

How to use Intel® DAAL PCA via SageMaker web interface

Description of algorithm:

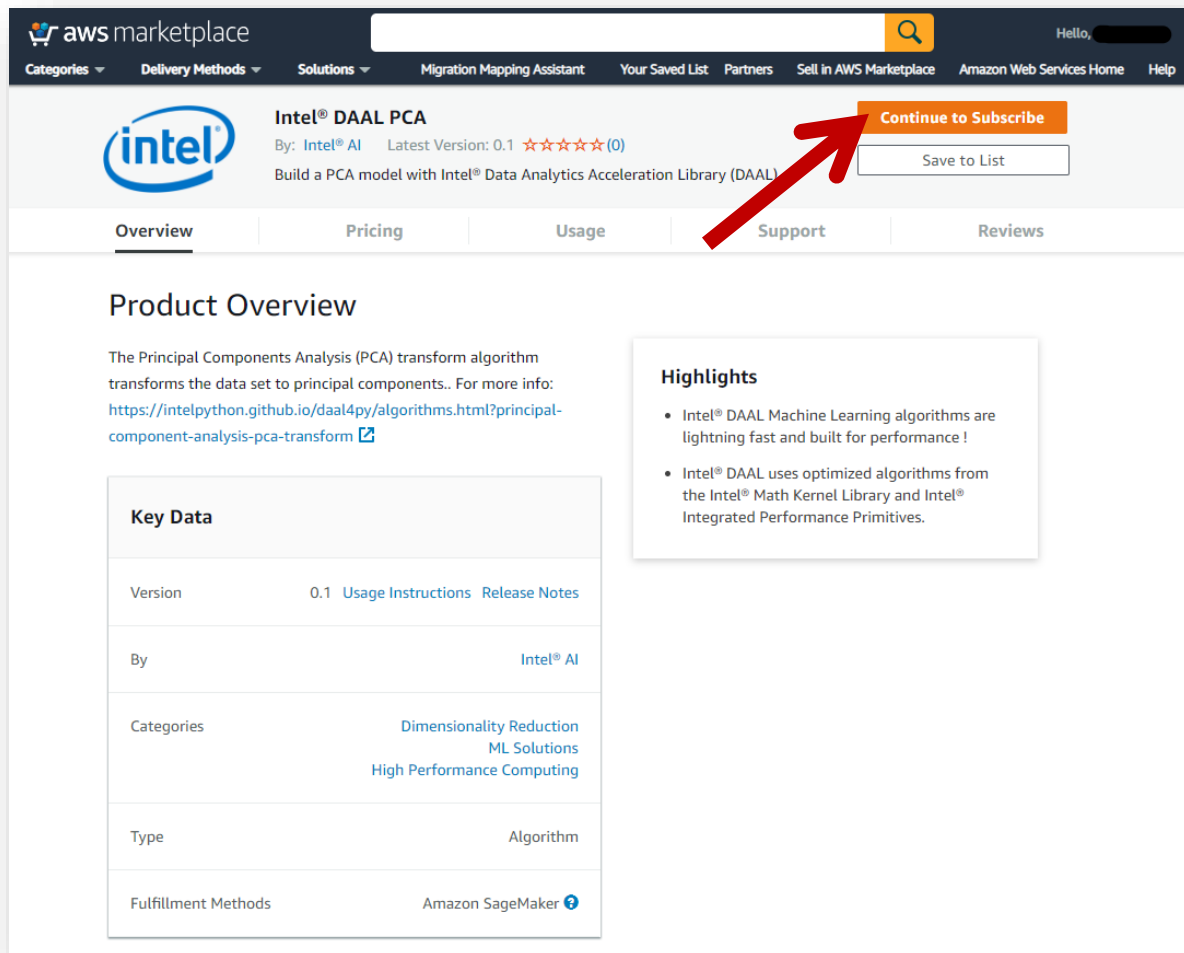
Principal Component Analysis (PCA) is a method for exploratory data analysis. PCA transforms a set of observations of possibly correlated variables to a new set of uncorrelated variables, called principal components. Principal components are the directions of the largest variance, that is, the directions where the data is mostly spread out. Because all principal components are orthogonal to each other, there is no redundant information. This is a way of replacing a group of variables with a smaller set of new variables. PCA is one of powerful techniques for dimension reduction.

[Intel® DAAL developer guide](#)

[Intel® DAAL documentation for PCA](#)

Instruction:

1. Visit page on SageMaker Marketplace and click “Continue to Subscribe”



The screenshot shows the AWS Marketplace page for the Intel® DAAL PCA algorithm. The page header includes the AWS Marketplace logo, a search bar, and navigation links. The main content area features the Intel logo, the product name 'Intel® DAAL PCA', the provider 'Intel® AI', the latest version '0.1', and a star rating '(0)'. Below this is a description: 'Build a PCA model with Intel® Data Analytics Acceleration Library (DAAL)'. A red arrow points to the 'Continue to Subscribe' button. Other buttons include 'Save to List'. The page has tabs for 'Overview', 'Pricing', 'Usage', 'Support', and 'Reviews'. The 'Overview' tab is selected, showing a 'Product Overview' section with a description of PCA and a link to the GitHub repository. A 'Key Data' table is also present, listing version, provider, categories, type, and fulfillment methods. A 'Highlights' box on the right lists two bullet points about the algorithm's performance and optimization.

Key Data

Version	0.1 Usage Instructions Release Notes
By	Intel® AI
Categories	Dimensionality Reduction ML Solutions High Performance Computing
Type	Algorithm
Fulfillment Methods	Amazon SageMaker

Highlights

- Intel® DAAL Machine Learning algorithms are lightning fast and built for performance !
- Intel® DAAL uses optimized algorithms from the Intel® Math Kernel Library and Intel® Integrated Performance Primitives.

2. Click "Accept Offer" if you agree with EULA at end of page. If you already subscribed on algorithm on Marketplace this step will be skipped.

The screenshot shows the AWS Marketplace interface for the 'Intel® DAAL PCA' product. The page is titled 'Subscribe to this software' and includes a section for 'Pricing Terms'. A red arrow points to the 'Accept Offer' button, which is located at the top right of the pricing terms section.

Intel® AI Offer
By: Intel® AI

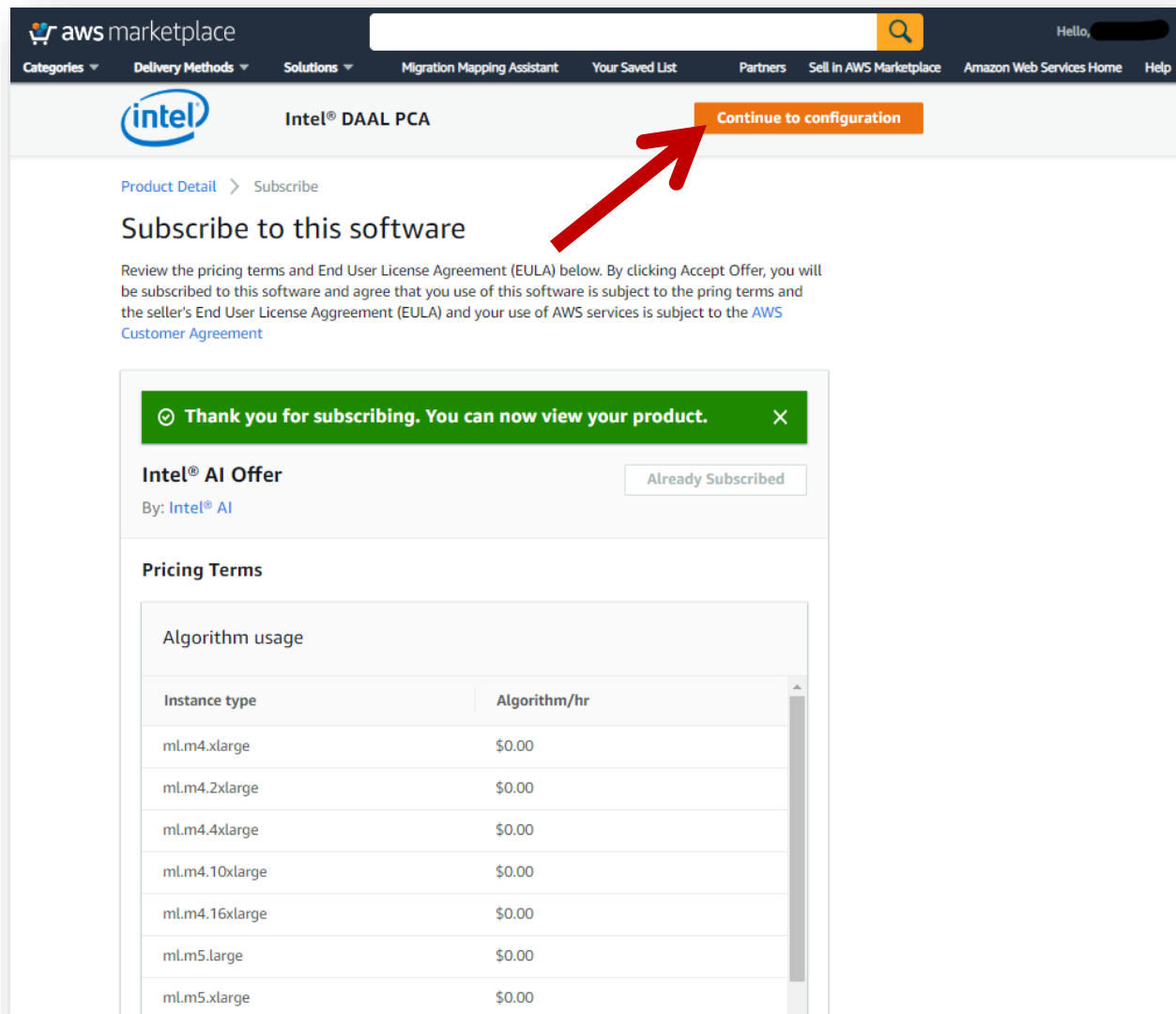
Accept Offer

Pricing Terms

Algorithm usage

Instance type	Algorithm/hr
ml.m4.xlarge	\$0.00
ml.m4.2xlarge	\$0.00
ml.m4.4xlarge	\$0.00
ml.m4.10xlarge	\$0.00
ml.m4.16xlarge	\$0.00
ml.m5.large	\$0.00
ml.m5.xlarge	\$0.00
ml.m5.2xlarge	\$0.00
ml.m5.4xlarge	\$0.00

3. Click "Continue to configuration"



The screenshot shows the AWS Marketplace interface for the Intel DAAL PCA software. The top navigation bar includes the AWS Marketplace logo, a search bar, and links to Categories, Delivery Methods, Solutions, Migration Mapping Assistant, Your Saved List, Partners, Sell in AWS Marketplace, Amazon Web Services Home, and Help. The Intel logo and product name 'Intel® DAAL PCA' are displayed. A red arrow points to the 'Continue to configuration' button. Below the product name, there is a 'Subscribe' link and a 'Product Detail' link. The main heading is 'Subscribe to this software'. A paragraph of text explains the subscription process and mentions the End User License Agreement (EULA). A green notification banner states 'Thank you for subscribing. You can now view your product.' Below this, there is an 'Intel® AI Offer' section with a link to 'Already Subscribed'. The 'Pricing Terms' section includes a table for 'Algorithm usage' with columns for 'Instance type' and 'Algorithm/hr'.

aws marketplace

Categories ▾ Delivery Methods ▾ Solutions ▾ Migration Mapping Assistant Your Saved List Partners Sell in AWS Marketplace Amazon Web Services Home Help

intel Intel® DAAL PCA

Continue to configuration

Product Detail > Subscribe

Subscribe to this software

Review the pricing terms and End User License Agreement (EULA) below. By clicking Accept Offer, you will be subscribed to this software and agree that you use of this software is subject to the pring terms and the seller's End User License Aggreement (EULA) and your use of AWS services is subject to the [AWS Customer Agreement](#)

🕒 Thank you for subscribing. You can now view your product. ✕

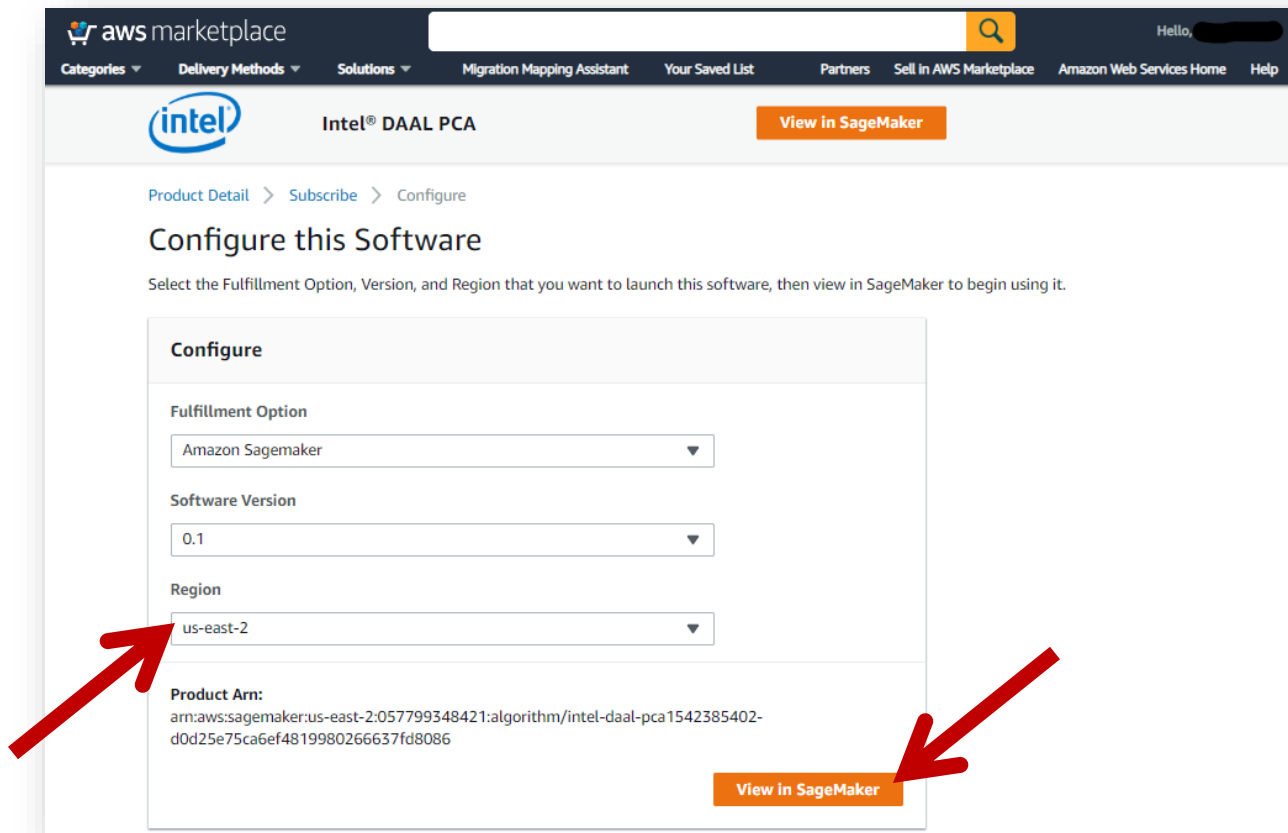
Intel® AI Offer Already Subscribed

By: [Intel® AI](#)

Pricing Terms

Algorithm usage	
Instance type	Algorithm/hr
ml.m4.xlarge	\$0.00
ml.m4.2xlarge	\$0.00
ml.m4.4xlarge	\$0.00
ml.m4.10xlarge	\$0.00
ml.m4.16xlarge	\$0.00
ml.m5.large	\$0.00
ml.m5.xlarge	\$0.00

4. Choose the Region and click “View in SageMaker”



PCA algorithm on AWS SageMaker is divided into two stages: training job and getting inference from endpoint.

Training job is computing principal components and other values from provided training data.

After that, you should create model with computed values and endpoint based on it.

Sending data to endpoint gives you transformed (dimension reduced) data in response.

5. Select needed algorithm version and click “Create training job”

The screenshot shows the Amazon SageMaker console interface. On the left is a navigation sidebar with options like Dashboard, Search, Ground Truth, Notebook, and Inference. The main content area is titled 'Intel® DAAL PCA' and shows a table of 'Algorithm versions'. The table has columns for Title, Version, and Algorithm ARN. The first entry is 'Intel® DAAL PCA' with version '0.1' and a specific ARN. A red arrow points from the 'Create training job' button in the top right to the first row of the table.

Title	Version	Algorithm ARN
Intel® DAAL PCA	0.1	arn:aws:sagemaker:us-east-2:057799348421:algorithm/intel-daal-pca1542385402-d0d25e75ca6ef4819980266637fd8086

6. Type job name, select IAM role and instance type

The screenshot shows the 'Job settings' configuration page in the Amazon SageMaker console. The page is divided into sections: Job settings, Algorithm options, and Resource configuration. Red arrows point to the 'Job name' input field, the 'IAM role' dropdown menu (which is set to 'AmazonSageMaker-ExecutionRole-...'), and the 'Instance type' dropdown menu (which is set to 'ml.m4.xlarge').

Job settings

Job name: [Input field]

IAM role: AmazonSageMaker-ExecutionRole- [Dropdown]

Algorithm options

Algorithm source: [Dropdown]

Choose an algorithm subscription: [Dropdown]

Resource configuration

Instance type: ml.m4.xlarge [Dropdown]

Instance count: 1 [Input field]

Additional storage volume per instance (GB): 1 [Input field]

7. Choose hyperparameters

Hyperparameters

You can use hyperparameters to finely control training. We've set default hyperparameters for the algorithm you've chosen.

Key	Value
fptype	double
method	defaultDense
nComponents	0
resultsToCompute	mean variance eigenvalue
isDeterministic	False
transformOnTrain	False

Parameter name	Type	Default value	Description
fptype	str	"double"	The floating-point type that the algorithm uses for intermediate computations. Can be "float" or "double"
method	str	"correlationDense"	Available methods for PCA computation: "correlationDense" ("defaultDense") or "svdDense"
resultsToCompute	str	"none"	Provide one of the following values to request a single characteristic or use bitwise OR to request a combination of the characteristics: mean, variance, eigenvalue. For example, combination of all is "mean variance eigenvalue"
nComponents	int	0	Number of principal components. If it is zero, the algorithm will compute the result for number of principal components = number of features. Remember that number of components must be equal or less than number of features for PCA algorithm
isDeterministic	bool	False	If True, the algorithm applies the "sign flip" technique to the results
transformOnTrain	bool	False	If True, training data will be transformed and saved in model package on training stage

8. Specify S3 location of input data for training

Input data configuration

Create up to 8 channels of input sources. If the algorithm you chose supports multiple input channels, you can specify those here. See [Algorithms Provided by Amazon SageMaker: Common Parameters](#)

Channels

▼ training

Remove

Channel name

training

Input mode - optional

File

Content type - optional

text/csv

Choose one of the formats below

- text/csv

Compression type

None

Record wrapper

None

S3 data type

S3Prefix

S3 data distribution type

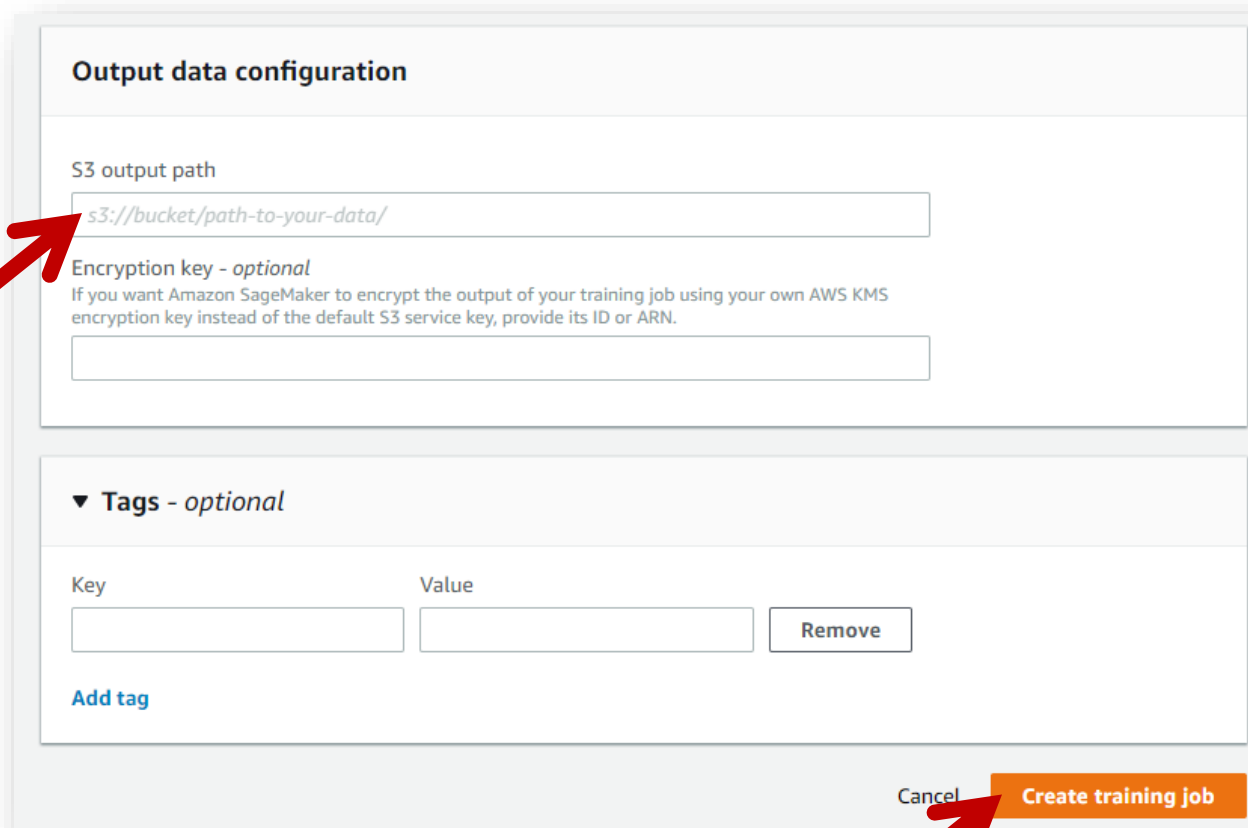
FullyReplicated

S3 location

s3://bucket/path-to-your-data/

Add channel

9. Specify S3 output path (model will be stored here) and click “Create training job”



Output data configuration

S3 output path

Encryption key - *optional*

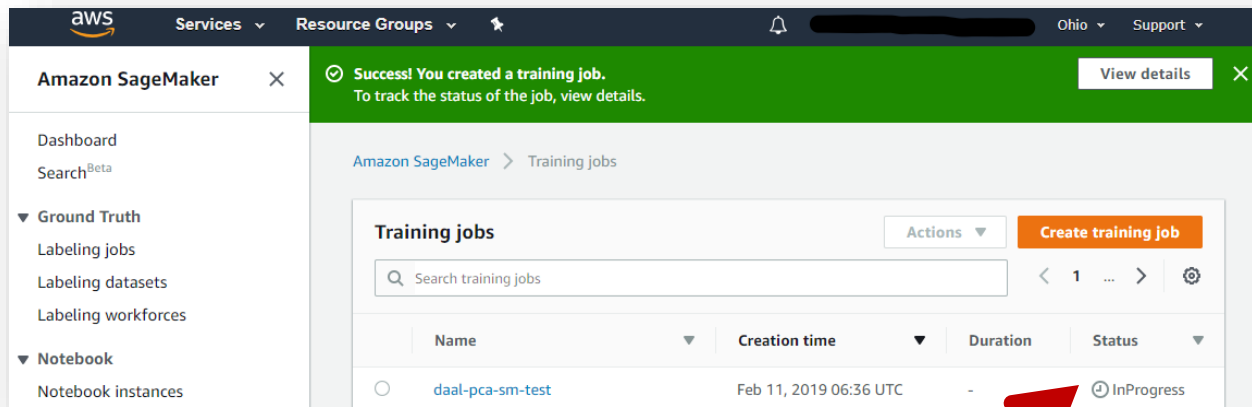
If you want Amazon SageMaker to encrypt the output of your training job using your own AWS KMS encryption key instead of the default S3 service key, provide its ID or ARN.

▼ **Tags - optional**

Key	Value	
<input type="text"/>	<input type="text"/>	<input type="button" value="Remove"/>

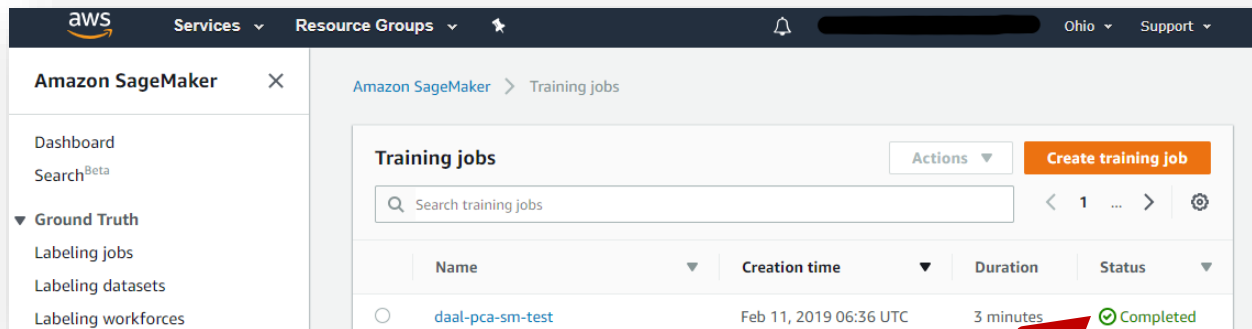
[Add tag](#)

10. Wait until finish of training job



The screenshot shows the Amazon SageMaker console with a green success banner at the top: "Success! You created a training job. To track the status of the job, view details." The left sidebar contains navigation links for Dashboard, Search, Ground Truth, Labeling jobs, Labeling datasets, Labeling workforces, Notebook, and Notebook instances. The main content area is titled "Training jobs" and includes a search bar and a table of training jobs. A red arrow points to the "InProgress" status of the job named "daal-pca-sm-test".

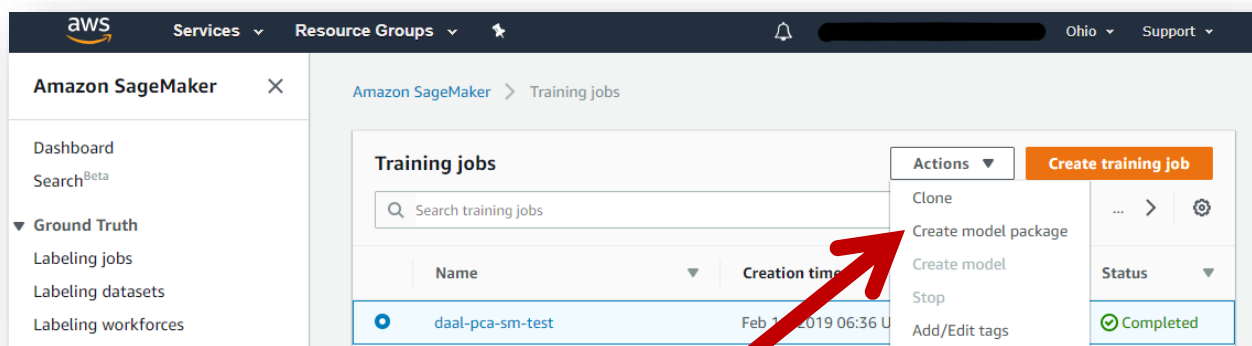
Name	Creation time	Duration	Status
daal-pca-sm-test	Feb 11, 2019 06:36 UTC	-	InProgress



The screenshot shows the Amazon SageMaker console with the same training job table. The job "daal-pca-sm-test" now has a duration of "3 minutes" and a status of "Completed", indicated by a green checkmark. A red arrow points to the "Completed" status.

Name	Creation time	Duration	Status
daal-pca-sm-test	Feb 11, 2019 06:36 UTC	3 minutes	Completed

11. Select training job and take action "Create model package"



The screenshot shows the Amazon SageMaker console with the training job table. The job "daal-pca-sm-test" is selected, and the "Actions" dropdown menu is open. A red arrow points to the "Create model package" option in the menu.

Name	Creation time	Duration	Status
daal-pca-sm-test	Feb 11, 2019 06:36 UTC	3 minutes	Completed

- Clone
- Create model package
- Create model
- Stop
- Add/Edit tags

12. Type model package name and click “Next”

Create model package

Inference specifications

Model package name and description

Model package name

The model package name must be unique in your account and in the AWS Region and can have up to 63 characters. Valid characters: a-z, A-Z, 0-9, and - (hyphen)

Description - *optional*

The description can be up to 1024 characters.

Inference specification options

- ☐ Provide the location of the inference image and model artifacts
Choose this option if your model was trained using an algorithm stored in ECR.
- ☒ Provide the algorithm used for training and its model artifacts
Choose this option if you are using a model trained by an algorithm resource or subscription algorithm from AWS Marketplace.

Algorithm and model artifacts

Algorithm ARN

Enter the Amazon Resource Name (ARN) used to create the training job and model artifacts.

arn:aws:sagemaker:us-east-2:057799348421:algorithm/intel-daal-pca1542385402-dC

Location of model artifacts - *optional*

If you want buyers to use the model artifacts from a specific model, enter the path to the S3 bucket where they are stored.

s3://daal-pca-test/output/daal-pca-sm-test/output/model.tar.gz

To find a path, [go to Amazon S3](#)

Cancel **Next**

13. Click "Create model package"

Step 1
Inference specifications

Step 2
Validation specifications

Create model package

Validation specifications

To list your model package on AWS Marketplace, you must have it validated by Amazon SageMaker. Provide the information that Amazon SageMaker needs to run transform jobs to validate your product.

Validation and scanning

Publish this model package on AWS Marketplace
AWS SageMaker requires successful validation before you can publish to AWS Marketplace.

☐ Yes ☒ No

Validate this resource
AWS SageMaker will create a training job and/or transform job based on your validation profiles below.

☐ Yes ☒ No

Cancel Previous **Create model package**

14. Wait until package is created

Amazon SageMaker

New model package created successfully.

Amazon SageMaker > My model packages

My model packages | AWS Marketplace subscriptions

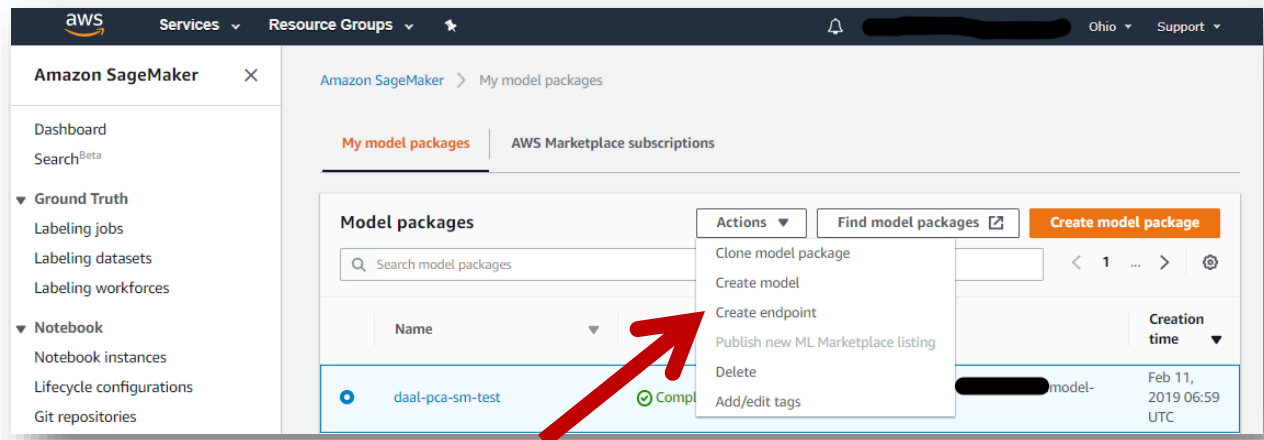
Model packages

Actions Find model packages Create model package

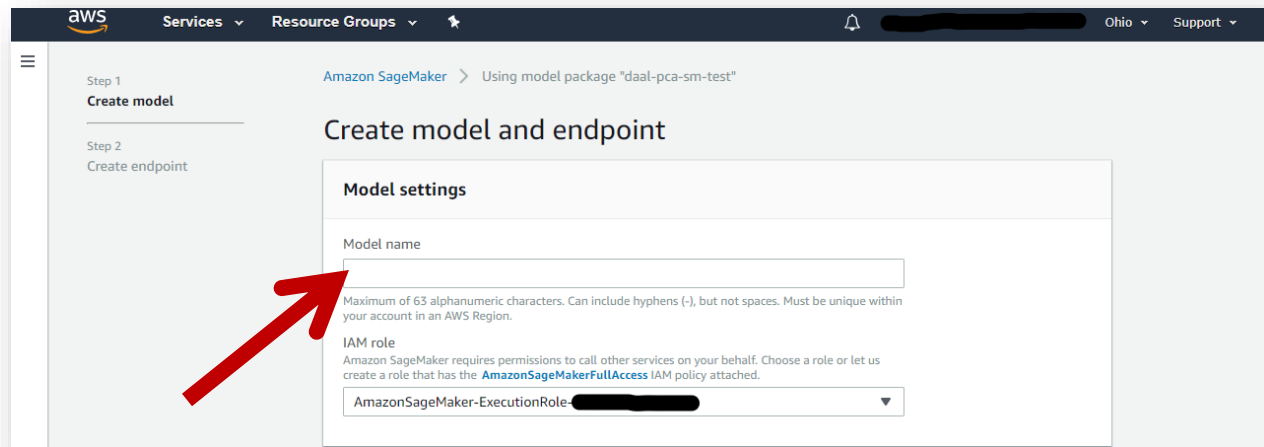
Search model packages

	Name	Status	ARN	Creation time
<input type="radio"/>	daal-pca-sm-test	InProgress	arn:aws:sagemaker:us-east-2:[redacted]:model-package/daal-pca-sm-test	Feb 11, 2019 06:59 UTC
<input type="radio"/>	daal-pca-sm-test	Completed	arn:aws:sagemaker:us-east-2:[redacted]:model-package/daal-pca-sm-test	Feb 11, 2019 06:59 UTC

15. Select package and take action "Create endpoint"



16. Type model name and click "Next"



17. Type endpoint name, edit and create endpoint configuration and click “Submit”

Model was successfully updated. Continue to create an endpoint.

Step 1
Create model

Step 2
Create endpoint

Create model and endpoint

Endpoint

Endpoint name
Your application uses this name to access this endpoint.

Maximum of 63 alphanumeric characters. Can include hyphens (-), but not spaces. Must be unique within your account in an AWS Region.

Attach endpoint configuration

☐ Use an existing endpoint configuration
Use an existing endpoint configuration or clone an endpoint configuration.

☒ Create a new endpoint configuration
Add models and configure the instance and initial weight for each model.

New endpoint configuration

To deploy models to Amazon SageMaker, first create an endpoint configuration. In the configuration, specify which models to deploy, and the relative traffic weighting and hardware requirements for each.

Endpoint configuration name
endpointConfig-
Maximum of 63 alphanumeric characters. Can include hyphens (-), but not spaces. Must be unique within your account in an AWS Region.

Encryption key - optional
Encrypt your data. Choose an existing KMS key or enter a key's ARN.
No Custom Encryption

Production variants

Model name	Training job	Variant name	Instance type	Elastic Inference	Initial instance count	Initial weight	Actions
daal-pca-sm-test		variant-name-1	mLm4.xlarge	none	1	1	Edit Remove

Add model

Create endpoint configuration

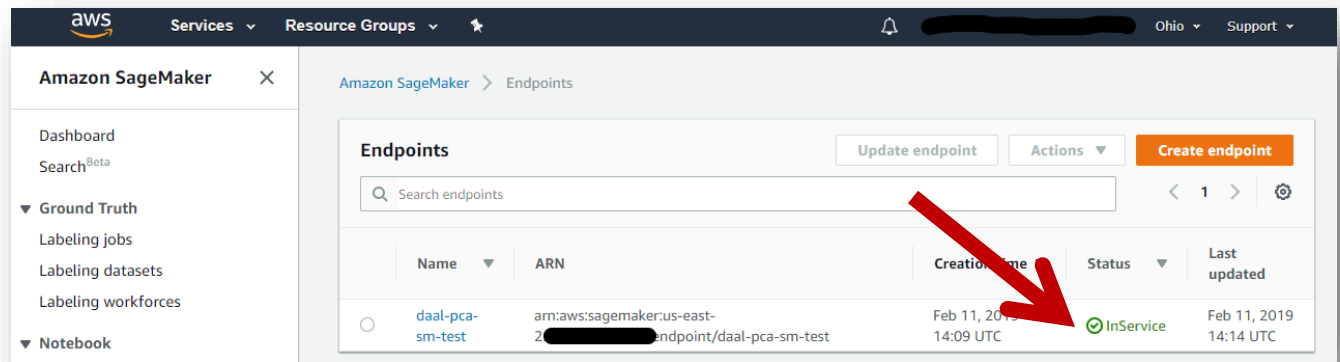
Tags - optional

Key	Value	Remove
		Remove

Add tag

Cancel Previous Submit

18. Wait until endpoint is ready



19. Use AWS CLI to get real-time prediction.

NOTE: training data and data for transformation should have same number of columns

Type command:

```
aws sagemaker-runtime invoke-endpoint --endpoint-name <endpoint-name> --body "$(cat <prediction_data_file_name>)" --content-type text/csv --accept text/csv <output_data_file_name>
```

```
(base) ubuntu@ip-172-31-11-84:~$ aws sagemaker-runtime invoke-endpoint --endpoint-name daal-pca-sm-test --body "$(cat probe_data.csv)" --content-type text/csv --accept text/csv output.txt
```

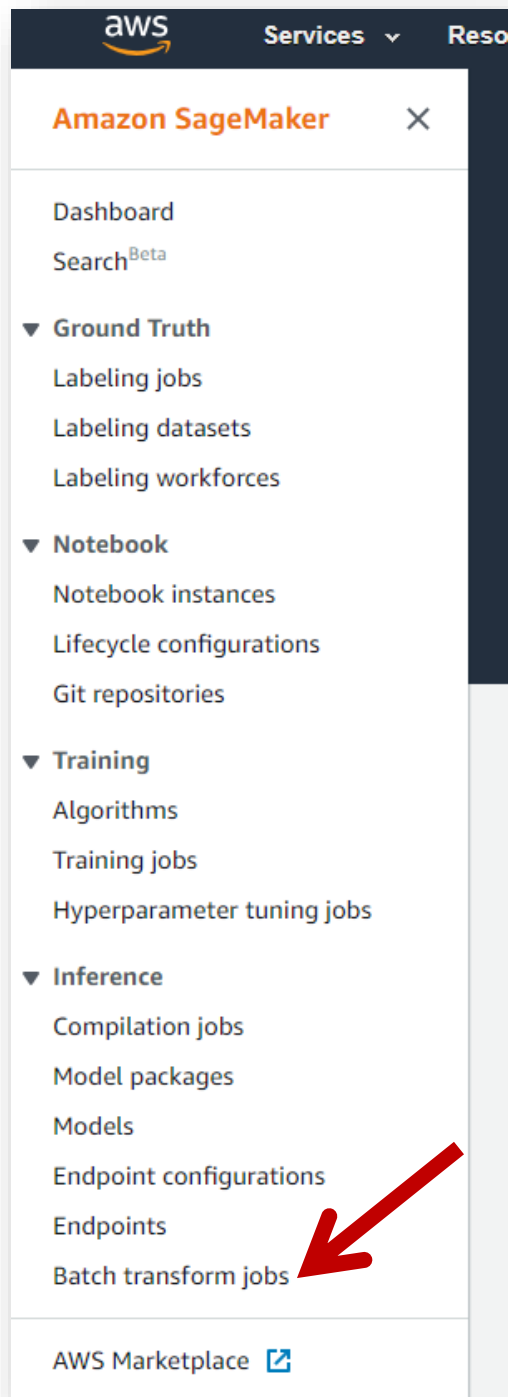
Then, see content of output file:

```
(base) ubuntu@ip-172-31-11-84:~$ cat output.txt
2.542488849344665791e+00 -2.854963662925595891e+00 -2.271127952158932484e+00 -4.334902591131868377e+00 1
.758331387711757454e+00 -7.787602453094198296e+00 4.088446277535492945e-02 6.764952963322853563e+00 -2.0
68428356656741851e+00 -2.120813987019414260e+00
-4.231628192652492793e+00 4.513466784953362065e+00 -5.795219335405072947e+00 5.912821351018124005e+00 -2
.529964637079089140e+00 -1.006528697468562150e+01 2.596521551525335703e+00 6.107773474853122941e+00 1.55
6518408950566812e+00 -5.840441330756375393e+00
3.599620307004356867e+00 -3.283862123751410955e+00 1.921631601939848943e+00 6.452101341314213201e+00 2.9
36440718013534901e-01 -2.152231238056123708e+00 2.840116637812633016e+00 2.000304293780199583e+00 1.8024
98395592655678e+00 -1.459109835559649682e+00
```

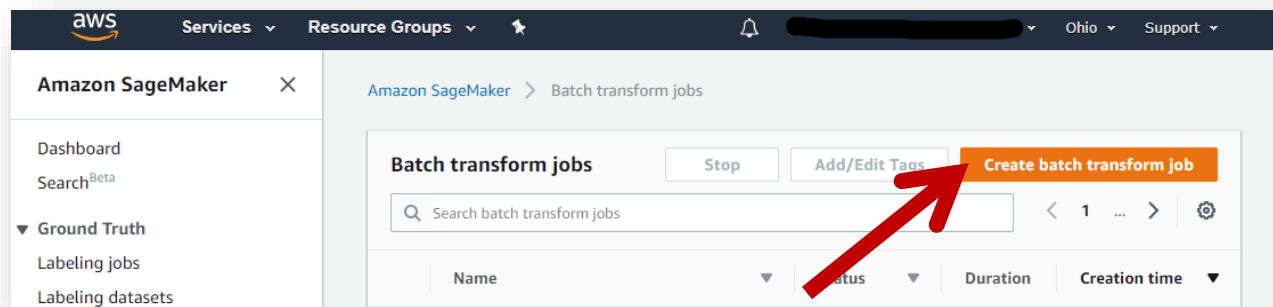
Batch transform job as alternative to endpoint

You can use batch transform job if you need compute transformed data once.

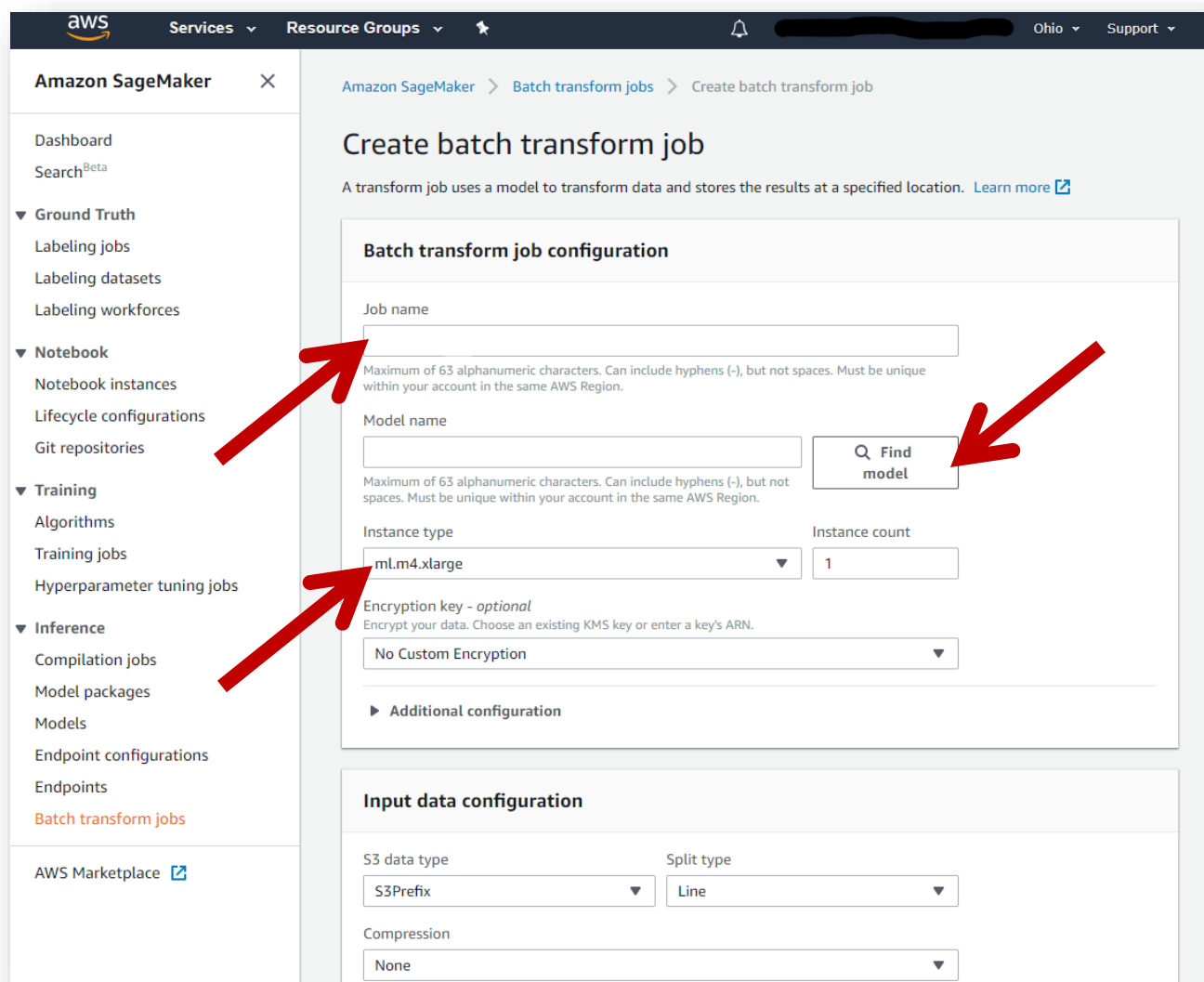
1. Go to “Batch transform job” page



2. Click "Create batch transform job"



3. Enter job name, select previously created model, instance and set instance count to 1



- Specify S3 location of input data for transformation, S3 output path (transformed data will be stored here) and click "Create job"

The screenshot shows the Amazon SageMaker console interface for configuring a batch transform job. The left sidebar contains navigation links for various SageMaker services, with 'Batch transform jobs' highlighted under the 'Inference' section. The main content area is titled 'Input data configuration' and 'Output data configuration'.

Input data configuration:

- S3 data type:** S3Prefix
- Split type:** Line
- Compression:** None
- Content type - optional:** text/csv
- S3 location:** (Empty text field with a link to 'go to Amazon S3' for finding a path)

Output data configuration:

- S3 output path:** (Empty text field with a link to 'go to Amazon S3' for finding a path)
- Encryption key - optional:** No Custom Encryption
- Accept - optional:** text/csv
- Assemble with:** Line

Tags - optional: (Expandable section)

At the bottom right, there are two buttons: 'Cancel' and 'Create job'. A red arrow points to the 'Create job' button.

- Wait until job is completed and find transformed data in previously specified S3 output path

The screenshot shows the Amazon SageMaker console with a green notification banner at the top stating "Batch transform job daal-pca-test was successfully created". The left sidebar contains navigation links for Dashboard, Search, Ground Truth, Labeling jobs, Labeling datasets, Labeling workforces, Notebook, and Notebook instances. The main content area is titled "Batch transform jobs" and includes a search bar, a "Stop" button, an "Add/Edit Tags" button, and a "Create batch transform job" button. Below these is a table with columns: Name, Status, Duration, and Creation time. The table contains one entry: "daal-pca-test" with a status of "InProgress", a duration of "a few seconds", and a creation time of "Feb 17, 2019 14:07 UTC". A red arrow points to the "InProgress" status.

Name	Status	Duration	Creation time
daal-pca-test	InProgress	a few seconds	Feb 17, 2019 14:07 UTC

The screenshot shows the same Amazon SageMaker console interface, but the status of the "daal-pca-test" job has changed to "Completed". The duration is now "3 minutes" and the creation time remains "Feb 17, 2019 14:07 UTC". A red arrow points to the "Completed" status.

Name	Status	Duration	Creation time
daal-pca-test	Completed	3 minutes	Feb 17, 2019 14:07 UTC