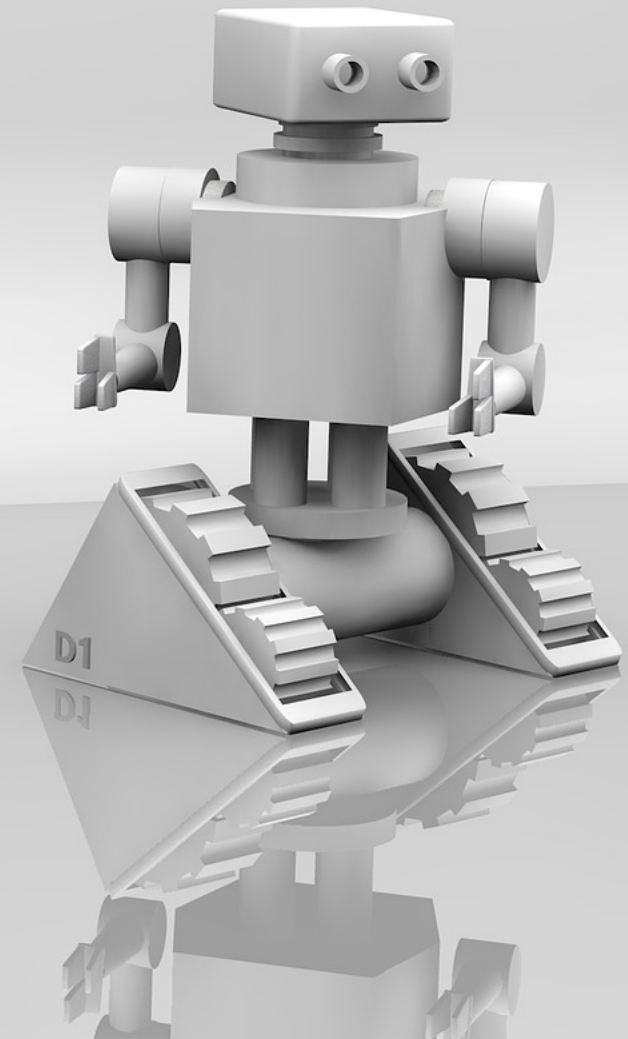


# Machine Learning on AWS

Stefan Bergstein





## Intro

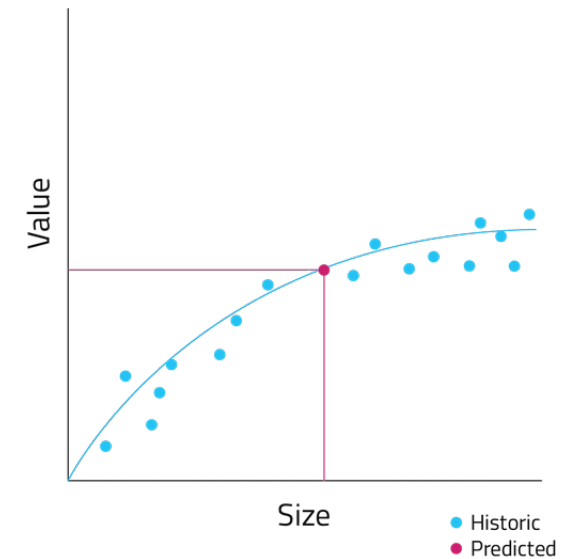
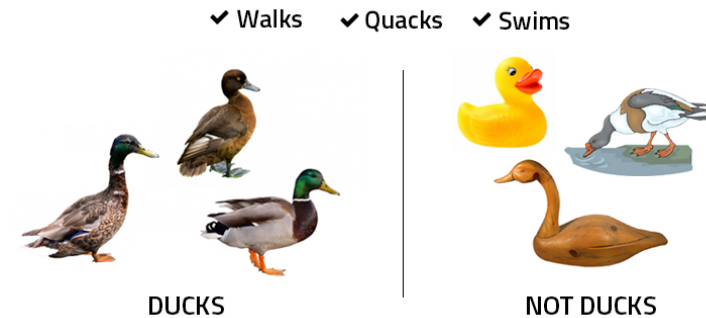
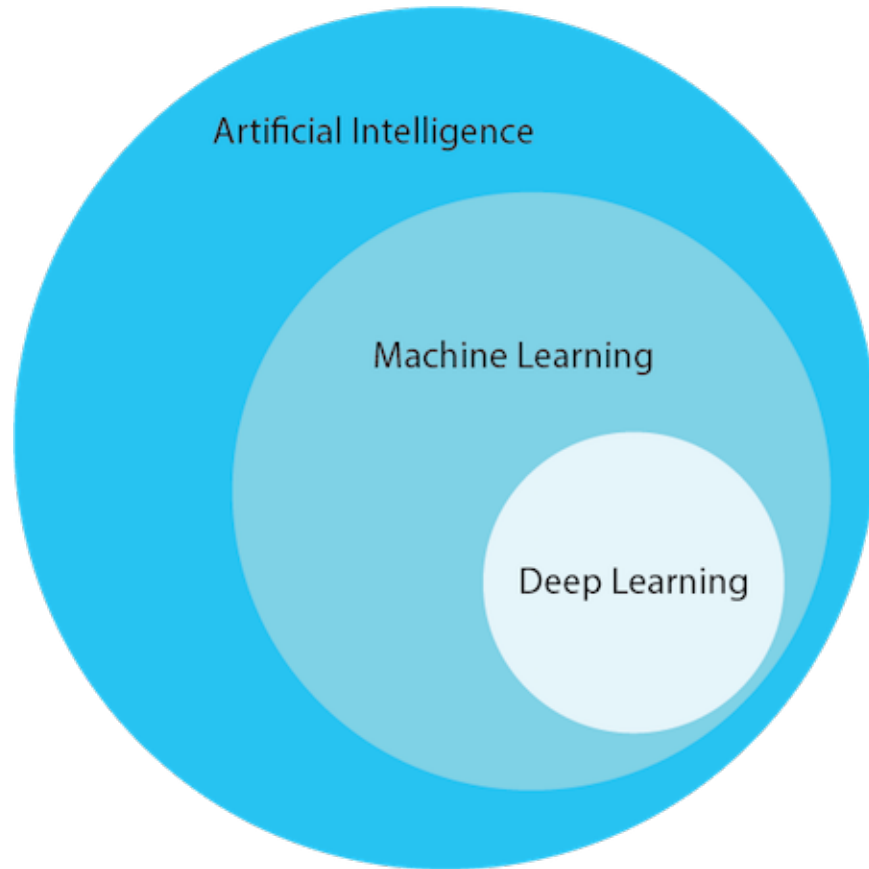
- ML Use cases
- Type of problems
- Learnings techniques
- Algorithms



## AWS

- Service overview
- AWS ML
- AWS SageMaker
- Deep Learning AMI

# Ducks, not ducks, which size?



Source: <https://www.moogsoft.com/blog/aiops/understanding-machine-learning-aiops/>

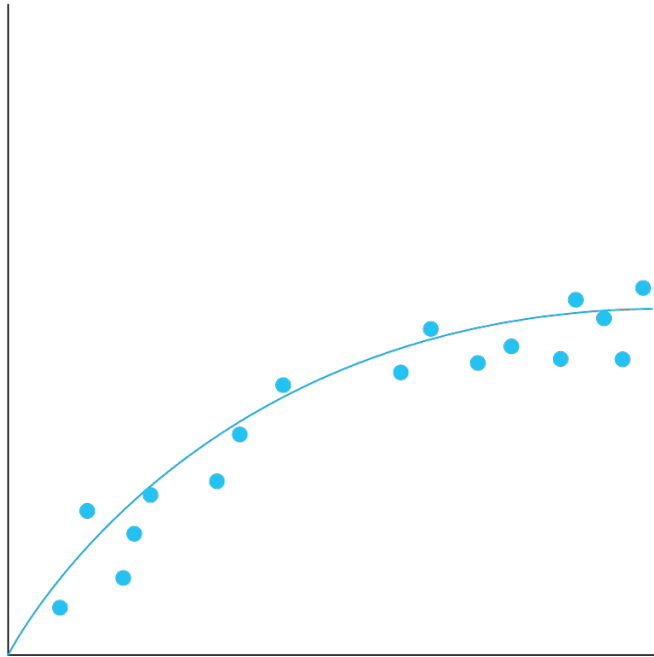
# Top AI And Machine Learning Use Cases

- **Data Security** - predict malware
- **Personal Security** - spot things human screeners might miss
- **Financial Trading** - predict what the stock markets will do
- **Healthcare** - spotted cancers a year before were officially diagnosed
- **Marketing Personalization** - lead consumers reliably towards a sale
- **Fraud Detection** - [PayPal](#) is using ML to fight money laundering

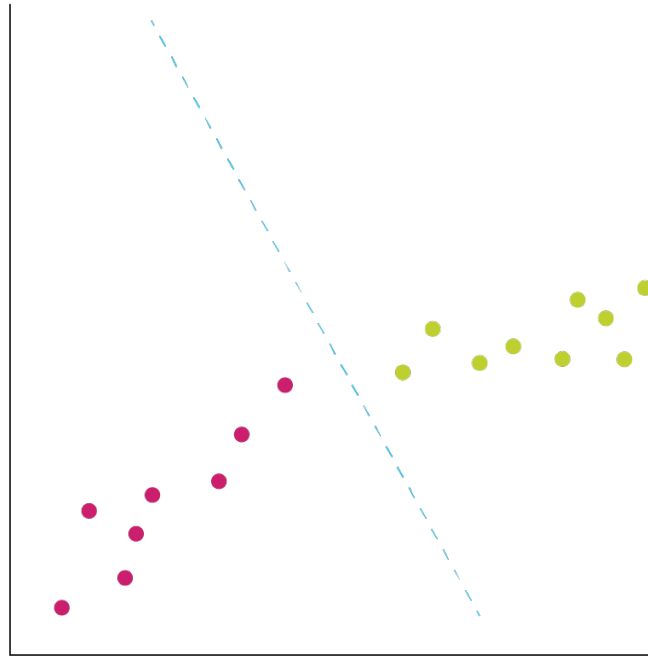
Source: <https://www.forbes.com/sites/bernardmarr/2016/09/30/what-are-the-top-10-use-cases-for-machine-learning-and-ai/#424cb0594c90>

# Types of machine learning problems

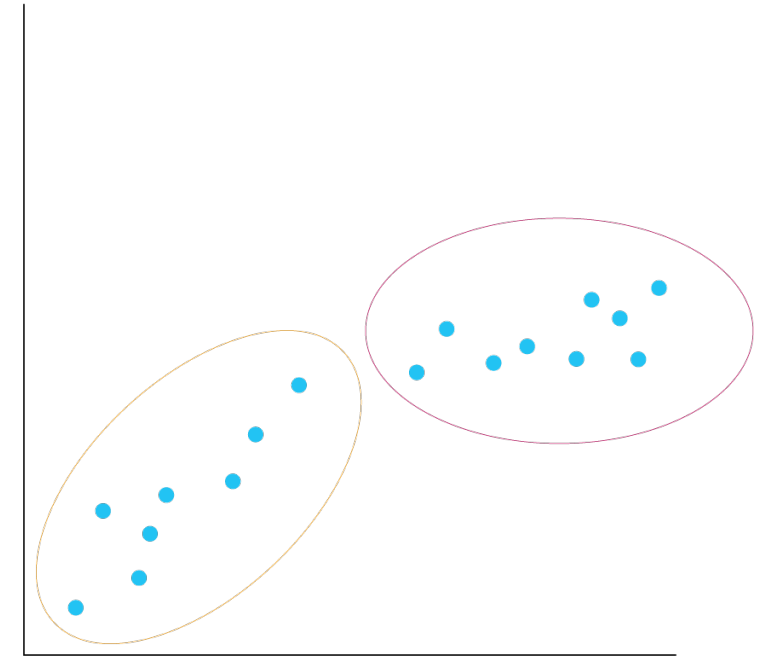
Regression



Classification

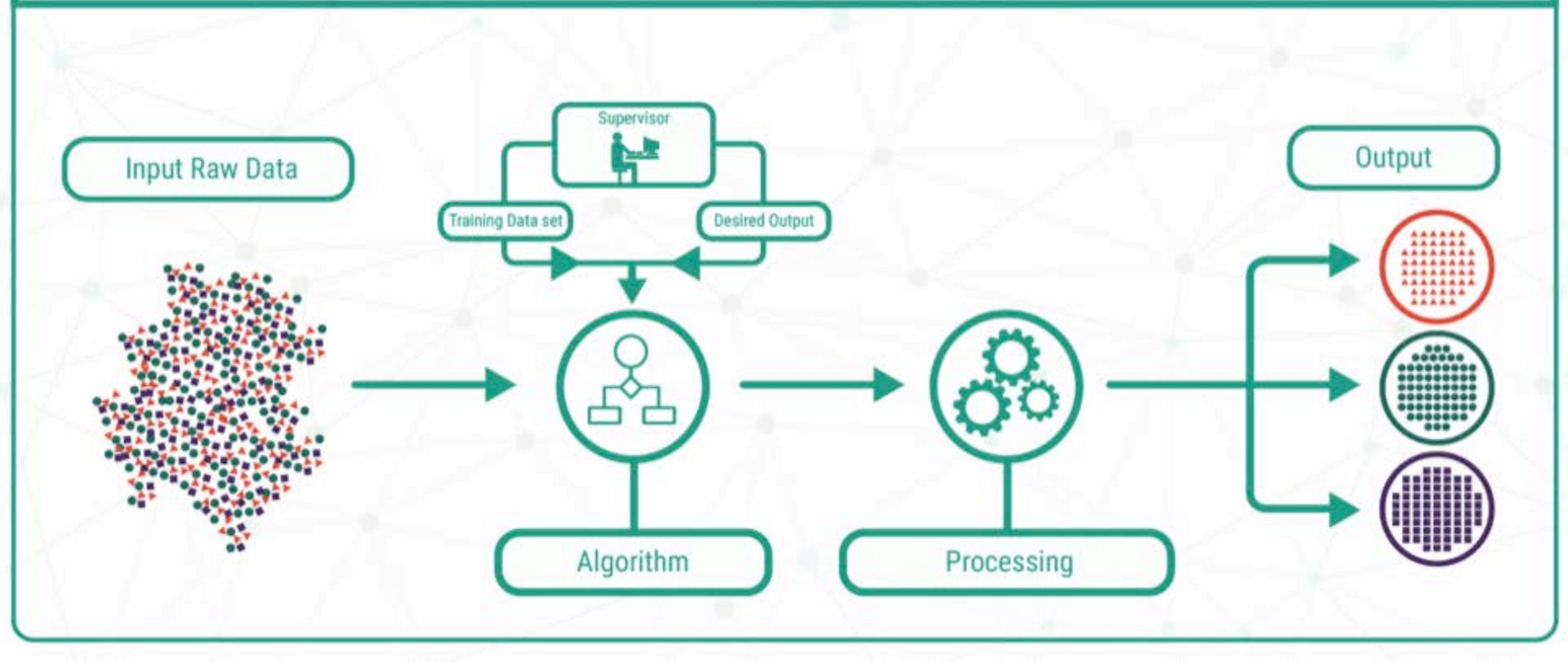


Clustering



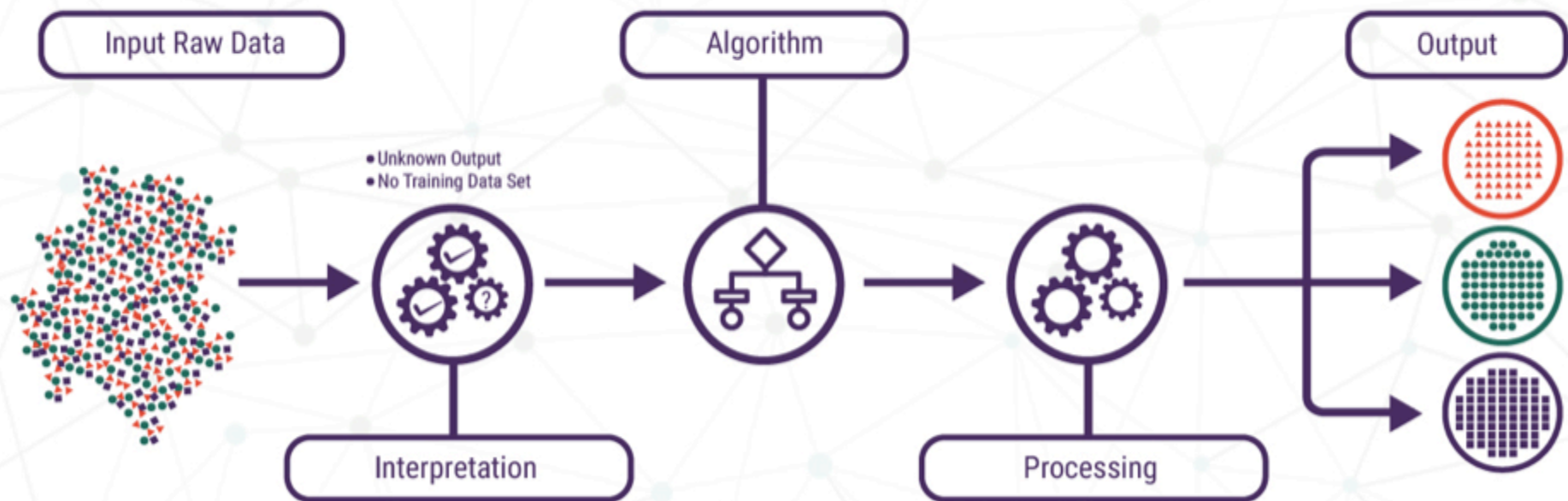
Source: <https://www.moogsoft.com/blog/aiops/understanding-machine-learning-aiops/>

# SUPERVISED LEARNING



Source: <https://www.datasciencecentral.com/profiles/blogs/machine-learning-explained-understanding-supervised-unsupervised>

# UNSUPERVISED LEARNING



Source: <https://www.datasciencecentral.com/profiles/blogs/machine-learning-explained-understanding-supervised-unsupervised>



# REINFORCEMENT LEARNING



Source: <https://www.datasciencecentral.com/profiles/blogs/machine-learning-explained-understanding-supervised-unsupervised>

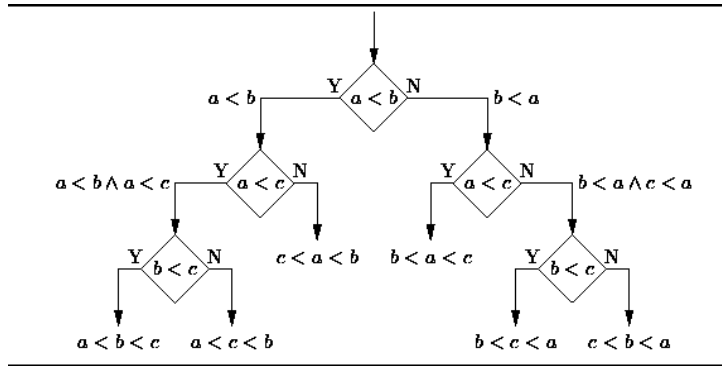




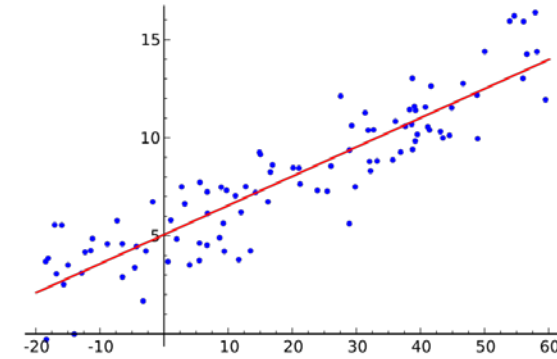
Source: <https://s3.amazonaws.com/MLMastery/MachineLearningAlgorithms.png>

# Algorithms ML Engineers Need to Know (4/10)

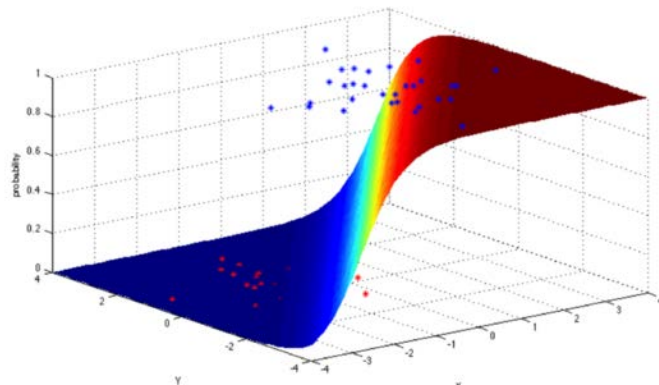
## Decision Trees



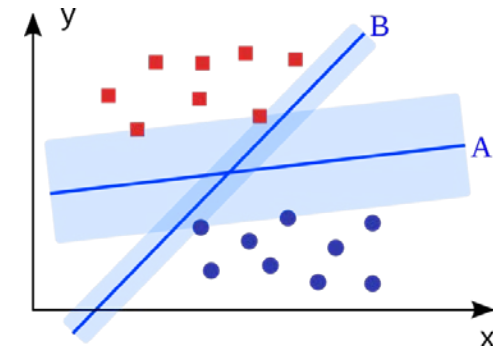
## Least Squares Regression



## Logistic Regression



## Support Vector Machines



Source: <https://www.kdnuggets.com/2016/08/10-algorithms-machine-learning-engineers.html>

# AWS ML Services



## Machine Learning

Amazon SageMaker  
Amazon Comprehend  
AWS DeepLens  
Amazon Lex  
Machine Learning  
Amazon Polly  
Rekognition  
Amazon Transcribe  
Amazon Translate

Today's discussion:

Amazon Machine Learning  
Amazon SageMaker  
AWS Deep Learning AMI

# Solving Business Problems with Amazon ML

Examples of binary classification problems

Examples of multiclass classification problems

Examples of regression classification problems

Source: <https://docs.aws.amazon.com/machine-learning/latest/dg/machine-learning-problems-in-amazon-machine-learning.html>

# Solving Business Problems with Amazon ML

- Examples of binary classification problems:
  - Will the customer buy this product or not buy this product?
  - Is this email spam or not spam?
  - Is this product a book or a farm animal?
  - Is this review written by a customer or a robot?

Source: <https://docs.aws.amazon.com/machine-learning/latest/dg/machine-learning-problems-in-amazon-machine-learning.html>

# Solving Business Problems with Amazon ML

- Examples of multiclass classification problems:
  - Is this product a book, movie, or clothing?
  - Is this movie a romantic comedy, documentary, or thriller?
  - Which category of products is most interesting to this customer?

Source: <https://docs.aws.amazon.com/machine-learning/latest/dg/machine-learning-problems-in-amazon-machine-learning.html>

# Solving Business Problems with Amazon ML

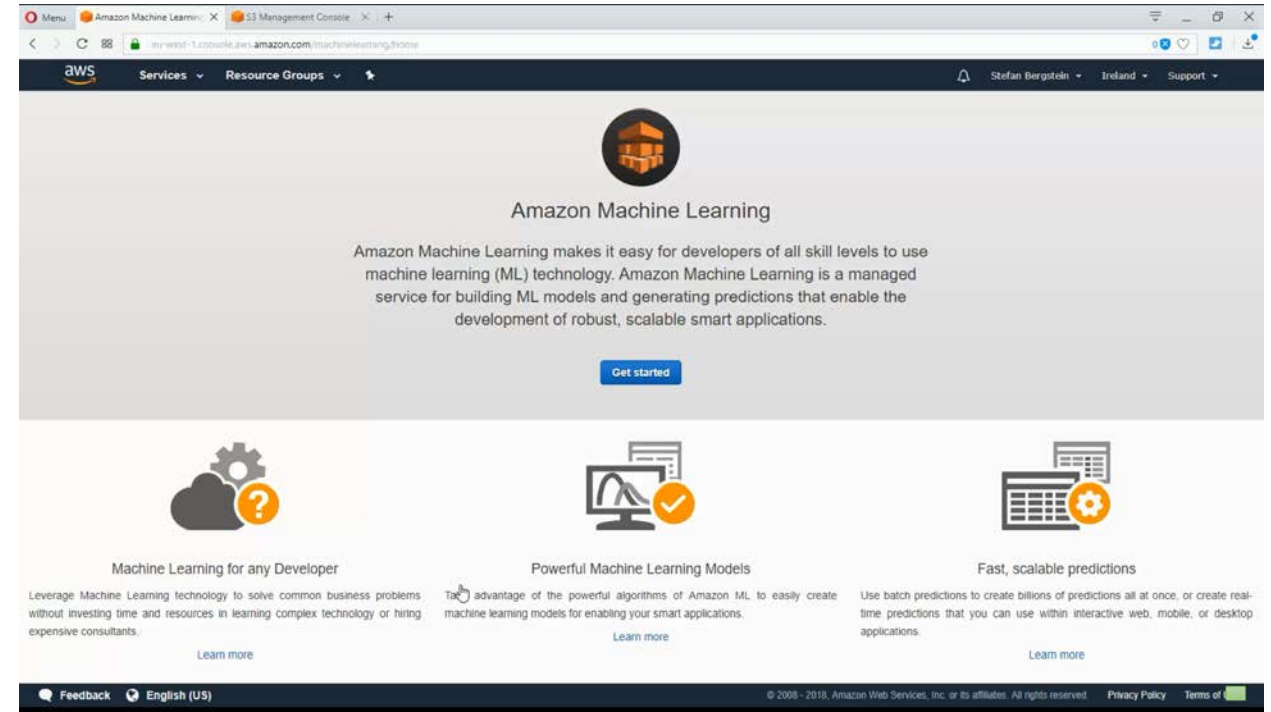
- Examples of regression classification problems:
  - What will the temperature be in Seattle tomorrow?
  - For this product, how many units will sell?
  - How many days before this customer stops using the application?
  - What price will this house sell for?

Source: <https://docs.aws.amazon.com/machine-learning/latest/dg/machine-learning-problems-in-amazon-machine-learning.html>



# Amazon Machine Learning Demo

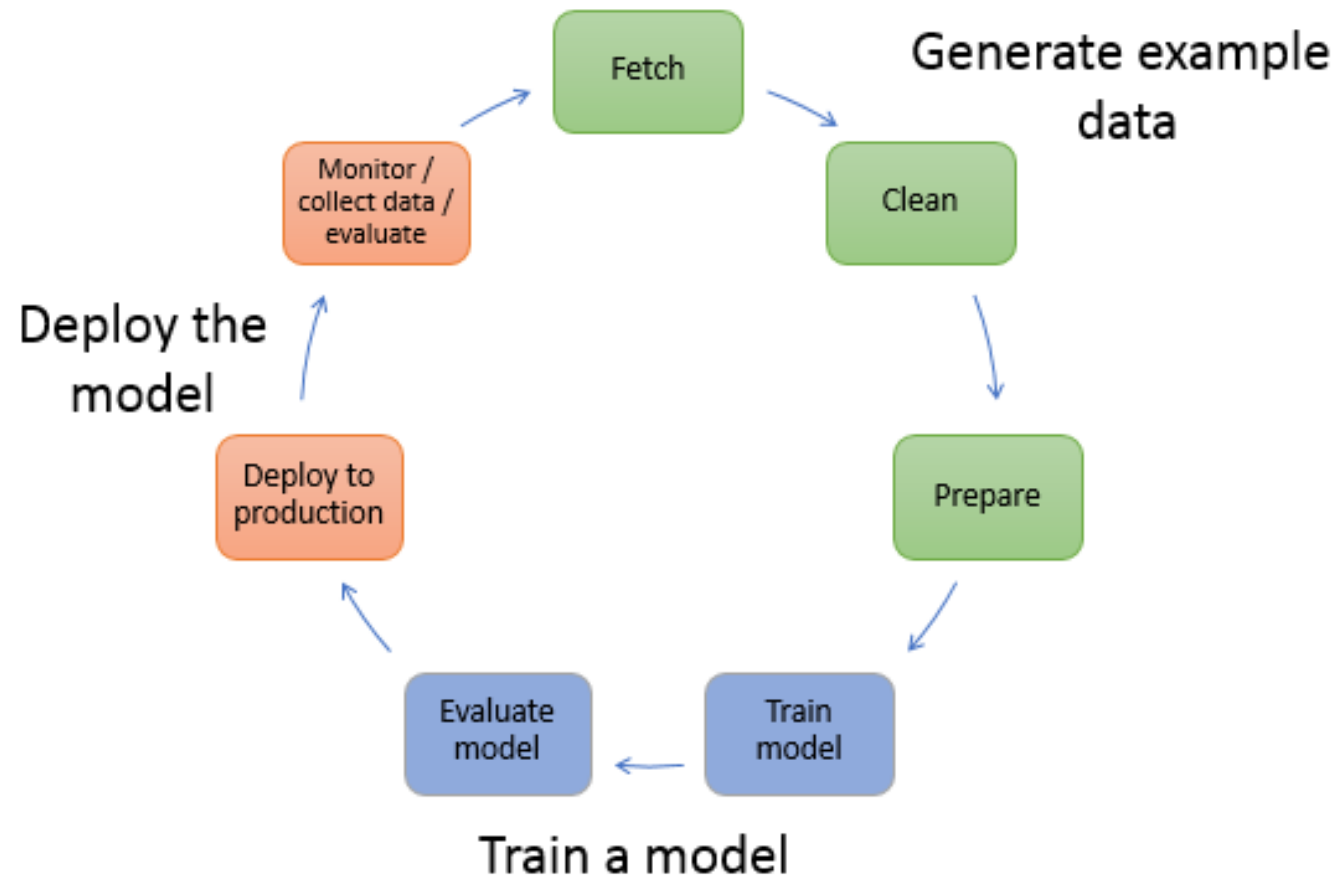
- Live Demo:
- AWS Tutorial:  
Using Amazon ML to Predict Responses to a Marketing Offer



DIY:

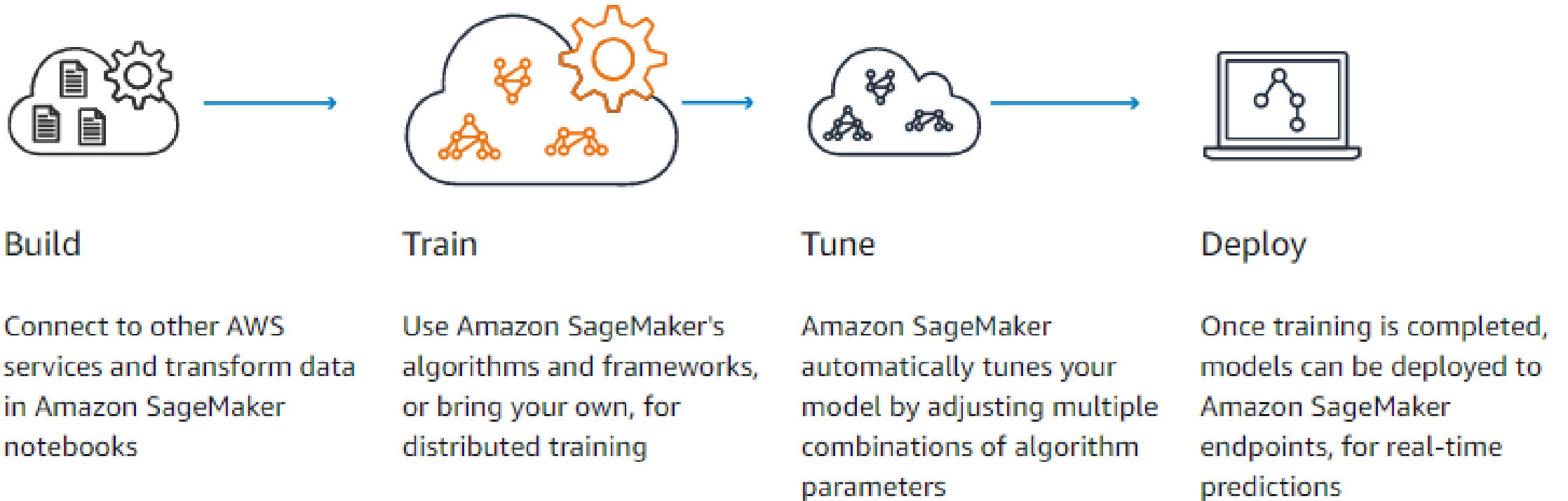
[https://docs.aws.amazon.com/machine-learning/latest/dg/tutorial.html?icmpid=docs\\_machinelearning\\_console](https://docs.aws.amazon.com/machine-learning/latest/dg/tutorial.html?icmpid=docs_machinelearning_console)

# Typical workflow for creating a ML model



Source: <https://docs.aws.amazon.com/sagemaker/latest/dg/how-it-works-mlconcepts.html>

# SageMaker - How it works



Source: <https://eu-west-1.console.aws.amazon.com/sagemaker/home?region=eu-west-1#/landing>

# SageMaker - Benefits and features

## Fully-managed notebook instances

For training data exploration and preprocessing, Amazon SageMaker provides fully managed instances running Jupyter notebooks that include example code for common model training and hosting exercises.

## One-click training

When you're ready to train in Amazon SageMaker, simply indicate the type and quantity of instances you need and initiate training with a single click.

## Highly-optimized machine learning algorithms

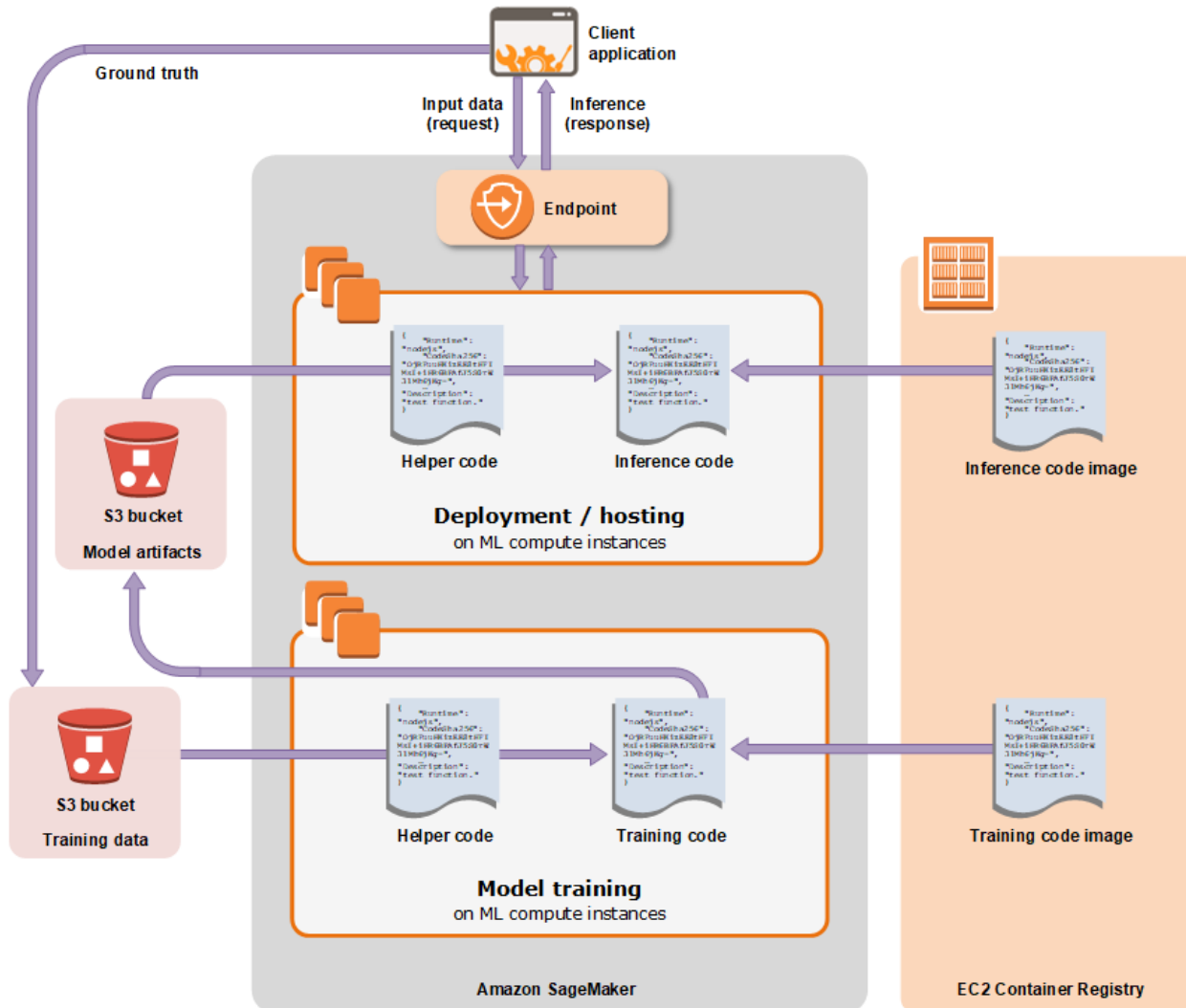
Amazon SageMaker installs high-performance, scalable machine learning algorithms optimized for speed, scale, and accuracy, to run on extremely large training datasets.

## Deployment without engineering effort

After training, SageMaker provides the model artifacts and scoring images to you for deployment to Amazon EC2 or anywhere else.

Source: <https://eu-west-1.console.aws.amazon.com/sagemaker/home?region=eu-west-1#/landing>

# Training a Model with Amazon SageMaker



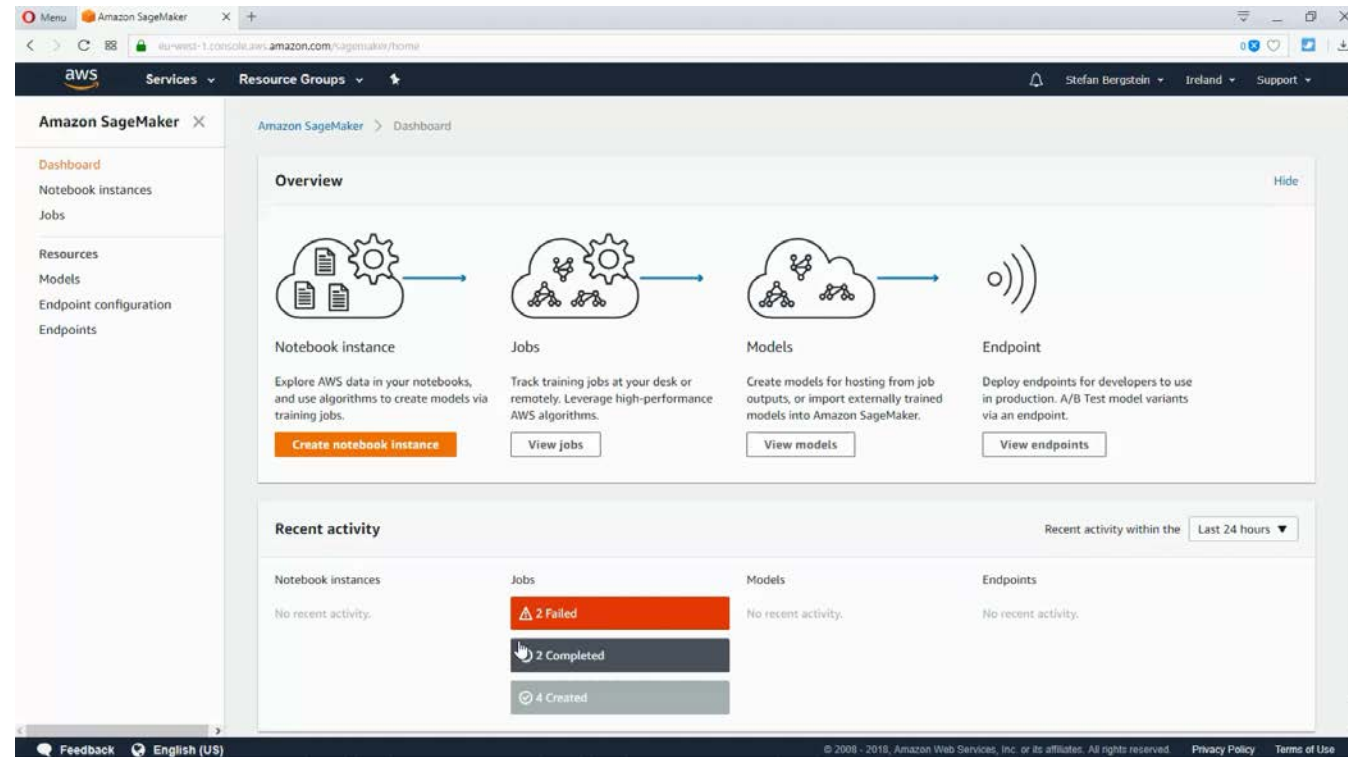
## Options for a training algorithm:

- A. Use a built-in algorithm.  
(see [Using Built-in Algorithms with Amazon SageMaker](#))
- B. Use SageMaker's Apache Spark MLlib
- C. Submit custom code to train with deep learning frameworks (TensorFlow or Apache MXNet)
- D. Provide your own custom algorithms as a Docker container image

Source: <https://docs.aws.amazon.com/sagemaker/latest/dg/how-it-works-mlconcepts.html>

# Amazon SageMaker Demo

- Live Demo:
- SageMaker sample notebook
- Multiclass classification with Amazon SageMaker XGBoost algorithm

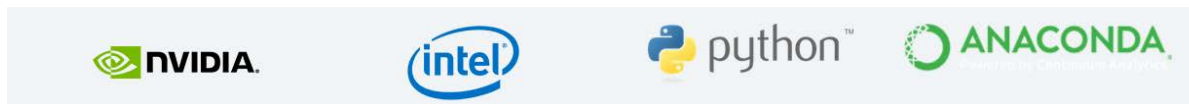


# AWS Deep Learning AMIs

Support of popular deep learning frameworks:



Accelerate model training:



Three types of AMIs:

## CONDA AMI

For developers who want pre-installed pip packages of deep learning frameworks in separate virtual environments, the Deep Learning Conda-based AMI is available in **Ubuntu** and **Amazon Linux** versions.

## BASE AMI

For developers who want a clean slate to set up private deep learning engine repositories or custom builds of deep learning engines, the Deep Learning Base AMI is available in **Ubuntu** and **Amazon Linux** versions.

## AMI WITH SOURCE CODE

For developers who want pre-installed deep learning frameworks and their source code in a shared Python environment, this Deep Learning AMI is available for P3 instances in **CUDA 9 Ubuntu** and **Amazon Linux** versions as well as for P2 instances in **CUDA 8 Ubuntu** and **Amazon Linux** versions.

Source: <https://docs.aws.amazon.com/dlami/latest/devguide/conda.html>



# DL AMIs available in different regions

Region	Code
US East (Ohio)	ec2-us-east-2
US East (N. Virginia)	ec2-us-east-1
US West (Oregon)	ec2-us-west-2
Beijing (China)	cn-north-1
Asia Pacific (Mumbai)	ec2-ap-south-1
Asia Pacific (Seoul)	ec2-ap-northeast-2
Asia Pacific (Singapore)	ec2-ap-southeast-1
Asia Pacific (Sydney)	ec2-ap-southeast-2
Asia Pacific (Tokyo)	ec2-ap-northeast-1
EU (Frankfurt)	ec2-eu-central-1
EU (Ireland)	ec2-eu-west-1

Source: <https://docs.aws.amazon.com/dlami/latest/devguide/conda.html>

# AWS Deep Learning AMI Demo

The screenshot shows the AWS Management Console interface for the 'Choose an Amazon Machine Image (AMI)' step. The console is in the 'us-west-2' region. The left sidebar shows the 'Quick Start' section with 'My AMIs', 'AWS Marketplace', and 'Community AMIs'. The main content area displays a list of AMIs, including Amazon Linux, Amazon Linux 2, SUSE Linux Enterprise Server, Red Hat Enterprise Linux, and Ubuntu Server. The 'Amazon Linux 2 LTS Candidate AMI 2017.12.0 (HVM), SSD Volume Type' is highlighted. The console also shows the 'Cancel and Exit' button and the 'Feedback' button.

Step 1: Choose an Amazon Machine Image (AMI)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start

My AMIs

AWS Marketplace

Community AMIs

☐ Free tier only ⓘ

Amazon Linux 2017.09.1 (HVM), SSD Volume Type - ami-f2d3638a

The Amazon Linux AMI is an EBS-backed, AWS-supported image. The default image includes AWS command line tools, Python, Ruby, Perl, and Java. The repositories include Docker, PHP, MySQL, PostgreSQL, and other packages.

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Amazon Linux 2 LTS Candidate AMI 2017.12.0 (HVM), SSD Volume Type - ami-7f43f307

Amazon Linux 2 is the next generation of Amazon Linux. It includes the latest LTS kernel (4.9) tuned for enhanced performance on Amazon EC2, systemd support, newer versions of glibc, gcc and binutils, and an additional set of core packages for performance and security improvements.

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

SUSE Linux Enterprise Server 12 SP3 (HVM), SSD Volume Type - ami-6bc56f13

SUSE Linux Enterprise Server 12 Service Pack 3 (HVM), EBS General Purpose (SSD) Volume Type. Public Cloud, Advanced Systems Management, Web and Scripting, and Legacy modules enabled.

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Red Hat Enterprise Linux 7.4 (HVM), SSD Volume Type - ami-223f945a

Red Hat Enterprise Linux version 7.4 (HVM), EBS General Purpose (SSD) Volume Type

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Ubuntu Server 16.04 LTS (HVM), SSD Volume Type - ami-1ee65166

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# Thank you!