Machine Learning Madness into Web Applications on **AWS**

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- **Part 1** (Training the ML model)
  - Brief about Gradient Boosting Algorithm
  - Training a model
  - Save the model artifacts
- **Part 2** (Hosting on AWS)
  - Brief about AWS Elastic Beanstalk
  - Deploy the model via a simple Flask app on Beanstalk

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Where we will end up after *30mins* from now …

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Gradient Boosting **Algorithm**

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Ensemble Methods

Weak learner 1
Weak learner 2
Weak learner 3
Weak learner 4
Weak learner 5

Strong learner

Bagging and Boosting

Bagging - Parallel   Boosting - Sequential
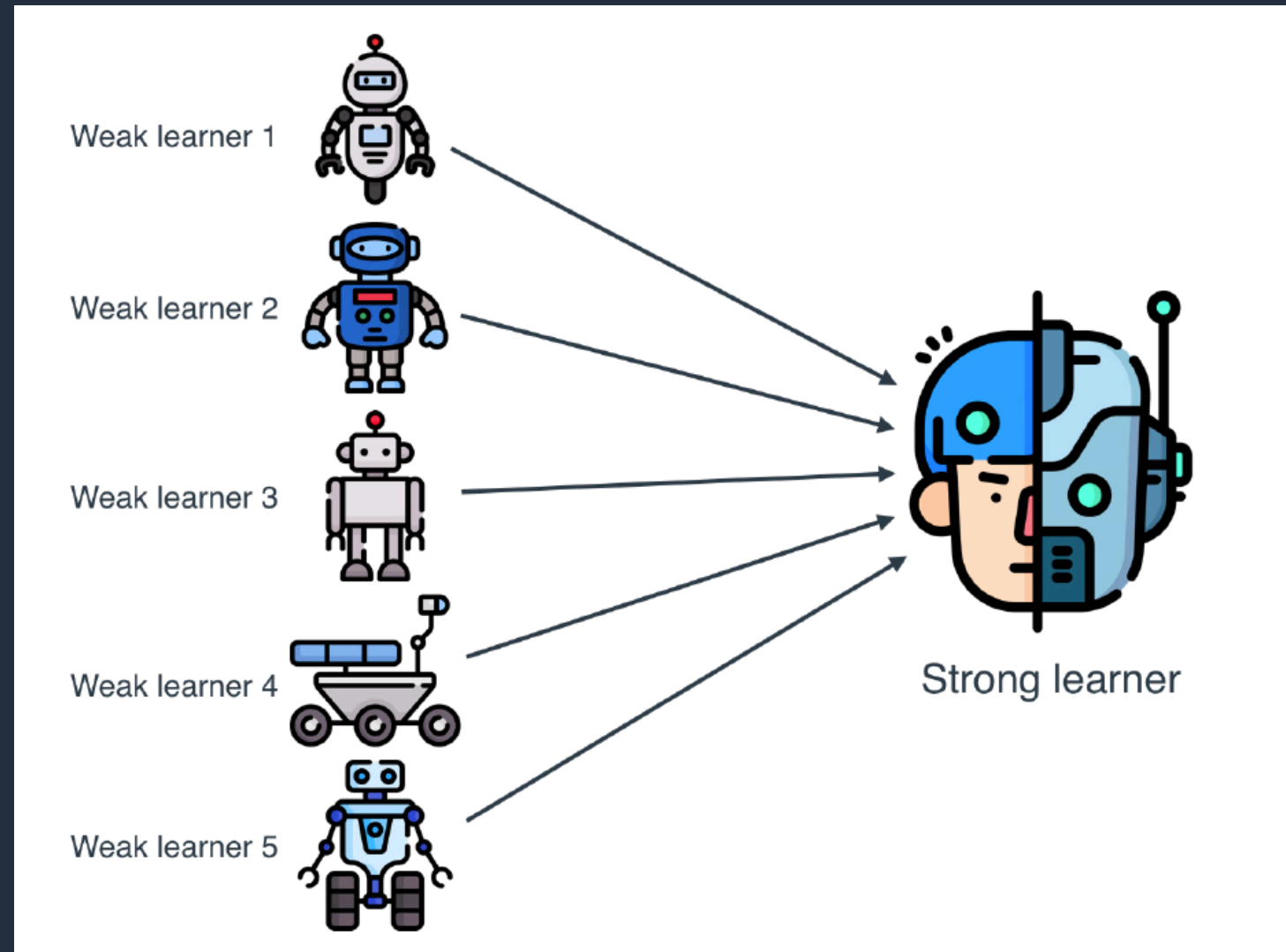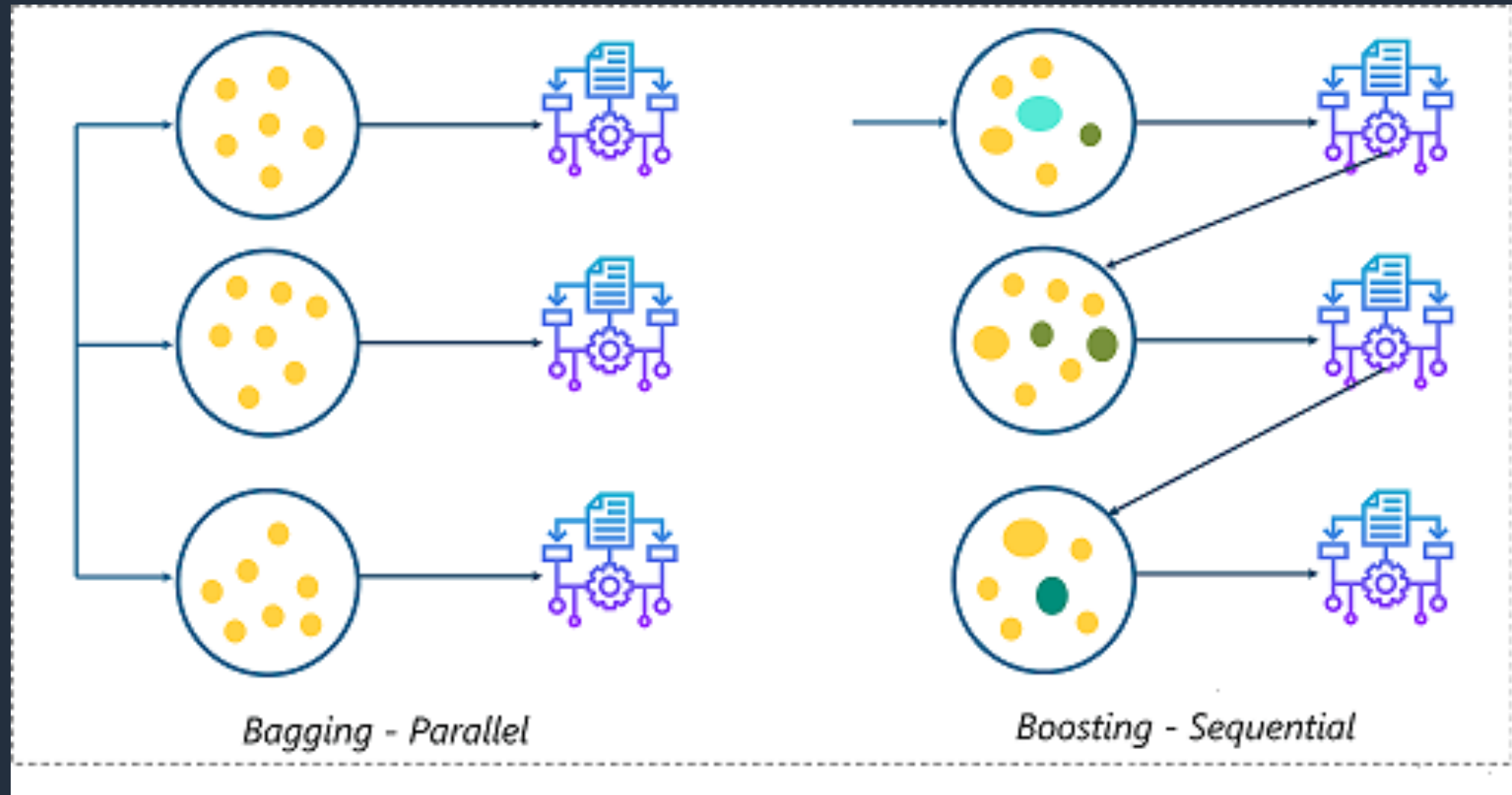
Boosting Algorithm
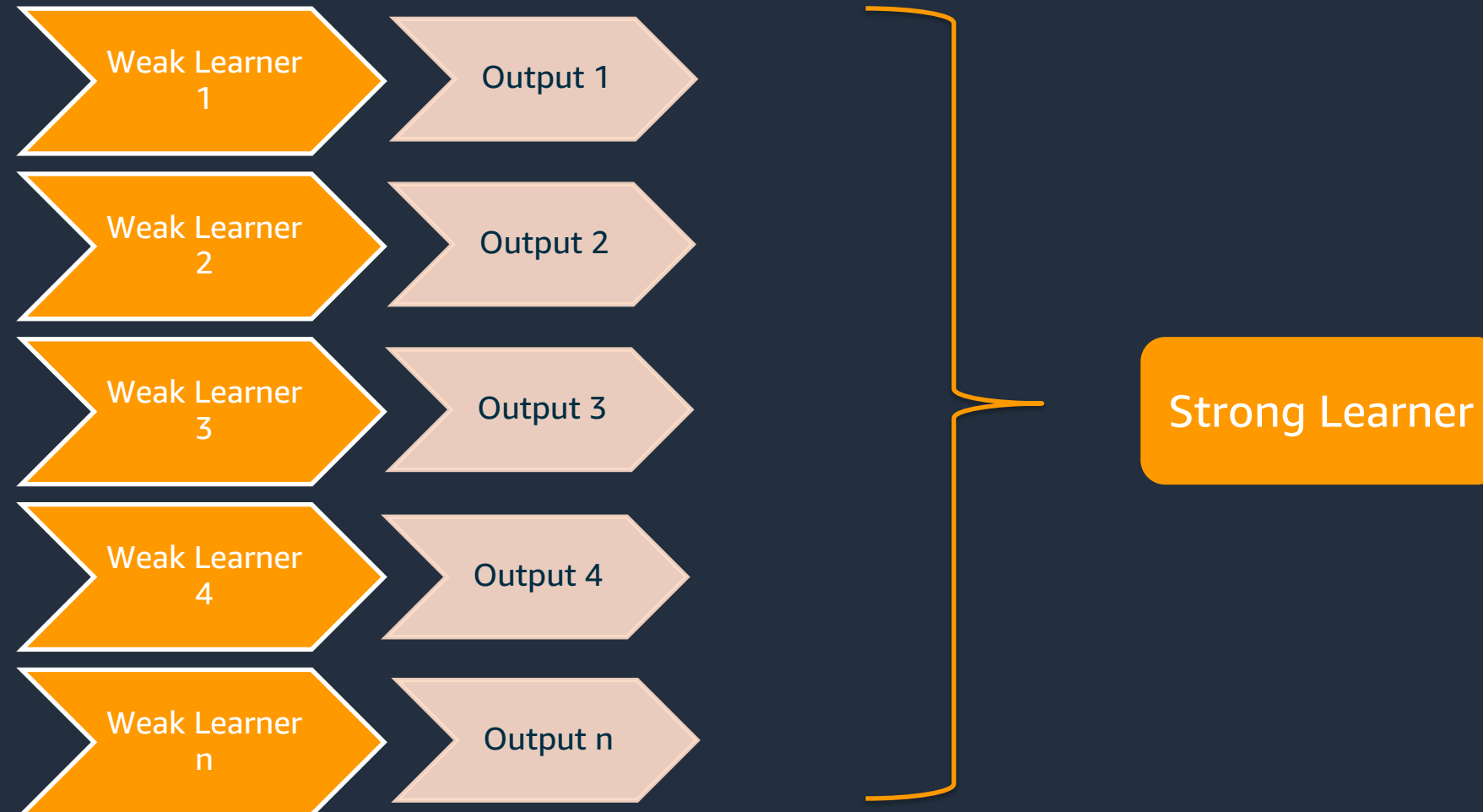
Gradient Boosting

- Each iteration, a weight assigned to each sample

- A weak learner trained on reweighted sample

- Combines the weak classifiers to build a strong classifier

Loss Function

f(x) = W*x + b

Error (f(X_j) – Y_j)

Output Y

x_n

x_o

$$Loss_{(w, b)} = \frac{1}{n} \sum_{j=1}^{n} (f(x_j) - y_j)^2$$

Mean Square Error(MSE) Function

Input X

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Gradient Descent

$$W_{j+1} = W_j - \alpha \frac{\partial}{\partial W_j} \text{Loss}(W_j)$$

Partial Derivative (slope)

Learning Rate

Partial Derivative

Minimum loss

Loss

W_j W_{j+1}

W

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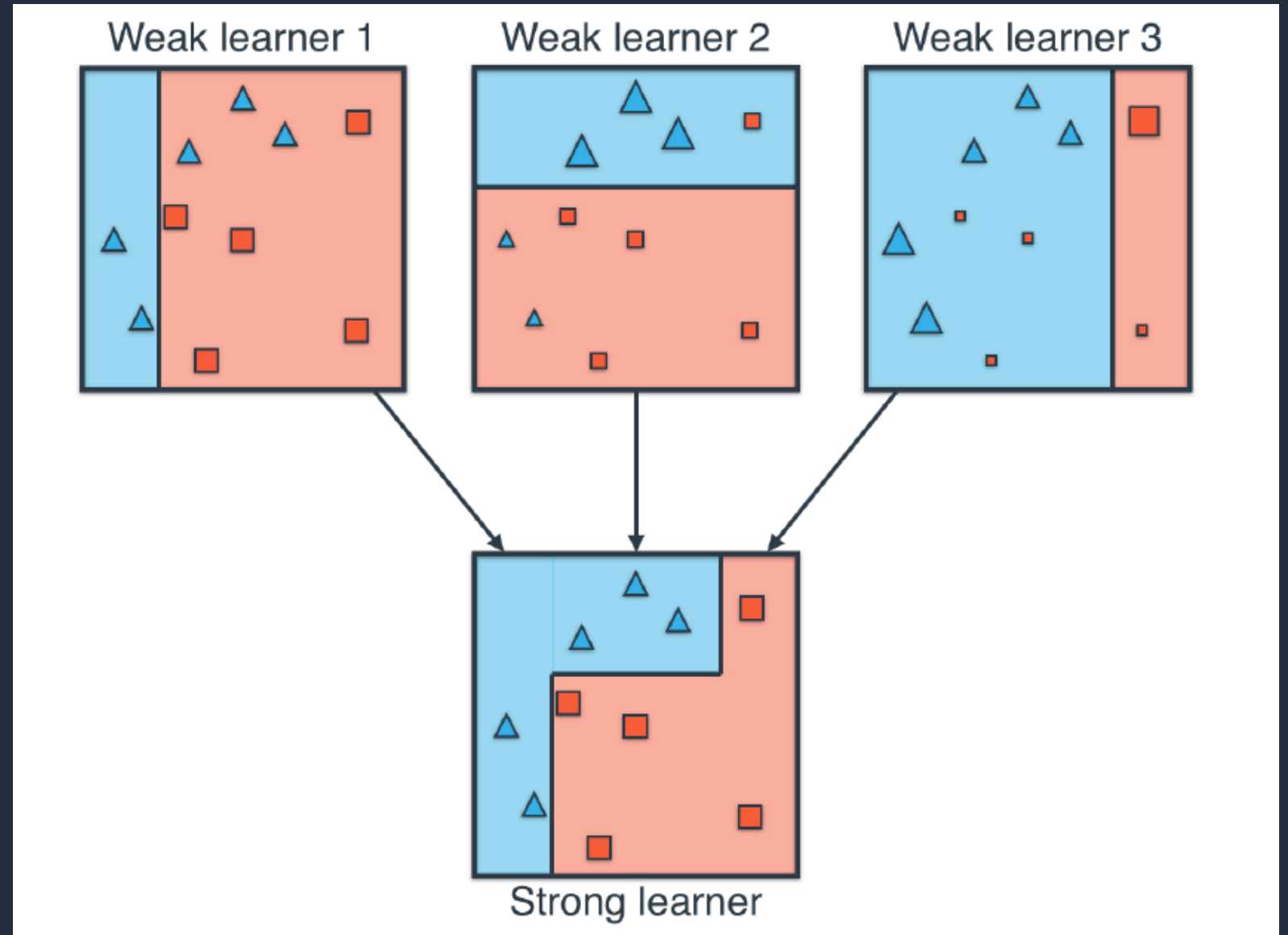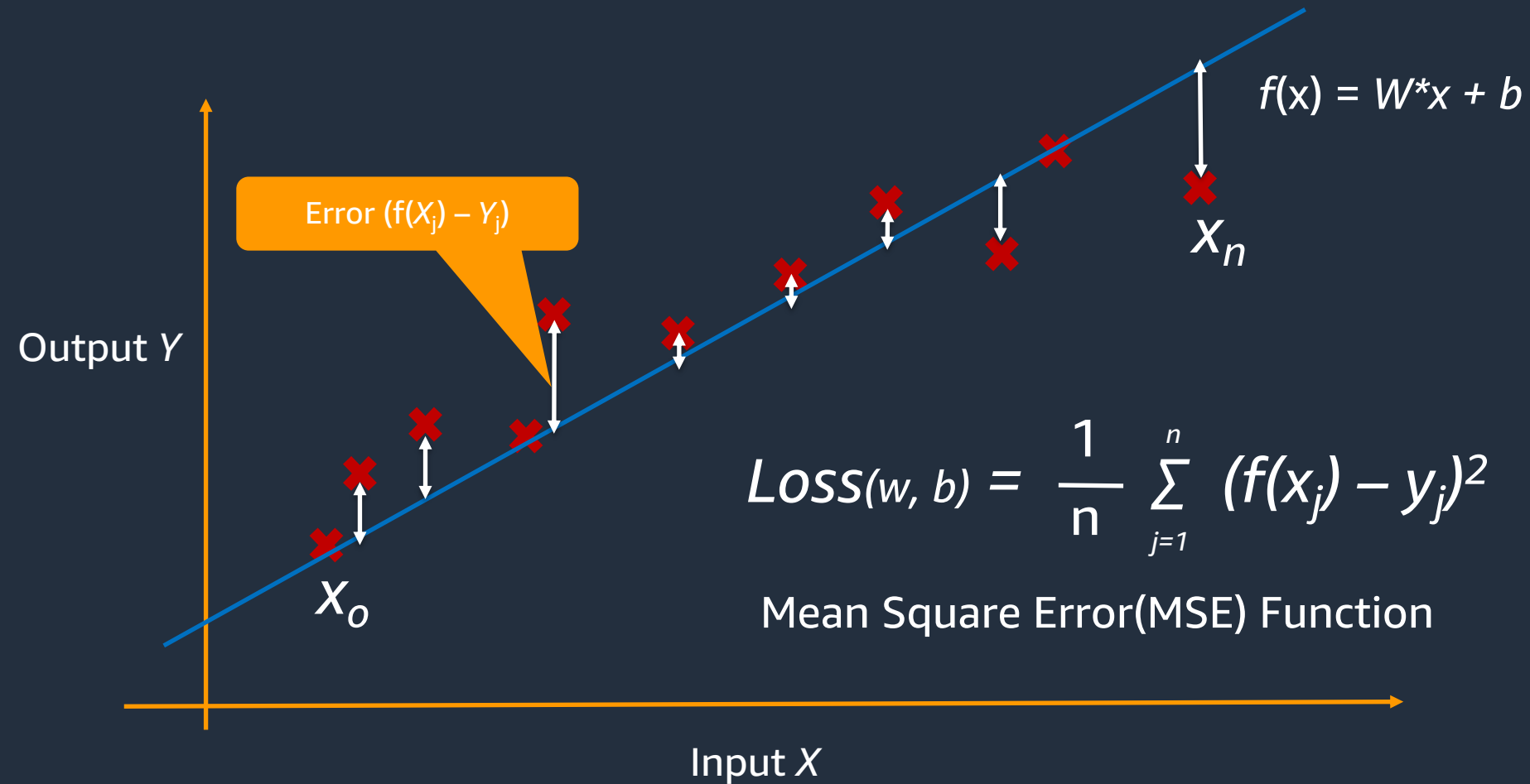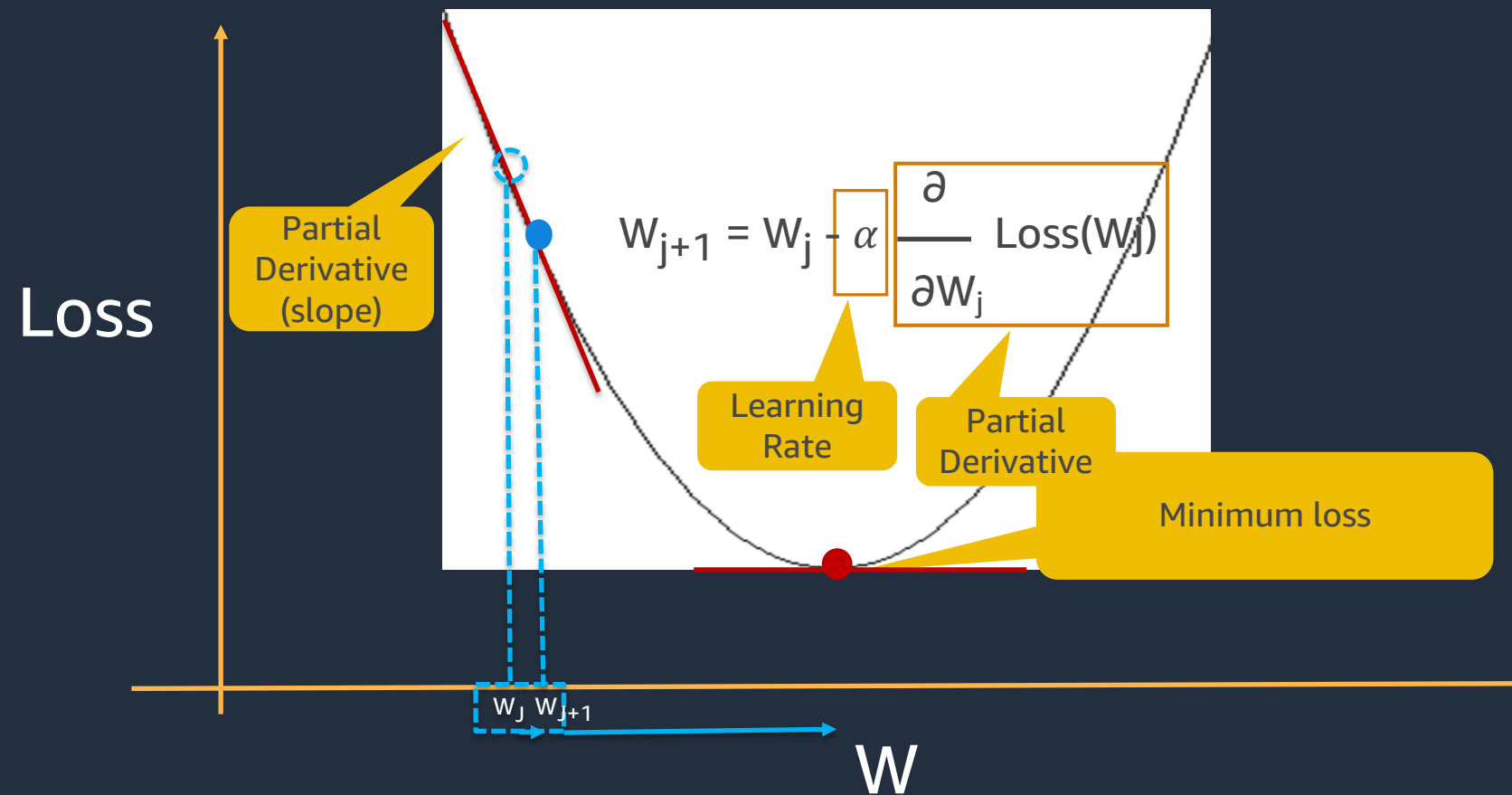
XGBoost (eXtreme Gradient Boosting)

- Open-source implementation of gradient-boosted trees algorithm

- Applies gradient boosting to decision tree models in a highly scalable manner

- Robustly handles a variety of data types, relationships, and distributions.

- Provides a large number of hyperparameters—variables that can be tuned to improve model performance

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Code please!

AWS Elastic **Beanstlak**

Running **web applications** on AWS

Provision / Configure → Deploy → Manage / Monitor

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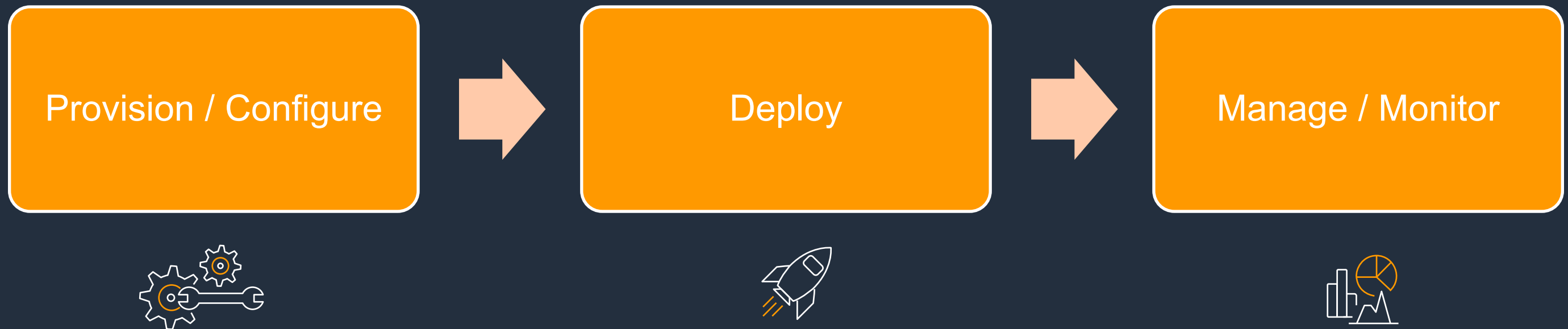
Running web applications on AWS

AWS has multiple services that enable you to run your web application including

Compute	• Amazon EC2, AWS Lambda, Amazon ECS, Amazon EKS, AWS Fargate, Lightsail
Storage	• Amazon S3, Amazon EFS
Database	• Amazon RDS, DynamoDB, Aurora
Networking	• Elastic Load Balancing, Amazon VPC
Management Tools	• Application Auto Scaling, AWS CloudFormation, Systems Manager

While each service is powerful and simple to use, running a web application requires that you learn multiple services and leaves the selection, configuration, and management up to you.

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Elastic Beanstalk

- Applications run on an Elastic Beanstalk platform

- Ensures all of the components are working seamlessly together

Your app

HTTP Server

Application Server

Language Interpreter

Operating System

EC2 Host

managed by Elastic Beanstalk
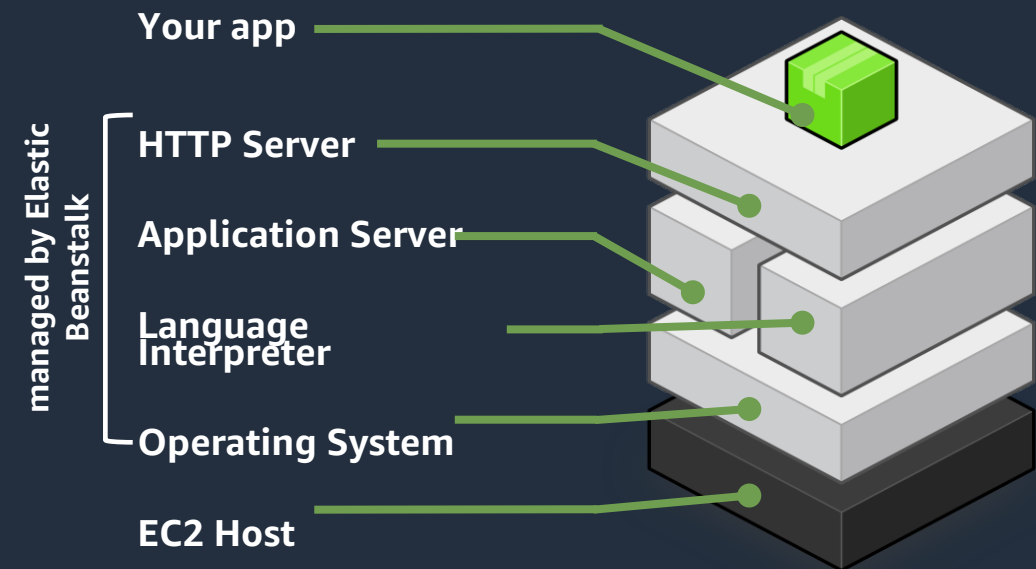
How it looks like …

01   Create your Elastic Beanstalk app
```
$ eb init
```

02   Create the resources and launch the application
```
$ eb create
```

03   Deploy updates
```
$ eb deploy
```

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How it **looks** like …


```
~/AW/c/pwc2020/eb-flask    on   master !5
~/AW/c/pwc2020/eb-flask    on   master !5   eb init -p python-3.7 winedemo --region us-east-1
Application winedemo has been created.
```
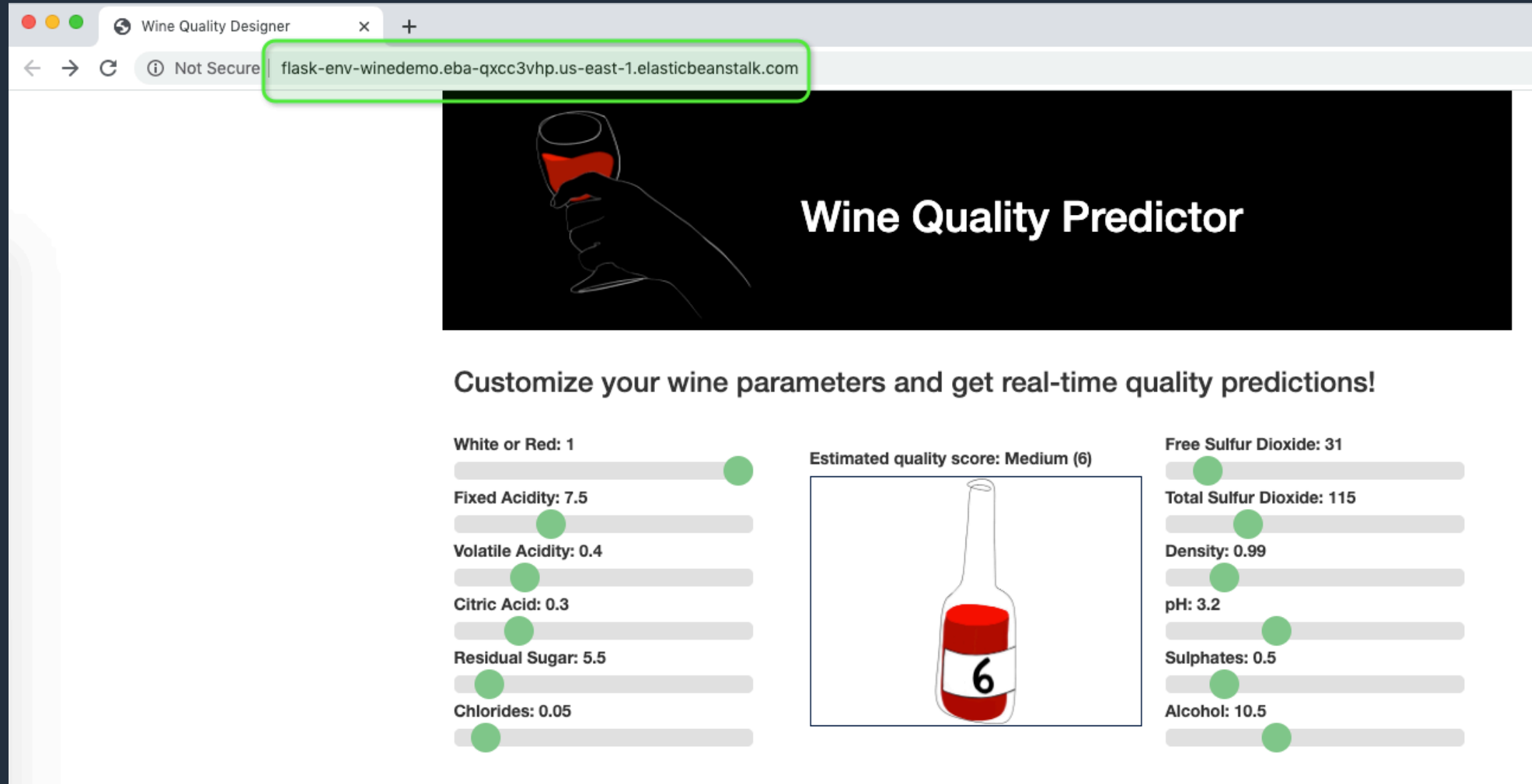
01

```
~/AW/c/pwc2020/eb-flask    on   master !5   eb create flask-env-winedemo
Creating application version archive "app-200619_120439".
Uploading: [#################################################] 100% Done...
Environment details for: flask-env-winedemo
  Application name: winedemo
  Region: us-east-1
  Deployed Version: app-200619_120439
  Environment ID: e-xusiaja6f8
  Platform: arn:aws:elasticbeanstalk:us-east-1::platform/Python 3.7 running on 64bit Amazon Linux 2/3.0.2
  Tier: WebServer-Standard-1.0
  CNAME: UNKNOWN
  Updated: 2020-06-19 06:34:58.202000+00:00
Printing Status:
2020-06-19 06:34:56    INFO    createEnvironment is starting.
2020-06-19 06:34:58    INFO    Using elasticbeanstalk-us-east-1-507922848584 as Amazon S3 storage bucket for environment data.
2020-06-19 06:35:23    INFO    Created security group named: sg-0f939aaaf9c4fc13c
2020-06-19 06:35:38    INFO    Created load balancer named: awseb-e-x-AWSEBLoa-ZO0JWP8XZHFH
2020-06-19 06:35:54    INFO    Created security group named: awseb-e-xusiaja6f8-stack-AWSEBSecurityGroup-14KUBB5TMTR54
2020-06-19 06:35:55    INFO    Created Auto Scaling launch configuration named: awseb-e-xusiaja6f8-stack-AWSEBAutoScalingLaunchConfiguration-10KW91\
2020-06-19 06:36:57    INFO    Created Auto Scaling group named: awseb-e-xusiaja6f8-stack-AWSEBAutoScalingGroup-129ZIQVCXSMVC
2020-06-19 06:36:57    INFO    Waiting for EC2 instances to launch. This may take a few minutes.
2020-06-19 06:36:57    INFO    Created Auto Scaling group policy named: arn:aws:autoscaling:us-east-1:507922848584:scalingPolicy:4be5321a-e284-411e
-stack-AWSEBAutoScalingGroup-129ZIQVCXSMVC:policyName/awseb-e-xusiaja6f8-stack-AWSEBAutoScalingScaleUpPolicy-DHTA0318J1GK
2020-06-19 06:36:57    INFO    Created Auto Scaling group policy named: arn:aws:autoscaling:us-east-1:507922848584:scalingPolicy:d33f2e12-a7e9-45a3
-stack-AWSEBAutoScalingGroup-129ZIQVCXSMVC:policyName/awseb-e-xusiaja6f8-stack-AWSEBAutoScalingScaleDownPolicy-8UO22JPZRC1P
2020-06-19 06:37:13    INFO    Created CloudWatch alarm named: awseb-e-xusiaja6f8-stack-AWSEBCloudwatchAlarmLow-10MXWSXCHT15M
2020-06-19 06:37:13    INFO    Created CloudWatch alarm named: awseb-e-xusiaja6f8-stack-AWSEBCloudwatchAlarmHigh-1I0YCVK3HPSAI
2020-06-19 06:38:37    INFO    Application available at flask-env-winedemo.eba-qxcc3vhp.us-east-1.elasticbeanstalk.com.
2020-06-19 06:38:38    INFO    Successfully launched environment: flask-env-winedemo
~/AW/c/pwc2020/eb-flask    on   master !5                                              ✓  took 4m 8s ⌛  virt 🐍
```
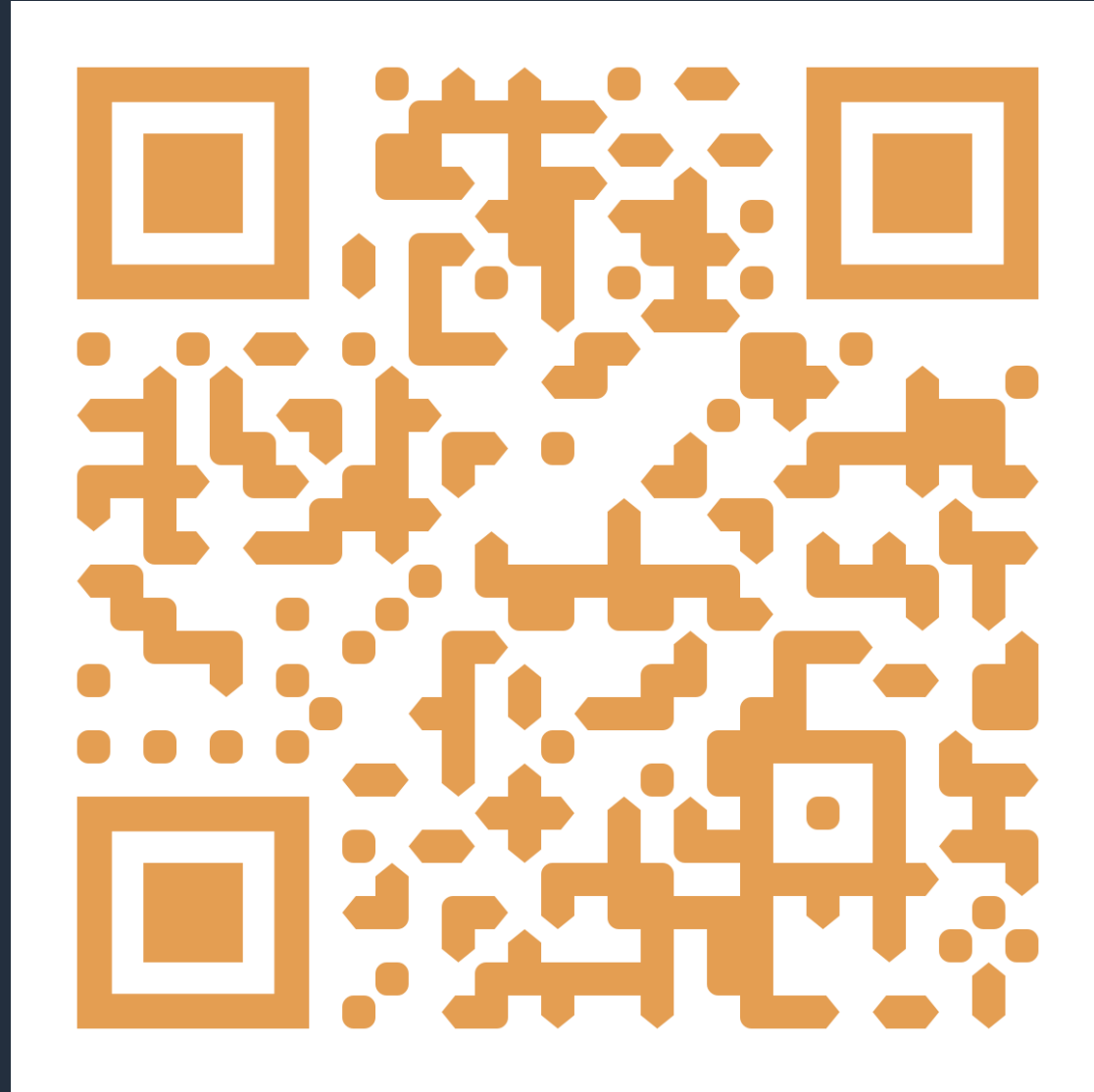
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After deployment

Destroy the **environment**


```
 ~/AW/c/pwc2020/eb-flask   on  master !5   eb terminate
The environment "flask-env-winedemo" and all associated instances will be terminated.
To confirm, type the environment name: flask-env-winedemo
2020-06-19 06:54:32    INFO      terminateEnvironment is starting.
2020-06-19 06:54:50    INFO      Deleted CloudWatch alarm named: awseb-e-xusiaja6f8-stack-AWSEBCloudwatchAlarmHigh-1I0Y
2020-06-19 06:54:50    INFO      Deleted CloudWatch alarm named: awseb-e-xusiaja6f8-stack-AWSEBCloudwatchAlarmLow-10MXW
2020-06-19 06:54:50    INFO      Deleted Auto Scaling group policy named: arn:aws:autoscaling:us-east-1:507922848584:sc
-stack-AWSEBAutoScalingGroup-129ZIQVCXSMVC:policyName/awseb-e-xusiaja6f8-stack-AWSEBAutoScalingScaleUpPolicy-DHTA0318
2020-06-19 06:54:50    INFO      Deleted Auto Scaling group policy named: arn:aws:autoscaling:us-east-1:507922848584:sc
-stack-AWSEBAutoScalingGroup-129ZIQVCXSMVC:policyName/awseb-e-xusiaja6f8-stack-AWSEBAutoScalingScaleDownPolicy-8UO22J
2020-06-19 06:54:50    INFO      Waiting for EC2 instances to terminate. This may take a few minutes.
2020-06-19 06:56:52    INFO      Deleted Auto Scaling group named: awseb-e-xusiaja6f8-stack-AWSEBAutoScalingGroup-129ZI
2020-06-19 06:56:52    INFO      Deleted load balancer named: awseb-e-x-AWSEBLoa-ZO0JWP8XZHFH
2020-06-19 06:57:07    INFO      Deleted Auto Scaling launch configuration named: awseb-e-xusiaja6f8-stack-AWSEBAutoSca
2020-06-19 06:57:07    INFO      Deleted security group named: awseb-e-xusiaja6f8-stack-AWSEBSecurityGroup-14KUBB5TMTR5
2020-06-19 06:57:38    INFO      Deleted security group named: sg-0f939aaaf9c4fc13c
2020-06-19 06:57:40    INFO      Deleting SNS topic for environment flask-env-winedemo.
2020-06-19 06:57:41    INFO      terminateEnvironment completed successfully.

 ~/AW/c/pwc2020/eb-flask   on  master !5 
 ~/AW/c/pwc2020/eb-flask   on  master !5 
```
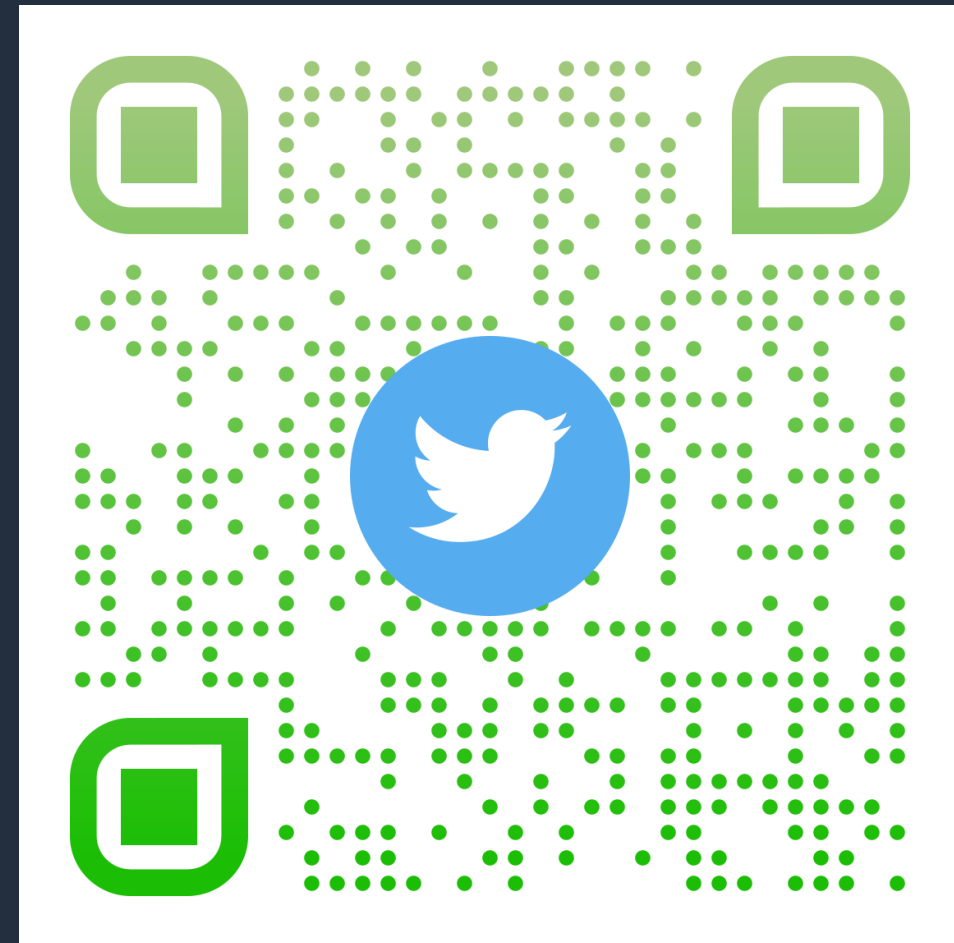
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Code please!

https://ratings.go-aws.com/rate/142

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Stay Connected ...

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Thank You!

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