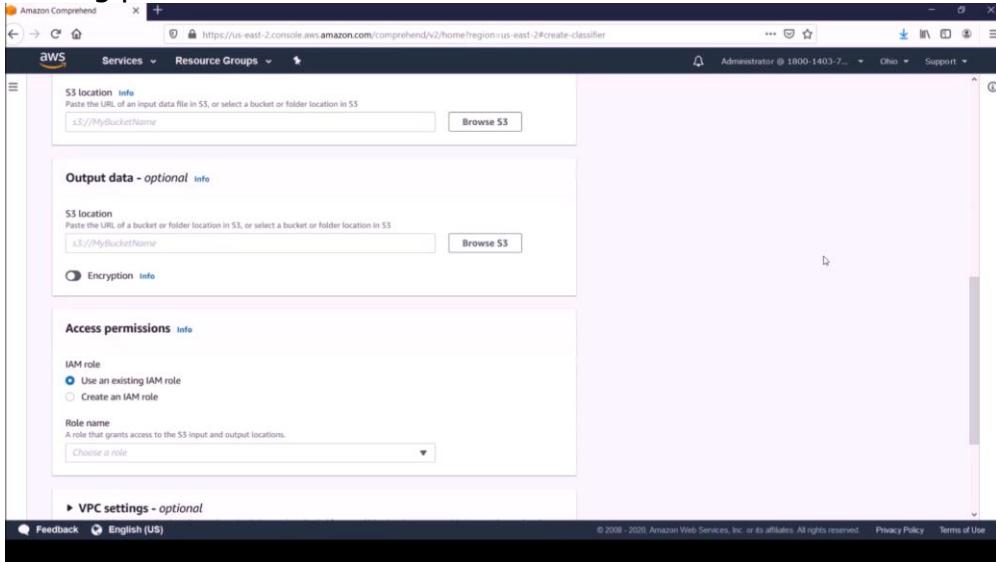
- b. Multi-label mode: Choose this option if multiple categories can be applied to a document at the same time and you are training your classifier to assign one, many, all, or no label to each document.



- c. If you chose Multi-label mode, choose the character delimiter you want to use to separate labels when there is more than one label per line from Delimiter for labels.

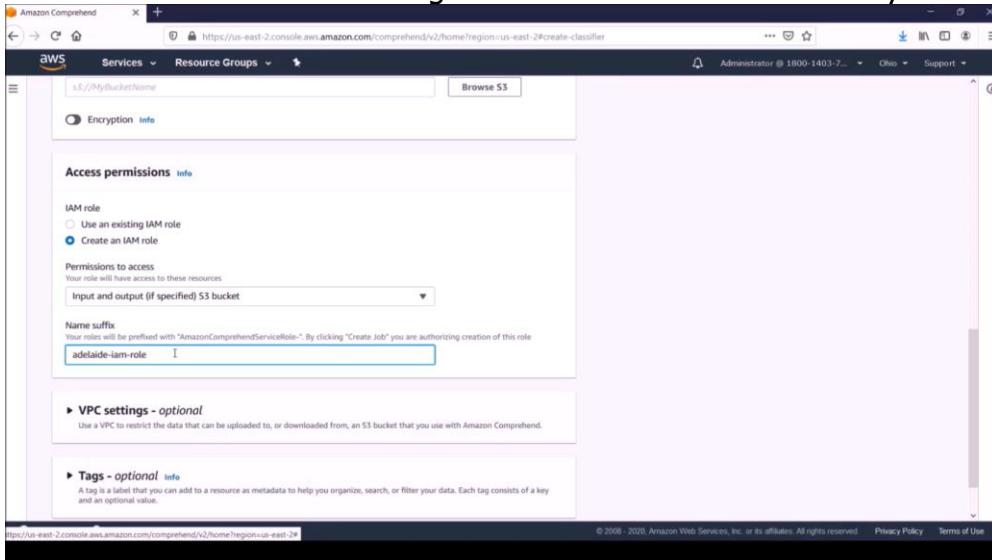


7. Enter the location of the Amazon S3 bucket that contains your training documents or navigate to it by choosing Browse S3 then navigate to your training file. The IAM role you're using for access permissions for the training job must have reading permissions for the S3 bucket.



8. If you want Amazon Comprehend to create a confusion matrix that provides metrics on how well the classifier performed during training, enter the location of an Amazon S3 bucket where it will be saved (Output data field).
9. If you choose to encrypt the output result from your training job, choose Encryption and then choose whether to use a KMS key associated with the current account, or one from another account.
 - a. If you are using a key associated with the current account, choose the key alias for KMS key ID.
 - b. If you are using a key associated with a different account, enter the ARN for the key alias or ID under KMS key ID.
10. Choose Use an existing IAM role, and then choose an existing IAM role that has read permissions for the S3 bucket that contains your training documents. Only roles that have a trust policy that begins with comprehend.amazonaws.com are valid.

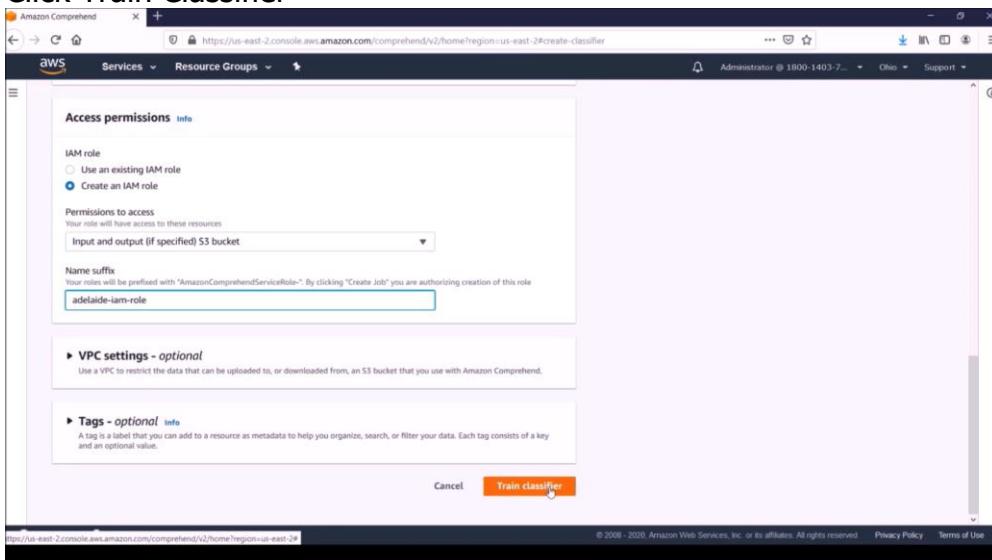
If you don't already have an IAM role with these permissions, choose Create an IAM role to make one. Choose the access permissions to grant this role, and then choose a name suffix to distinguish the role from IAM roles in your account.



11. To launch your resources into AWS Comprehend from a VPC (Virtual Private Cloud), enter the VPC ID under VPC or choose the ID from the drop-down list.
 - a. Choose the subnet under Subnets(s). After you select the first subnet, you can choose additional ones.
 - b. Under Security Group(s), choose the security group to use if you specified one. After you select the first security group, you can choose additional ones.

To add a tag to the custom classifier, enter a key-value pair under Tags. Choose Add tag.

12. Click Train Classifier



13. The new classifier will then appear in the list, showing its status. It will first show as Submitted.

The screenshot shows the 'Custom classification' page in the AWS Amazon Comprehend service. On the left, there's a navigation sidebar with options like 'Real-time analysis', 'Analysis jobs', 'Customization' (which is expanded to show 'Custom classification'), 'Amazon Comprehend Medical', 'Real-time analysis', and 'Analysis jobs'. The main content area is titled 'Custom classification' and contains sections for 'Overview', 'Classifiers (1)', and 'Actions'.

Overview section:

- Custom classification**: Build and train models to classify your documents with custom categories or labels.
- Batch analysis**: Create asynchronous custom classification jobs to classify documents using custom categories or labels.
- Endpoint**: Create one or more endpoints for your model to enable synchronous analysis requests.
- Custom real-time analysis**: Select an endpoint to use your model to analyze your document in real-time.

Classifiers (1) table:

Name	Training started	Training ended	Mode	Endpoints	Status
adelaide-classifier	6/28/2020, 10:34:27 PM	-	Multi-class	-	Submitted

At the bottom, there are links for 'Feedback', 'English (US)', and the standard AWS footer with copyright information and links to 'Privacy Policy' and 'Terms of Use'.

14. It will then show Training for a classifier that is processing training documents.

This screenshot is identical to the previous one, showing the 'Custom classification' page in the AWS Amazon Comprehend service. The navigation sidebar and overall layout are the same. The 'Classifiers (1)' table shows the same entry for 'adelaide-classifier'.

Classifiers (1) table:

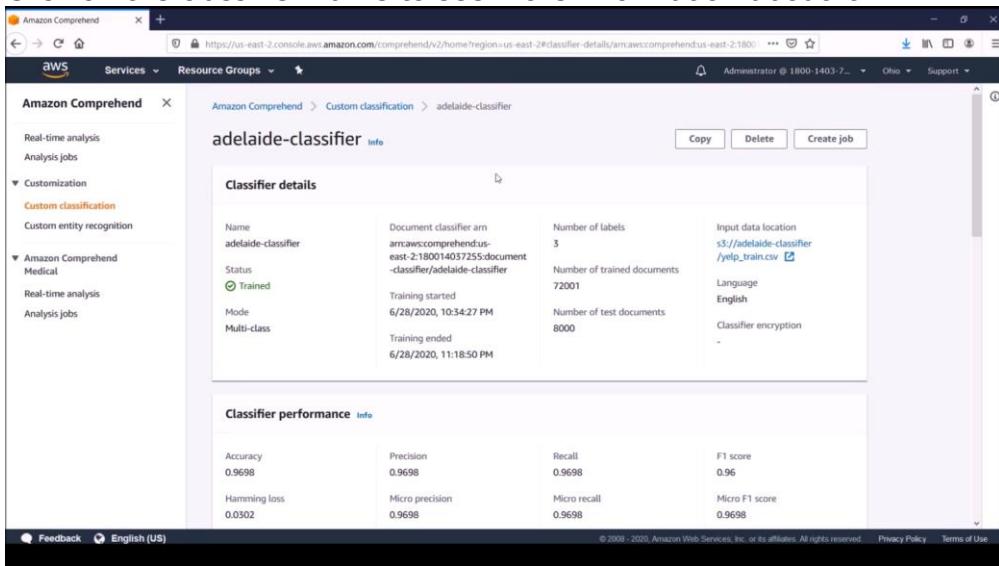
Name	Training started	Training ended	Mode	Endpoints	Status
adelaide-classifier	6/28/2020, 10:34:27 PM	-	Multi-class	-	Training

The status of the classifier has changed from 'Submitted' to 'Training', indicating that the training process is currently underway.

15. It will finally show Trained for a classifier that is ready to use

The screenshot shows the AWS Amazon Comprehend service in the AWS Management Console. The left sidebar shows various services like Real-time analysis, Customization (with 'Custom classification' selected), and Amazon Comprehend Medical. The main content area is titled 'Custom classification' and shows an overview of the service. Below the overview, there's a table titled 'Classifiers (1)' with one item: 'adelaide-classifier'. The status of this classifier is 'Trained'. There are buttons for 'Actions' and 'Train classifier'.

16. Click on the classifier name to see more information about it.



The screenshot shows the details for the 'adelaide-classifier'. The 'Classifier details' section lists the following information:

Name	Document classifier arn	Number of labels	Input data location
adelaide-classifier	arn:aws:comprehend:us-east-2:180014037255:document-classifier/adelaide-classifier	3	s3://adelaide-classifier/yelp_train.csv
Status	Training started	Number of trained documents	Language
Trained	6/28/2020, 10:34:27 PM	72001	English
Mode	Training ended	Number of test documents	Classifier encryption
Multi-class	6/28/2020, 11:18:50 PM	8000	-

The 'Classifier performance' section lists the following metrics:

Accuracy	Precision	Recall	F1 score
0.9698	0.9698	0.9698	0.96
Hamming loss	Micro precision	Micro recall	Micro F1 score
0.0302	0.9698	0.9698	0.9698

17. Click on Custom Classification to go back to the list.

18. Now it's your turn! Let's apply what we've just learned about AWS Comprehend.



Part 3: Getting Started Using the Amazon Comprehend Console



Amazon Comprehend

Learning Objective:

B. Creating and Using Custom Classifiers

ii. Running an Asynchronous Custom Classification Job

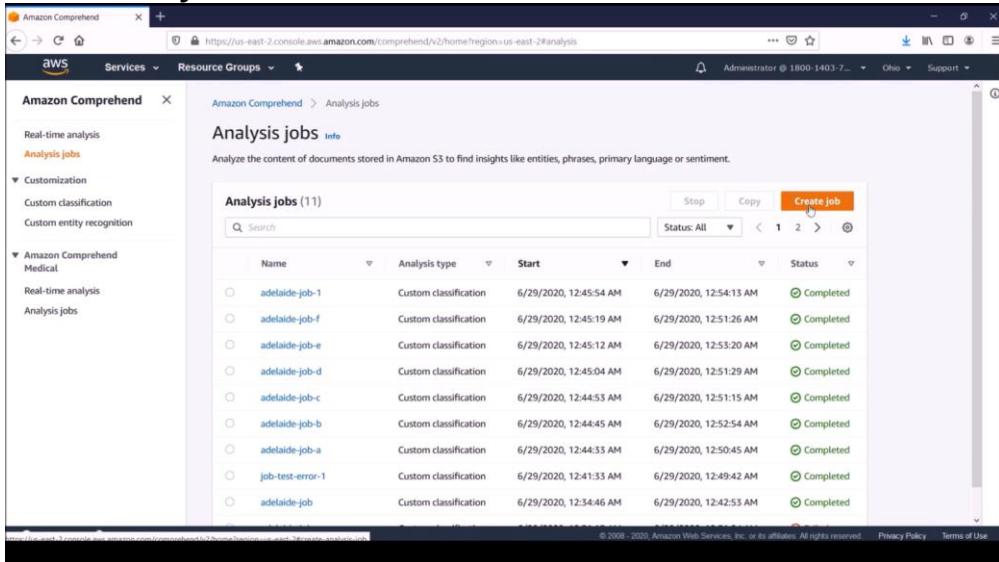
Adelaide 2020 MHAI

Create an Asynchronous Custom Classification Job

1. On the AWS Comprehend Console, from the left menu, click Analysis Jobs

The screenshot shows the AWS Comprehend console interface. The left sidebar has 'Analysis Jobs' selected under 'Real-time analysis'. The main content area displays information about real-time analysis, including sections for 'Real-time analysis with built-in models' and 'Custom real-time analysis with endpoint'. At the bottom, there are fields for 'Input text' and 'Analysis type'.

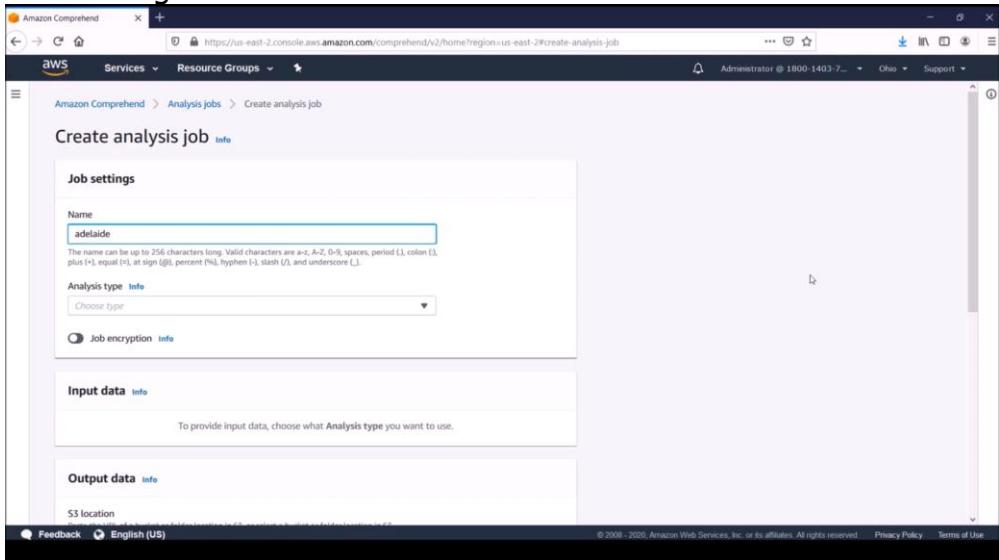
2. Click Create job.



The screenshot shows the 'Analysis jobs' page in the Amazon Comprehend service. The left sidebar has sections for 'Real-time analysis' (Analysis jobs), 'Customization' (Custom classification, Custom entity recognition), and 'Amazon Comprehend Medical' (Real-time analysis, Analysis jobs). The main area displays a table titled 'Analysis jobs (11)' with columns: Name, Analysis type, Start, End, and Status. All listed jobs are 'Completed'. The 'Create job' button is highlighted in orange at the top right of the table area.

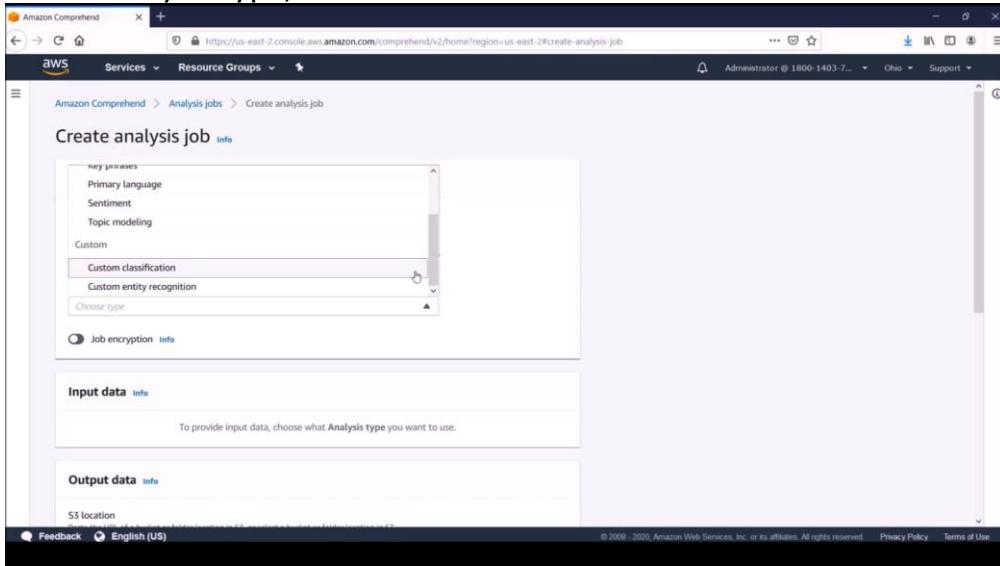
Name	Analysis type	Start	End	Status
adelaide-job-1	Custom classification	6/29/2020, 12:45:54 AM	6/29/2020, 12:54:13 AM	Completed
adelaide-job-f	Custom classification	6/29/2020, 12:45:19 AM	6/29/2020, 12:51:26 AM	Completed
adelaide-job-e	Custom classification	6/29/2020, 12:45:12 AM	6/29/2020, 12:53:20 AM	Completed
adelaide-job-d	Custom classification	6/29/2020, 12:45:04 AM	6/29/2020, 12:51:29 AM	Completed
adelaide-job-c	Custom classification	6/29/2020, 12:44:53 AM	6/29/2020, 12:51:15 AM	Completed
adelaide-job-b	Custom classification	6/29/2020, 12:44:45 AM	6/29/2020, 12:52:54 AM	Completed
adelaide-job-a	Custom classification	6/29/2020, 12:44:33 AM	6/29/2020, 12:50:45 AM	Completed
job-test-error-1	Custom classification	6/29/2020, 12:41:33 AM	6/29/2020, 12:49:42 AM	Completed
adelaide-job	Custom classification	6/29/2020, 12:34:46 AM	6/29/2020, 12:42:53 AM	Completed

3. Give the classification job a name. The name must be unique your account and current Region.

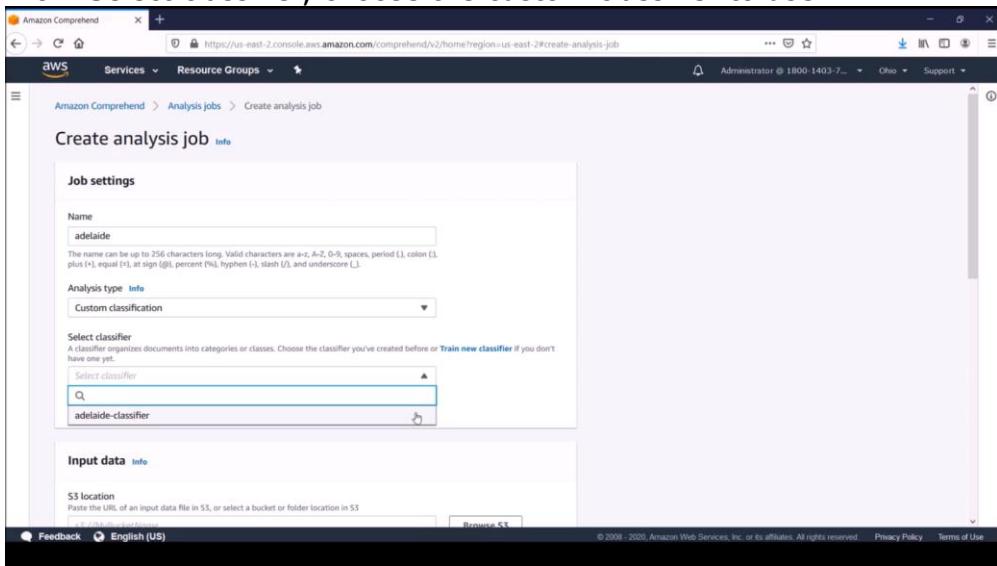


The screenshot shows the 'Create analysis job' configuration page. The 'Job settings' section includes fields for 'Name' (set to 'adelaide'), 'Analysis type' (set to 'Choose type'), and 'Job encryption' (set to 'None'). The 'Input data' section contains a note: 'To provide input data, choose what Analysis type you want to use.' The 'Output data' section includes a 'S3 location' field. The bottom of the page features standard AWS navigation links: Feedback, English (US), Privacy Policy, and Terms of Use.

4. Under Analysis type, choose Custom classification.

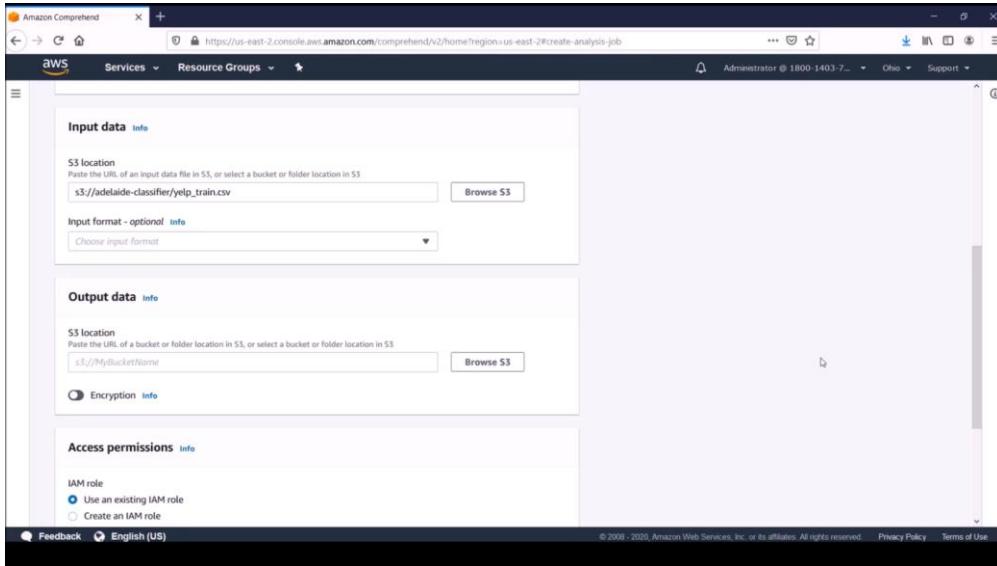


5. From Select classifier, choose the custom classifier to use.

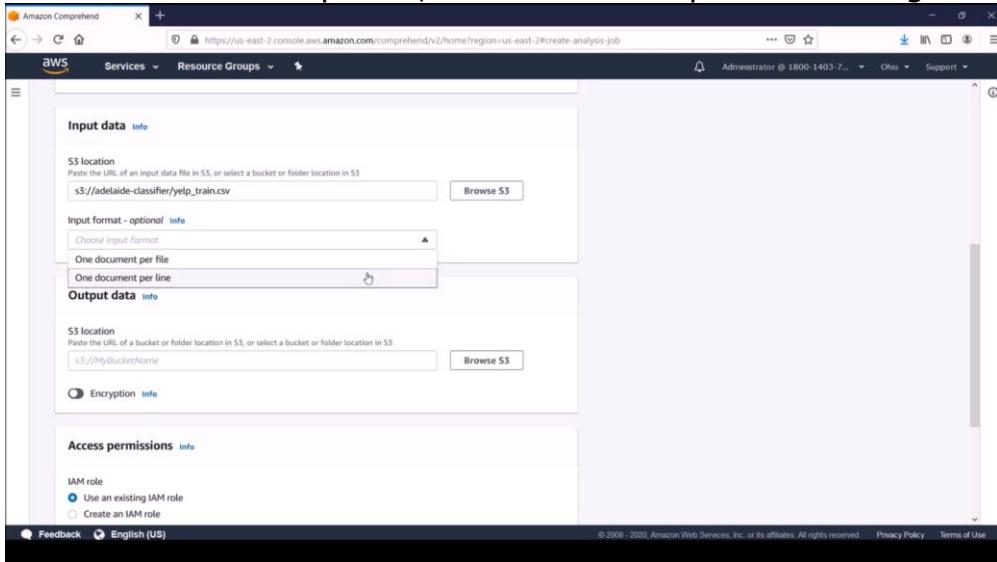


6. If you want to encrypt the data in the storage volume while your training job is being processed, choose Classifier encryption and then choose whether to use a KMS key associated with your current account, or one from another account.
- If you are using a key associated with the current account, choose the key ID for KMS key ID.
 - If you are using a key associated with a different account, enter the ARN for the key ID under KMS key ARN.
7. Under Input data, enter the location of the Amazon S3 bucket that contains your input documents or navigate to it by choosing Browse S3. This bucket must be in the same region as the API that you are calling. The IAM role you're using for

access permissions for the classification job must have reading permissions for the S3 bucket.

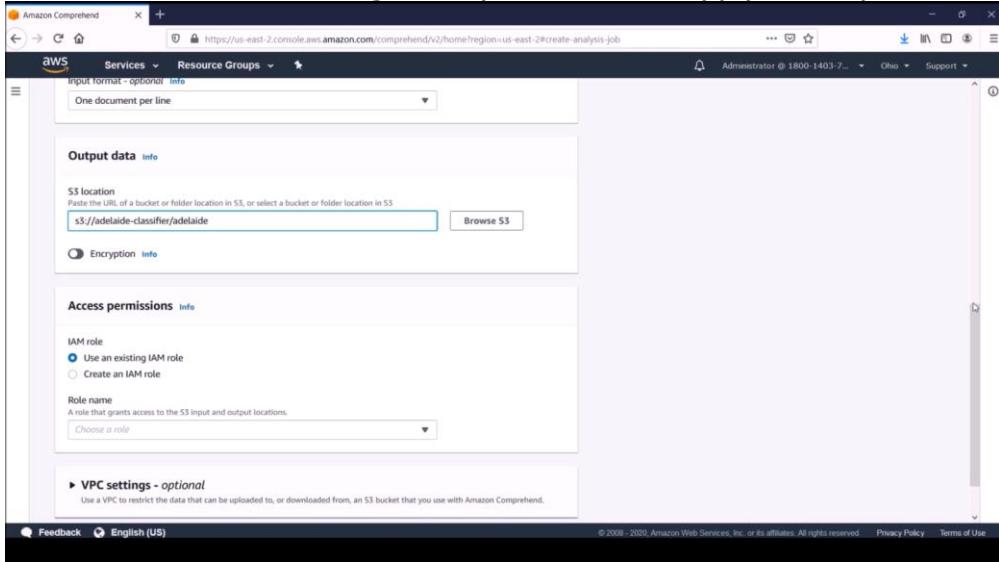


8. Choose the format of the documents to be classified under Input format. These can be one document per file, or one document per line in a single file.



9. Under Output data, enter the location of the Amazon S3 bucket where Amazon Comprehend should write the job's output data or navigate to it by choosing Select folder. This bucket must be in the same region as the API that you are calling. The IAM role you're using for access permissions for the classification job must have write permissions for the S3 bucket.

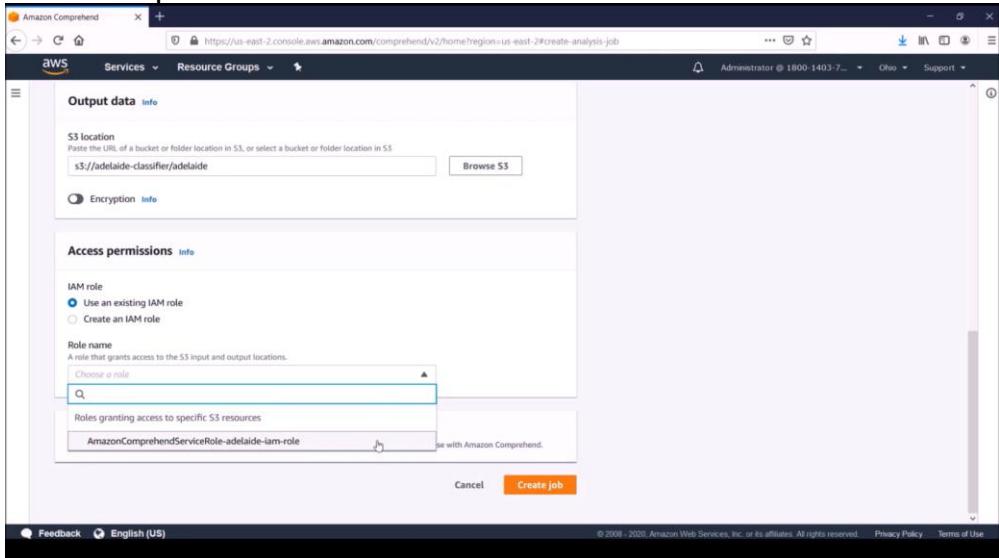
Click Browse S3 then navigate to your bucket. Supply an output folder.



10. If you choose to encrypt the output result from your job, choose Encryption and then choose whether to use a KMS key associated with the current account, or one from another account.

- If you are using a key associated with the current account, choose the key alias or ID for KMS key ID.
- If you are using a key associated with a different account, enter the ARN for the key alias or ID under KMS key ID.

11. Select the permission.

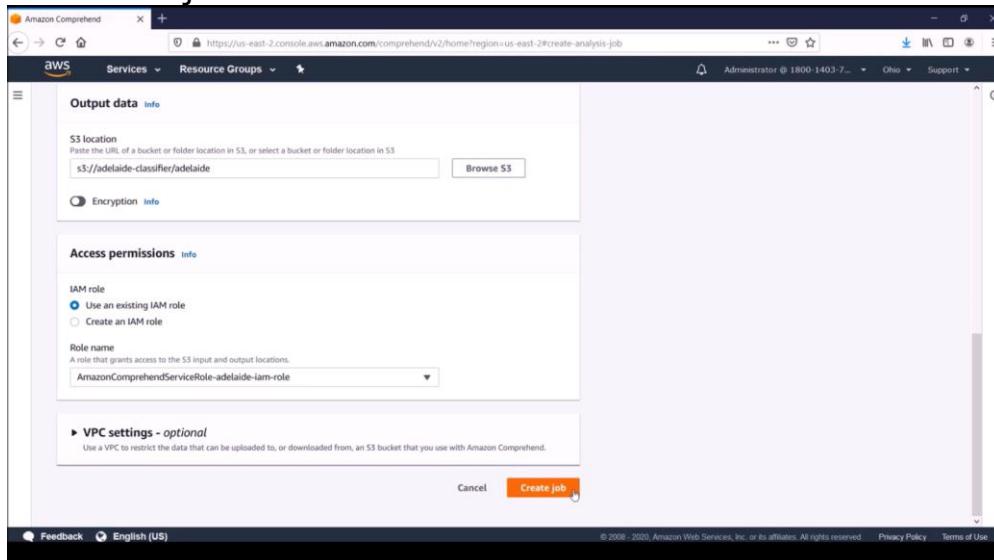


12. To launch your resources into AWS Comprehend from a VPC (Virtual Private Cloud), enter the VPC ID under VPC or choose the ID from the drop-down list.

- Choose the subnet under Subnets(s). After you select the first subnet, you can choose additional ones.

- b. Under Security Group(s), choose the security group to use if you specified one. After you select the first security group, you can choose additional ones.

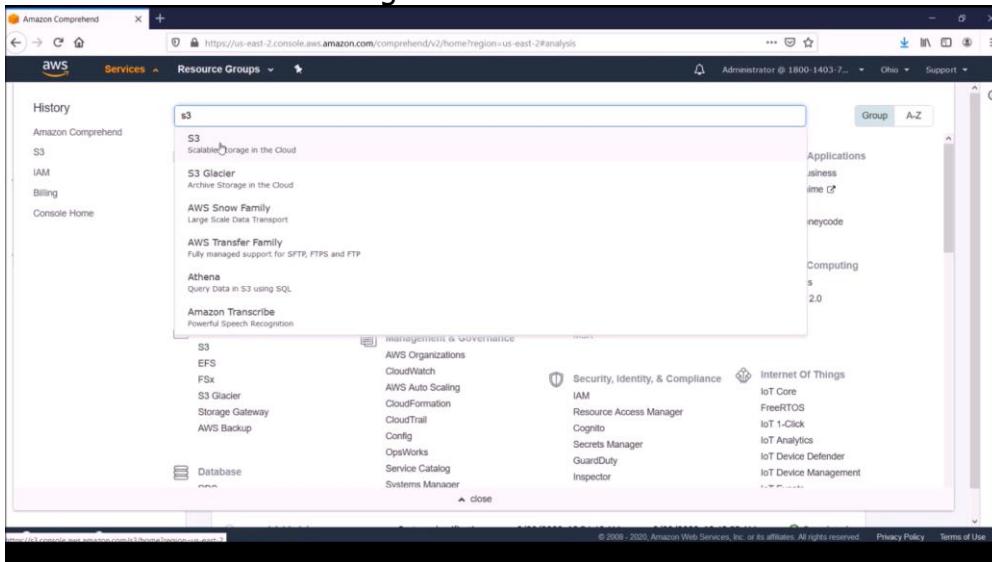
13. Click Create job.



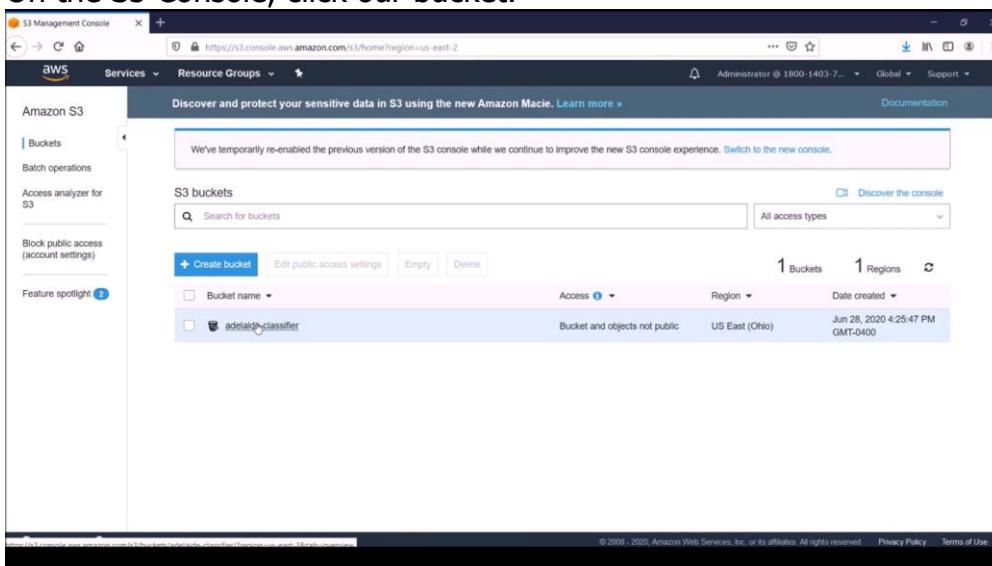
14. Job will be completed.

Analysis jobs (12)						
Name	Analysis type	Start	End	Status		
adelaide	Custom classification	6/29/2020, 1:03:44 AM	6/29/2020, 1:11:53 AM	Completed		
adelaide-job-1	Custom classification	6/29/2020, 12:45:54 AM	6/29/2020, 12:54:13 AM	Completed		
adelaide-job-f	Custom classification	6/29/2020, 12:45:19 AM	6/29/2020, 12:51:26 AM	Completed		
adelaide-job-e	Custom classification	6/29/2020, 12:45:12 AM	6/29/2020, 12:53:20 AM	Completed		
adelaide-job-d	Custom classification	6/29/2020, 12:45:04 AM	6/29/2020, 12:51:29 AM	Completed		
adelaide-job-c	Custom classification	6/29/2020, 12:45:53 AM	6/29/2020, 12:51:15 AM	Completed		
adelaide-job-b	Custom classification	6/29/2020, 12:44:45 AM	6/29/2020, 12:52:54 AM	Completed		
adelaide-job-a	Custom classification	6/29/2020, 12:44:33 AM	6/29/2020, 12:50:45 AM	Completed		
job-test-error-1	Custom classification	6/29/2020, 12:41:33 AM	6/29/2020, 12:49:42 AM	Completed		

15. Check the result on S3 by clicking Services on the navigation bar and searching for S3. Click S3 Scalable Storage in the Cloud.



16. On the S3 Console, click our bucket.



17. Click the output folder we have created from step 9.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide/?region=us-east-2&tab=overview>. The page title is "adelaide-classifier". The "Overview" tab is selected. A search bar at the top says "Type a prefix and press Enter to search. Press ESC to clear." Below the search bar are buttons for "Upload", "+ Create folder", "Download", and "Actions". The region is set to "US East (Ohio)". The table below shows two items:

Name	Last modified	Size	Storage class
adelaide	–	–	–
yelp_train.csv	Jun 28, 2020 4:26:07 PM GMT-0400	48.1 MB	Standard

18. Click the first option.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide/adelaide/?region=us-east-2&tab=overview>. The page title is "adelaide-classifier". The "Overview" tab is selected. A search bar at the top says "Type a prefix and press Enter to search. Press ESC to clear." Below the search bar are buttons for "Upload", "+ Create folder", "Download", and "Actions". The region is set to "US East (Ohio)". The table below shows two items:

Name	Last modified	Size	Storage class
180014037255-CLN-7dc77c7a810470d6396eab03712a2a06	–	–	–
.write_access_check_file.temp	Jun 29, 2020 1:03:48 AM GMT-0400	0 B	Standard

19. Click the output folder.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide/180014037255-CLN-7dc77c7a810470d6396eab03712a2a06>. The left sidebar shows the bucket 'adelaide-classifier'. The main area is titled 'Overview' and shows a single item named 'output'. Below the item, there are buttons for 'Upload', 'Create folder', 'Download', and 'Actions'. The location 'US East (Ohio)' is indicated. At the bottom, there are links for 'Feedback' and 'English (US)'. A note at the bottom right says '© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use'.

20. Download the .gz file for analysis.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide/180014037255-CLN-7dc77c7a810470d6396eab03712a2a06/output>. The left sidebar shows the bucket 'adelaide-classifier'. The main area shows the 'output' folder. A modal window is open for the file 'output.tar.gz'. The modal has tabs for 'Latest version' and 'Previous versions'. The 'Latest version' tab is selected, showing the file's details: Key: output.tar.gz, Size: 498.5 KB, Last modified: Jun 29, 2020 1:09:49 AM GMT-0400. It also shows the Object URL: <https://adelaide-classifier.s3-us-east-2.amazonaws.com/adelaide/180014037255-CLN-7dc77c7a810470d6396eab03712a2a06/output/output.tar.gz>. Below the modal, there are tabs for 'Properties', 'Storage class', 'Encryption', and 'Metadata'. The 'Properties' tab shows the following values: Storage class: Standard, Encryption: AWS-KMS, Metadata: 1, Tags: 0, Object Lock: Disabled. The location 'US East (Ohio)' is indicated. At the bottom, there are links for 'Feedback' and 'English (US)'. A note at the bottom right says '© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use'.

21. Now it's your turn! Let's apply what we've just learned about AWS Comprehend.



Part 3: Getting Started Using the Amazon Comprehend Console



Amazon Comprehend

Learning Objective:

C. Create Sentiment Analysis Task Using the Console

Adelaide 2020 MM&AI

Create a Sentiment Analysis Task Using the Console

1. On the AWS Comprehend Console, on the left menu, click Analysis jobs.

The screenshot shows the AWS Comprehend console interface. The left sidebar has 'Real-time analysis' selected under 'Amazon Comprehend'. The main content area is titled 'Real-time analysis' and contains two sections: 'Real-time analysis with built-in models' and 'Custom real-time analysis with endpoint'. At the bottom, there are fields for 'Input text' (with 'Supported languages' dropdown) and 'Analysis type' (radio button for 'Built-in'). A small modal window titled 'Learn more' is open, providing information about indexing unstructured text with Amazon Comprehend in an Elasticsearch Service domain.

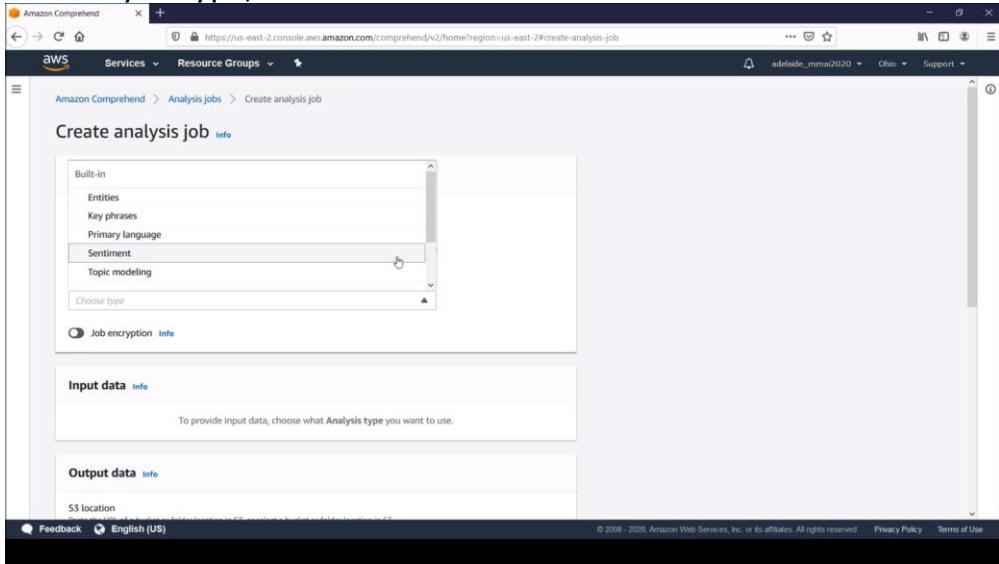
2. Click Create job.

The screenshot shows the 'Analysis jobs' section of the Amazon Comprehend console. On the left, there's a navigation menu with options like 'Real-time analysis', 'Analysis jobs', 'Customization', 'Custom classification', 'Custom entity recognition', and 'Amazon Comprehend Medical'. The main area displays a table titled 'Analysis jobs (14)'. The columns are 'Name', 'Analysis type', 'Start', 'End', and 'Status'. The status column includes icons for 'Stop requested' (a circle with a diagonal line), 'Completed' (a green checkmark), and 'Running' (a blue circle). The table lists 14 entries, all of which are completed. At the top right of the table, there are buttons for 'Stop', 'Copy', and 'Create job'.

3. Under Job settings, give the job a name. The name must be unique within the region and account.

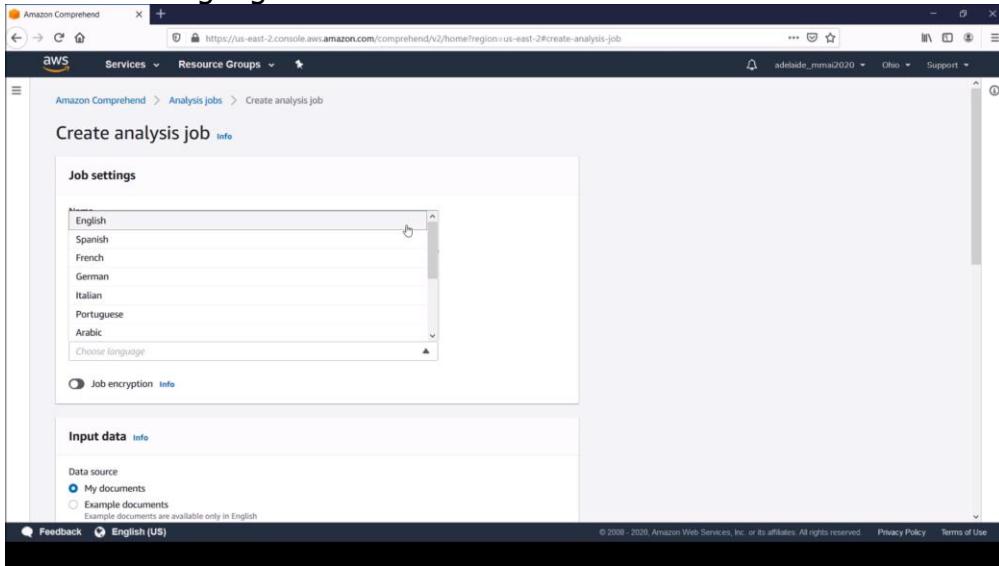
The screenshot shows the 'Create analysis job' page. The first section, 'Job settings', has a 'Name' field containing 'adelaide-sentiment-3'. Below it is a note about valid character ranges. The 'Analysis type' section has a dropdown set to 'Choose type'. The 'Job encryption' section has a radio button selected for 'Job encryption'. The 'Input data' section contains a note about choosing an analysis type. The 'Output data' section is currently empty. The bottom of the page includes standard AWS footer links for 'Feedback', 'English (US)', and 'Privacy Policy'.

4. For Analysis type, choose sentiment.



You can also select other task such as Entities, Key phrases, Primary language, or Topic modeling.

5. Select the language.



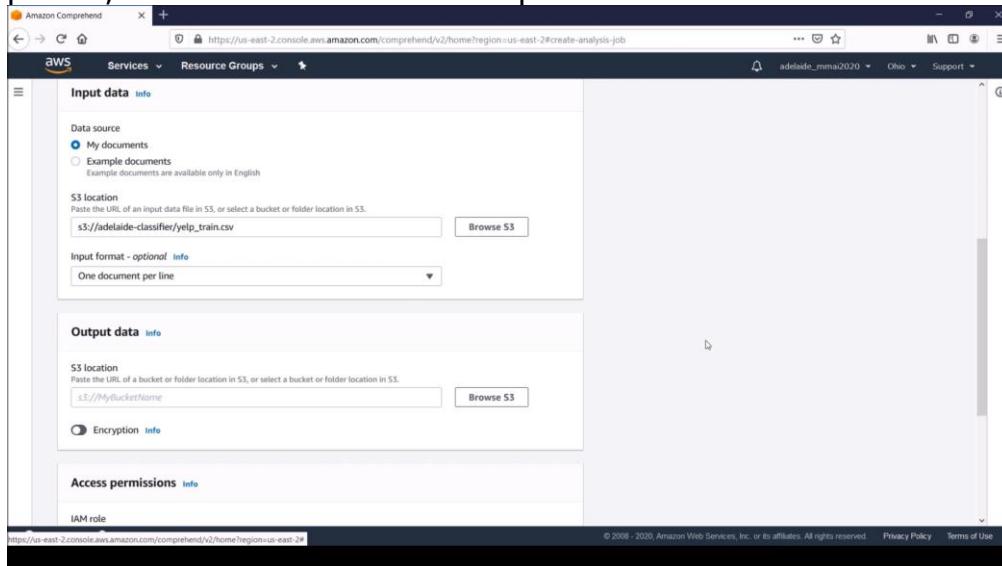
6. If you want to encrypt the data in the storage volume while your training job is being processed, choose Classifier encryption and then choose whether to use a KMS key associated with your current account, or one from another account.
- If you are using a key associated with the current account, choose the key ID for KMS key ID.
 - If you are using a key associated with a different account, enter the ARN for the key ID under KMS key ARN.

7. Choose the data source to use, click Browse S3. You can use either sample data or you can analyze your own data stored in an Amazon S3 bucket.

If you choose to use your own data, provide the following information:

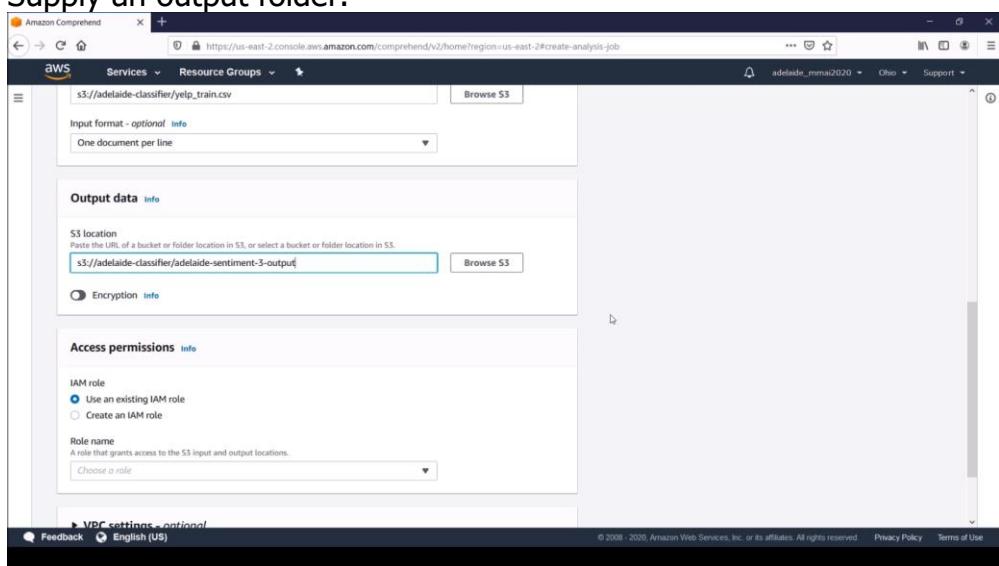
S3 data location – An Amazon S3 data bucket that contains the documents to analyze. You can choose the folder icon to browse to the location of your data. The bucket must be in the same region as the API that you are calling.

Input format – Optionally choose whether input data is contained in one document per file, or if there is one document per line in a file.



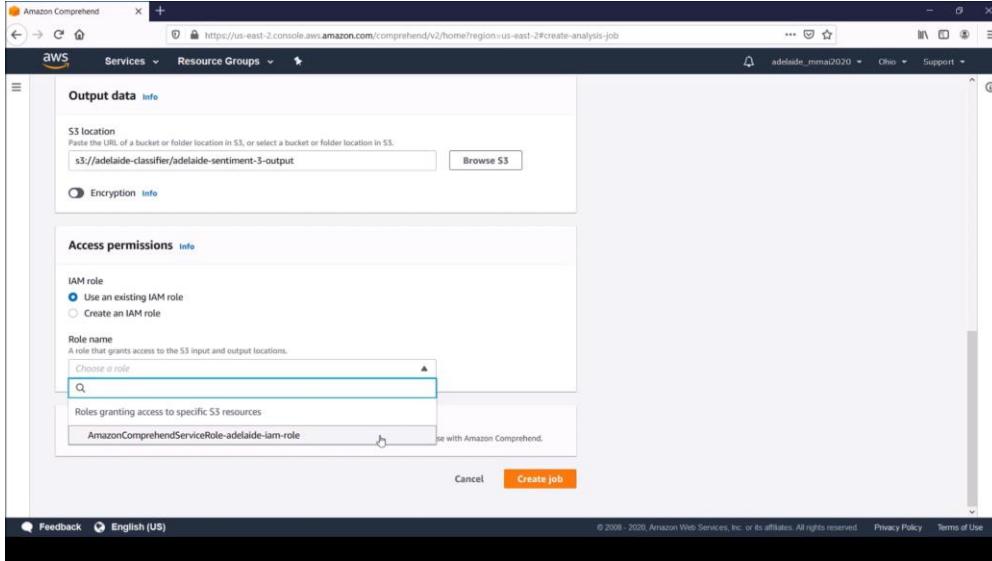
8. Supply an output data location, click Browse S3.

Supply an output folder.



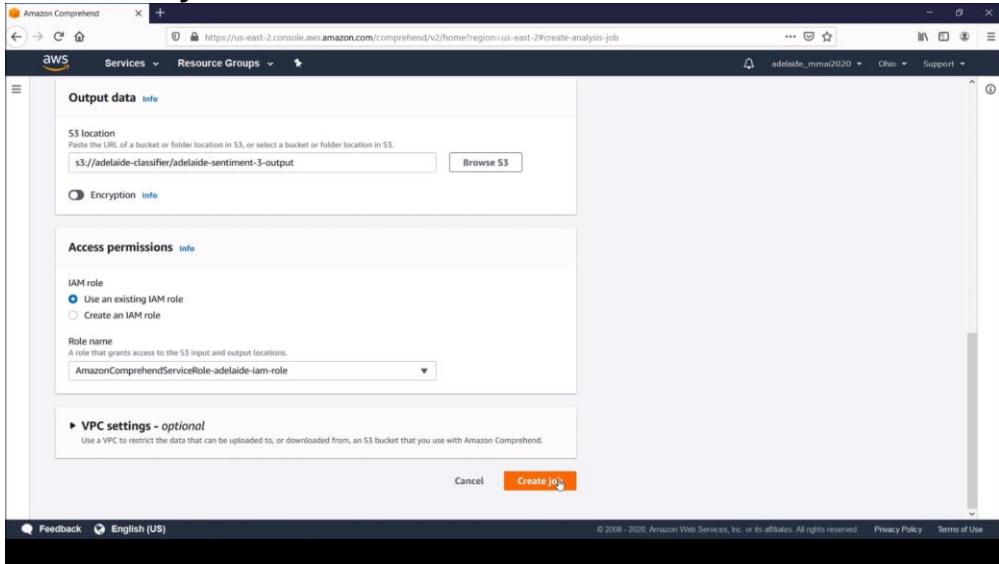
9. If you choose to encrypt the output result from your job, choose Encryption and then choose whether to use a KMS key associated with the current account, or one from another account.
- If you are using a key associated with the current account, choose the key alias or ID for KMS key ID.
 - If you are using a key associated with a different account, enter the ARN for the key alias or ID under KMS key ID.

10. Select the IAM role.

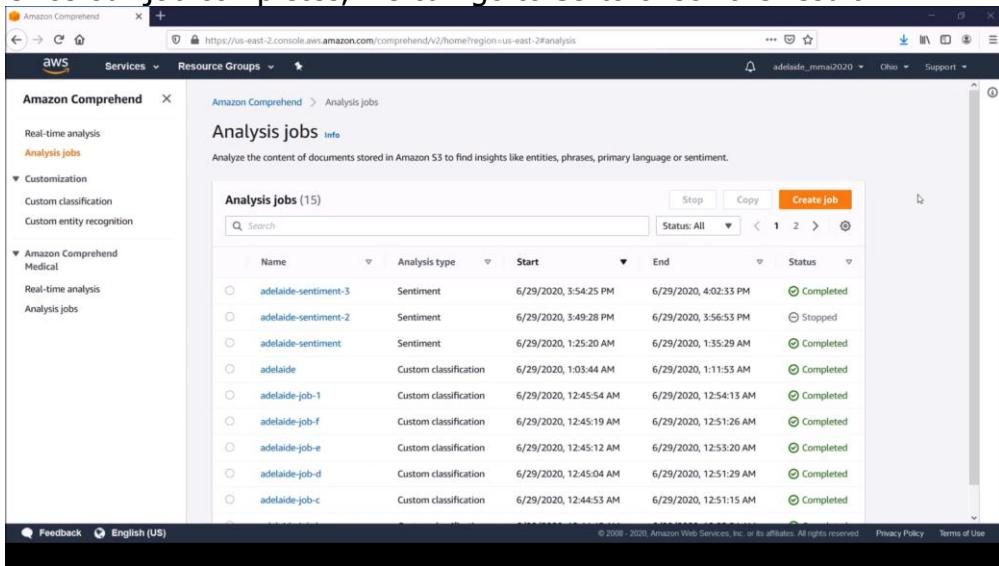


11. To launch your resources into AWS Comprehend from a VPC (Virtual Private Cloud), enter the VPC ID under VPC or choose the ID from the drop-down list.
- Choose the subnet under Subnet(s). After you select the first subnet, you can choose additional ones.
 - Under Security Group(s), choose the security group to use if you specified one. After you select the first security group, you can choose additional ones.

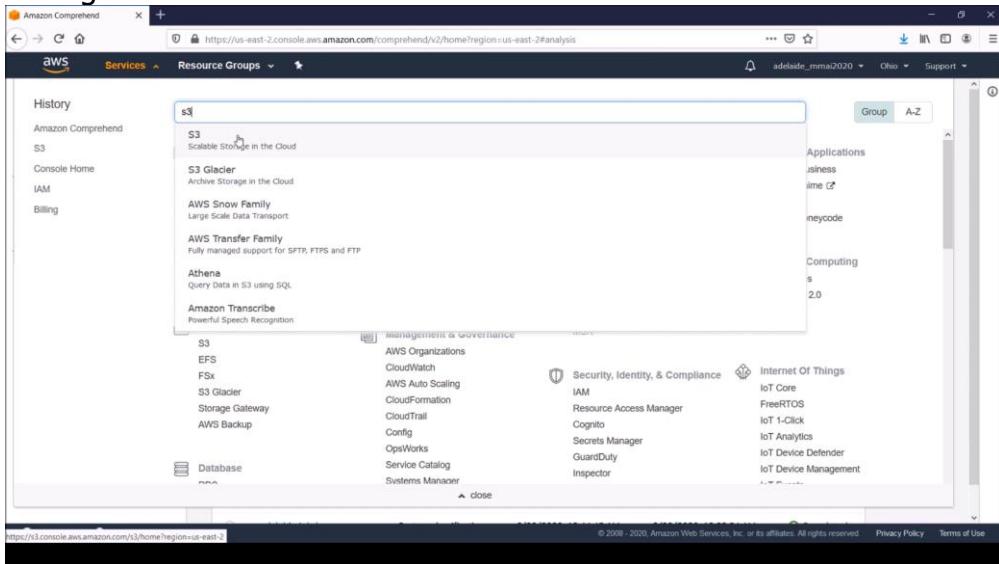
12. Click Create job.



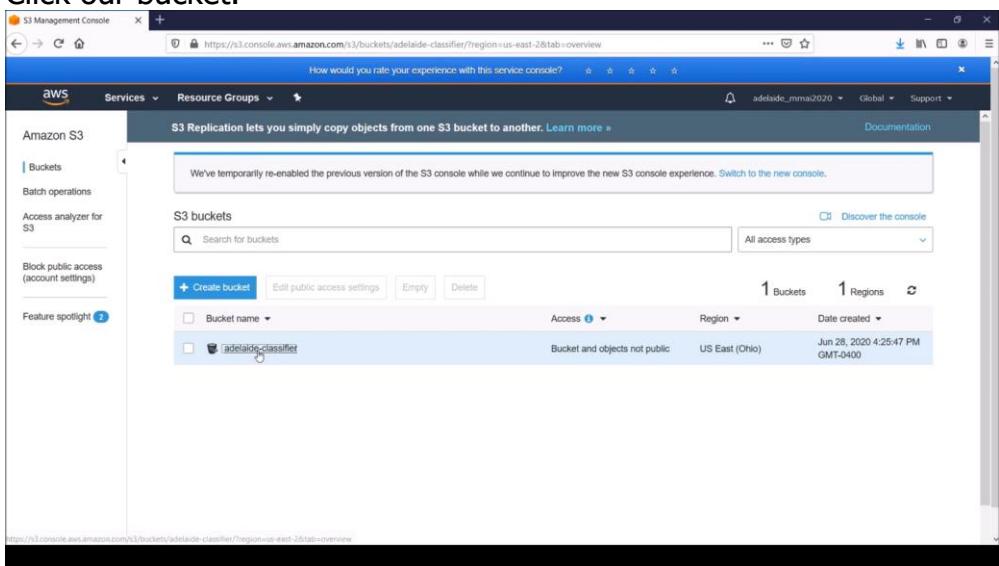
13. Once our job completes, we can go to S3 to check the result.



14. On the navigation bar, click on Services, search for s3, click on S3 Scalable Storage in the Cloud.



15. Click our bucket.



16. Click our output folder from step 8.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide-sentiment-3-output/?region=us-east-2&tab=overview>. The page title is "How would you rate your experience with this service console?". The top navigation bar includes "Services", "Resource Groups", and "Global". The main navigation bar shows "Amazon S3 > adelaide-classifier". The left sidebar shows the bucket name "adelaide-classifier". The "Overview" tab is selected. The main content area displays the contents of the "adelaide-sentiment-3-output" folder. The folder structure is as follows:

- adelaide-sentiment-3-output (Folder)
- adelaide (Folder)
- yelp_train.csv (File)

Details for the "adelaide-sentiment-3-output" folder:

- Name: adelaide-sentiment-3-output
- Last modified: --
- Size: --
- Storage class: --

Details for the "yelp_train.csv" file:

- Name: yelp_train.csv
- Last modified: Jun 28, 2020 4:26:07 PM GMT-0400
- Size: 48.1 MB
- Storage class: Standard

At the bottom of the page, there are links for "Feedback", "English (US)", and "© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use".

17. Click the first option.

The screenshot shows the AWS S3 Management Console interface, similar to the previous one. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide-sentiment-3-output/?region=us-east-2&tab=overview>. The page title is "How would you rate your experience with this service console?". The top navigation bar includes "Services", "Resource Groups", and "Global". The main navigation bar shows "Amazon S3 > adelaide-classifier > adelaide-sentiment-3-output". The left sidebar shows the bucket name "adelaide-classifier". The "Overview" tab is selected. The main content area displays the contents of the "adelaide-sentiment-3-output" folder. The folder structure is as follows:

- 180014037255-SENTIMENT-e0ed580af92eb50fa93da5dc3079464 (File)
- write_access_check_file.temp (File)

Details for the "180014037255-SENTIMENT-e0ed580af92eb50fa93da5dc3079464" file:

- Name: 180014037255-SENTIMENT-e0ed580af92eb50fa93da5dc3079464
- Last modified: --
- Size: --
- Storage class: --

Details for the "write_access_check_file.temp" file:

- Name: write_access_check_file.temp
- Last modified: Jun 29, 2020 3:54:28 PM GMT-0400
- Size: 0 B
- Storage class: Standard

At the bottom of the page, there are links for "Feedback", "English (US)", and "© 2008 - 2020, Amazon Web Services, Inc. or its affiliates. All rights reserved. Privacy Policy Terms of Use".

18. Click the output folder.

The screenshot shows the AWS S3 Management Console interface. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide-sentiment-3-output/180014037255-SENTIMENT-e0ed580a8f92eb50a93da5dc307d464>. The page displays the contents of the 'output' folder within the 'adelaide-sentiment-3-output' bucket. The folder contains a single item named 'output'. The console includes standard navigation and search features, along with buttons for Upload, Create folder, Download, and Actions.

19. Download the .gz file for analysis.

The screenshot shows the AWS S3 Management Console interface, similar to the previous one but focusing on a specific file. The URL in the address bar is <https://s3.console.aws.amazon.com/s3/buckets/adelaide-classifier/adelaide/180014037255-CLN-7dc77c7a810470d6396eab03712a2a06/output>. A modal window is open for the file 'output.tar.gz'. The modal provides detailed information about the object, including its key ('output.tar.gz'), size (498.5 KB), storage class (Standard), and encryption status (AWS-KMS). It also shows the object URL (<https://adelaide-classifier.s3-us-east-2.amazonaws.com/adelaide/180014037255-CLN-7dc77c7a810470d6396eab03712a2a06/output/output.tar.gz>). The main S3 interface shows the 'output' folder containing the 'output.tar.gz' file.

20. Now it's your turn! Let's apply what we've just learned about AWS Comprehend.

Part 4: Getting Started Using the AWS Comprehend API



Part 4: Getting Started Using the AWS Comprehend API



Amazon Comprehend

Learning Objective:

A. Detecting the Dominant Language



Adelaide 2020 MHAI

1. On Jupyter, import boto3 (see Appendix III: Install boto3).

```
In [1]: 1 import boto3
```

2. Create an instance of boto3 (see Appendix II: Creating an AWS Comprehend Access Key).

```
In [2]: 1 comprehend = boto3.client('comprehend',
                                region_name='us-east-2',
                                aws_access_key_id="AKIAST2NMHED6F25KTJL",
                                aws_secret_access_key="cD8hlkYKEx8UuccJ1pxconMS7ANDDgyMGSJI7Wrp")
```

3. Define a text variable.

```
In [3]: 1 sample_tweet="It's always great when I can randomly put my equestrian knowledge to good use at work! Queen's University!"
```

4. Call the detect_dominant_language() method of boto3.

```
In [4]: 1 dom_lang = comprehend.detect_dominant_language(Text=sample_tweet)
2 print(dom_lang)
```

```
{"Languages": [{"LanguageCode": "en", "Score": 0.9916251301765442}], "ResponseMetadata": {"RequestId": "34603609-623a-49dd-96f4-030e0dfafddd", "HTTPStatusCode": 200, "HTTPHeaders": {"x-amzn-requestid": "34603609-623a-49dd-96f4-030e0dfafddd", "content-type": "application/x-amz-json-1.1", "content-length": "64", "date": "Wed, 08 Jul 2020 03:54:00 GMT"}, "RetryAttempts": 0}}
```



Part 4: Getting Started Using the AWS Comprehend API



Amazon Comprehend

Learning Objective:

B. Detecting the Named Entities

Adelaide 2020 MHAI

1. On Jupyter, import boto3 (see Appendix III: Install boto3).

```
In [1]: 1 import boto3
```

2. Create an instance of boto3 (see Appendix II: Creating an AWS Comprehend Access Key).

```
In [2]: 1 comprehend = boto3.client('comprehend',
                                region_name='us-east-2',
                                aws_access_key_id="AKIAST2NMHED6F25KTJL",
                                aws_secret_access_key="cD8hlkYKEx8UuccJ1pxconMS7ANDDgyMgsJI7Wrp")
```

3. Define a text variable.

```
In [3]: 1 sample_tweet="It's always great when I can randomly put my equestrian knowledge to good use at work! Queen's University!"
```

4. Call the detect_entities() method of boto3.

```
In [6]: 1 entities = comprehend.detect_entities(Text=sample_tweet, LanguageCode='en')
2
3 print('----- entity : entity type -----')
4 for i in range(0, len(entities['Entities'])):
5     print(entities['Entities'][i]['Text'] + ' : ' + entities['Entities'][i]['Type'])

----- entity : entity type -----
Queen's University : ORGANIZATION
```



Part 4: Getting Started Using the AWS Comprehend API



Amazon Comprehend

Learning Objective:

C. Detecting Key Phrases



Adelaide 2020 MHAI

1. On Jupyter, import boto3 (see Appendix III: Install boto3).

```
In [1]: 1 import boto3
```

2. Create an instance of boto3 (see Appendix II: Creating an AWS Comprehend Access Key).

```
In [2]: 1 comprehend = boto3.client('comprehend',
                                region_name='us-east-2',
                                aws_access_key_id="AKIAST2NMHED6F25KTJL",
                                aws_secret_access_key="cD8hlkYKEx8UuccJ1pxconMS7ANDDgyMGSJI7Wrp")
```

3. Define a text variable.

```
In [3]: 1 sample_tweet="It's always great when I can randomly put my equestrian knowledge to good use at work! Queen's University!"
```

4. Call the detect_key_phrases() method of boto3.

```
In [5]: 1 # Key phrases
2 phrases = comprehend.detect_key_phrases(Text=sample_tweet, LanguageCode='en')
3
4 # Print the phrases:
5 print('----- phrases -----')
6 for i in range(0, len(phrases['KeyPhrases'])):
7     print((phrases['KeyPhrases'][i]['Text']))
```

```
----- phrases -----
my equestrian knowledge
good use
work
Queen
University
```



Part 4: Getting Started Using the AWS Comprehend API



Amazon Comprehend

Learning Objective:

D. Detecting Sentiment



Adelaide 2020 MHAI

1. On Jupyter, import boto3 (see Appendix III: Install boto3).

```
In [1]: 1 import boto3
```

2. Create an instance of boto3 (see Appendix II: Creating an AWS Comprehend Access Key).

```
In [2]: 1 comprehend = boto3.client('comprehend',
                                region_name='us-east-2',
                                aws_access_key_id="AKIAST2NMHED6F25KTJL",
                                aws_secret_access_key="cD8hlkYKEx8OuccJ1pxconMS7ANDDgyMgsJI7Wrp")
```

3. Define a text variable.

```
In [3]: 1 sample_tweet="It's always great when I can randomly put my equestrian knowledge to good use at work! Queen's University!"
```

4. Call the detect_sentiment() method of boto3.

```
In [7]: 1 sentiments = comprehend.detect_sentiment(Text=sample_tweet, LanguageCode='en')
2
3 print('----- sentiment -----')
4 print(sentiments['Sentiment'])
```

```
----- sentiment -----
POSITIVE
```



Part 4: Getting Started Using the AWS Comprehend API



Amazon Comprehend

Learning Objective:

E. Detecting Syntax

Adelaide 2020 MHAI

1. On Jupyter, import boto3 (see Appendix III: Install boto3).

```
In [1]: 1 import boto3
```

2. Create an instance of boto3 (see Appendix II: Creating an AWS Comprehend Access Key).

```
In [2]: 1 comprehend = boto3.client('comprehend',
                                region_name='us-east-2',
                                aws_access_key_id="AKIAST2NMHED6F25KTJL",
                                aws_secret_access_key="cD8hlkYKEx8UuccJ1pxconMS7ANDDgyMgsJI7Wrp")
```

3. Define a text variable.

```
In [3]: 1 sample_tweet="It's always great when I can randomly put my equestrian knowledge to good use at work! Queen's University!"
```

4. Call the detect_syntax() method of boto3.

```
In [8]: 1 #Syntax
2 syntax = comprehend.detect_syntax(Text=sample_tweet, LanguageCode='en')
3
4 print('-----syntax-----')
5 print(syntax)
```

```
-----syntax-----
{"SyntaxTokens": [{"TokenId": 1, "Text": "It", "BeginOffset": 0, "EndOffset": 2, "PartOfSpeech": {"Tag": "PRON", "Score": 0.99947547912598}}, {"TokenId": 2, "Text": "s", "BeginOffset": 2, "EndOffset": 4, "PartOfSpeech": {"Tag": "VERB", "Score": 0.999566282081604}}, {"TokenId": 3, "Text": "always", "BeginOffset": 5, "EndOffset": 11, "PartOfSpeech": {"Tag": "ADV", "Score": 0.999983310699463}}, {"TokenId": 4, "Text": "great", "BeginOffset": 12, "EndOffset": 17, "PartOfSpeech": {"Tag": "ADJ", "Score": 0.9972237348556519}}, {"TokenId": 5, "Text": "when", "BeginOffset": 18, "EndOffset": 22, "PartOfSpeech": {"Tag": "ADV", "Score": 0.9999743700027466}}, {"TokenId": 6, "Text": "I", "BeginOffset": 23, "EndOffset": 24, "PartOfSpeech": {"Tag": "PRON", "Score": 0.9999840093612671}}, {"TokenId": 7, "Text": "can", "BeginOffset": 25, "EndOffset": 28, "PartOfSpeech": {"Tag": "AUX", "Score": 0.9999958276748657}}, {"TokenId": 8, "Text": "randomly", "BeginOffset": 29, "EndOffset": 37, "PartOfSpeech": {"Tag": "ADV", "Score": 0.99999582711639404}}, {"TokenId": 9, "Text": "put", "BeginOffset": 38, "EndOffset": 41, "PartOfSpeech": {"Tag": "VERB", "Score": 0.9999991655349731}}, {"TokenId": 10, "Text": "my", "BeginOffset": 42, "EndOffset": 44, "PartOfSpeech": {"Tag": "PRON", "Score": 0.99999688863754272}}, {"TokenId": 11, "Text": "equestrian", "BeginOffset": 45, "EndOffset": 55, "PartOfSpeech": {"Tag": "ADJ", "Score": 0.8308550715446472}}, {"TokenId": 12, "Text": "knowledge", "BeginOffset": 56, "EndOffset": 65, "PartOfSpeech": {"Tag": "NOUN", "Score": 0.9999425411224365}}, {"TokenId": 13, "Text": "to", "BeginOffset": 66, "EndOffset": 68, "PartOfSpeech": {"Tag": "ADP", "Score": 0.9506584405899048}}, {"TokenId": 14, "Text": "good", "BeginOffset": 69, "EndOffset": 73, "PartOfSpeech": {"Tag": "ADJ", "Score": 0.9889143109321594}}, {"TokenId": 15, "Text": "use", "BeginOffset": 74, "EndOffset": 77, "PartOfSpeech": {"Tag": "NOUN", "Score": 0.9988011121749878}}, {"TokenId": 16, "Text": "at", "BeginOffset": 78, "EndOffset": 80, "PartOfSpeech": {"Tag": "ADP", "Score": 0.9999999999999999}}]
```

Part D: Trivia Questions



Amazon Comprehend

Level 1 Questions: AWS Comprehend



Adelaide 2020 MM&AI



What is not a most common use case of Amazon Comprehend?



Amazon Comprehend

- a. Voice of customer analytics
- b. Identifying the main topics from a library of documents
- c. Semantic search
- d. Knowledge management and discovery



Correct answer:

- b. Identifying the main topics from a library of documents



AWS Comprehend allows import or use of a developer's custom NLP model.



Amazon Comprehend

- a. Yes
- b. No



Correct answer:

b. No



What security measures does Amazon Comprehend have?



Amazon Comprehend

- a. Requests to the API and console are made over a secure (SSL) connection
- b. Comprehend utilizes a checksum which ensures that no one tampers with the contents of a message and prevents a malevolent actor from intercepting a legitimate service call and changing it to perform an unacceptable action
- c. Focused on stopping threats at the perimeter of the data center



Correct Answer:

- a. Requests to the API and console are made over a secure (SSL) connection



Which of the following do you need to manage with Amazon Comprehend?



Amazon Comprehend

- a. Scaling of resources
- b. Code
- c. Training data set
- d. None of the above



Adelaide 2020 MM&AI

Correct Answer:

d. None of the above



Which metric best tells if Amazon Comprehend is giving accurate results?



Amazon Comprehend

- a. Accuracy score
- b. F1 score
- c. Confidence score
- d. Logarithmic score

Adelaide 2020 MM&AI

Correct answer:

c. Confidence score



Amazon Comprehend

Congratulations!
You have completed Level 1.



Adelaide 2020 MM&AI



Amazon Comprehend

Level 2 Questions: General AWS



Adelaide 2020 MM&AI



This AWS service includes EC2, Elastic Beanstalk, Lambda, Auto-Scaling and Lightsat.



Amazon Comprehend

- a. Computing
- b. Storage
- c. Networking



Correct answer:

- a. Computing



This AWS service includes S3, Glacier, Elastic Block Storage, Elastic File System.



Amazon Comprehend

a. Computing

b. Networking

c. Storage



Adelaide 2020 MM&AI

Correct answer:

c. Storage



In AWS, what is auto-scaling?



Amazon Comprehend

- a. A concept where businesses can show personalized content to their audience based on their geographic location without changing the URL
- b. Helps to create customized content for the audience of a specific geographical area, keeping their needs in the forefront
- c. A function that allows you to provision and launch new instances whenever there is a demand



Adelaide 2020 MM&AI

Correct answer:

- c. A function that allows you to provision and launch new instances whenever there is a demand



What is not an instance in EC2?



Amazon Comprehend

- a. On-demand Instance
- b. Execution Instance
- c. Spot Instance
- d. Reserved Instance

Correct answer:

b. Execution Instance



What is true about an IAM role?



Amazon Comprehend

- a. It defines a set of permissions for making AWS service requests
- b. It has full access to all the AWS IAM functionalities
- c. It is used to interact with the AWS services directly



Adelaide 2020 MM&AI

Correct answer:

- a. It defines a set of permissions for making AWS service requests



Amazon Comprehend

Congratulations!
You have completed Level 2.



Adelaide 2020 MM&AI



Amazon Comprehend

Level 3 Questions: Advanced



Adelaide 2020 NLP4AI



You are a Machine Learning Engineer who is on the lookout for a solution that will discover sensitive information that your enterprise stores in AWS and then use NLP to classify the data and provide business-related insights. Which among the services would you choose?



Amazon Comprehend

- a. Firewall Manager
- b. IAM
- c. Macie
- d. CloudHSM



Correct answer:

c. Macie



Suppose you are a game designer and want to develop a game with single-digit millisecond latency, which of the following database services would you use?



Amazon Comprehend

- a. RDS
- b. Neptune
- c. Snowball
- d. DynamoDB



Correct answer:

d. DynamoDB



If you need to perform real-time monitoring of AWS services and get actionable insights, which service would you use?



Amazon Comprehend

- a. CloudWatch
- b. GuardDuty
- c. Firewall Manager
- d. EBS

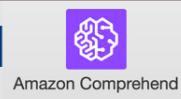


Correct answer:

- a. CloudWatch



As a web developer, you are developing an app, targeted especially for the mobile platform. Which of the following lets you add user sign-up, sign-in, and access control to your web and mobile apps quickly and easily?



- a. Shield
- b. Macie
- c. Inspector
- d. Cognito



Correct answer:

d. Cognito



You are a Machine Learning engineer and you are looking for a service that helps you build and train Machine Learning models in AWS. Which among the following is being referred to?



Amazon Comprehend

- a. SageMaker
- b. DeepLens
- c. Comprehend
- d. Device Farm



Correct answer:

- a. SageMaker



Amazon Comprehend

Congratulations!
You have completed Level 3.

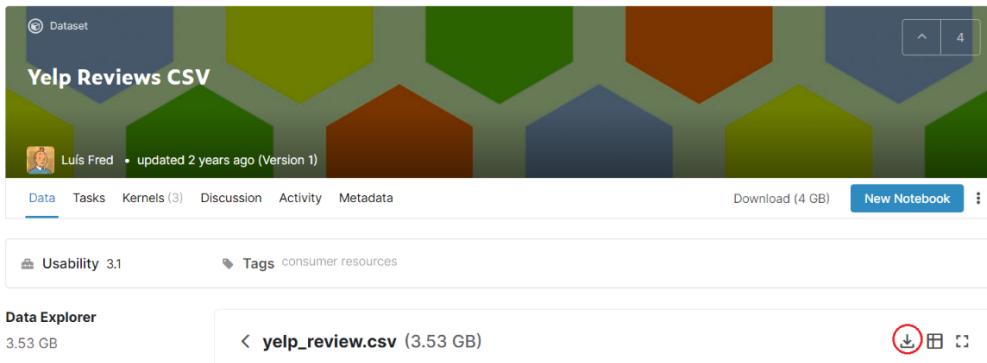


Adelaide 2020 MM&AI

Part E: Appendix

The screenshot shows a presentation slide with a dark blue header and footer. The header features the AWS logo on the left and the Amazon Comprehend logo with the text 'Amazon Comprehend' on the right. The main title 'Appendix I: Download the Yelp Dataset' is centered in a large, bold, dark blue font. Below the title, there is a section header 'A. Download the Yelp Dataset'. At the bottom of the slide, there is a navigation bar with several icons and the text 'Adelaide 2020 MHAI'.

1. Go to <https://www.kaggle.com/luisfredgs/yelp-reviews-csv>
2. Click on download



3. The file is about 3.53 gigabytes.



Appendix I: Download the Yelp Dataset



Amazon Comprehend

B. Prepare the train and test data sets using Python/Jupyter

Adelaide 2020 MHAI

1. Import the libraries.

```
In [1]: 1 import pandas as pd  
2 import numpy as np  
3 from sklearn.model_selection import train_test_split
```

2. Read the file.

```
In [2]: 1 df = pd.read_csv('yelp_reviews_bal.csv')
```

3. Drop the fields that are not needed.

```
In [4]: 1 df = df.drop(['business_id', 'date', 'review_id',  
2 'type', 'user_id', 'cool', 'useful', 'funny'], axis=1)
```

4. Remove records having "stars" of 3 and 4.

```
In [5]: 1 df = df.drop(df[(df.stars == 3) | (df.stars == 4)].index)
```

5. Rename the "stars" feature to "sentiment".

```
In [6]: 1 df = df.rename(columns={'stars': 'sentiment'})
```

6. Update records with "sentiment" of 5 to 1, else 0.

```
In [7]: 1 df['sentiment'] = np.where(df['sentiment'] == 5, 1, 0)
```

7. Split the dataset to train and test sets.

```
In [9]: 1 train, test = train_test_split(df, test_size=0.2)
```

8. Save the train and test sets to CSV files.

```
In [10]: 1 train.to_csv('yelp_train.csv', index=False)
```

```
In [11]: 1 test.to_csv('yelp_test.csv', index=False)
```



Appendix II: Creating an AWS Comprehend Access Key

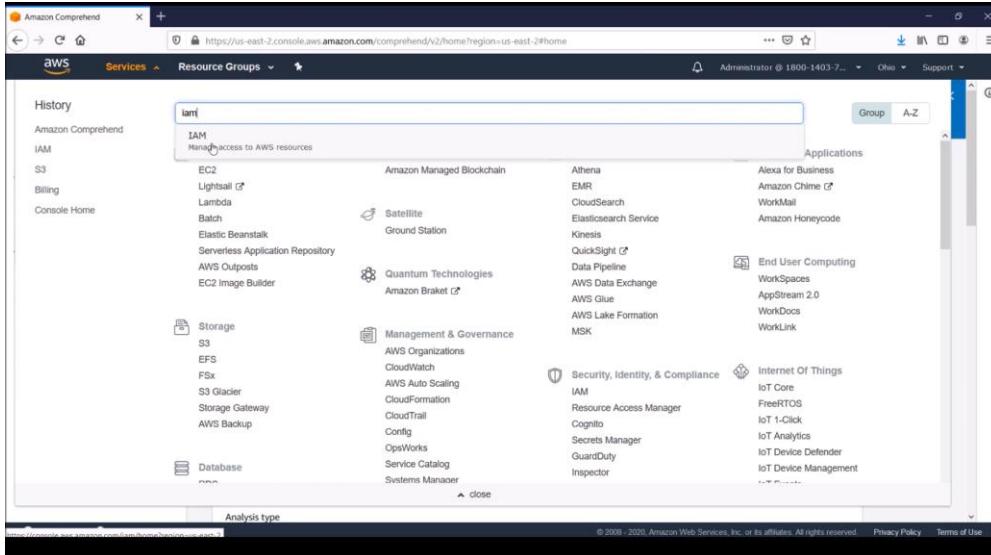


Amazon Comprehend

- A. Generating the Access Key ID**
- B. Generating the Secret Access Key**



1. On the navigation bar, click on Services, search for IAM.



- On the IAM console, on the left-hand menu, click on Users, and click the appropriate user.

- On the Summary page, click the Security credentials tab, click Create access key. Take note of the access key.



Amazon Comprehend

Appendix III: Install boto3

Adelaide 2020 MHAI

1. On the Python or Jupyter prompt: pip install boto3

```
1>pip install boto3
```

2. Wait until the service is installed.

```
Collecting boto3
  Downloading https://files.pythonhosted.org/packages/35/d9/f3606e9f4e23132ba44bfff04aac65
    |
    133kB 595kB/s
Collecting botocore<1.18.0,>=1.17.12 (from boto3)
  Downloading https://files.pythonhosted.org/packages/99/fa/933d9b4205863bdd24ce151bc4cea72
    |
    6.3MB 2.2MB/s
Collecting jmespath<1.0.0,>=0.7.1 (from boto3)
  Downloading https://files.pythonhosted.org/packages/07/cb/5f001272b6faeb23c1c9e0acc04d48e
Collecting s3transfer<0.4.0,>=0.3.0 (from boto3)
  Downloading https://files.pythonhosted.org/packages/69/79/e6afb3d8b0b4e96cefbd690f741d7d
    |
    71kB 1.5MB/s
Requirement already satisfied: urllib3<1.26,>=1.20; python_version != "3.4" in c:\users\fbe
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in c:\users\fbello1\appdata\loca
Requirement already satisfied: docutils<0.16,>=0.10 in c:\users\fbello1\appdata\local\cont
Requirement already satisfied: six>=1.5 in c:\users\fbello1\appdata\local\continuum\anacond
Installing collected packages: jmespath, botocore, s3transfer, boto3
Successfully installed boto3-1.14.12 botocore-1.17.12 jmespath-0.10.0 s3transfer-0.3.3
```

References

6 Unique AWS Features - Why Amazon Web Service is Popular
dzone.com

Amazon Comprehend
[aws.amazon.com](https://aws.amazon.com/comprehend/)

Amazon Comprehend Customers and Partners
[aws.amazon.com](https://aws.amazon.com/comprehend/customers-partners/)

AWS Services List - Top 10 AWS Services
[mindmajix.com](https://www.mindmajix.com/aws-top-10-services)

Comprehend
[boto3.amazonaws.com](https://boto3.amazonaws.com/v1/documentation/api/latest/reference/services/comprehend.html)

Comparison of the Most Useful Text Processing APIs
[activewizards.com](https://www.activewizards.com/tutorials/text-processing-api-comparison/)

Getting Started with Amazon Comprehend
[docs.aws.amazon.com](https://docs.aws.amazon.com/comprehend/latest/dg/getting-started.html)

NLP (Natural Language Processing) Tutorial:
What is, History, Example
[www.guru99.com](https://www.guru99.com/nlp-tutorial.html)

What Is Amazon Comprehend?
[docs.aws.amazon.com](https://docs.aws.amazon.com/comprehend/latest/dg/what-is.html)

What is Amazon S3?
[docs.aws.amazon.com](https://docs.aws.amazon.com/AmazonS3/latest/dev/Welcome.html)

Yelp Reviews CSV
Luis Fred
[www.kaggle.com](https://www.kaggle.com/lfrederick/yelp-dataset)