AWS-Based Fraud Detection Demo

🎯 Objective

Build a lightweight end-to-end skeleton of a fraud detection ML system using AWS services to highlight design bottlenecks that MLOps solves.

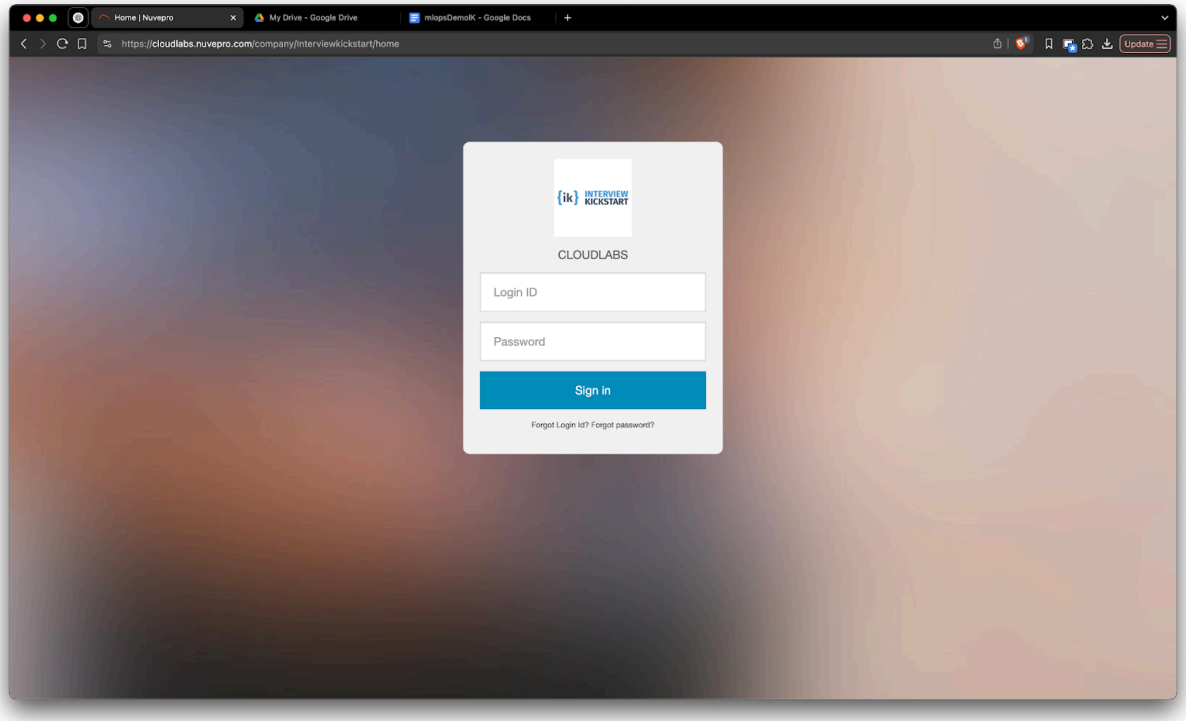
✅ Prerequisites

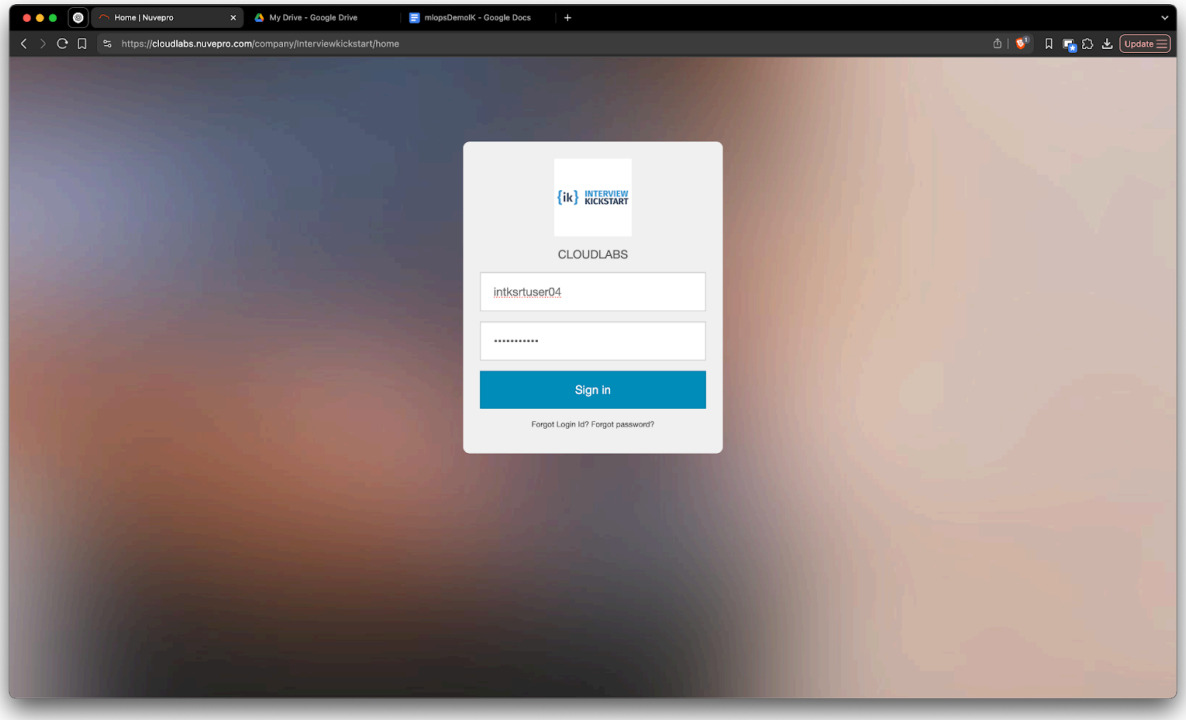
- AWS account with billing enabled
- IAM user with admin or required permissions
- AWS CLI installed and configured
- Python 3.8+ environment (EC2 or local)
- Kaggle account and API token (kaggle.json)

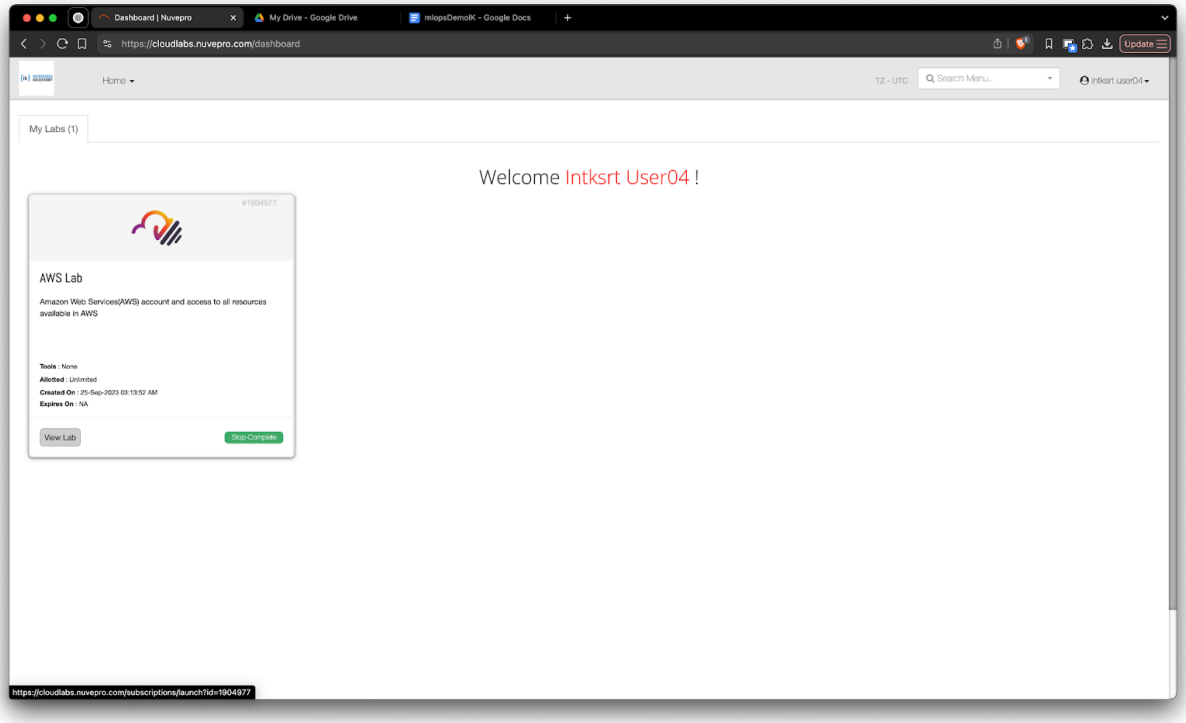
🔐 Step 0: Access AWS Console via Nuvepro

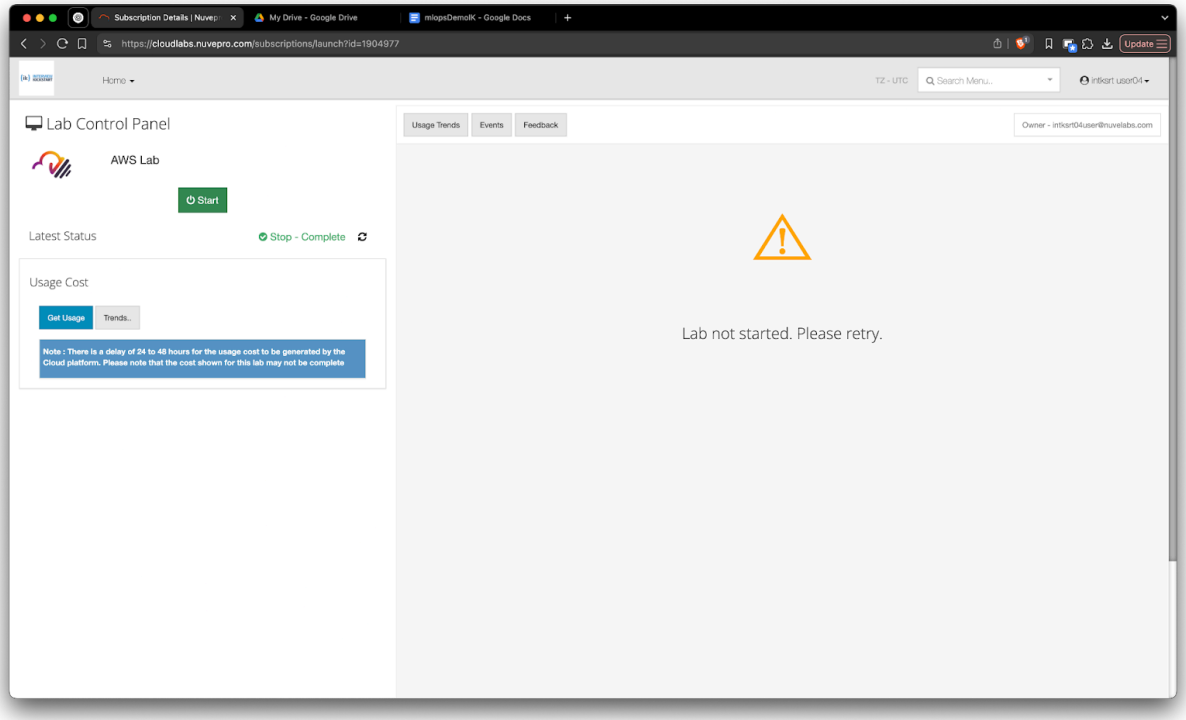
Goal: Begin from the Nuvepro-provided cloud lab environment

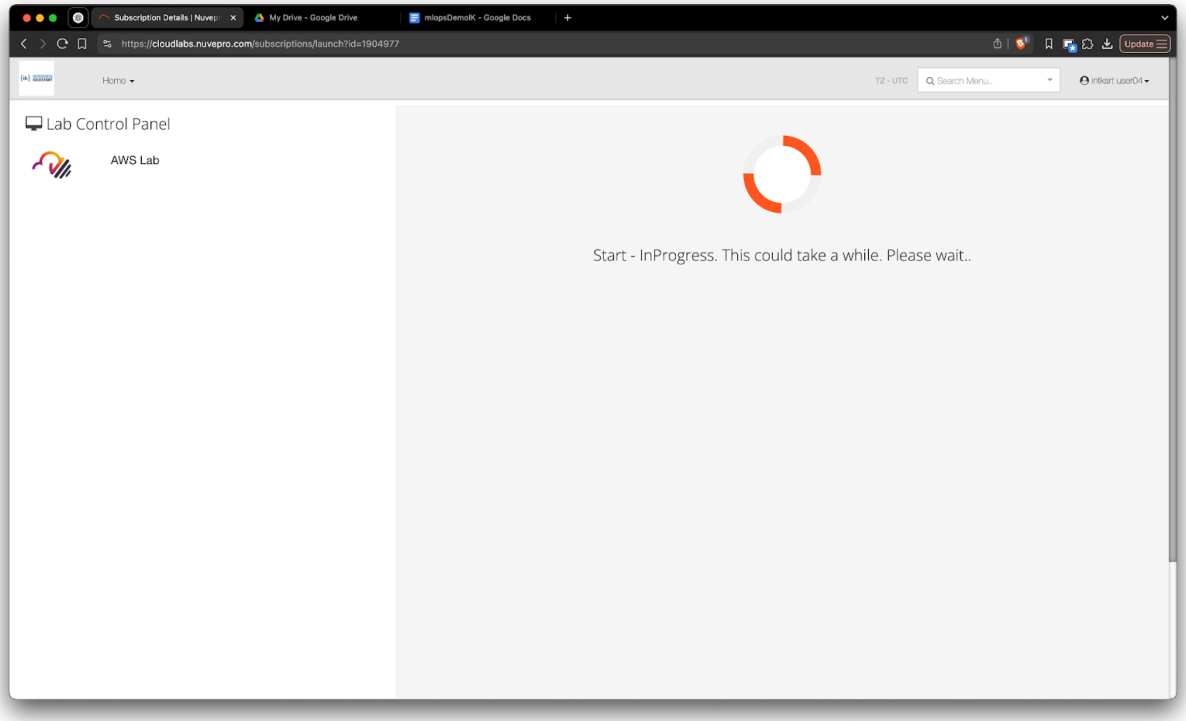
1. Log in to your Nuvepro account.
2. Navigate to the lab dashboard.
3. Click on the assigned AWS environment.
4. Use provided credentials or direct link to access the AWS Console.

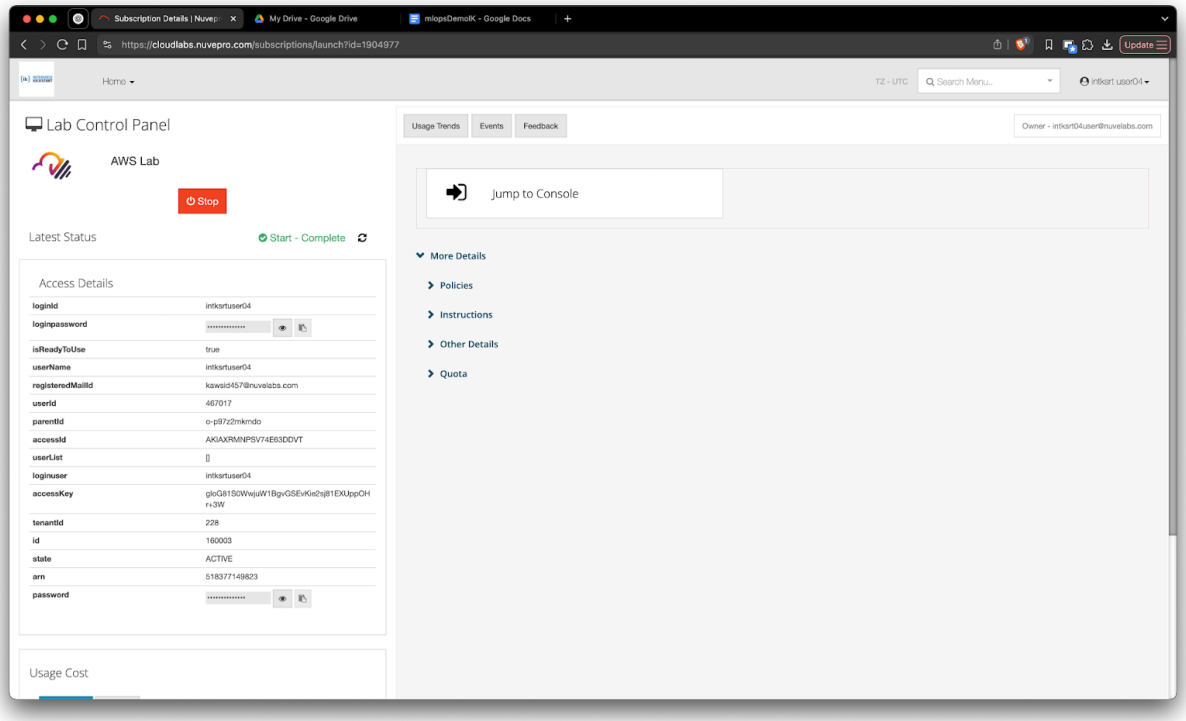

Home | Nuvepro
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/company/interviewkickstart/home
Update
{ik} INTERVIEW KICKSTART
CLOUDLABS
Login ID
Password
Sign in
Forgot Login Id? Forgot password?

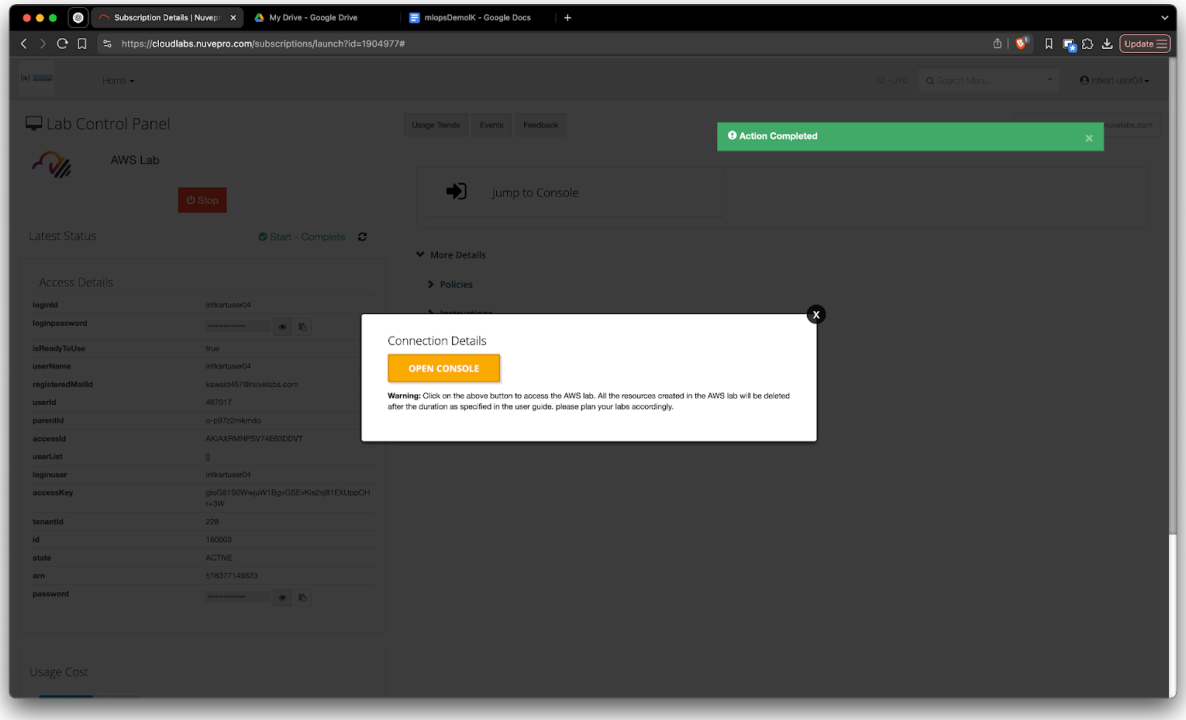

Home | Nuvepro
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/company/interviewkickstart/home
Update
{ik} INTERVIEW KICKSTART
CLOUDLABS
intksrtuser04
Sign in
Forgot Login Id? Forgot password?


Dashboard | Nuvepro
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/dashboard
Update
Home
TZ - UTC
Search Menu...
intksrt user04
My Labs (1)
Welcome Intksrt User04 !
#1904977
AWS Lab
Amazon Web Services(AWS) account and access to all resources available in AWS
Tools : None
Allotted : Unlimited
Created On : 25-Sep-2023 03:13:52 AM
Expires On : NA
View Lab
Stop-Complete
https://cloudlabs.nuvepro.com/subscriptions/launch?id=1904977


Subscription Details | Nuvep
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/subscriptions/launch?id=1904977
Update
Home
TZ - UTC
Search Menu...
intksrt user04
Lab Control Panel
AWS Lab
Start
Latest Status
Stop - Complete
Usage Cost
Get Usage
Trends..
Note : There is a delay of 24 to 48 hours for the usage cost to be generated by the Cloud platform. Please note that the cost shown for this lab may not be complete
Usage Trends
Events
Feedback
Owner - intksrt04user@nuvelabs.com
Lab not started. Please retry.


Subscription Details | Nuvep
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/subscriptions/launch?id=1904977
Update
Home
TZ - UTC
Search Menu...
intikart user04
Lab Control Panel
AWS Lab
Start - InProgress. This could take a while. Please wait..


Subscription Details | Nuvep
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/subscriptions/launch?id=1904977
Update
Home
TZ - UTC
Search Menu...
intksrt user04
Lab Control Panel
AWS Lab
Stop
Latest Status
Start - Complete
Access Details
loginId intksrtuser04
loginpassword
isReadyToUse true
userName intksrtuser04
registeredMailId kawsid457@nuvelabs.com
userId 467017
parentId o-p97z2mkmdo
accessId AKIAXRMNPSV74E63DDVT
userList []
loginuser intksrtuser04
accessKey gloG8150WwjuW1BgvGSEvKis2sj81EXUppOHr+3W
tenantId 228
id 160003
state ACTIVE
arn 518377149823
password
Usage Cost
Usage Trends
Events
Feedback
Owner - intksrt04user@nuvelabs.com
Jump to Console
More Details
Policies
Instructions
Other Details
Quota

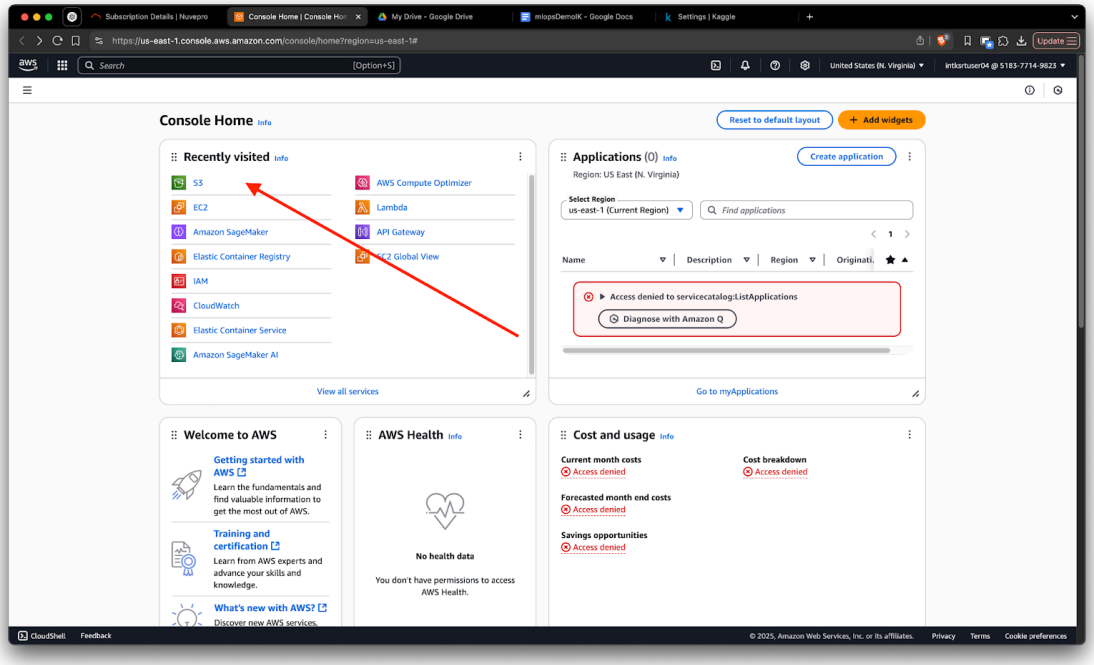

Subscription Details | Nuvep
My Drive - Google Drive
mlopsDemoIK - Google Docs
https://cloudlabs.nuvepro.com/subscriptions/launch?id=1904977#
Update
Lab Control Panel
AWS Lab
Stop
Latest Status
Start - Complete
Action Completed
Connection Details
OPEN CONSOLE
Warning: Click on the above button to access the AWS lab. All the resources created in the AWS lab will be deleted after the duration as specified in the user guide. please plan your labs accordingly.
Jump to Console
More Details
Policies
Usage Cost

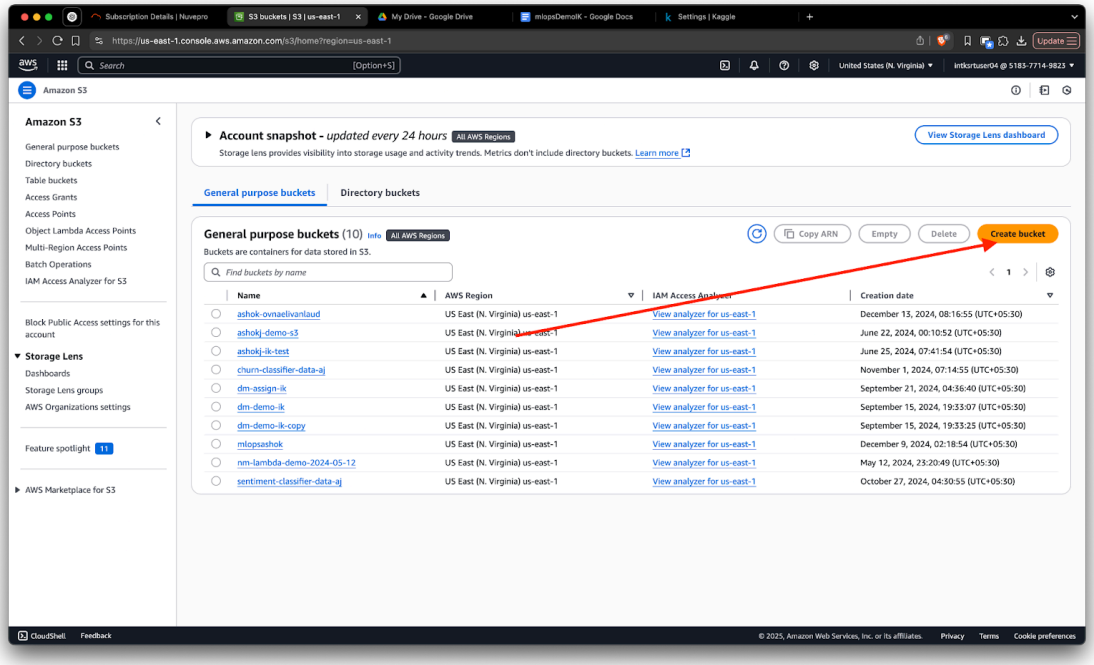
Nuvepro offers sandboxed environments for training and demos. Ensure your session remains active.

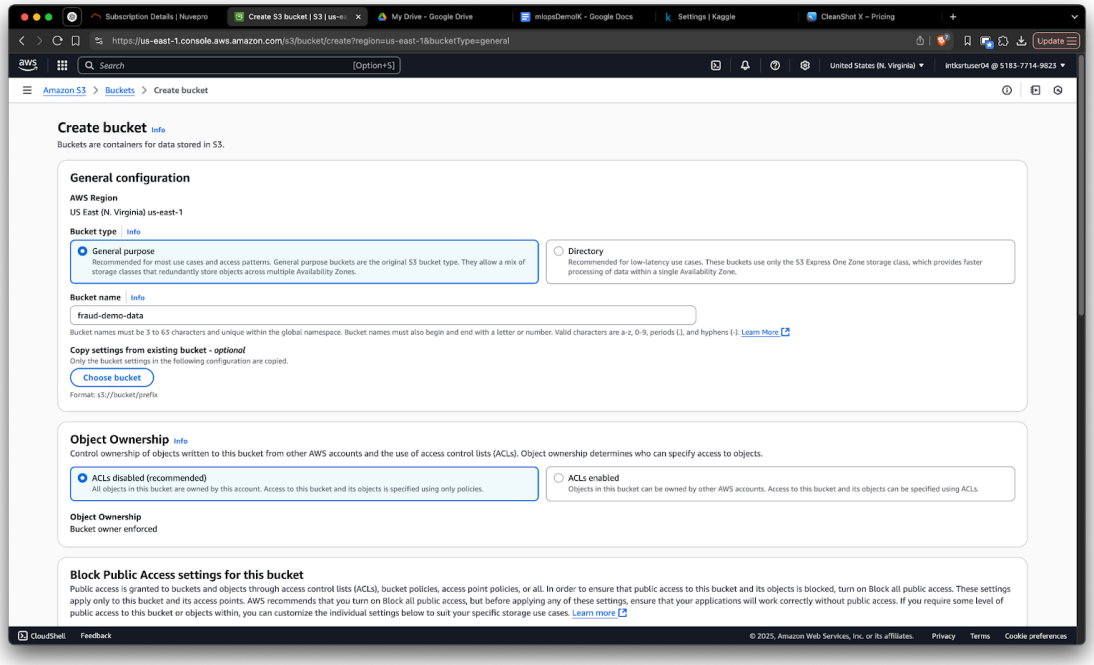
📊 Step 1: Setup S3 Bucket

Goal: Store raw data and simulate ingestion

1. Go to AWS Console > S3
2. Create bucket: fraud-demo-data-yourname
3. Enable **versioning**
4. **Block all public access**







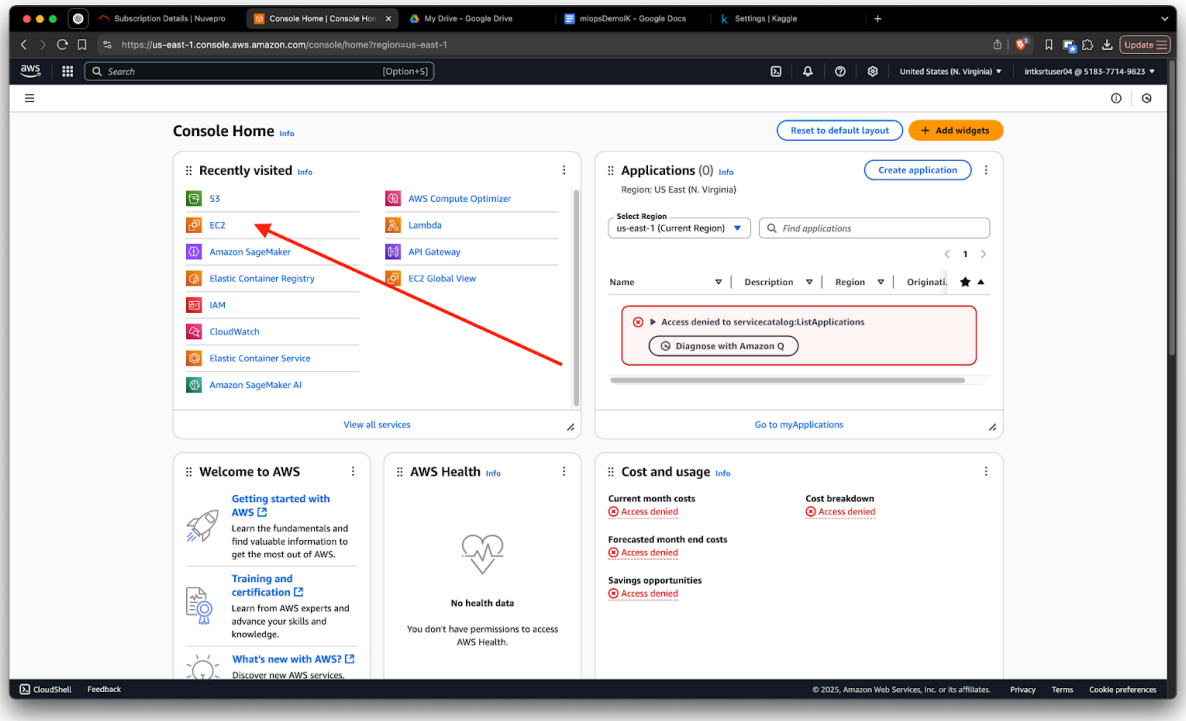
This bucket is your data lake. Versioning ensures traceability and reproducibility in ML pipelines.

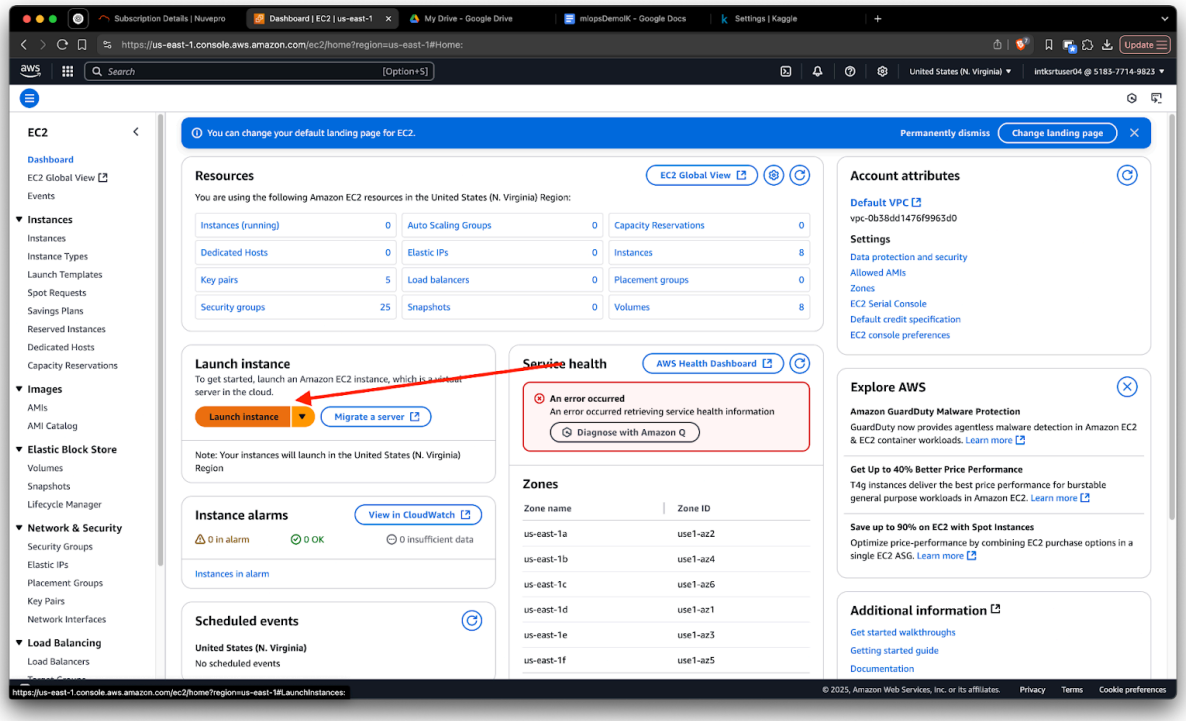
🚀 Step 2: Launch EC2 Instance (Compute Node)

Goal: Act as the data ingestion + training server

1. Launch an EC2 instance with **Ubuntu 22.04**
2. Attach IAM Role with these permissions:
   - AmazonS3FullAccess
   - AmazonSageMakerFullAccess
   - CloudWatchFullAccess
   - AmazonSSMManagedInstanceCore
3. Add tag: Purpose=fraud-demo

Access options: - **SSH**: Create/select key pair, allow port 22 - **Session Manager**: Ensure IAM role has SSM access and instance is in public subnet




EC2
Dashboard
EC2 Global View
Events
Instances
Instances
Instance Types
Launch Templates
Spot Requests
Savings Plans
Reserved Instances
Dedicated Hosts
Capacity Reservations
Images
AMIs
AMI Catalog
Elastic Block Store
Volumes
Snapshots
Lifecycle Manager
Network & Security
Security Groups
Elastic IPs
Placement Groups
Key Pairs
Network Interfaces
Load Balancing
Load Balancers
You can change your default landing page for EC2.
Permanently dismiss
Change landing page
Resources
EC2 Global View
You are using the following Amazon EC2 resources in the United States (N. Virginia) Region:
Instances (running) 0
Auto Scaling Groups 0
Capacity Reservations 0
Dedicated Hosts 0
Elastic IPs 0
Instances 8
Key pairs 5
Load balancers 0
Placement groups 0
Security groups 25
Snapshots 0
Volumes 8
Launch instance
To get started, launch an Amazon EC2 instance, which is a virtual server in the cloud.
Launch instance
Migrate a server
Note: Your instances will launch in the United States (N. Virginia) Region
Service health
AWS Health Dashboard
An error occurred
An error occurred retrieving service health information
Diagnose with Amazon Q
Zones
Zone name
Zone ID
us-east-1a use1-az2
us-east-1b use1-az4
us-east-1c use1-az6
us-east-1d use1-az1
us-east-1e use1-az3
us-east-1f use1-az5
Instance alarms
View in CloudWatch
0 in alarm
0 OK
0 insufficient data
Instances in alarm
Scheduled events
United States (N. Virginia)
No scheduled events
Account attributes
Default VPC
vpc-0b38dd1476f9963d0
Settings
Data protection and security
Allowed AMIs
Zones
EC2 Serial Console
Default credit specification
EC2 console preferences
Explore AWS
Amazon GuardDuty Malware Protection
GuardDuty now provides agentless malware detection in Amazon EC2 & EC2 container workloads. Learn more
Get Up to 40% Better Price Performance
T4g instances deliver the best price performance for burstable general purpose workloads in Amazon EC2. Learn more
Save up to 90% on EC2 with Spot Instances
Optimize price-performance by combining EC2 purchase options in a single EC2 ASG. Learn more
Additional information
Get started walkthroughs
Getting started guide
Documentation
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#LaunchInstances:
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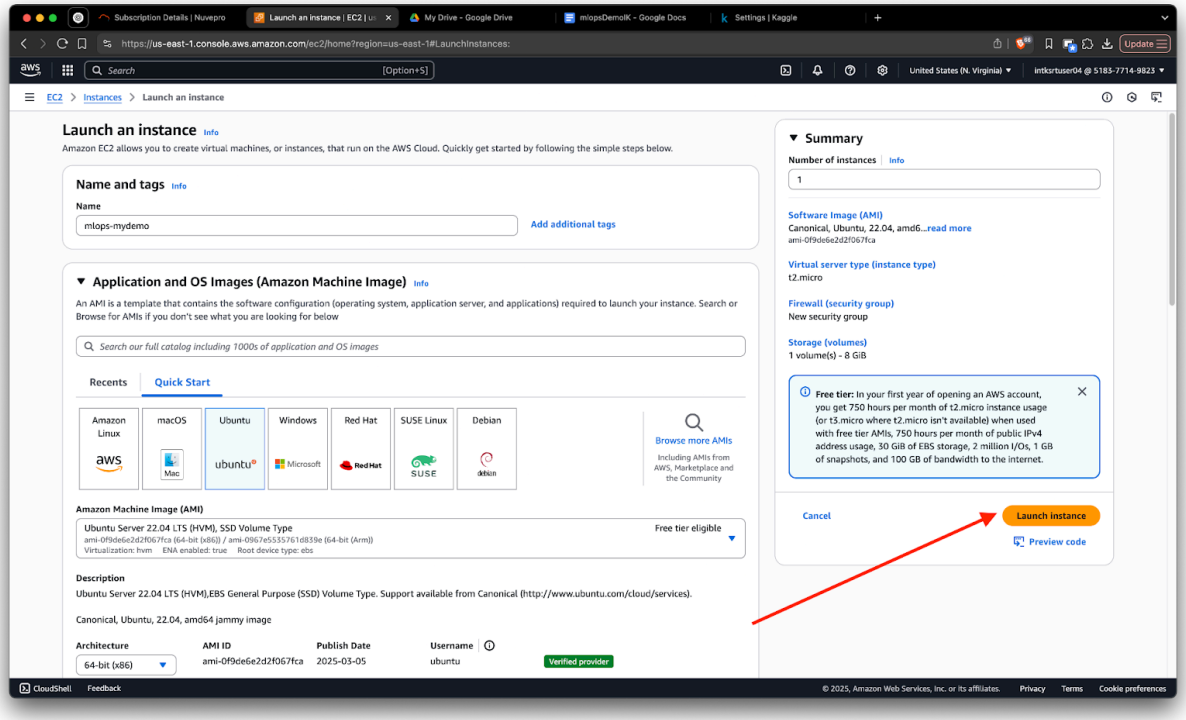
EC2 > Instances > Launch an instance
Launch an instance Info
Amazon EC2 allows you to create virtual machines, or instances, that run on the AWS Cloud. Quickly get started by following the simple steps below.
Name and tags Info
Name
mlops-mydemo
Add additional tags
Application and OS Images (Amazon Machine Image) Info
An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below
Search our full catalog including 1000s of application and OS images
Recents
Quick Start
Amazon Linux
macOS
Ubuntu
Windows
Red Hat
SUSE Linux
Debian
Browse more AMIs
Including AMIs from AWS, Marketplace and the Community
Amazon Machine Image (AMI)
Ubuntu Server 22.04 LTS (HVM), SSD Volume Type
Free tier eligible
Description
Ubuntu Server 22.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services).
Canonical, Ubuntu, 22.04, amd64 jammy image
Architecture
AMI ID
Publish Date
Username
64-bit (x86)
ami-0f9de6e2d2f067fca
2025-03-05
ubuntu
Verified provider
Summary
Number of instances Info
1
Software Image (AMI)
Canonical, Ubuntu, 22.04, amd6...read more
Virtual server type (instance type)
t2.micro
Firewall (security group)
New security group
Storage (volumes)
1 volume(s) - 8 GiB
Free tier: In your first year of opening an AWS account, you get 750 hours per month of t2.micro instance usage (or t3.micro where t2.micro isn't available) when used with free tier AMIs, 750 hours per month of public IPv4 address usage, 30 GiB of EBS storage, 2 million I/Os, 1 GB of snapshots, and 100 GB of bandwidth to the internet.
Cancel
Launch instance
Preview code
CloudShell
Feedback
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Terms
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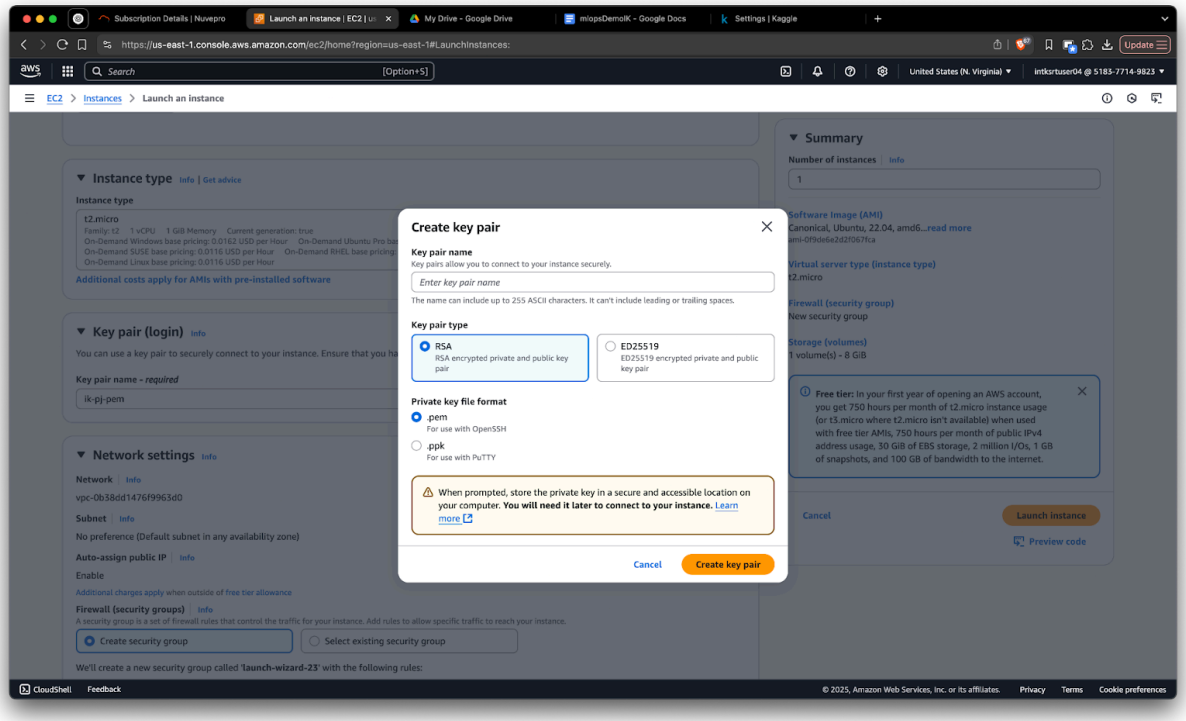
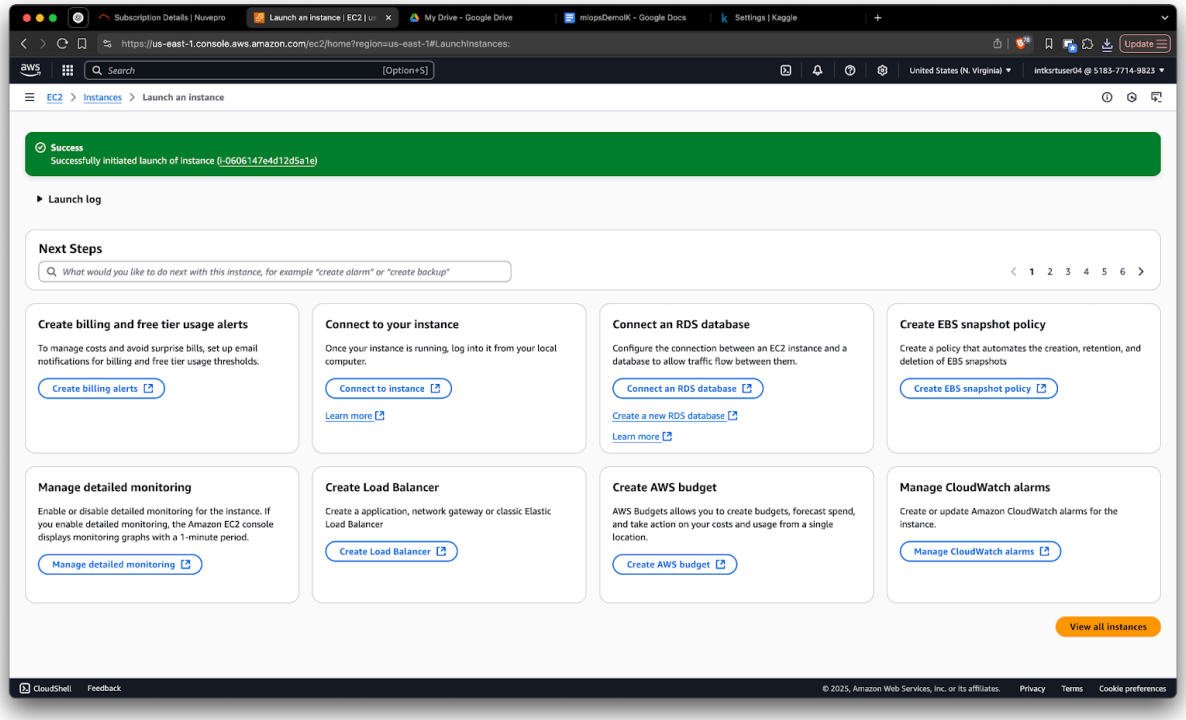
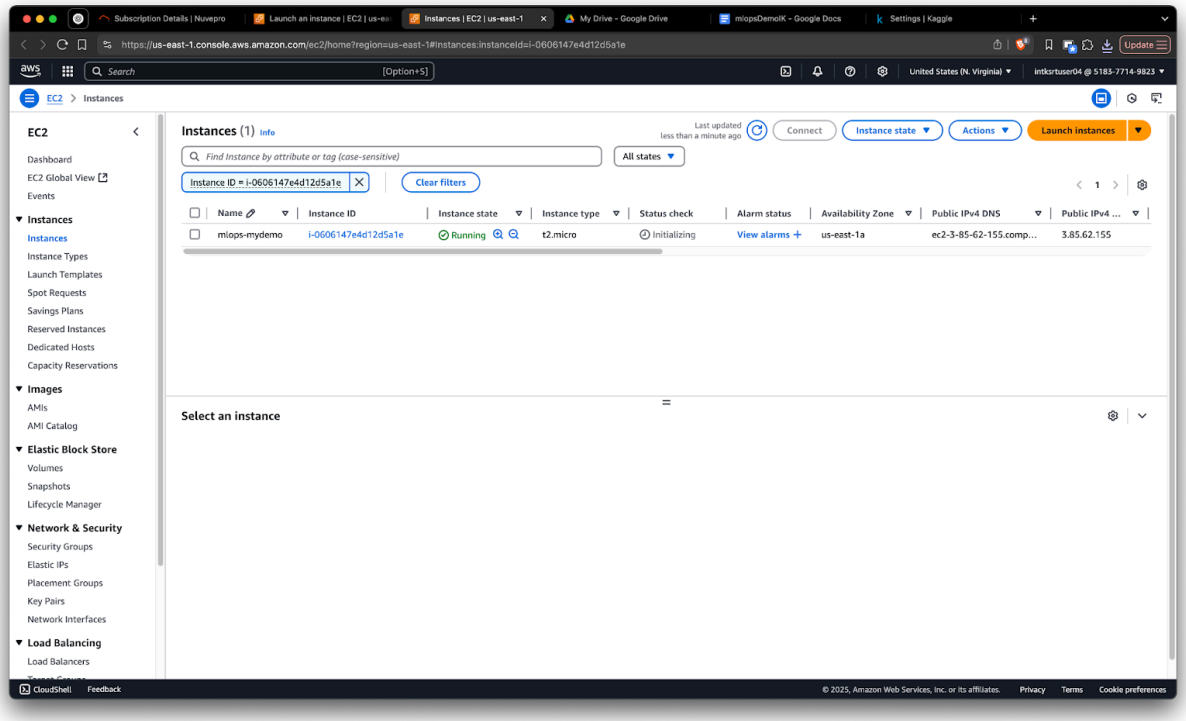

Create key pair
Key pair name
Key pairs allow you to connect to your instance securely.
Enter key pair name
The name can include up to 255 ASCII characters. It can't include leading or trailing spaces.
Key pair type
RSA
RSA encrypted private and public key pair
ED25519
ED25519 encrypted private and public key pair
Private key file format
.pem
For use with OpenSSH
.ppk
For use with PuTTY
When prompted, store the private key in a secure and accessible location on your computer. You will need it later to connect to your instance. Learn more
Cancel
Create key pair
Summary
Number of instances
Instance type
Key pair (login)
Network settings
Launch instance
Preview code


Success
Successfully initiated launch of instance (i-0606147e4d12d5a1e)
Launch log
Next Steps
What would you like to do next with this instance, for example "create alarm" or "create backup"
Create billing and free tier usage alerts
To manage costs and avoid surprise bills, set up email notifications for billing and free tier usage thresholds.
Create billing alerts
Connect to your instance
Once your instance is running, log into it from your local computer.
Connect to instance
Learn more
Connect an RDS database
Configure the connection between an EC2 instance and a database to allow traffic flow between them.
Connect an RDS database
Create a new RDS database
Learn more
Create EBS snapshot policy
Create a policy that automates the creation, retention, and deletion of EBS snapshots
Create EBS snapshot policy
Manage detailed monitoring
Enable or disable detailed monitoring for the instance. If you enable detailed monitoring, the Amazon EC2 console displays monitoring graphs with a 1-minute period.
Manage detailed monitoring
Create Load Balancer
Create a application, network gateway or classic Elastic Load Balancer
Create Load Balancer
Create AWS budget
AWS Budgets allows you to create budgets, forecast spend, and take action on your costs and usage from a single location.
Create AWS budget
Manage CloudWatch alarms
Create or update Amazon CloudWatch alarms for the instance.
Manage CloudWatch alarms
View all instances


Instances | EC2 | us-east-1
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#instances:instanceId=i-0606147e4d12d5a1e
EC2 > Instances
Instances (1) Info
Last updated less than a minute ago
Connect
Instance state
Actions
Launch instances
Find Instance by attribute or tag (case-sensitive)
All states
Instance ID = i-0606147e4d12d5a1e
Clear filters
Name | Instance ID | Instance state | Instance type | Status check | Alarm status | Availability Zone | Public IPv4 DNS | Public IPv4 ...
mlops-mydemo | i-0606147e4d12d5a1e | Running | t2.micro | Initializing | View alarms | us-east-1a | ec2-3-85-62-155.comp... | 3.85.62.155
Select an instance
EC2
Dashboard
EC2 Global View
Events
Instances
Instances
Instance Types
Launch Templates
Spot Requests
Savings Plans
Reserved Instances
Dedicated Hosts
Capacity Reservations
Images
AMIs
AMI Catalog
Elastic Block Store
Volumes
Snapshots
Lifecycle Manager
Network & Security
Security Groups
Elastic IPs
Placement Groups
Key Pairs
Network Interfaces
Load Balancing
Load Balancers
CloudShell
Feedback
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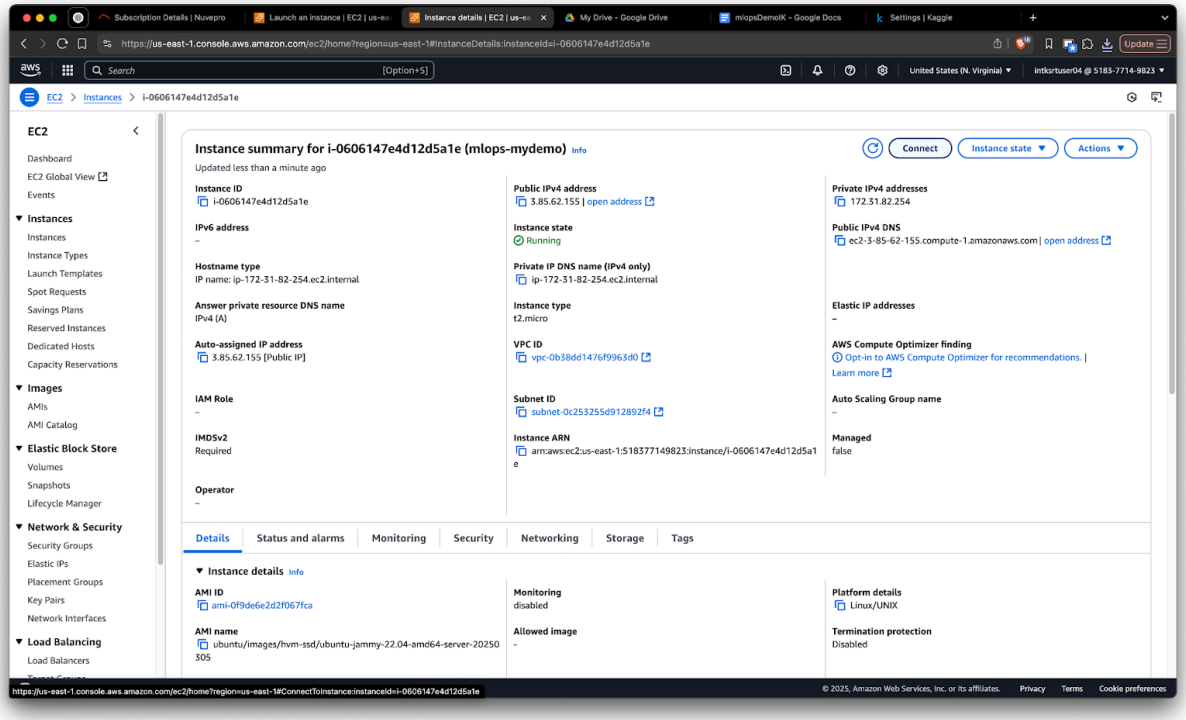
Instance details | EC2 | us-east-1
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#InstanceDetails:instanceId=i-0606147e4d12d5a1e
EC2 > Instances > i-0606147e4d12d5a1e
Instance summary for i-0606147e4d12d5a1e (mlops-mydemo) Info
Updated less than a minute ago
Connect
Instance state
Actions
Instance ID
i-0606147e4d12d5a1e
IPv6 address
–
Hostname type
IP name: ip-172-31-82-254.ec2.internal
Answer private resource DNS name
IPv4 (A)
Auto-assigned IP address
3.85.62.155 [Public IP]
IAM Role
–
IMDSv2
Required
Operator
–
Public IPv4 address
3.85.62.155 | open address
Instance state
Running
Private IP DNS name (IPv4 only)
ip-172-31-82-254.ec2.internal
Instance type
t2.micro
VPC ID
vpc-0b38dd1476f9963d0
Subnet ID
subnet-0c253255d912892f4
Instance ARN
arn:aws:ec2:us-east-1:518377149823:instance/i-0606147e4d12d5a1e
Private IPv4 addresses
172.31.82.254
Public IPv4 DNS
ec2-3-85-62-155.compute-1.amazonaws.com | open address
Elastic IP addresses
–
AWS Compute Optimizer finding
Opt-in to AWS Compute Optimizer for recommendations. | Learn more
Auto Scaling Group name
–
Managed
false
Details
Status and alarms
Monitoring
Security
Networking
Storage
Tags
Instance details Info
AMI ID
ami-0f9de6e2d2f067fca
AMI name
ubuntu/images/hvm-ssd/ubuntu-jammy-22.04-amd64-server-20250305
Monitoring
disabled
Allowed image
-
Platform details
Linux/UNIX
Termination protection
Disabled
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#ConnectToInstance:instanceId=i-0606147e4d12d5a1e
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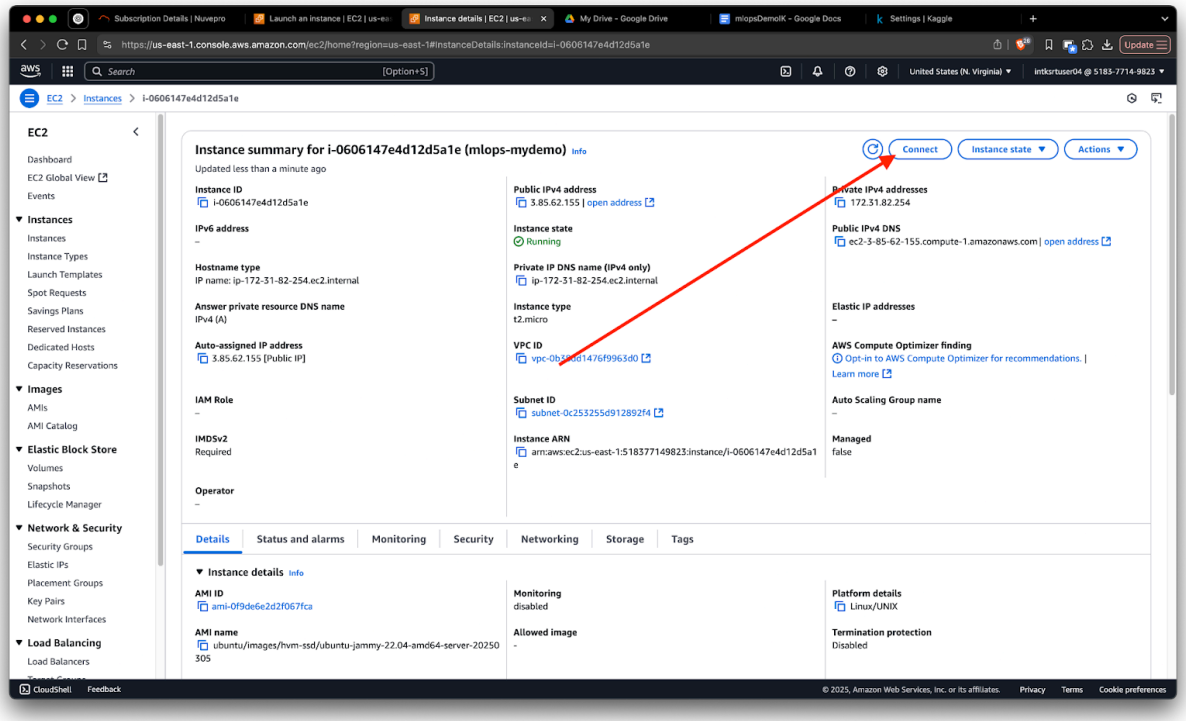
Privacy
Terms
Cookie preferences


Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Instance details | EC2 | us-ea
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#instanceDetails:instanceId=i-0606147e4d12d5a1e
Update
Search
[Option+S]
United States (N. Virginia)
intkstruser04 @ 5183-7714-9823
EC2 > Instances > i-0606147e4d12d5a1e
EC2
Dashboard
EC2 Global View
Events
Instances
Instances
Instance Types
Launch Templates
Spot Requests
Savings Plans
Reserved Instances
Dedicated Hosts
Capacity Reservations
Images
AMIs
AMI Catalog
Elastic Block Store
Volumes
Snapshots
Lifecycle Manager
Network & Security
Security Groups
Elastic IPs
Placement Groups
Key Pairs
Network Interfaces
Load Balancing
Load Balancers
Instance summary for i-0606147e4d12d5a1e (mlops-mydemo) Info
Updated less than a minute ago
Connect
Instance state
Actions
Instance ID
i-0606147e4d12d5a1e
IPv6 address
–
Hostname type
IP name: ip-172-31-82-254.ec2.internal
Answer private resource DNS name
IPv4 (A)
Auto-assigned IP address
3.85.62.155 [Public IP]
IAM Role
–
IMDSv2
Required
Operator
–
Public IPv4 address
3.85.62.155 | open address
Instance state
Running
Private IP DNS name (IPv4 only)
ip-172-31-82-254.ec2.internal
Instance type
t2.micro
VPC ID
Subnet ID
subnet-0c253255d912892f4
Instance ARN
arn:aws:ec2:us-east-1:518377149823:instance/i-0606147e4d12d5a1e
Private IPv4 addresses
172.31.82.254
Public IPv4 DNS
ec2-3-85-62-155.compute-1.amazonaws.com | open address
Elastic IP addresses
–
AWS Compute Optimizer finding
Opt-in to AWS Compute Optimizer for recommendations. | Learn more
Auto Scaling Group name
–
Managed
false
Details
Status and alarms
Monitoring
Security
Networking
Storage
Tags
Instance details Info
AMI ID
ami-0f9de6e2d2f067fca
AMI name
ubuntu/images/hvm-ssd/ubuntu-jammy-22.04-amd64-server-20250305
Monitoring
disabled
Allowed image
-
Platform details
Linux/UNIX
Termination protection
Disabled
CloudShell
Feedback
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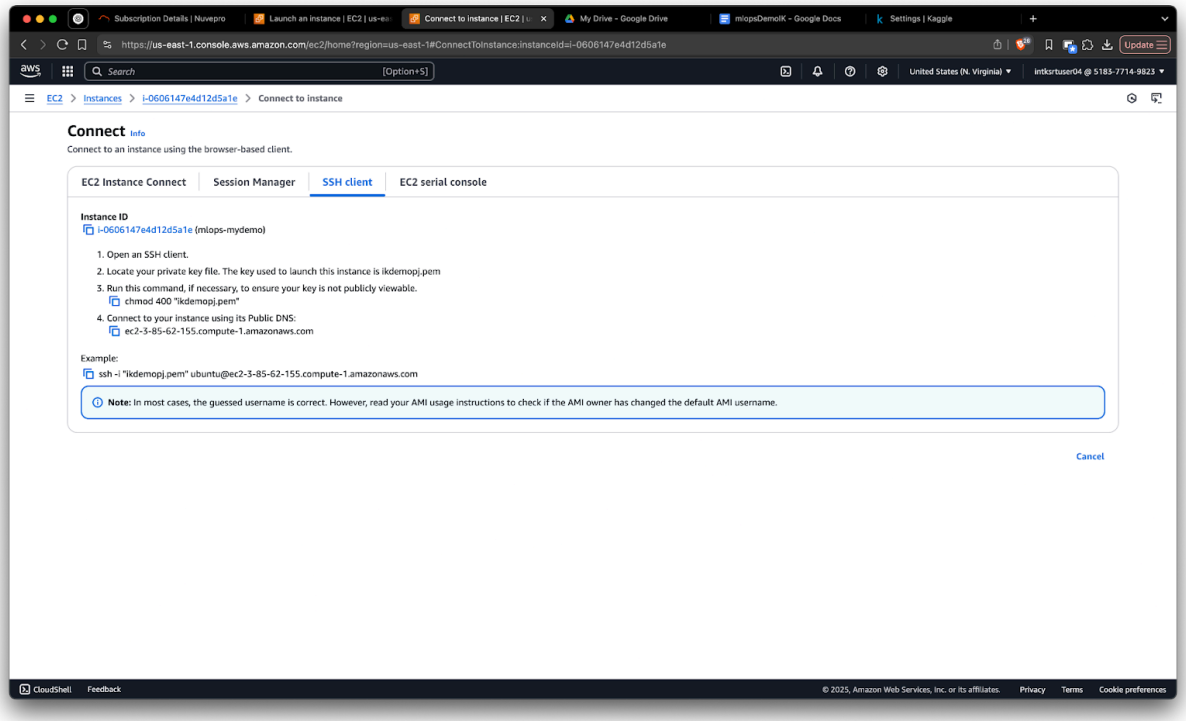
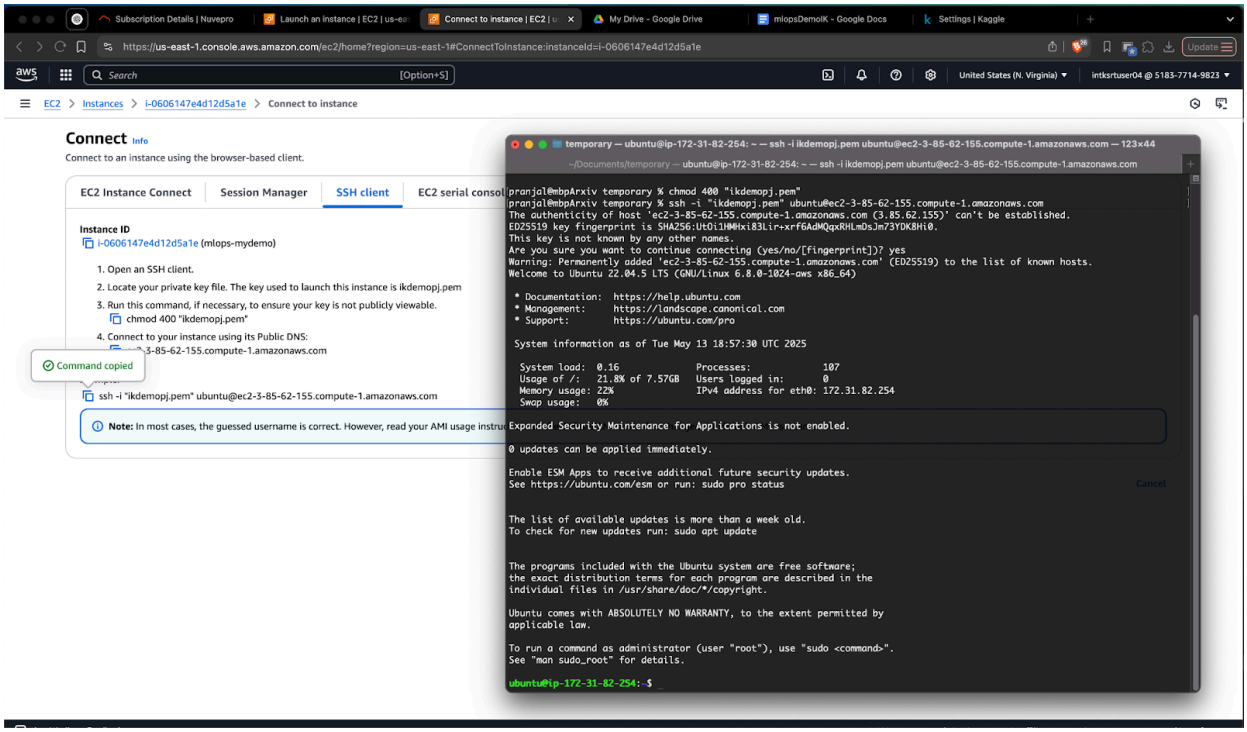
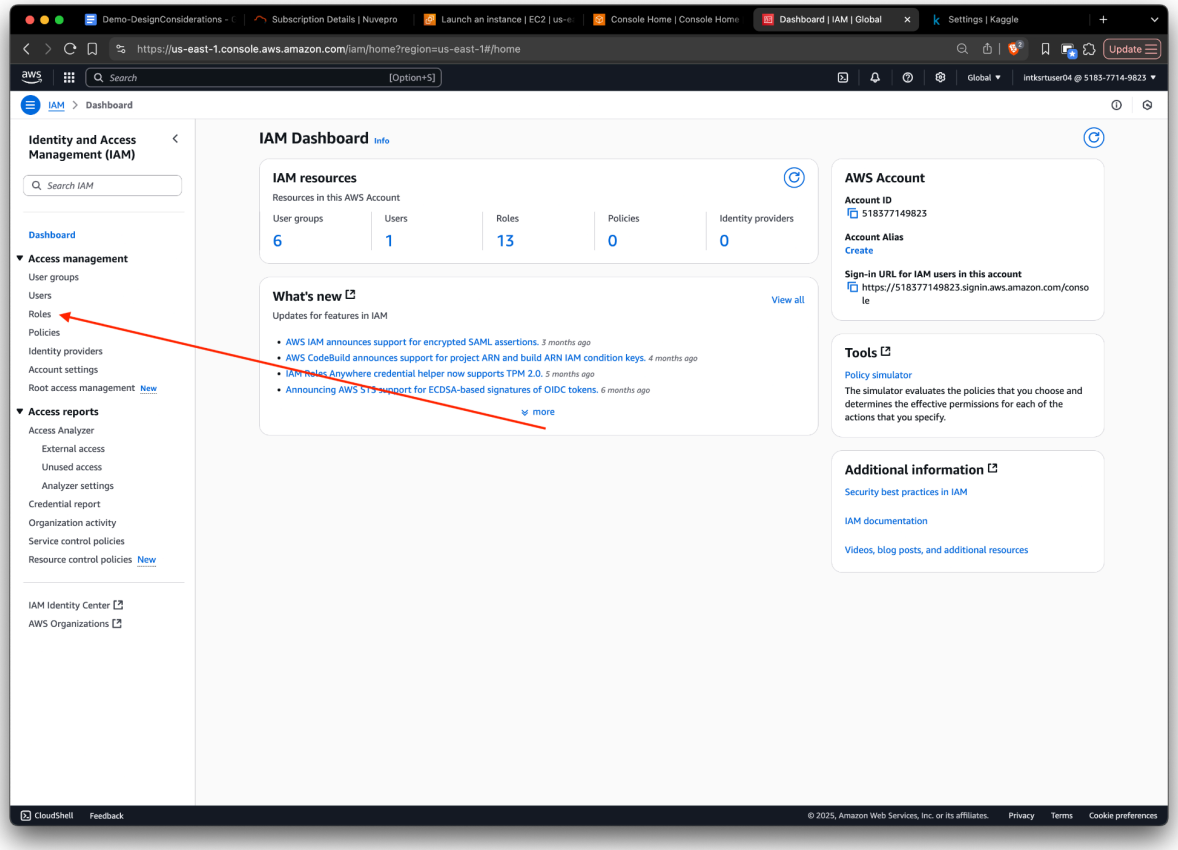

Connect
Info
Connect to an instance using the browser-based client.
EC2 Instance Connect
Session Manager
SSH client
EC2 serial console
Instance ID
i-0606147e4d12d5a1e (mlops-mydemo)
1. Open an SSH client.
2. Locate your private key file. The key used to launch this instance is ikdemopj.pem
3. Run this command, if necessary, to ensure your key is not publicly viewable.
chmod 400 "ikdemopj.pem"
4. Connect to your instance using its Public DNS:
ec2-3-85-62-155.compute-1.amazonaws.com
Example:
ssh -i "ikdemopj.pem" ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
Note: In most cases, the guessed username is correct. However, read your AMI usage instructions to check if the AMI owner has changed the default AMI username.
Cancel


Connect
Info
Connect to an instance using the browser-based client.
EC2 Instance Connect
Session Manager
SSH client
Instance ID
i-0606147e4d12d5a1e (mlops-mydemo)
1. Open an SSH client.
2. Locate your private key file. The key used to launch this instance is ikdemopj.pem
3. Run this command, if necessary, to ensure your key is not publicly viewable.
chmod 400 "ikdemopj.pem"
4. Connect to your instance using its Public DNS:
Command copied
ssh -i "ikdemopj.pem" ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 123×44
pranjal@mbpArxiv temporary % chmod 400 "ikdemopj.pem"
pranjal@mbpArxiv temporary % ssh -i "ikdemopj.pem" ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
The authenticity of host 'ec2-3-85-62-155.compute-1.amazonaws.com (3.85.62.155)' can't be established.
ED25519 key fingerprint is SHA256:UtOi1HMHxi83Lir+xrf6AdMQqxRHLmDsJm73YDK8Hi0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-3-85-62-155.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
Welcome to Ubuntu 22.04.5 LTS (GNU/Linux 6.8.0-1024-aws x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/pro
System information as of Tue May 13 18:57:30 UTC 2025
System load: 0.16 Processes: 107
Usage of /: 21.8% of 7.57GB Users logged in: 0
Memory usage: 22% IPv4 address for eth0: 172.31.82.254
Swap usage: 0%
Expanded Security Maintenance for Applications is not enabled.
0 updates can be applied immediately.
Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status
The list of available updates is more than a week old.
To check for new updates run: sudo apt update
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
ubuntu@ip-172-31-82-254:~$


Demo-DesignConsiderations -
Subscription Details | Nuvepro
Launch an instance | EC2 | us-e
Console Home | Console Home
Dashboard | IAM | Global
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/home
Update
Search
[Option+S]
Global
intksrtuser04 @ 5183-7714-9823
IAM
Dashboard
Identity and Access Management (IAM)
Search IAM
Dashboard
Access management
User groups
Users
Roles
Policies
Identity providers
Account settings
Root access management New
Access reports
Access Analyzer
External access
Unused access
Analyzer settings
Credential report
Organization activity
Service control policies
Resource control policies New
IAM Identity Center
AWS Organizations
IAM Dashboard Info
IAM resources
Resources in this AWS Account
User groups
6
Users
1
Roles
13
Policies
0
Identity providers
0
What's new
Updates for features in IAM
View all
AWS IAM announces support for encrypted SAML assertions. 3 months ago
AWS CodeBuild announces support for project ARN and build ARN IAM condition keys. 4 months ago
IAM Roles Anywhere credential helper now supports TPM 2.0. 5 months ago
Announcing AWS STS support for ECDSA-based signatures of OIDC tokens. 6 months ago
more
AWS Account
Account ID
518377149823
Account Alias
Create
Sign-in URL for IAM users in this account
https://518377149823.signin.aws.amazon.com/console
Tools
Policy simulator
The simulator evaluates the policies that you choose and determines the effective permissions for each of the actions that you specify.
Additional information
Security best practices in IAM
IAM documentation
Videos, blog posts, and additional resources
CloudShell
Feedback
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Privacy
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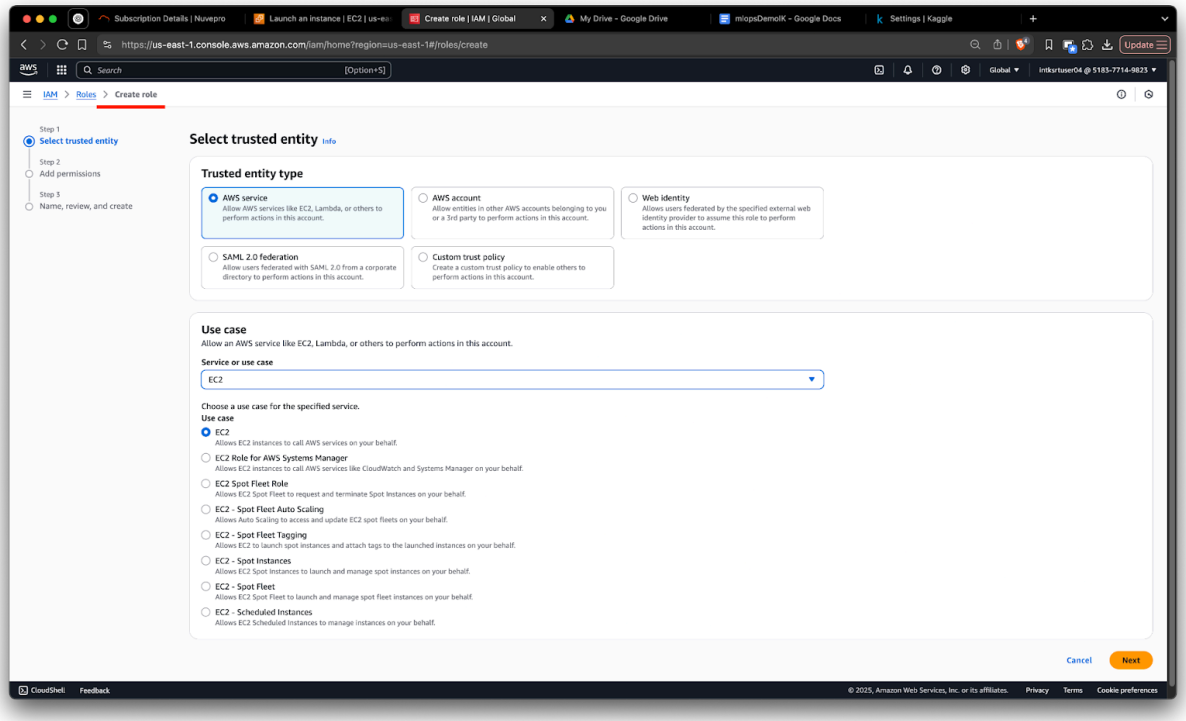
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create
Update
Search
[Option+S]
Global
intksrtuser04 @ 5183-7714-9823
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Select trusted entity Info
Trusted entity type
AWS service
Allow AWS services like EC2, Lambda, or others to perform actions in this account.
AWS account
Allow entities in other AWS accounts belonging to you or a 3rd party to perform actions in this account.
Web identity
Allows users federated by the specified external web identity provider to assume this role to perform actions in this account.
SAML 2.0 federation
Allow users federated with SAML 2.0 from a corporate directory to perform actions in this account.
Custom trust policy
Create a custom trust policy to enable others to perform actions in this account.
Use case
Allow an AWS service like EC2, Lambda, or others to perform actions in this account.
Service or use case
EC2
Choose a use case for the specified service.
Use case
EC2
Allows EC2 instances to call AWS services on your behalf.
EC2 Role for AWS Systems Manager
Allows EC2 instances to call AWS services like CloudWatch and Systems Manager on your behalf.
EC2 Spot Fleet Role
Allows EC2 Spot Fleet to request and terminate Spot Instances on your behalf.
EC2 - Spot Fleet Auto Scaling
Allows Auto Scaling to access and update EC2 spot fleets on your behalf.
EC2 - Spot Fleet Tagging
Allows EC2 to launch spot instances and attach tags to the launched instances on your behalf.
EC2 - Spot Instances
Allows EC2 Spot Instances to launch and manage spot instances on your behalf.
EC2 - Spot Fleet
Allows EC2 Spot Fleet to launch and manage spot fleet instances on your behalf.
EC2 - Scheduled Instances
Allows EC2 Scheduled Instances to manage instances on your behalf.
Cancel
Next
CloudShell
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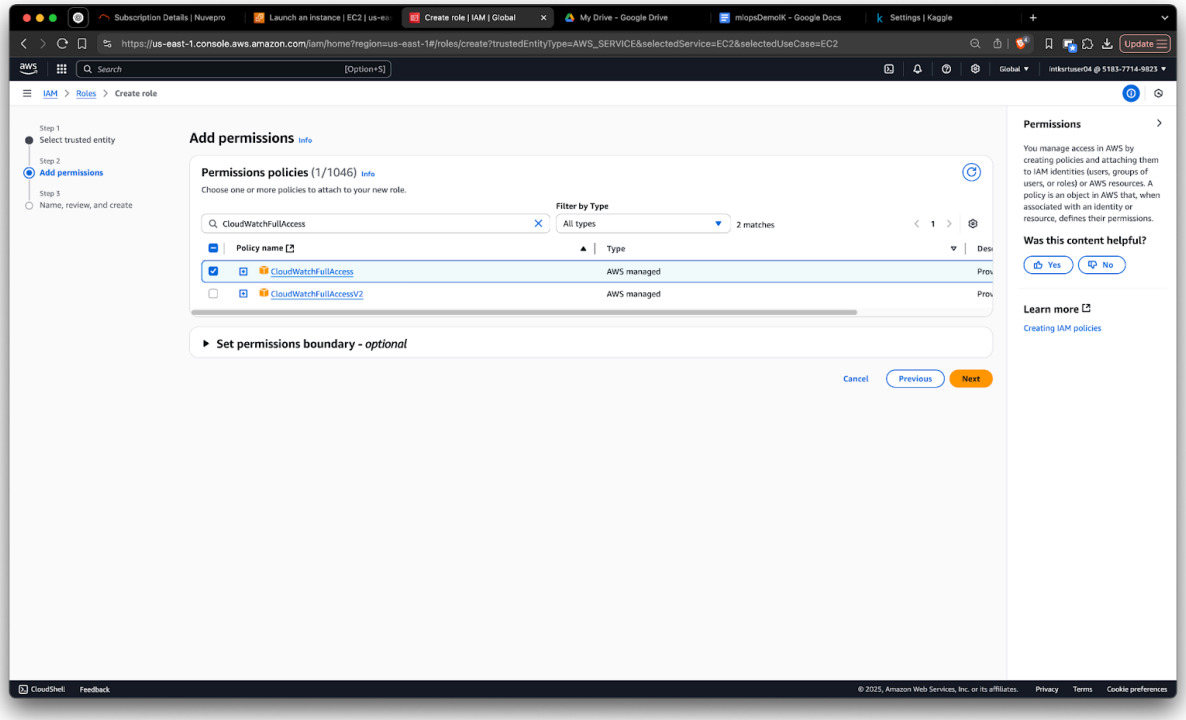
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create?trustedEntityType=AWS_SERVICE&selectedService=EC2&selectedUseCase=EC2
Update
Search
[Option+S]
Global
intksrtuser04 @ 5183-7714-9823
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Add permissions Info
Permissions policies (1/1046) Info
Choose one or more policies to attach to your new role.
Filter by Type
CloudWatchFullAccess
All types
2 matches
1
Policy name
Type
CloudWatchFullAccess
AWS managed
CloudWatchFullAccessV2
AWS managed
Set permissions boundary - optional
Cancel
Previous
Next
Permissions
You manage access in AWS by creating policies and attaching them to IAM identities (users, groups of users, or roles) or AWS resources. A policy is an object in AWS that, when associated with an identity or resource, defines their permissions.
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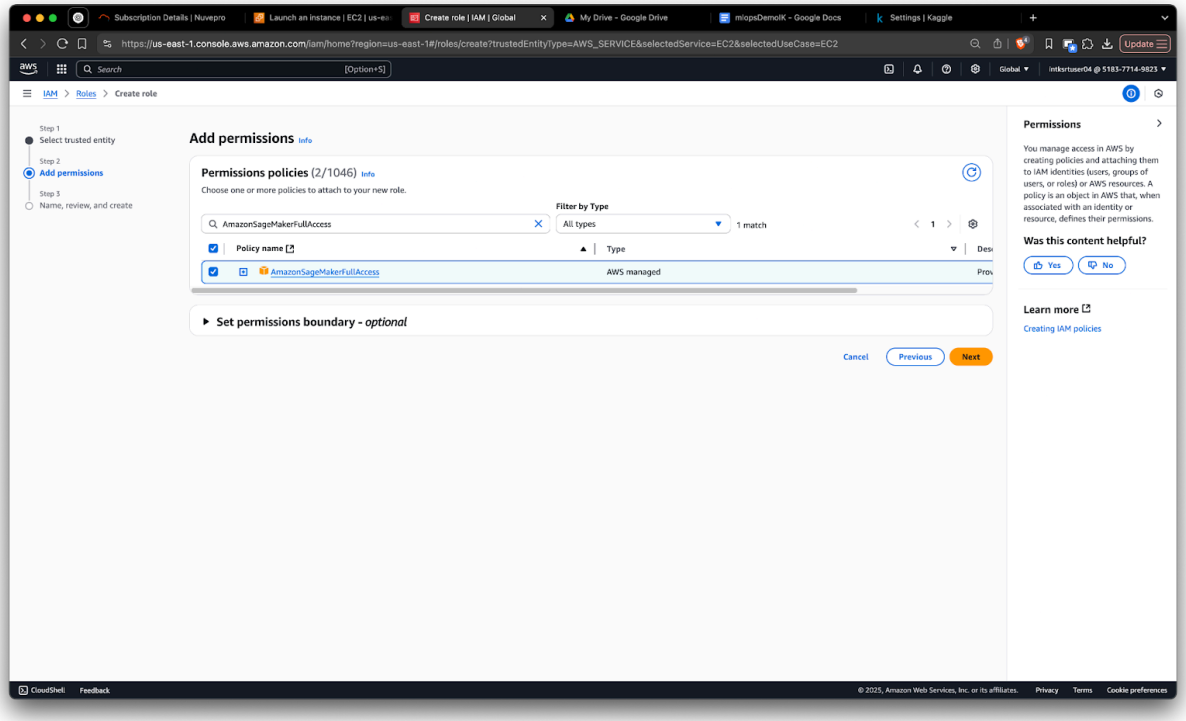
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create?trustedEntityType=AWS_SERVICE&selectedService=EC2&selectedUseCase=EC2
Update
Search
[Option+S]
Global
imtksrtuser04 @ 5183-7714-9823
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Add permissions Info
Permissions policies (2/1046) Info
Choose one or more policies to attach to your new role.
Filter by Type
AmazonSageMakerFullAccess
All types
1 match
Policy name
Type
AmazonSageMakerFullAccess
AWS managed
Set permissions boundary - optional
Cancel
Previous
Next
Permissions
You manage access in AWS by creating policies and attaching them to IAM identities (users, groups of users, or roles) or AWS resources. A policy is an object in AWS that, when associated with an identity or resource, defines their permissions.
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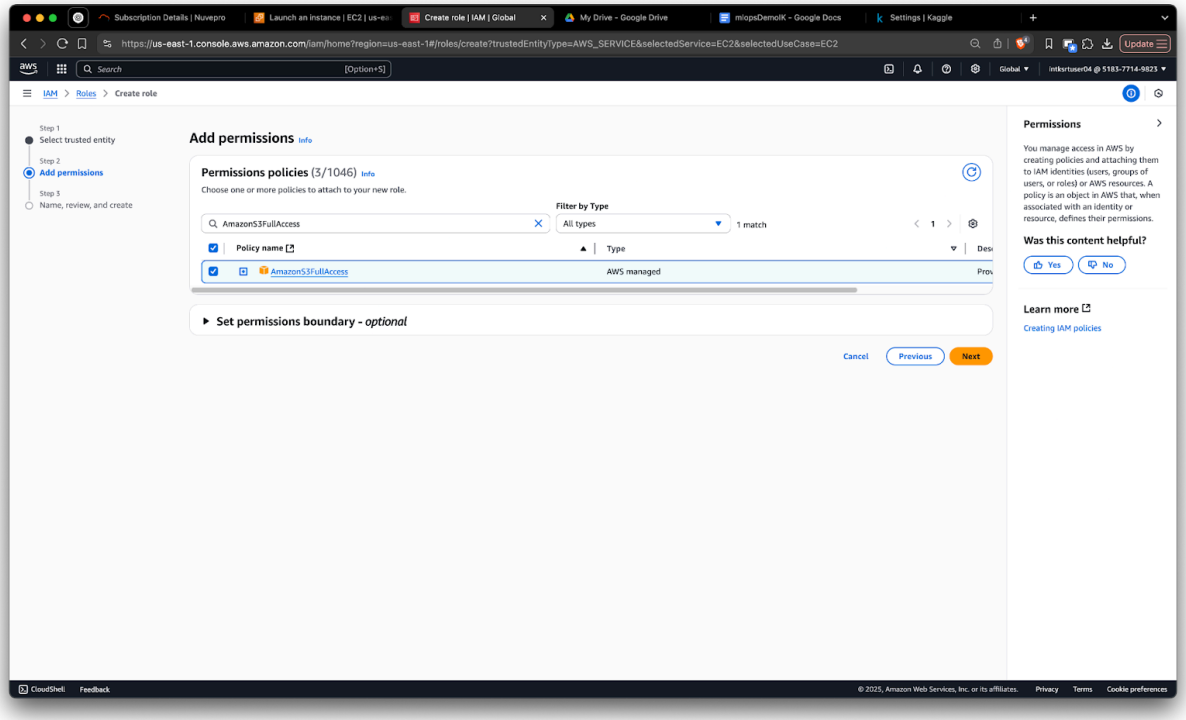
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create?trustedEntityType=AWS_SERVICE&selectedService=EC2&selectedUseCase=EC2
Update
Search
[Option+S]
Global
imtksrtuser04 @ 5183-7714-9823
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Add permissions Info
Permissions policies (3/1046) Info
Choose one or more policies to attach to your new role.
Filter by Type
AmazonS3FullAccess
All types
1 match
Policy name
Type
AmazonS3FullAccess
AWS managed
Set permissions boundary - optional
Cancel
Previous
Next
Permissions
You manage access in AWS by creating policies and attaching them to IAM identities (users, groups of users, or roles) or AWS resources. A policy is an object in AWS that, when associated with an identity or resource, defines their permissions.
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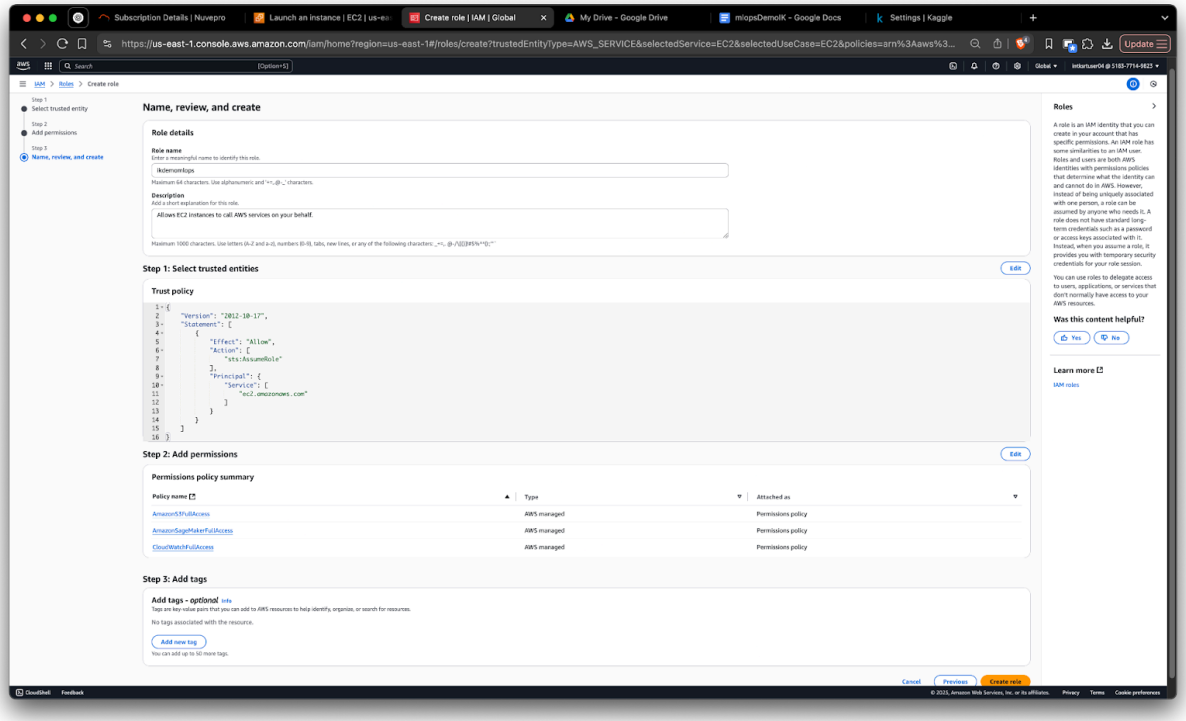
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create?trustedEntityType=AWS_SERVICE&selectedService=EC2&selectedUseCase=EC2&policies=arn%3Aaws%3...
Update
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Name, review, and create
Role details
Role name
Enter a meaningful name to identify this role.
ikdemomlops
Maximum 64 characters. Use alphanumeric and '+=,.@-_' characters.
Description
Add a short explanation for this role.
Allows EC2 instances to call AWS services on your behalf.
Maximum 1000 characters. Use letters (A-Z and a-z), numbers (0-9), tabs, new lines, or any of the following characters: _+=, .@-/\[]{}#$%^*();:'
Step 1: Select trusted entities
Edit
Trust policy
{
"Version": "2012-10-17",
"Statement": [
{
"Effect": "Allow",
"Action": [
"sts:AssumeRole"
],
"Principal": {
"Service": [
"ec2.amazonaws.com"
]
}
}
]
}
Step 2: Add permissions
Edit
Permissions policy summary
Policy name
Type
Attached as
AmazonS3FullAccess
AWS managed
Permissions policy
AmazonSageMakerFullAccess
AWS managed
Permissions policy
CloudWatchFullAccess
AWS managed
Permissions policy
Step 3: Add tags
Add tags - optional Info
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.
No tags associated with the resource.
Add new tag
You can add up to 50 more tags.
Cancel
Previous
Create role
Roles
A role is an IAM identity that you can create in your account that has specific permissions. An IAM role has some similarities to an IAM user. Roles and users are both AWS identities with permissions policies that determine what the identity can and cannot do in AWS. However, instead of being uniquely associated with one person, a role can be assumed by anyone who needs it. A role does not have standard long-term credentials such as a password or access keys associated with it. Instead, when you assume a role, it provides you with temporary security credentials for your role session.
You can use roles to delegate access to users, applications, or services that don't normally have access to your AWS resources.
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Yes
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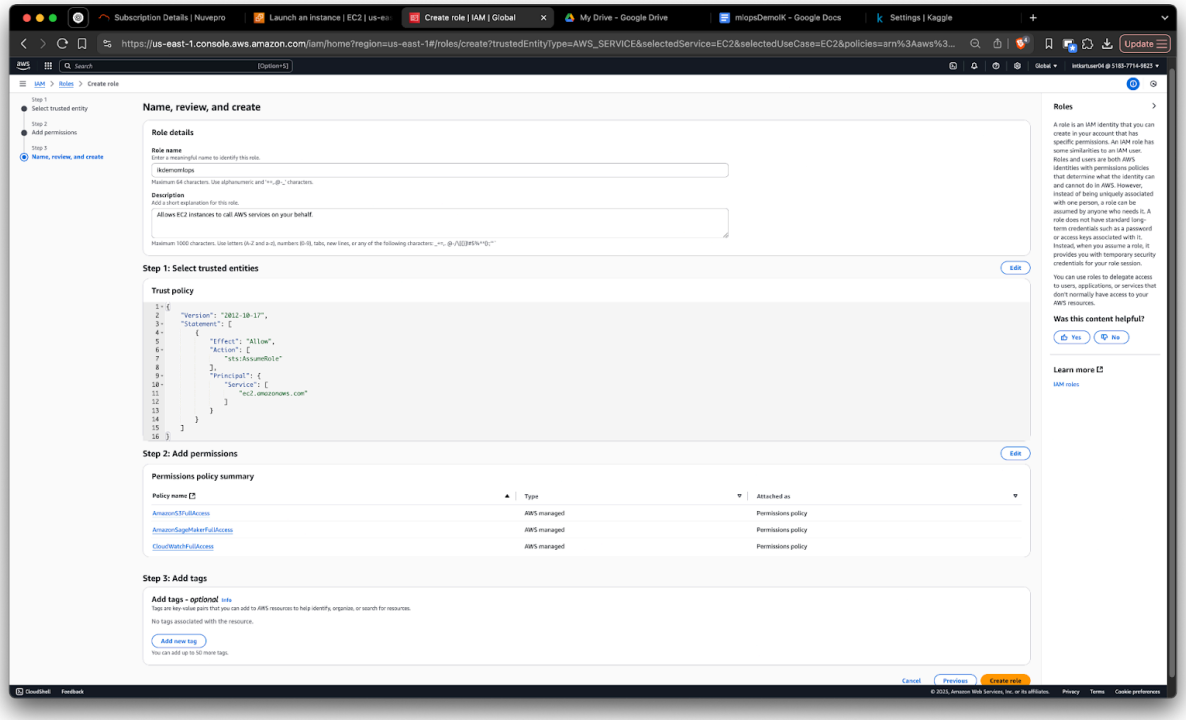
Subscription Details | Nuvepro
Launch an instance | EC2 | us-ea
Create role | IAM | Global
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/iam/home?region=us-east-1#/roles/create?trustedEntityType=AWS_SERVICE&selectedService=EC2&selectedUseCase=EC2&policies=arn%3Aaws%3...
Update
IAM > Roles > Create role
Step 1
Select trusted entity
Step 2
Add permissions
Step 3
Name, review, and create
Name, review, and create
Role details
Role name
Enter a meaningful name to identify this role.
ikdemomlops
Maximum 64 characters. Use alphanumeric and '+=,.@-_' characters.
Description
Add a short explanation for this role.
Allows EC2 instances to call AWS services on your behalf.
Maximum 1000 characters. Use letters (A-Z and a-z), numbers (0-9), tabs, new lines, or any of the following characters: _+=, .@-/\[]{}#$%^*();:'
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Trust policy
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"Statement": [
{
"Effect": "Allow",
"Action": [
"sts:AssumeRole"
],
"Principal": {
"Service": [
"ec2.amazonaws.com"
]
}
}
]
}
Step 2: Add permissions
Edit
Permissions policy summary
Policy name
Type
Attached as
AmazonS3FullAccess
AWS managed
Permissions policy
AmazonSageMakerFullAccess
AWS managed
Permissions policy
CloudWatchFullAccess
AWS managed
Permissions policy
Step 3: Add tags
Add tags - optional Info
Tags are key-value pairs that you can add to AWS resources to help identify, organize, or search for resources.
No tags associated with the resource.
Add new tag
You can add up to 50 more tags.
Cancel
Previous
Create role
Roles
A role is an IAM identity that you can create in your account that has specific permissions. An IAM role has some similarities to an IAM user. Roles and users are both AWS identities with permissions policies that determine what the identity can and cannot do in AWS. However, instead of being uniquely associated with one person, a role can be assumed by anyone who needs it. A role does not have standard long-term credentials such as a password or access keys associated with it. Instead, when you assume a role, it provides you with temporary security credentials for your role session.
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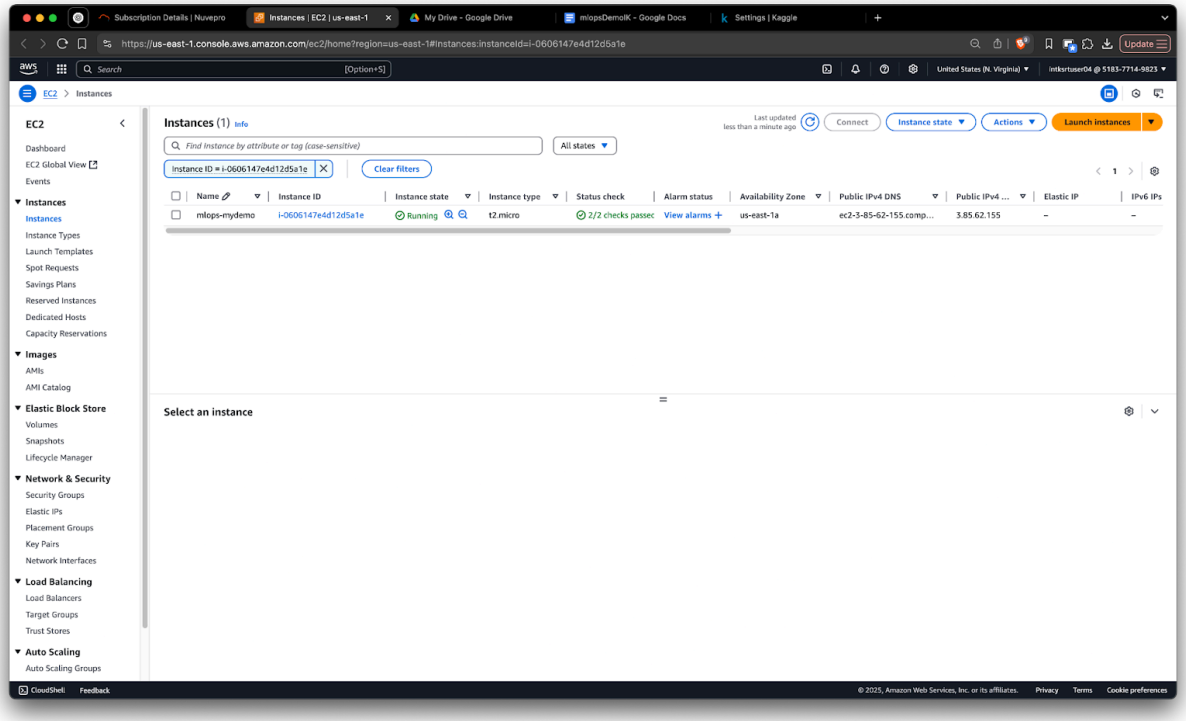
Subscription Details | Nuvepro
Instances | EC2 | us-east-1
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://us-east-1.console.aws.amazon.com/ec2/home?region=us-east-1#instances:instanceId=i-0606147e4d12d5a1e
Update
Search
[Option+S]
United States (N. Virginia)
imtksrtuser04 @ 5183-7714-9823
EC2 > Instances
EC2
Dashboard
EC2 Global View
Events
Instances
Instances
Instance Types
Launch Templates
Spot Requests
Savings Plans
Reserved Instances
Dedicated Hosts
Capacity Reservations
Images
AMIs
AMI Catalog
Elastic Block Store
Volumes
Snapshots
Lifecycle Manager
Network & Security
Security Groups
Elastic IPs
Placement Groups
Key Pairs
Network Interfaces
Load Balancing
Load Balancers
Target Groups
Trust Stores
Auto Scaling
Auto Scaling Groups
Instances (1) Info
Last updated less than a minute ago
Connect
Instance state
Actions
Launch instances
Find instance by attribute or tag (case-sensitive)
All states
Instance ID = i-0606147e4d12d5a1e
Clear filters
1
Name
Instance ID
Instance state
Instance type
Status check
Alarm status
Availability Zone
Public IPv4 DNS
Public IPv4 ...
Elastic IP
IPv6 IPs
mlops-mydemo
i-0606147e4d12d5a1e
Running
t2.micro
2/2 checks passed
View alarms
us-east-1a
ec2-3-85-62-155.comp...
3.85.62.155
–
–
Select an instance
CloudShell
Feedback
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Privacy
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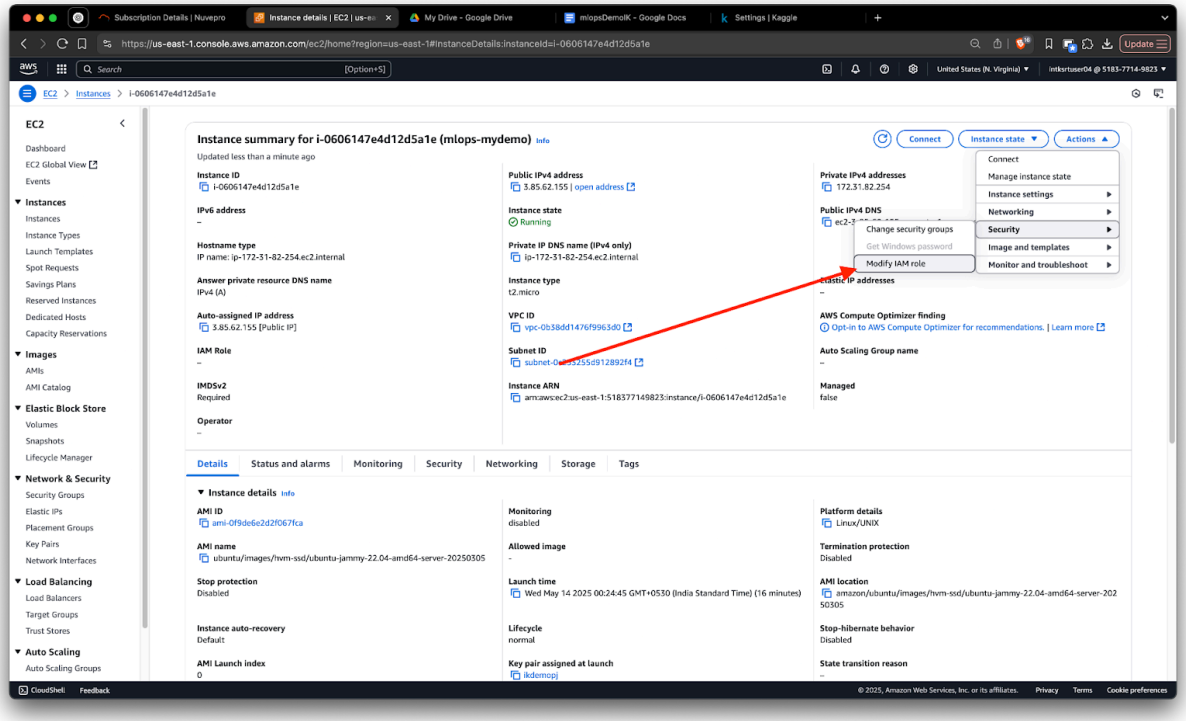
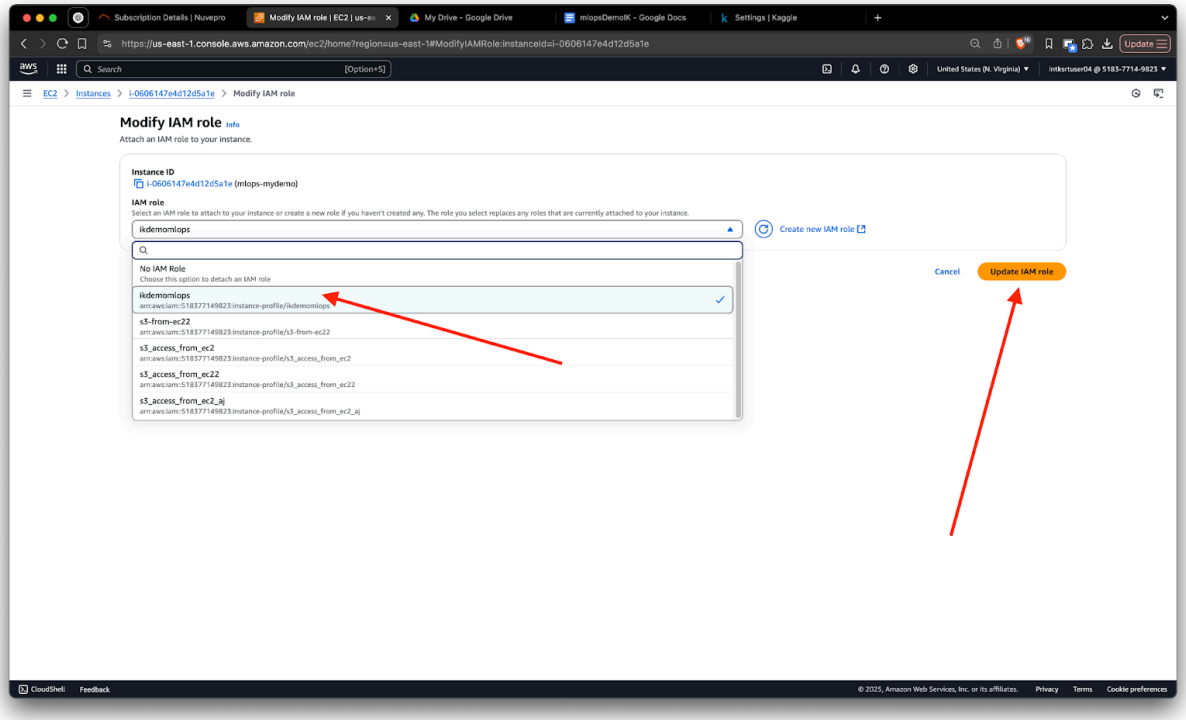
Cookie preferences





IAM roles provide secure access to services without hardcoding credentials.

🔄 Step 3: Configure EC2 Environment, Download and Upload Dataset to S3

```
→sudo apt update && sudo apt install -y python3-pip unzip
→pip3 install kaggle boto3 pandas watchtower
→mkdir ~/.kaggle
```

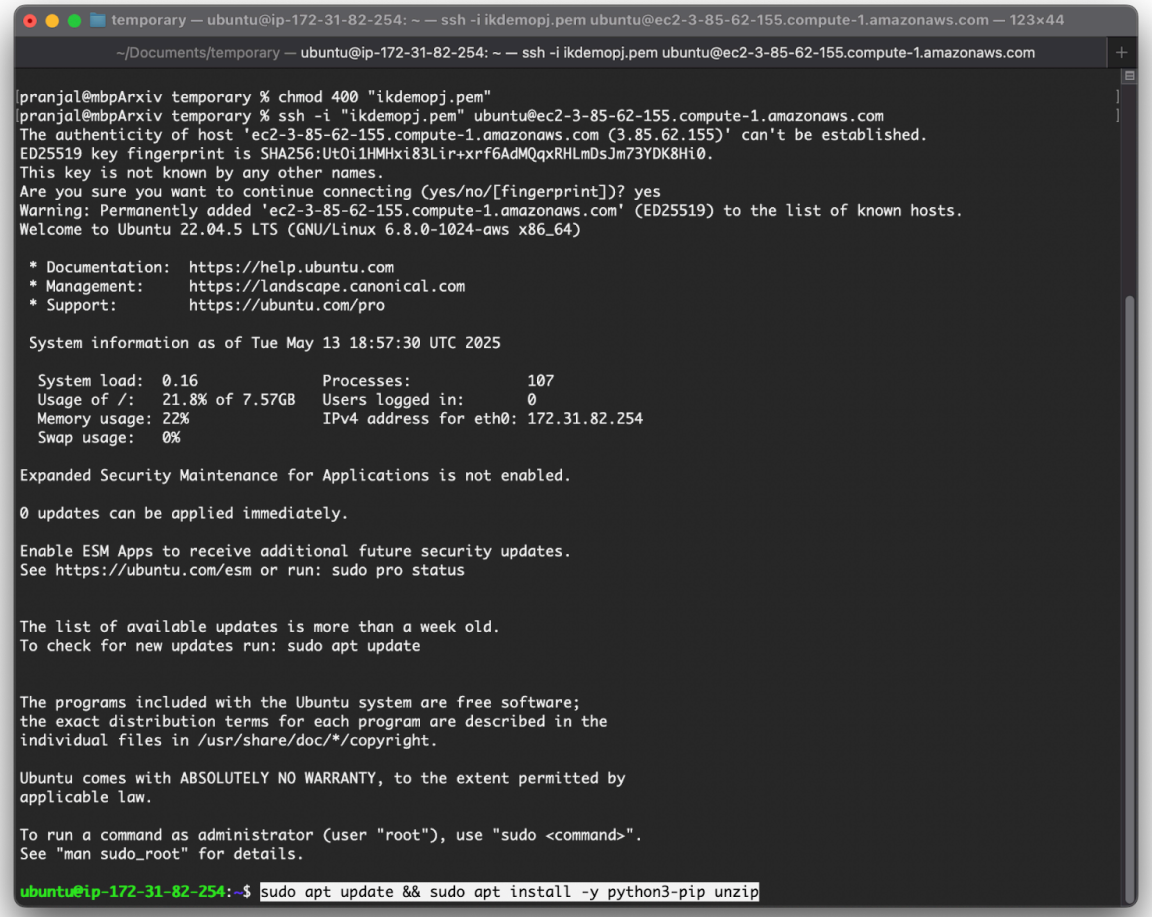
If kaggle not found:

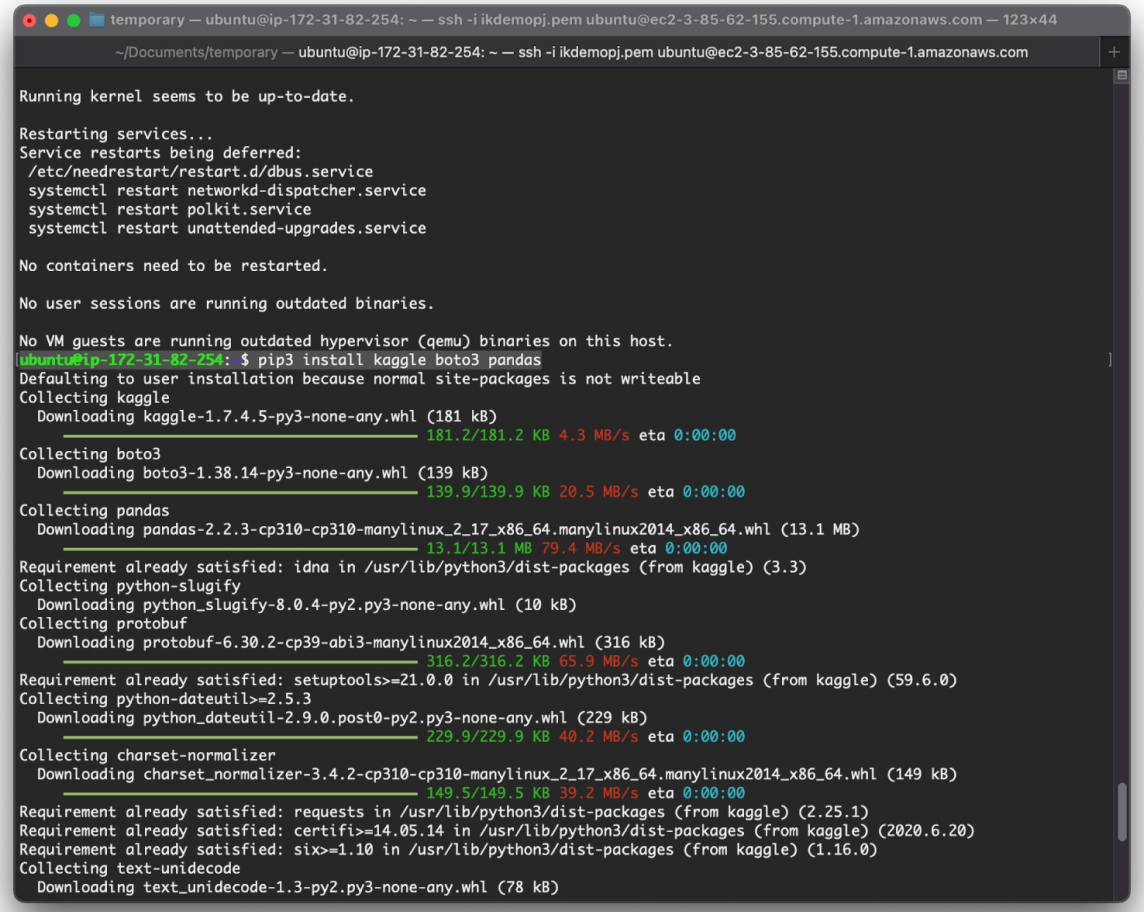
```
→pip3 install kaggle
→export PATH="$PATH:~/.local/bin"
→echo 'export PATH="$PATH:~/.local/bin"' >> ~/.bashrc
→source ~/.bashrc
```

Upload kaggle.json: - **SSH**: scp -i your-key.pem kaggle.json ubuntu@<EC2-IP>:~/.kaggle

(option) Session Manager: Use “Upload File” in AWS Console

```
→chmod 600 ~/.kaggle/kaggle.json
```


temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 123×44
~/Documents/temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
pranjal@mbpArxiv temporary % chmod 400 "ikdemopj.pem"
pranjal@mbpArxiv temporary % ssh -i "ikdemopj.pem" ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
The authenticity of host 'ec2-3-85-62-155.compute-1.amazonaws.com (3.85.62.155)' can't be established.
ED25519 key fingerprint is SHA256:UtOi1HMHxi83Lir+xrf6AdMQqxRHLmDsJm73YDK8Hi0.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-3-85-62-155.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
Welcome to Ubuntu 22.04.5 LTS (GNU/Linux 6.8.0-1024-aws x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/pro
System information as of Tue May 13 18:57:30 UTC 2025
System load: 0.16 Processes: 107
Usage of /: 21.8% of 7.57GB Users logged in: 0
Memory usage: 22% IPv4 address for eth0: 172.31.82.254
Swap usage: 0%
Expanded Security Maintenance for Applications is not enabled.
0 updates can be applied immediately.
Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status
The list of available updates is more than a week old.
To check for new updates run: sudo apt update
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
ubuntu@ip-172-31-82-254:~$ sudo apt update && sudo apt install -y python3-pip unzip



Kaggle CLI needs token authentication and correct permissions to work.

Create Kaggle Account and API Token

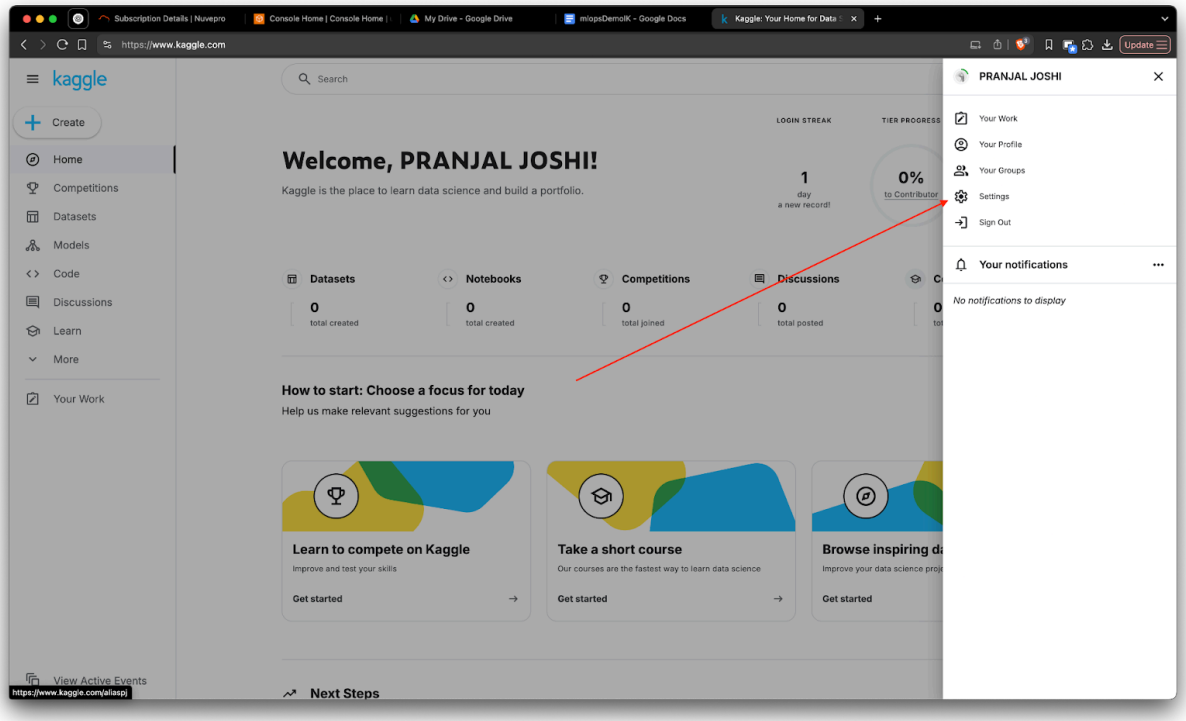
1. Go to https://www.kaggle.com and sign up or log in.
2. Click on your profile picture (top-right) > "Account".
3. Scroll down to the **API** section.
4. Click **"Create New API Token"**. This downloads a `kaggle.json` file.

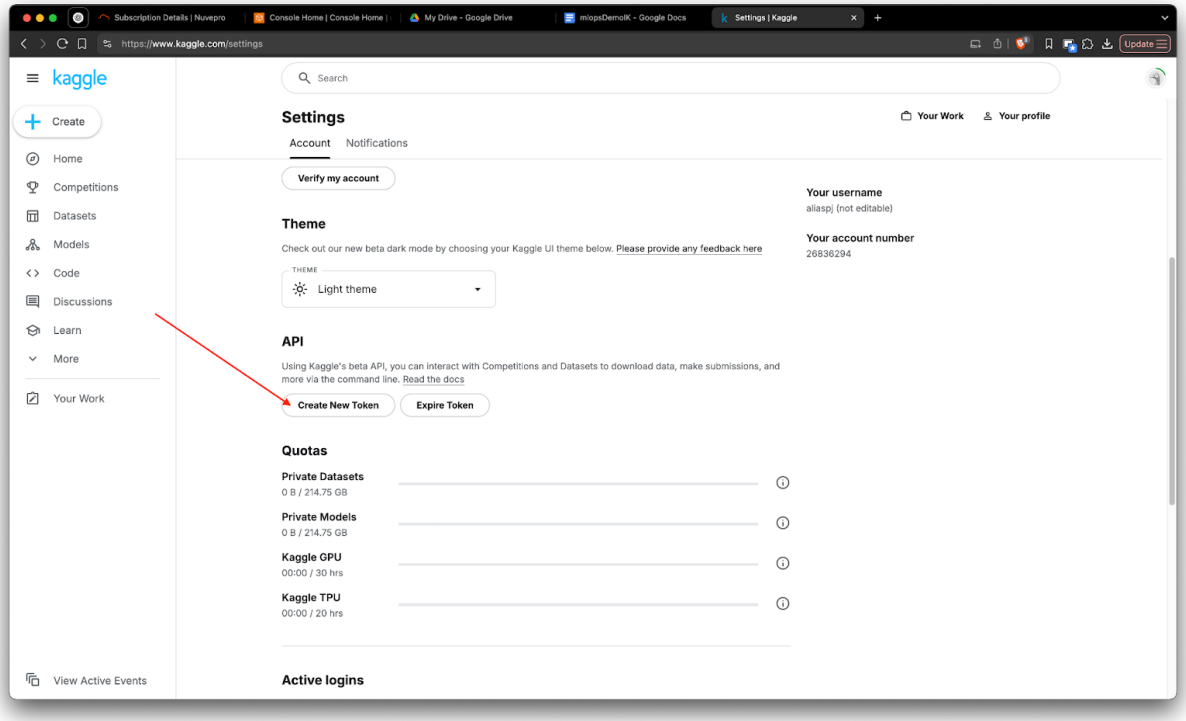
5. Upload this to your EC2 instance under `~/.kaggle/` as described above.

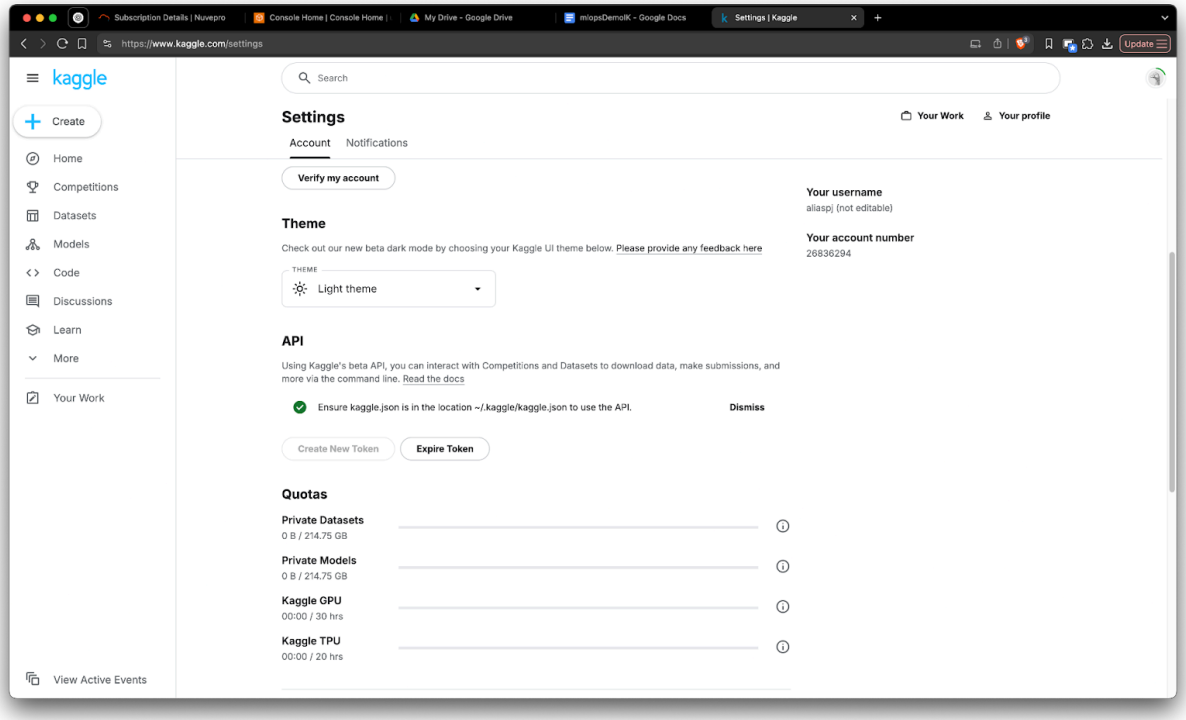
1. Join competition: IEEE Fraud Detection
2. On EC2:

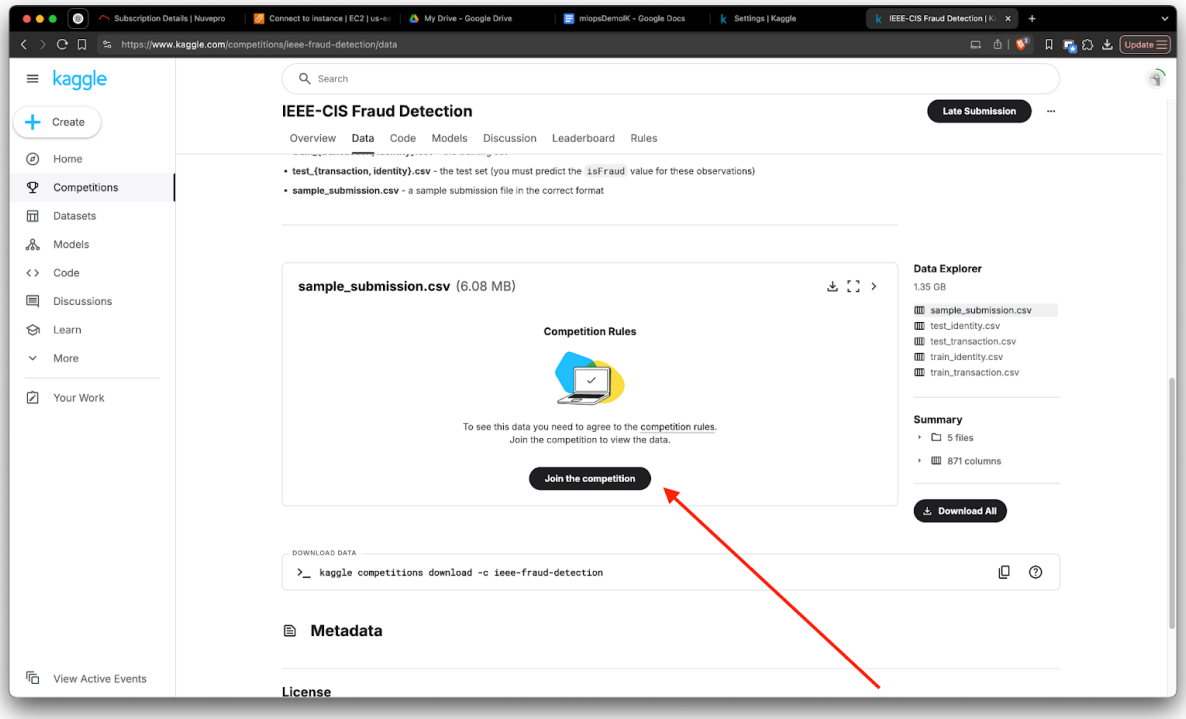
linux commands:

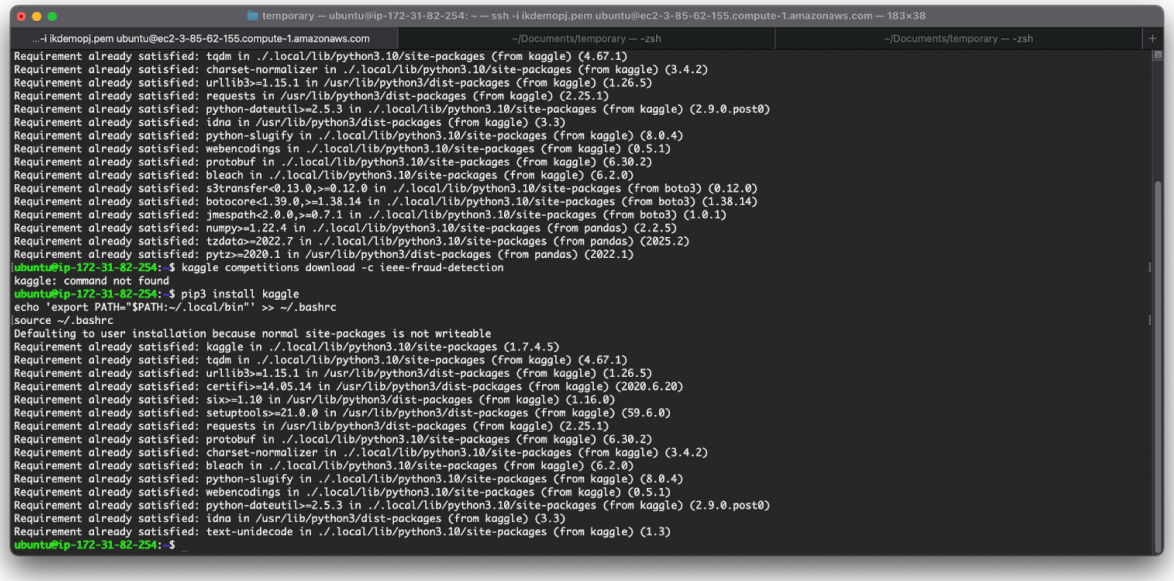
→kaggle competitions download -c ieee-fraud-detection
→unzip ieee-fraud-detection.zip -d ieee_fraud
→aws s3 cp ieee_fraud/ s3://fraud-demo-data/raw/ --recursive
→aws s3 ls s3://fraud-demo-data/raw/

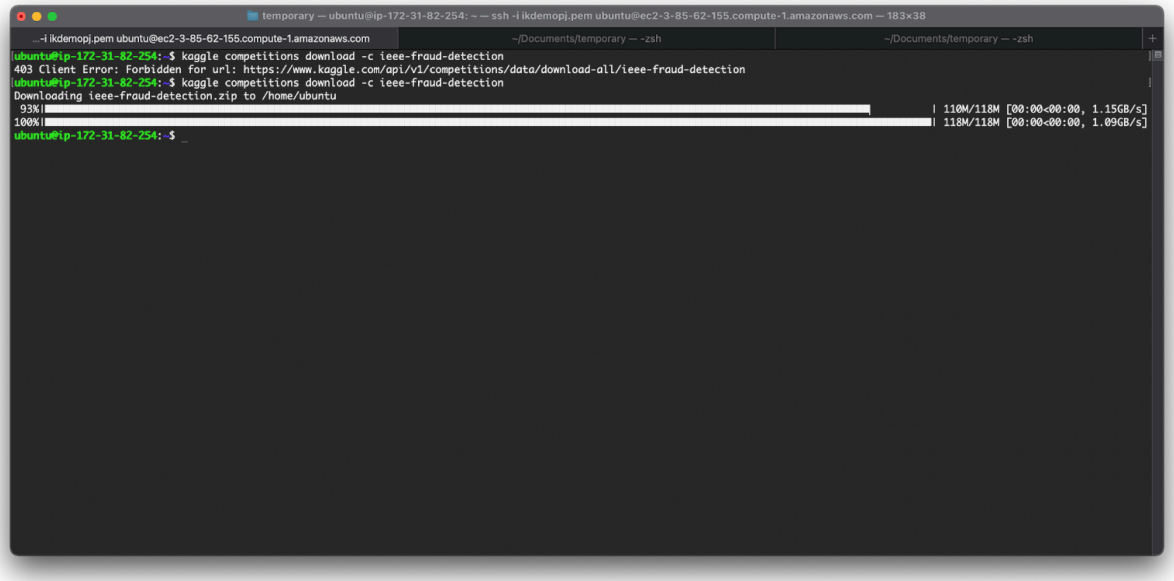


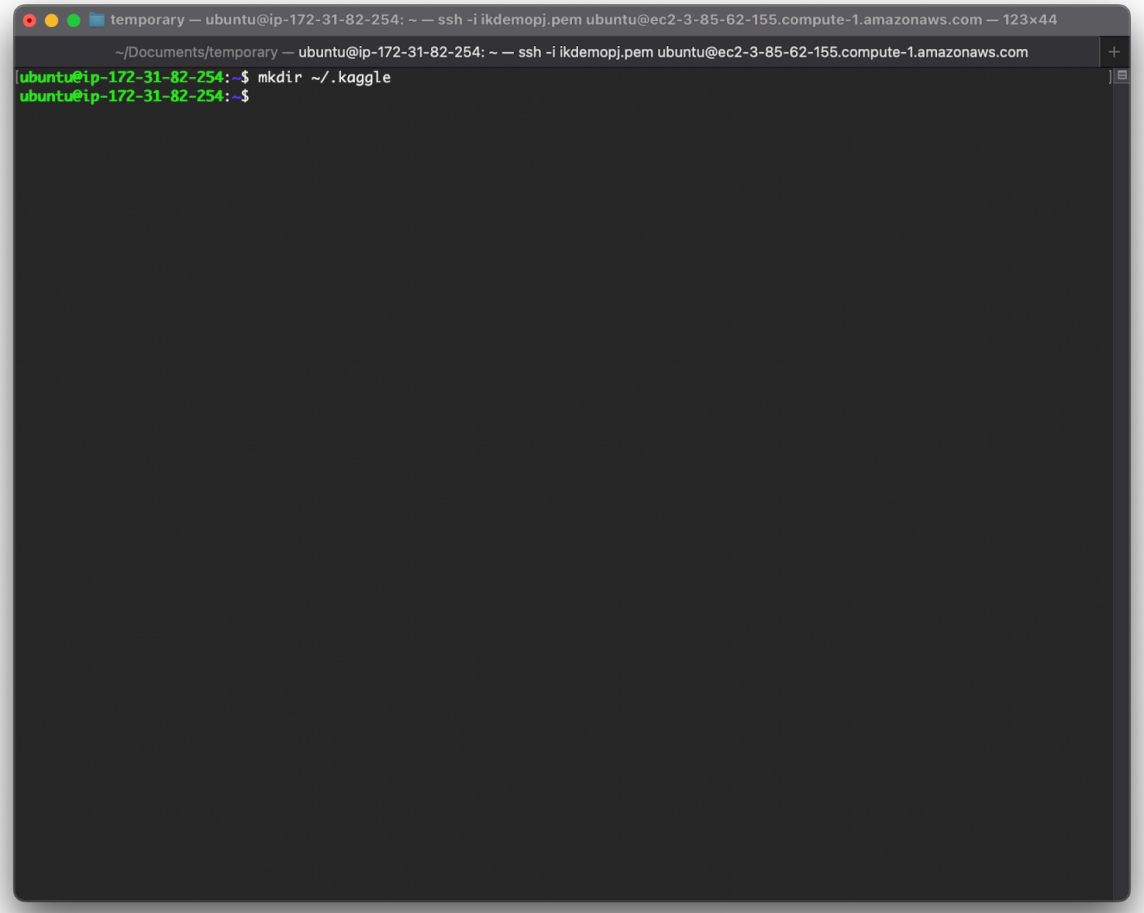

Subscription Details | Nuvepro
Console Home | Console Home |
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://www.kaggle.com/settings
Update
kaggle
Search
Create
Home
Competitions
Datasets
Models
Code
Discussions
Learn
More
Your Work
Settings
Your Work
Your profile
Account
Notifications
Verify my account
Your username
aliaspj (not editable)
Your account number
26836294
Theme
Check out our new beta dark mode by choosing your Kaggle UI theme below. Please provide any feedback here
THEME
Light theme
API
Using Kaggle's beta API, you can interact with Competitions and Datasets to download data, make submissions, and more via the command line. Read the docs
Create New Token
Expire Token
Quotas
Private Datasets
0 B / 214.75 GB
Private Models
0 B / 214.75 GB
Kaggle GPU
00:00 / 30 hrs
Kaggle TPU
00:00 / 20 hrs
Active logins
View Active Events


Subscription Details | Nuvepro
Console Home | Console Home |
My Drive - Google Drive
mlopsDemoIK - Google Docs
Settings | Kaggle
https://www.kaggle.com/settings
Update
kaggle
Search
Create
Home
Competitions
Datasets
Models
Code
Discussions
Learn
More
Your Work
Settings
Your Work
Your profile
Account
Notifications
Verify my account
Your username
aliaspj (not editable)
Your account number
26836294
Theme
Check out our new beta dark mode by choosing your Kaggle UI theme below. Please provide any feedback here
THEME
Light theme
API
Using Kaggle's beta API, you can interact with Competitions and Datasets to download data, make submissions, and more via the command line. Read the docs
Ensure kaggle.json is in the location ~/.kaggle/kaggle.json to use the API.
Dismiss
Create New Token
Expire Token
Quotas
Private Datasets
0 B / 214.75 GB
Private Models
0 B / 214.75 GB
Kaggle GPU
00:00 / 30 hrs
Kaggle TPU
00:00 / 20 hrs
View Active Events


kaggle
Create
Home
Competitions
Datasets
Models
Code
Discussions
Learn
More
Your Work
View Active Events
Search
IEEE-CIS Fraud Detection
Late Submission
Overview
Data
Code
Models
Discussion
Leaderboard
Rules
test_{transaction, identity}.csv - the test set (you must predict the isFraud value for these observations)
sample_submission.csv - a sample submission file in the correct format
sample_submission.csv (6.08 MB)
Competition Rules
To see this data you need to agree to the competition rules.
Join the competition to view the data.
Join the competition
Data Explorer
1.35 GB
sample_submission.csv
test_identity.csv
test_transaction.csv
train_identity.csv
train_transaction.csv
Summary
5 files
871 columns
Download All
DOWNLOAD DATA
kaggle competitions download -c ieee-fraud-detection
Metadata
License

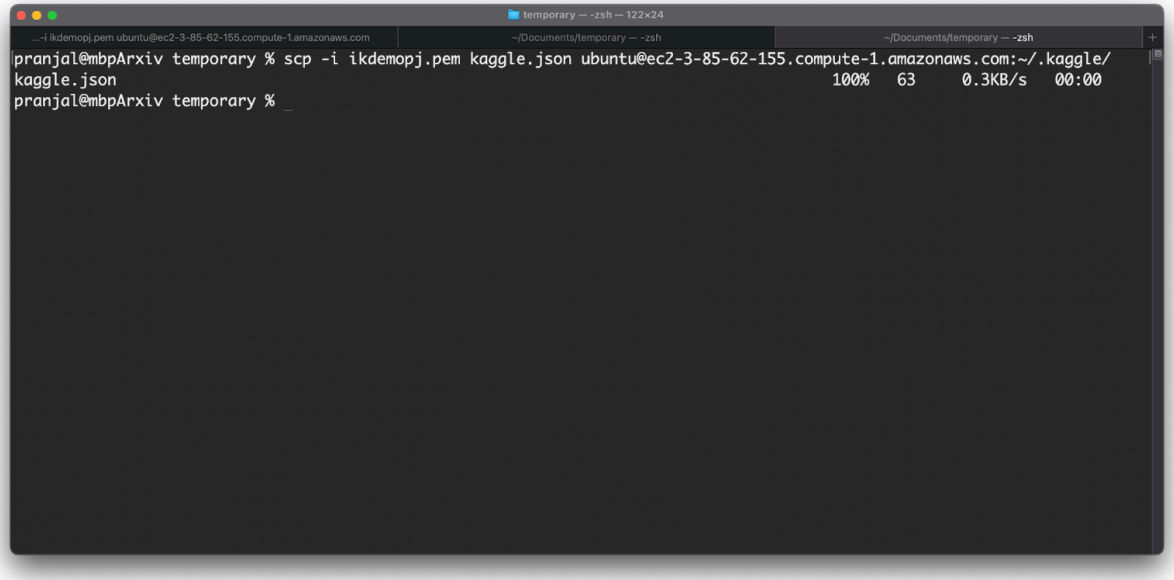

Requirement already satisfied: tqdm in ./.local/lib/python3.10/site-packages (from kaggle) (4.67.1)
Requirement already satisfied: charset-normalizer in ./.local/lib/python3.10/site-packages (from kaggle) (3.4.2)
Requirement already satisfied: urllib3>=1.15.1 in /usr/lib/python3/dist-packages (from kaggle) (1.26.5)
Requirement already satisfied: requests in /usr/lib/python3/dist-packages (from kaggle) (2.25.1)
Requirement already satisfied: python-dateutil>=2.5.3 in ./.local/lib/python3.10/site-packages (from kaggle) (2.9.0.post0)
Requirement already satisfied: idna in /usr/lib/python3/dist-packages (from kaggle) (3.3)
Requirement already satisfied: python-slugify in ./.local/lib/python3.10/site-packages (from kaggle) (8.0.4)
Requirement already satisfied: webencodings in ./.local/lib/python3.10/site-packages (from kaggle) (0.5.1)
Requirement already satisfied: protobuf in ./.local/lib/python3.10/site-packages (from kaggle) (6.30.2)
Requirement already satisfied: bleach in ./.local/lib/python3.10/site-packages (from kaggle) (6.2.0)
Requirement already satisfied: s3transfer<0.13.0,>=0.12.0 in ./.local/lib/python3.10/site-packages (from boto3) (0.12.0)
Requirement already satisfied: botocore<1.39.0,>=1.38.14 in ./.local/lib/python3.10/site-packages (from boto3) (1.38.14)
Requirement already satisfied: jmespath<2.0.0,>=0.7.1 in ./.local/lib/python3.10/site-packages (from boto3) (1.0.1)
Requirement already satisfied: numpy>=1.22.4 in ./.local/lib/python3.10/site-packages (from pandas) (2.2.5)
Requirement already satisfied: tzdata>=2022.7 in ./.local/lib/python3.10/site-packages (from pandas) (2025.2)
Requirement already satisfied: pytz>=2020.1 in /usr/lib/python3/dist-packages (from pandas) (2022.1)
ubuntu@ip-172-31-82-254:~$ kaggle competitions download -c ieee-fraud-detection
kaggle: command not found
ubuntu@ip-172-31-82-254:~$ pip3 install kaggle
echo 'export PATH="$PATH:~/.local/bin"' >> ~/.bashrc
source ~/.bashrc
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: kaggle in ./.local/lib/python3.10/site-packages (1.7.4.5)
Requirement already satisfied: tqdm in ./.local/lib/python3.10/site-packages (from kaggle) (4.67.1)
Requirement already satisfied: urllib3>=1.15.1 in /usr/lib/python3/dist-packages (from kaggle) (1.26.5)
Requirement already satisfied: certifi>=14.05.14 in /usr/lib/python3/dist-packages (from kaggle) (2020.6.20)
Requirement already satisfied: six>=1.10 in /usr/lib/python3/dist-packages (from kaggle) (1.16.0)
Requirement already satisfied: setuptools>=21.0.0 in /usr/lib/python3/dist-packages (from kaggle) (59.6.0)
Requirement already satisfied: requests in /usr/lib/python3/dist-packages (from kaggle) (2.25.1)
Requirement already satisfied: protobuf in ./.local/lib/python3.10/site-packages (from kaggle) (6.30.2)
Requirement already satisfied: charset-normalizer in ./.local/lib/python3.10/site-packages (from kaggle) (3.4.2)
Requirement already satisfied: bleach in ./.local/lib/python3.10/site-packages (from kaggle) (6.2.0)
Requirement already satisfied: python-slugify in ./.local/lib/python3.10/site-packages (from kaggle) (8.0.4)
Requirement already satisfied: webencodings in ./.local/lib/python3.10/site-packages (from kaggle) (0.5.1)
Requirement already satisfied: python-dateutil>=2.5.3 in ./.local/lib/python3.10/site-packages (from kaggle) (2.9.0.post0)
Requirement already satisfied: idna in /usr/lib/python3/dist-packages (from kaggle) (3.3)
Requirement already satisfied: text-unidecode in ./.local/lib/python3.10/site-packages (from kaggle) (1.3)
ubuntu@ip-172-31-82-254:~$

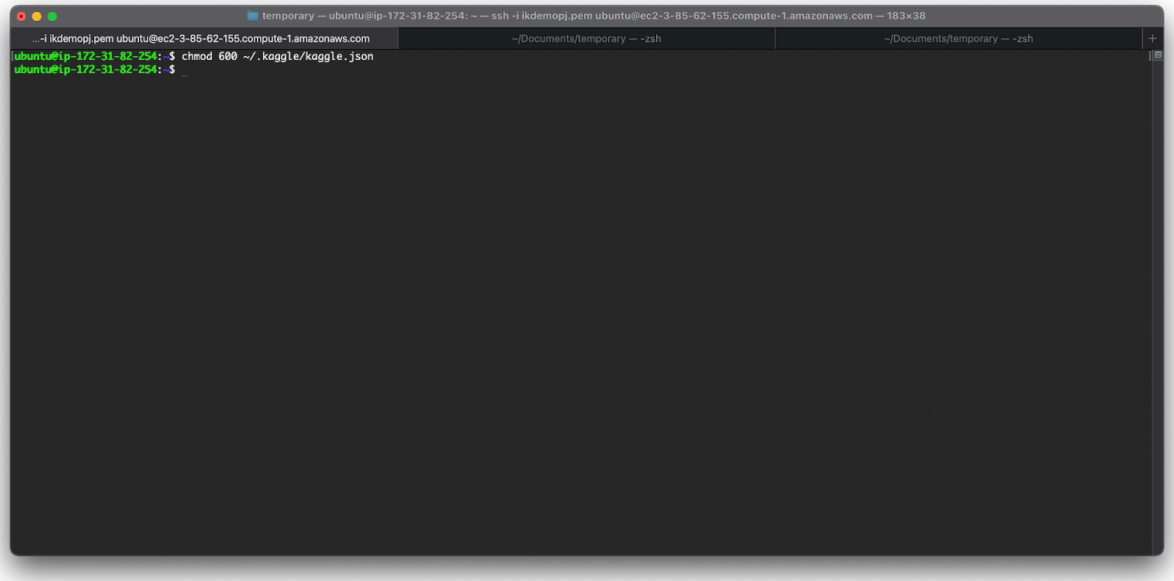

temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 183×38
...-i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
~/Documents/temporary — -zsh
~/Documents/temporary — -zsh
ubuntu@ip-172-31-82-254:~$ kaggle competitions download -c ieee-fraud-detection
403 Client Error: Forbidden for url: https://www.kaggle.com/api/v1/competitions/data/download-all/ieee-fraud-detection
ubuntu@ip-172-31-82-254:~$ kaggle competitions download -c ieee-fraud-detection
Downloading ieee-fraud-detection.zip to /home/ubuntu
93%| 110M/118M [00:00<00:00, 1.15GB/s]
100%| 118M/118M [00:00<00:00, 1.09GB/s]
ubuntu@ip-172-31-82-254:~$

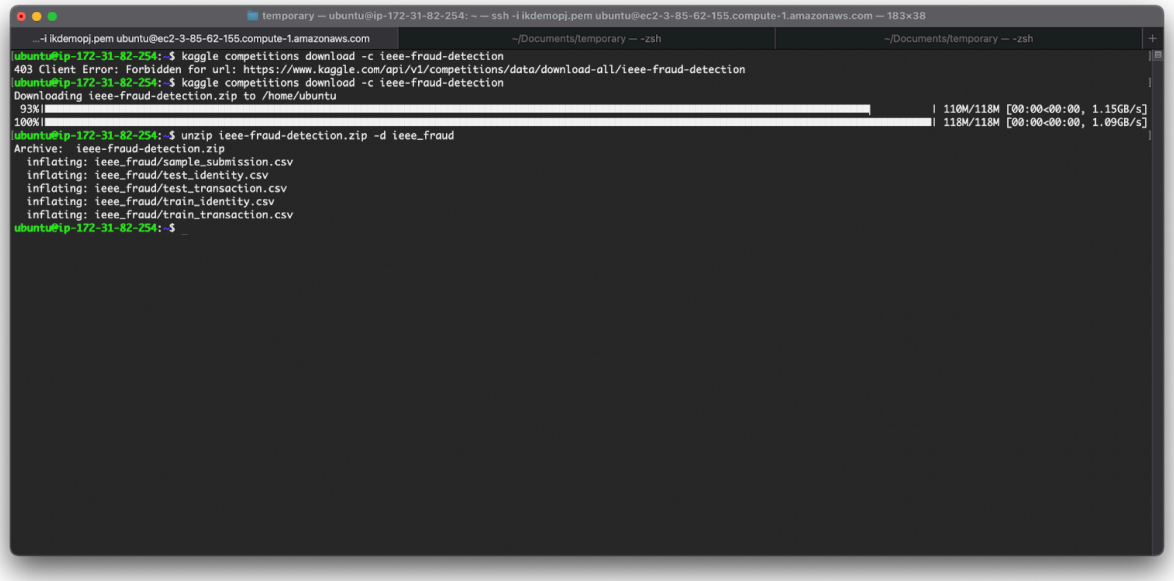

temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 123×44
~/Documents/temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
ubuntu@ip-172-31-82-254:~$ mkdir ~/.kaggle
ubuntu@ip-172-31-82-254:~$

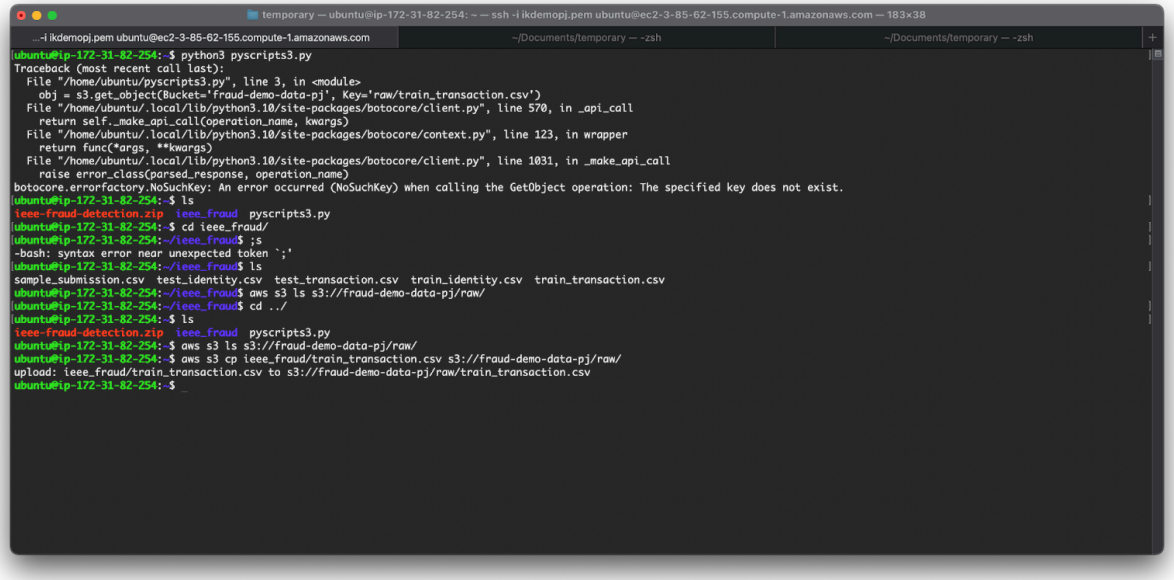
(

(in local windows/linux/mac terminal)









Simulates a typical pipeline where ingestion uploads raw data to the cloud.

📅 Step 5: Basic Data Ingestion + Logging Demo

Run this command to specify region for cloudwatch:

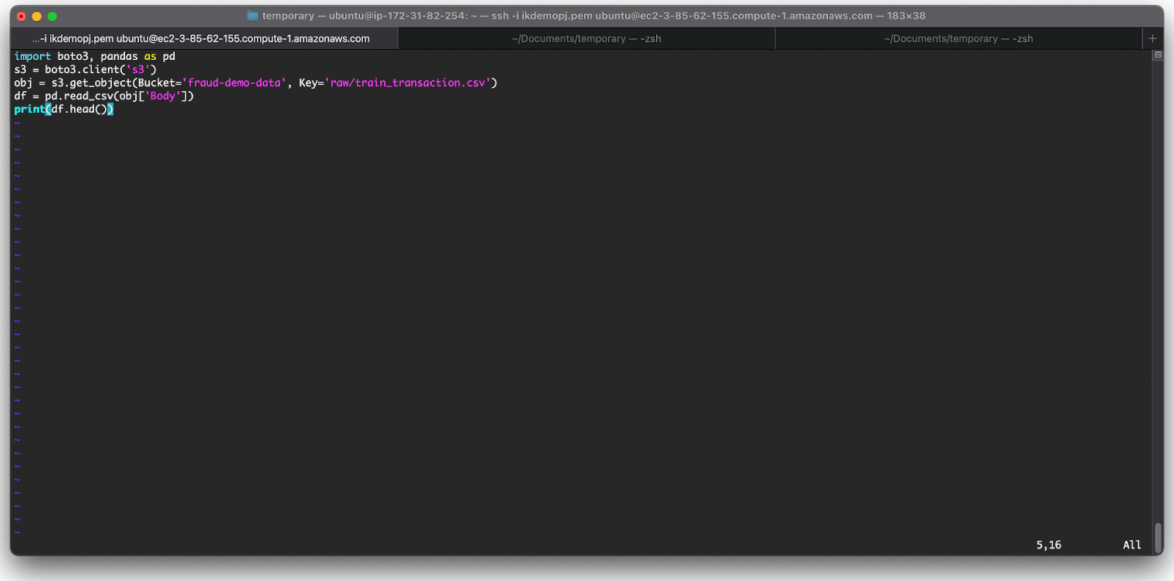
→export AWS_DEFAULT_REGION=us-east-1

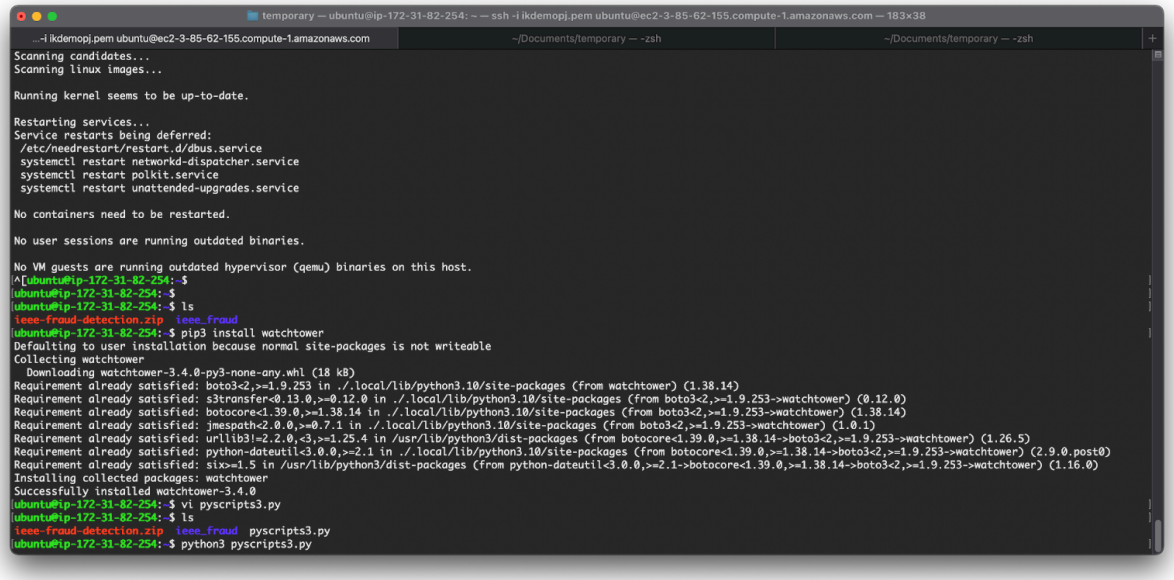
Run this script using editor by running command:

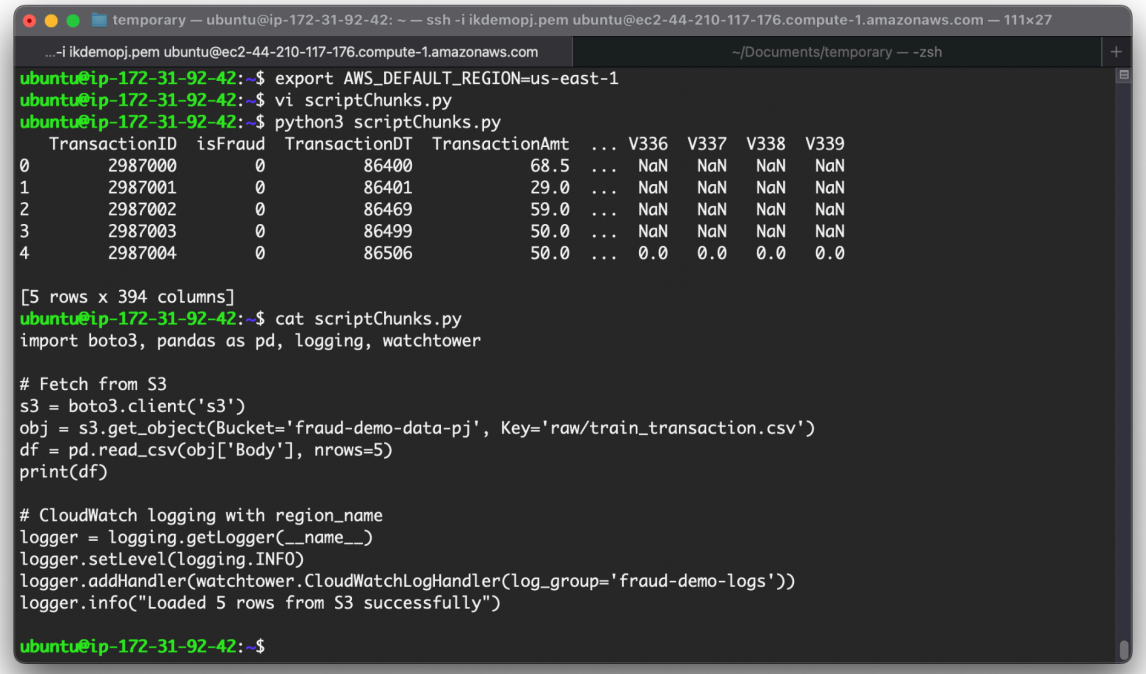
→vi script.py

Guide to vi editor

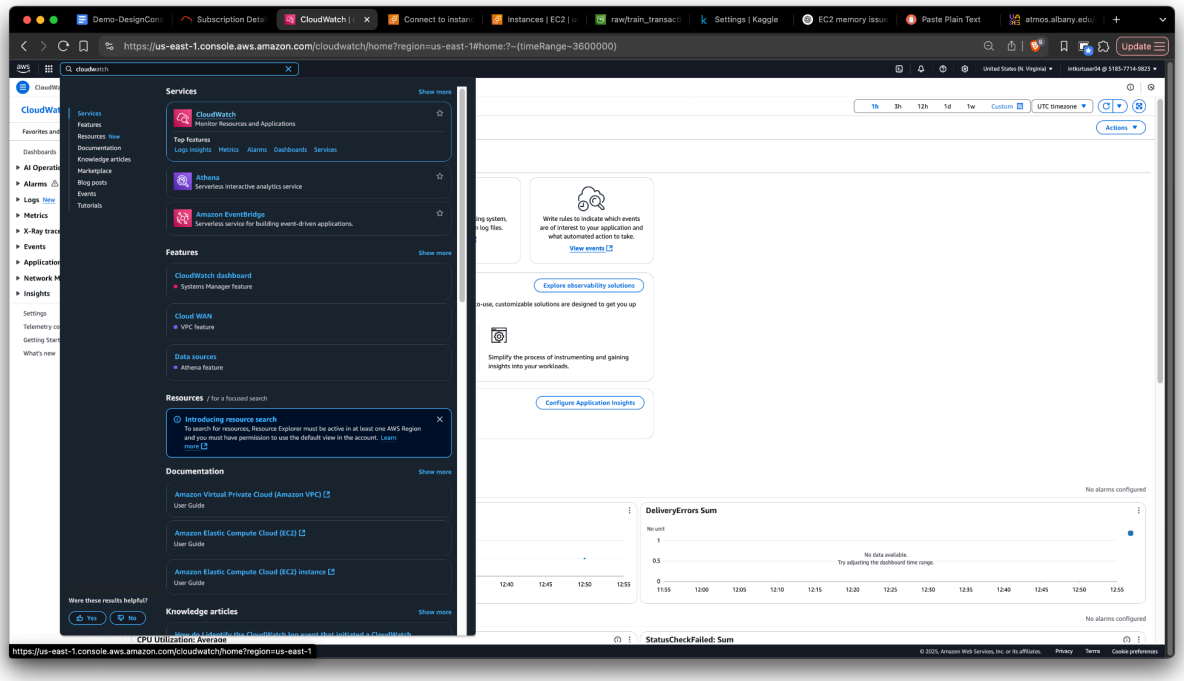
```
#script.py

import boto3, pandas as pd, logging, watchtower

# Fetch from S3

s3 = boto3.client('s3')

obj = s3.get_object(Bucket='fraud-demo-data-<yourname>',
Key='raw/train_transaction.csv')

df = pd.read_csv(obj['Body'], nrows=5)

print(df)


# CloudWatch logging with region_name

logger = logging.getLogger(__name__)

logger.setLevel(logging.INFO)

logger.addHandler(watchtower.CloudWatchLogHandler(log_group='fraud-demo-logs'))

logger.info("Loaded 5 rows from S3 successfully")
```

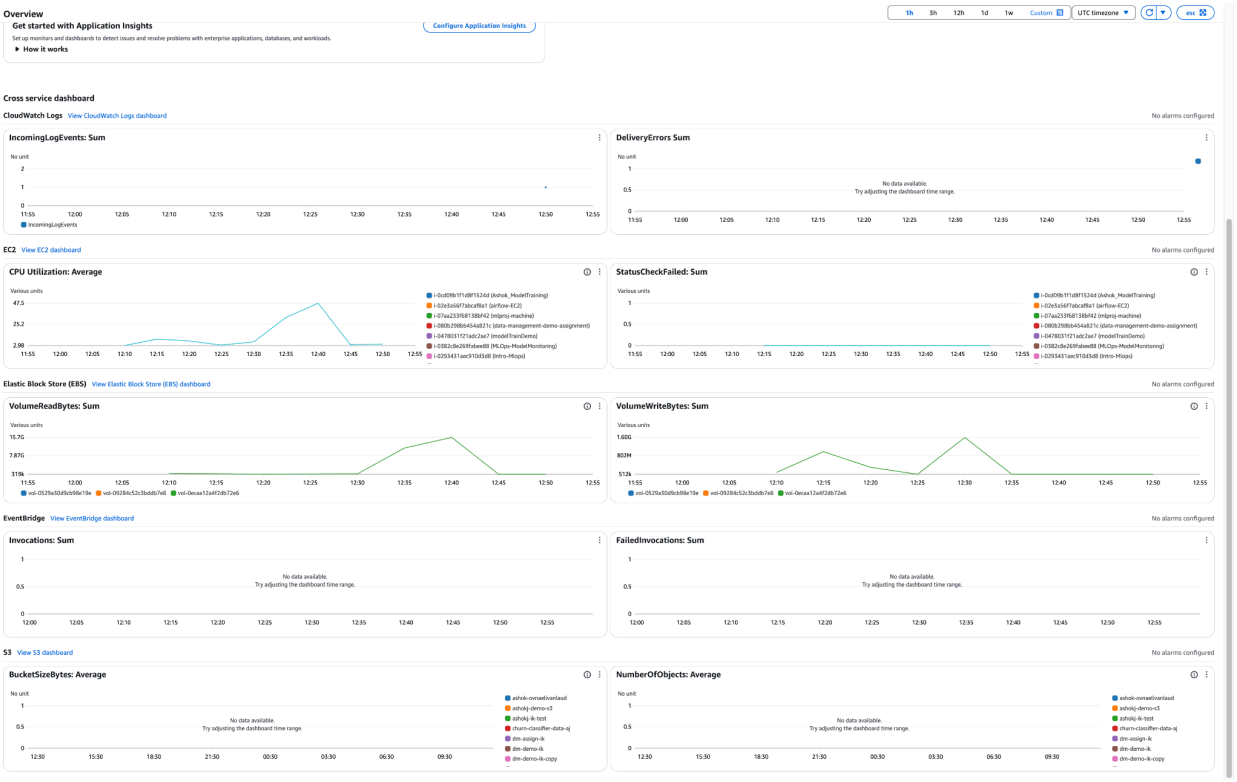

temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 183×38
...-i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
~/Documents/temporary — -zsh
~/Documents/temporary — -zsh
import boto3, pandas as pd
s3 = boto3.client('s3')
obj = s3.get_object(Bucket='fraud-demo-data', Key='raw/train_transaction.csv')
df = pd.read_csv(obj['Body'])
print(df.head())
5,16
All


temporary — ubuntu@ip-172-31-82-254: ~ — ssh -i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com — 183×38
...-i ikdemopj.pem ubuntu@ec2-3-85-62-155.compute-1.amazonaws.com
~/Documents/temporary — -zsh
~/Documents/temporary — -zsh
Scanning candidates...
Scanning linux images...
Running kernel seems to be up-to-date.
Restarting services...
Service restarts being deferred:
/etc/needrestart/restart.d/dbus.service
systemctl restart networkd-dispatcher.service
systemctl restart polkit.service
systemctl restart unattended-upgrades.service
No containers need to be restarted.
No user sessions are running outdated binaries.
No VM guests are running outdated hypervisor (qemu) binaries on this host.
^[[ubuntu@ip-172-31-82-254:~$
ubuntu@ip-172-31-82-254:~$
ubuntu@ip-172-31-82-254:~$ ls
ieee-fraud-detection.zip ieee_fraud
ubuntu@ip-172-31-82-254:~$ pip3 install watchtower
Defaulting to user installation because normal site-packages is not writeable
Collecting watchtower
Downloading watchtower-3.4.0-py3-none-any.whl (18 kB)
Requirement already satisfied: boto3<2,>=1.9.253 in ./.local/lib/python3.10/site-packages (from watchtower) (1.38.14)
Requirement already satisfied: s3transfer<0.13.0,>=0.12.0 in ./.local/lib/python3.10/site-packages (from boto3<2,>=1.9.253->watchtower) (0.12.0)
Requirement already satisfied: botocore<1.39.0,>=1.38.14 in ./.local/lib/python3.10/site-packages (from boto3<2,>=1.9.253->watchtower) (1.38.14)
Requirement already satisfied: jmespath<2.0.0,>=0.7.1 in ./.local/lib/python3.10/site-packages (from boto3<2,>=1.9.253->watchtower) (1.0.1)
Requirement already satisfied: urllib3!=2.2.0,<3,>=1.25.4 in /usr/lib/python3/dist-packages (from botocore<1.39.0,>=1.38.14->boto3<2,>=1.9.253->watchtower) (1.26.5)
Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in ./.local/lib/python3.10/site-packages (from botocore<1.39.0,>=1.38.14->boto3<2,>=1.9.253->watchtower) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in /usr/lib/python3/dist-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.39.0,>=1.38.14->boto3<2,>=1.9.253->watchtower) (1.16.0)
Installing collected packages: watchtower
Successfully installed watchtower-3.4.0
ubuntu@ip-172-31-82-254:~$ vi pyscripts3.py
ubuntu@ip-172-31-82-254:~$ ls
ieee-fraud-detection.zip ieee_fraud pyscripts3.py
ubuntu@ip-172-31-82-254:~$ python3 pyscripts3.py



Output on the aws cloudwatch dashboard:


https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1#home:?~(timeRange~3600000)
Services
CloudWatch
Monitor Resources and Applications
Athena
Serverless interactive analytics service
Amazon EventBridge
Serverless service for building event-driven applications.
Features
CloudWatch dashboard
Systems Manager feature
Cloud WAN
VPC feature
Data sources
Athena feature
Resources / for a focused search
Introducing resource search
Documentation
Amazon Virtual Private Cloud (Amazon VPC)
Amazon Elastic Compute Cloud (EC2)
Amazon Elastic Compute Cloud (EC2) instance
Knowledge articles
DeliveryErrors Sum
StatusCheckFailed: Sum
CPU Utilization: Average
https://us-east-1.console.aws.amazon.com/cloudwatch/home?region=us-east-1


Overview
Get started with Application Insights
Cross service dashboard
CloudWatch Logs
IncomingLogEvents: Sum
DeliveryErrors Sum
EC2
CPU Utilization: Average
StatusCheckFailed: Sum
Elastic Block Store (EBS)
VolumeReadBytes: Sum
VolumeWriteBytes: Sum
EventBridge
Invocations: Sum
FailedInvocations: Sum
S3
BucketSizeBytes: Average
NumberOfObjects: Average

Logging enables observability. Watchtower helps push logs directly to CloudWatch.

🛑 Common Errors

- AccessDenied: IAM role lacks permissions or typo in bucket/key
- NoSuchKey: Wrong file name or missing upload

🎯 Bottlenecks and Engineering Solutions

- No dataset versioning → DVC, LakeFS
- No schema validation → Great Expectations, Pandera
- No retraining workflow → GitHub Actions, Jenkins
- Model not tracked → MLflow, SageMaker Model Registry
- No deployment pipeline → EKS, Lambda, SageMaker Endpoint
- No drift detection → EvidentlyAI, WhyLabs

These bottlenecks motivate the need for MLOps practices and tooling.

🧩 System Design Sketch

Raw Data (S3)
↓
Validation + Feature Engineering (EC2/SageMaker)
↓
Training (SageMaker)
↓
Model Registry + CI/CD (MLflow/Jenkins)
↓
Deployment (EKS / Lambda / SageMaker Endpoint)
↓
Monitoring (CloudWatch + Drift Detector)

This architecture illustrates how production ML systems are modular, observable, and automated.
