

DigitalHouse >

DATA SCIENCE

Machine Learning – Modelos em Produção

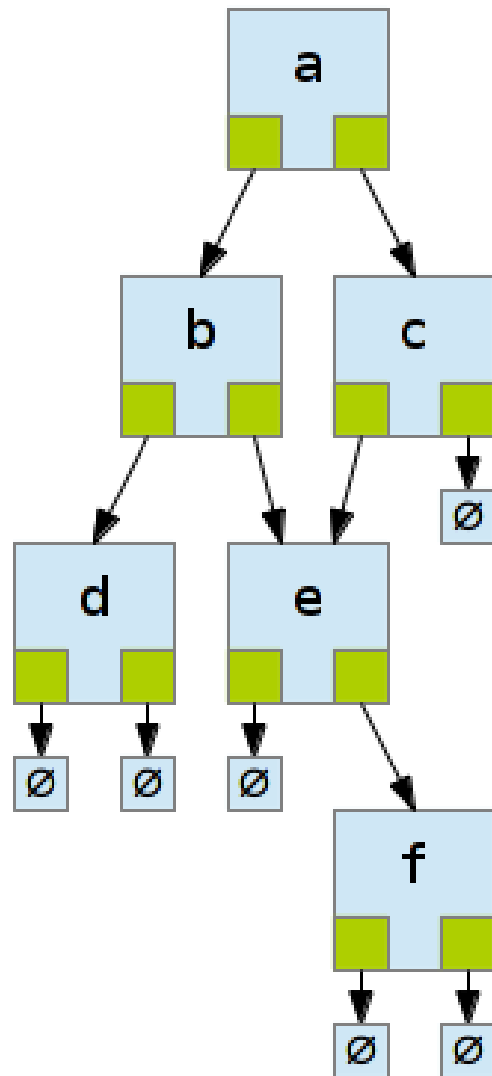
PERSISTÊNCIA DE MODELOS



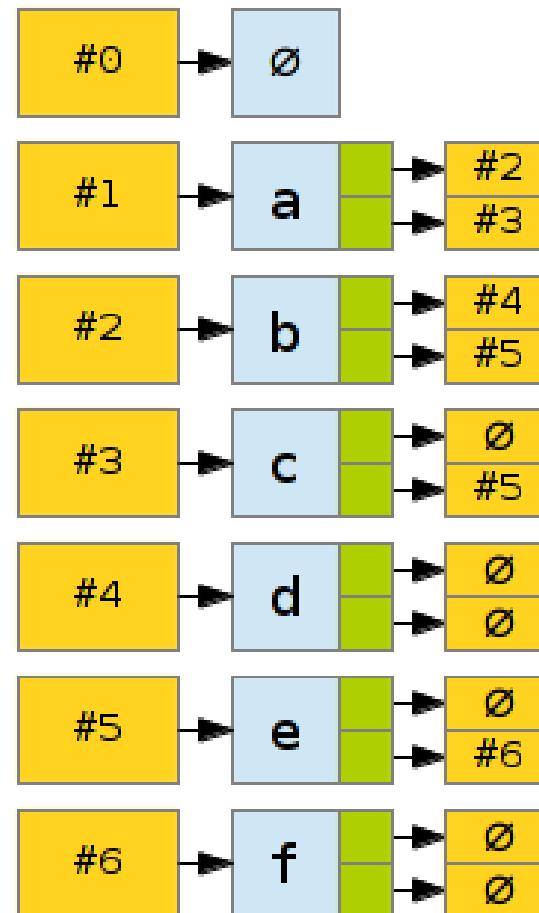
<https://docs.python.org/3/library/pickle.html>

O Pickle é uma biblioteca de SERIALIZAÇÃO de objetos do Python. Pode ser utilizado para gravar estruturas de dados, modelos preditivos, etc

Input Data



ser_serialize()



Output Format

```
node #1 { letter 'a';  
  left #2; right #3; }  
  
node #2 { letter 'b';  
  left #4; right #5; }  
  
node #3 { letter 'c';  
  left #5; right NULL; }  
  
node #4 { letter 'd';  
  left NULL; right NULL; }  
  
node #5 { letter 'e';  
  left NULL; right #6; }  
  
node #6 { letter 'f';  
  left NULL; right NULL; }
```

Your data as it appears
in Python's memory

```
['Is this the right room for an  
argument?', 'No you haven't!',  
'When?', 'No you didn't!', 'You  
didn't!', 'You did not!', 'Ah!  
(taking out his wallet and paying)  
Just the five minutes.', 'You  
most certainly did not!', 'Oh  
no you didn't!', 'Oh no you  
didn't!', 'Oh look, this isn't  
an argument!', 'No it isn't!',  
"It's just contradiction!", 'It  
IS!', 'You just contradicted  
me!', 'You DID!', 'You did just  
then!', '(exasperated) Oh, this  
is futile!!', 'Yes it is!']
```

The pickle engine

Feed your Python
data to pickle.

Out comes the
pickled version of
your data.

Your
pickled
data



TL;DR: Never unpickle data from sources you don't trust. Otherwise you open your app up to a relatively simple way of remote code execution.

[HOME](#) [FEATURES](#) [PRICING](#) [TEAM](#) [BLOG](#) [CONTACT](#)

DANGEROUS PICKLES – MALICIOUS PYTHON SERIALIZATION

BY [EVAN SANGALINE](#) | OCTOBER 17, 2017

[Follow @sangaline](#) 283 [★ Star](#) 205

What's so dangerous about pickles?

Those pickles are very dangerous pickles. I literally can't begin to tell you how really dangerous they are. You have to trust me on that. It's important, Ok?

– "Explosive Disorder" by Pan Telare

Before we get elbow deep in opcodes here, let's cover a little background. The Python standard library has a module called `pickle` that is

SEARCH

TAGS

[PYTHON \(19\)](#)

[BROWSE ALL TAGS](#)

Joblib: running Python functions as pipeline jobs

Introduction



Joblib is a set of tools to provide **lightweight pipelining in Python**. In particular:

1. transparent disk-caching of functions and lazy re-evaluation (memoize pattern)
2. easy simple parallel computing

Joblib is optimized to be **fast** and **robust** on large data in particular and has specific optimizations for *numpy* arrays. It is **BSD-licensed**.

Documentation:	https://joblib.readthedocs.io
Download:	https://pypi.python.org/pypi/joblib#downloads
Source code:	https://github.com/joblib/joblib
Report issues:	https://github.com/joblib/joblib/issues

<https://joblib.readthedocs.io/en/latest/>

O Joblib também oferece funcionalidades de persistência e serialização de dados, além de ser excelente para a paralelização de tarefas e montagem de pipelines complexos.

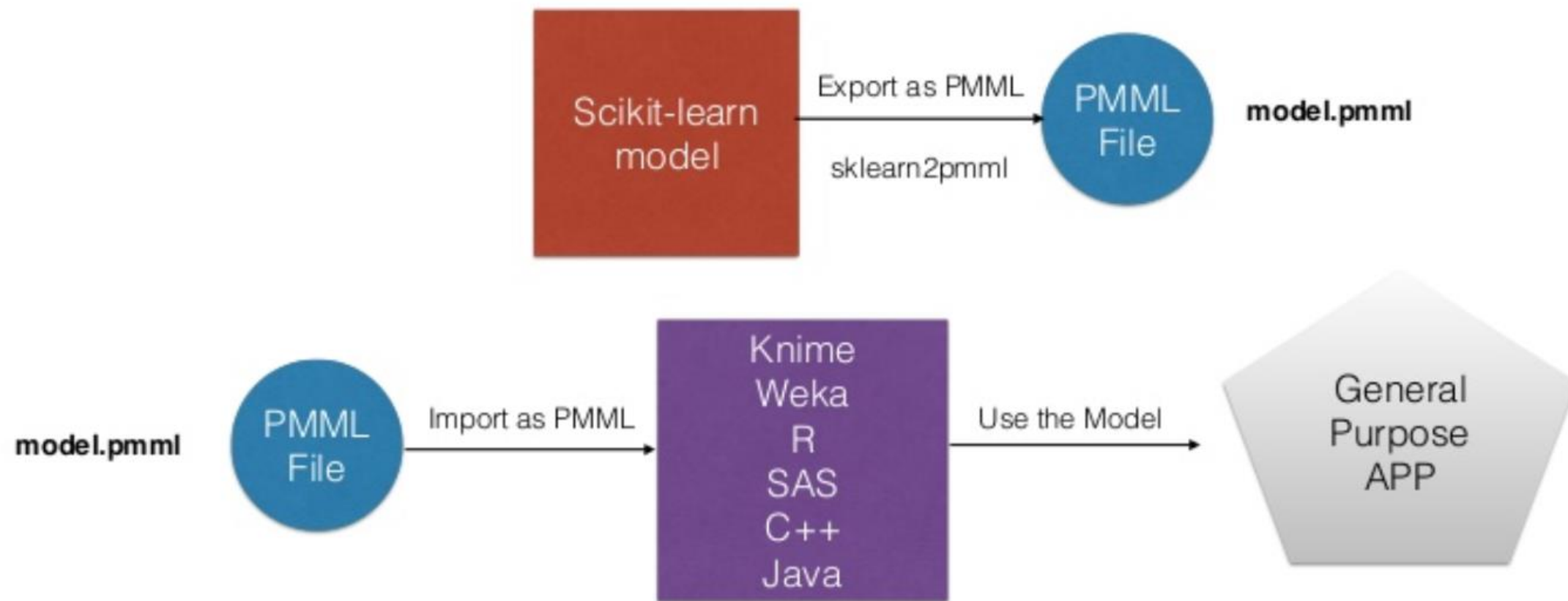
Pmmml XML File

```

<Node recordCount="0" score="Iris-virginica">CRUF
  <True/>CRUF
  <ScoreDistribution confidence="0.3333333333333333" recordCount="50" value="Iris-virginica"/>CRUF
  <ScoreDistribution confidence="0.3333333333333333" recordCount="50" value="Iris-setosa"/>CRUF
  <ScoreDistribution confidence="0.3333333333333333" recordCount="50" value="Iris-versicolor"/>CRUF
  <Node recordCount="0" score="Iris-virginica">CRUF
    <SimplePredicate field="a3" operator="greaterThan" value="2.450"/>CRUF
    <ScoreDistribution confidence="0.5" recordCount="50" value="Iris-virginica"/>CRUF
    <ScoreDistribution confidence="0.0" recordCount="0" value="Iris-setosa"/>CRUF
    <ScoreDistribution confidence="0.5" recordCount="50" value="Iris-versicolor"/>CRUF
    <Node recordCount="34" score="Iris-virginica">CRUF
      <SimplePredicate field="a3" operator="greaterThan" value="5.150"/>CRUF
      <ScoreDistribution confidence="1.0" recordCount="34" value="Iris-virginica"/>CRUF
      <ScoreDistribution confidence="0.0" recordCount="0" value="Iris-setosa"/>CRUF
      <ScoreDistribution confidence="0.0" recordCount="0" value="Iris-versicolor"/>CRUF
    </Node>CRUF
  </Node>CRUF
  <Node recordCount="0" score="Iris-versicolor">CRUF
    <SimplePredicate field="a3" operator="lessOrEqual" value="5.150"/>CRUF
    <ScoreDistribution confidence="0.24242424242424243" recordCount="16" value="Iris-virginica"/>CRUF
    <ScoreDistribution confidence="0.0" recordCount="0" value="Iris-setosa"/>CRUF
    <ScoreDistribution confidence="0.7575757575757576" recordCount="50" value="Iris-versicolor"/>CRUF
    <Node recordCount="8" score="Iris-virginica">CRUF
      <SimplePredicate field="a4" operator="greaterThan" value="1.850"/>CRUF
      <ScoreDistribution confidence="1.0" recordCount="8" value="Iris-virginica"/>CRUF
    </Node>CRUF
  </Node>CRUF

```


PMML Pipeline



<https://www.slideshare.net/AnassBenshirDatasci/deploying-machine-learning-models-to-production>

[Help](#)[Sponsor](#)[Log in](#)[Register](#)

sklearn-pmml-model 0.0.14.1

[Latest version](#)

```
pip install sklearn-pmml-model
```



Released: Mar 26, 2020

A library to parse PMML models into Scikit-learn estimators.

Navigation

[Project description](#)[Release history](#)[Download files](#)

Project links

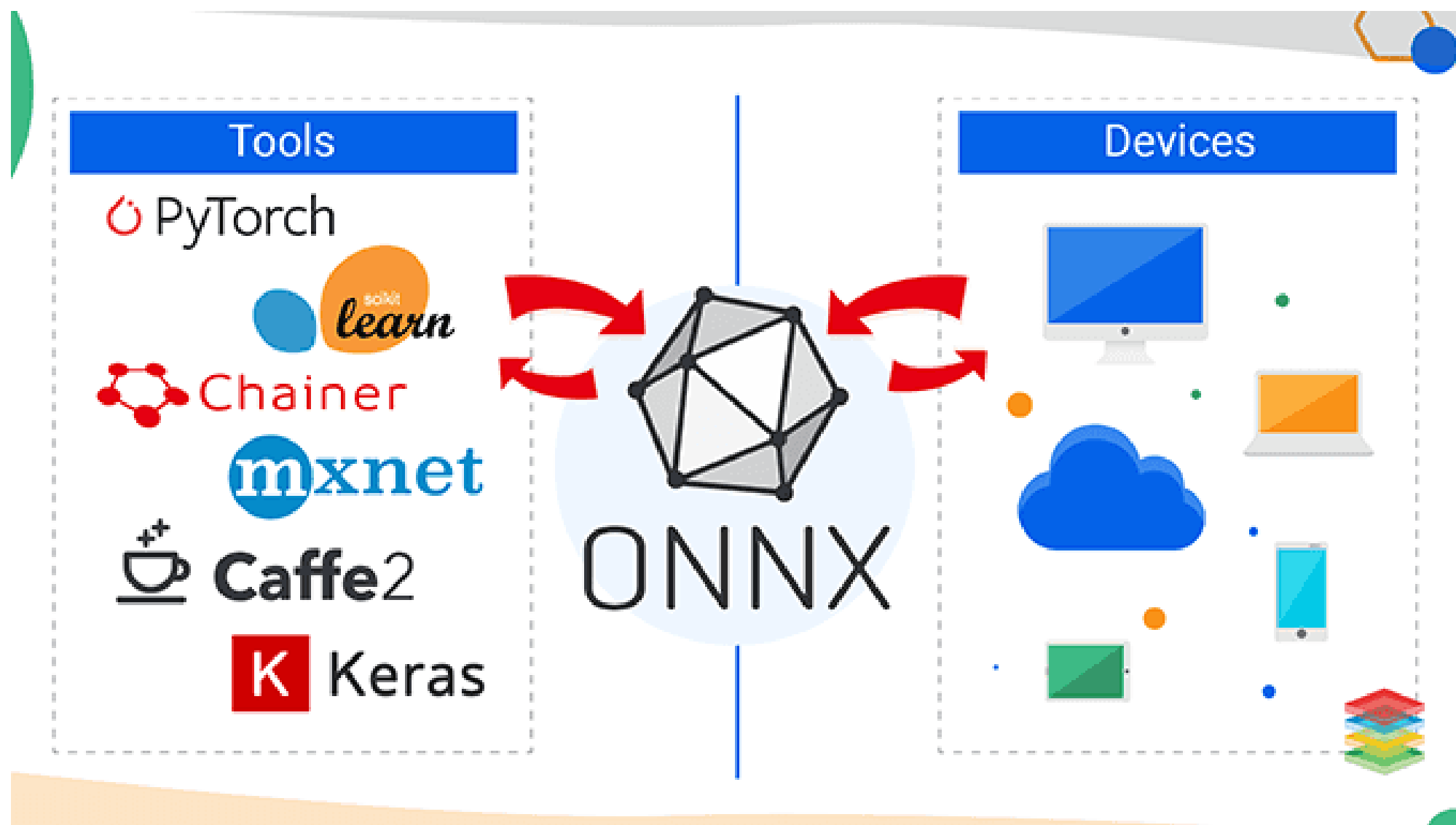
Project description

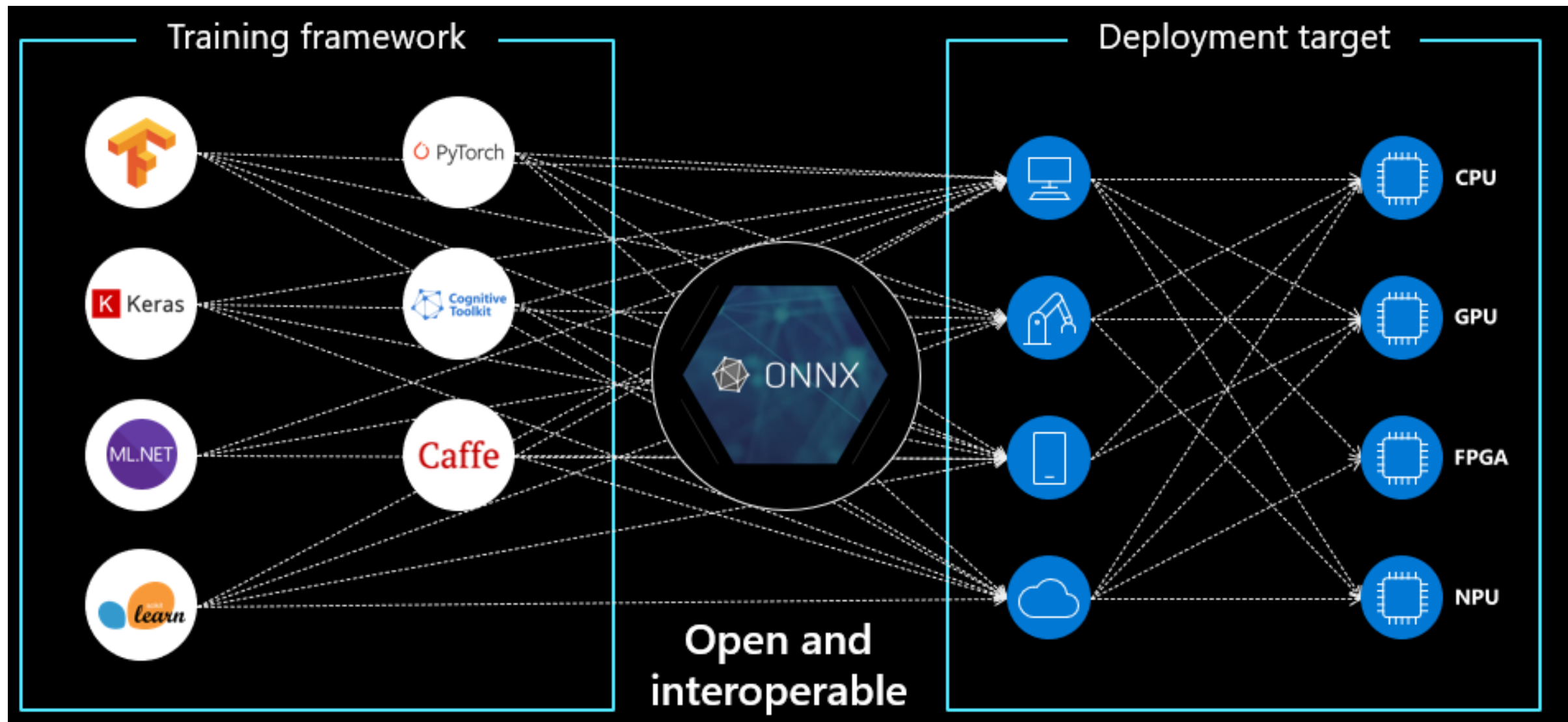


sklearn-pmml-model

pypi package 0.0.14.1 circleci failing codecov 100% docs passing

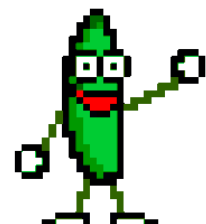
<https://pypi.org/project/sklearn-pmml-model/>







EXERCÍCIO



- Vamos rodar o o Notebook **SklearnPipelines_persistence_vf.ipynb** para vermos o Pickle e Joblib em ação.

**VAMOS COLOCAR UM
WEB APP EM PRODUÇÃO
(NA INTERNET)**



Streamlit.

The fastest way to build data apps

Streamlit's open-source app framework is the easiest way for data scientists and machine learning engineers to create beautiful, performant apps in only a few hours! All in pure Python. All for free.

<https://www.streamlit.io/>

```
pip install streamlit
```



Observação – poderá ser necessário colocar o caminho do streamlit.exe no PATH (Windows)

C:\Users\[**USUÁRIO**]\AppData\Roaming\Python\Python37\Scripts

```
(base) C:\streamlit>streamlit hello

Welcome to Streamlit. Check out our demo in your browser.

Local URL: http://localhost:8501
Network URL: http://192.168.0.10:8501

Ready to create your own Python apps super quickly?
Just head over to https://docs.streamlit.io

May you create awesome apps!
```

Vamos rodar o “Hello World” do Streamlit no prompt e ver o resultado no Browser:

- > streamlit hello

Depois iremos rodar também:

- > streamlit run tutorial.py

- > streamlit run bandrec-streamlit.py



Recomendação de Bandas

Escolha o país

- ☒ Estados Unidos
- ☐ Reino Unido
- ☐ Brasil

Digite o nome da Banda / Artista

megadeth

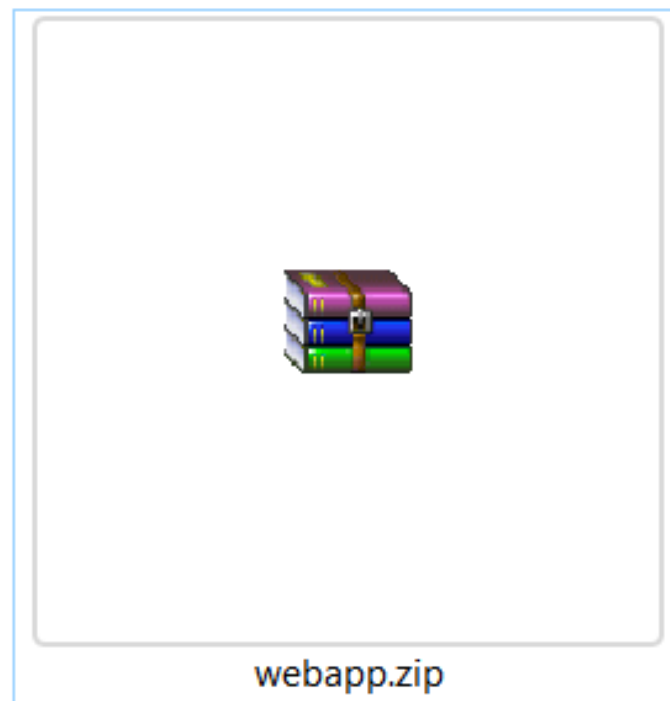
Submeter

Recommendations for megadeth:

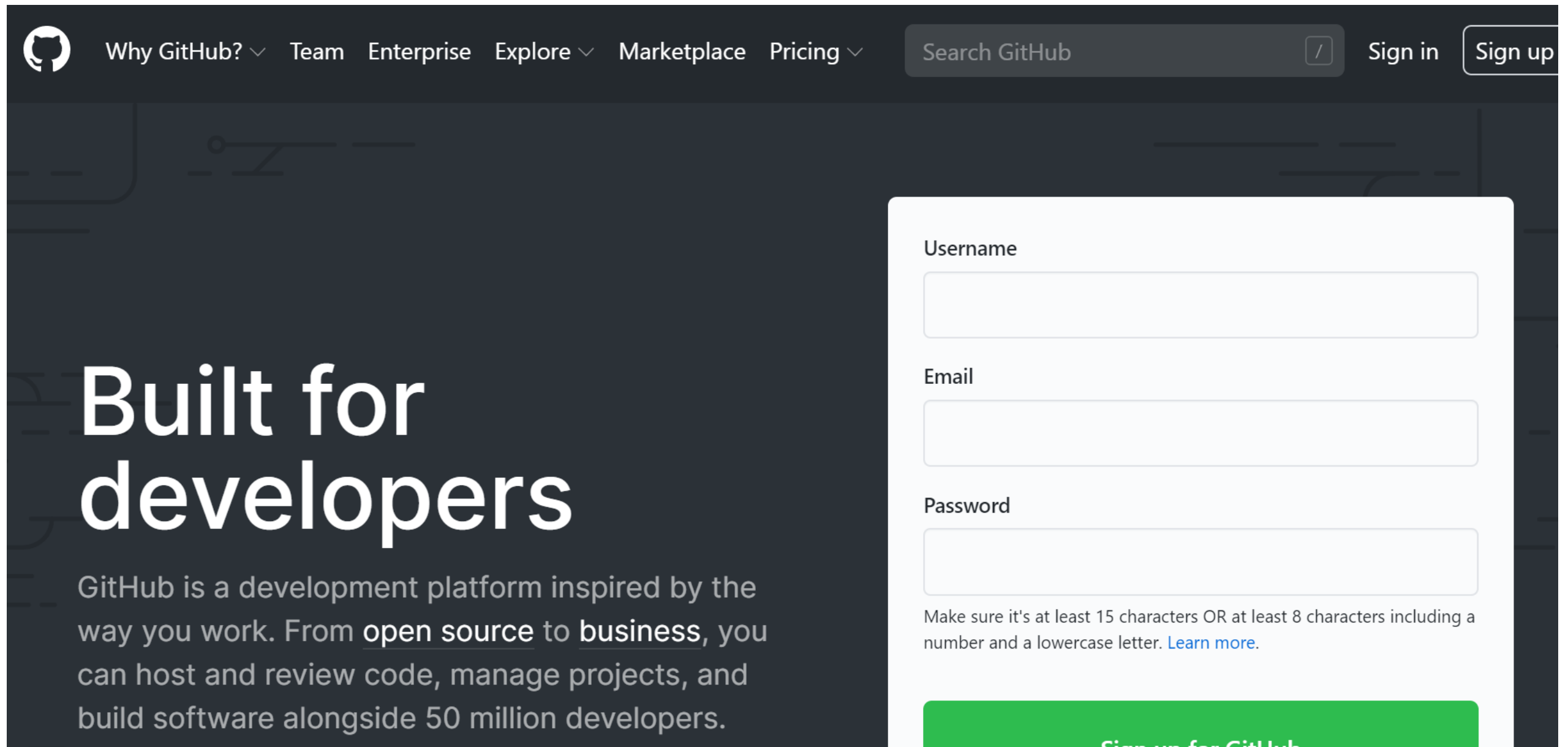
1: black sabbath, with distance of 0.3221987029536757:

2: koЯn, with distance of 0.3742111519629977:

3: slipknot, with distance of 0.37701311363710077:



Descompactar arquivos recebidos do pacote webapp.zip



The screenshot shows the GitHub homepage. The top navigation bar includes the GitHub logo, links for 'Why GitHub?', 'Team', 'Enterprise', 'Explore', 'Marketplace', and 'Pricing', a search bar, and 'Sign in' and 'Sign up' buttons. The main content area features the text 'Built for developers' and a description of GitHub as a development platform. A white sign-up form is overlaid on the right side of the page, containing fields for 'Username', 'Email', and 'Password', along with a 'Sign up for GitHub' button.

Why GitHub? ▾ Team Enterprise Explore ▾ Marketplace Pricing ▾ Search GitHub / Sign in Sign up

Built for developers

GitHub is a development platform inspired by the way you work. From open source to business, you can host and review code, manage projects, and build software alongside 50 million developers.

Username

Email

Password

Make sure it's at least 15 characters OR at least 8 characters including a number and a lowercase letter. [Learn more.](#)

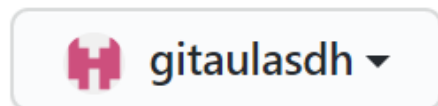
Sign up for GitHub

<https://github.com/>

Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository.](#)

Owner



Repository name *

/

Great repository names are short and memorable. Need inspiration? How about **ubiquitous-pancake**?

Description (optional)



Public

Anyone on the internet can see this repository. You choose who can commit.



Private

You choose who can see and commit to this repository.

Create repository

gitaulasdh / webapp

Unwatch

1

Star

0

Fork

0

<> Code

! Issues

🔗 Pull requests

🎮 Actions

📁 Projects

📖 Wiki

🛡 Security

📈 Insights

⚙ Settings


Quick setup — if you've done this kind of thing before

 Set up in Desktop or ☐ HTTPS ☒ SSH `https://github.com/gitaulasdh/webapp.git` 

Get started by [creating a new file](#) or [uploading an existing file](#). We recommend every repository include a [README](#), [LICENSE](#), and [.gitignore](#).

...or create a new repository on the command line

```
echo "# webapp" >> README.md
git init
git add README.md
git commit -m "first commit"
git remote add origin https://github.com/gitaulasdh/webapp.git
```









webapp /



Drag files here to add them to your repository

Or [choose your files](#)

Subir todos arquivos que estavam no webapp.zip, descompactados previamente

 bandrec-streamlit.py	×
 Procfile	×
 requirements.txt	×
 setup.sh	×
 usersha1-artmbid-artname-plays_1.tsv	×
 usersha1-profile.tsv	×



Commit changes

Carga inicial dos arquivos

Add an optional extended description...

Commit changes

Cancel

E nesta mesma tela dar “commit changes”.

gitaulasdh / webapp

Unwatch1

Star0

Fork0

<> Code

! Issues

🔗 Pull requests

🎬 Actions

📁 Projects

📖 Wiki

🛡 Security

📈 Insights

⚙ Settings

🔗 Branch: master ▾

Go to file

Add file ▾

📄 Clone ▾

gitaulasdh committed b25299e now ...

🕒 1 commits 🔗 1 branch 🏷 0 tags

📄 Procfile	Carga inicial dos arquivos	now
📄 bandrec-streamlit.py	Carga inicial dos arquivos	now
📄 requirements.txt	Carga inicial dos arquivos	now
📄 setup.sh	Carga inicial dos arquivos	now
📄 usersha1-artmbid-artname-pla...	Carga inicial dos arquivos	now
📄 usersha1-profile.tsv	Carga inicial dos arquivos	now

About

No description, website, or topics provided.

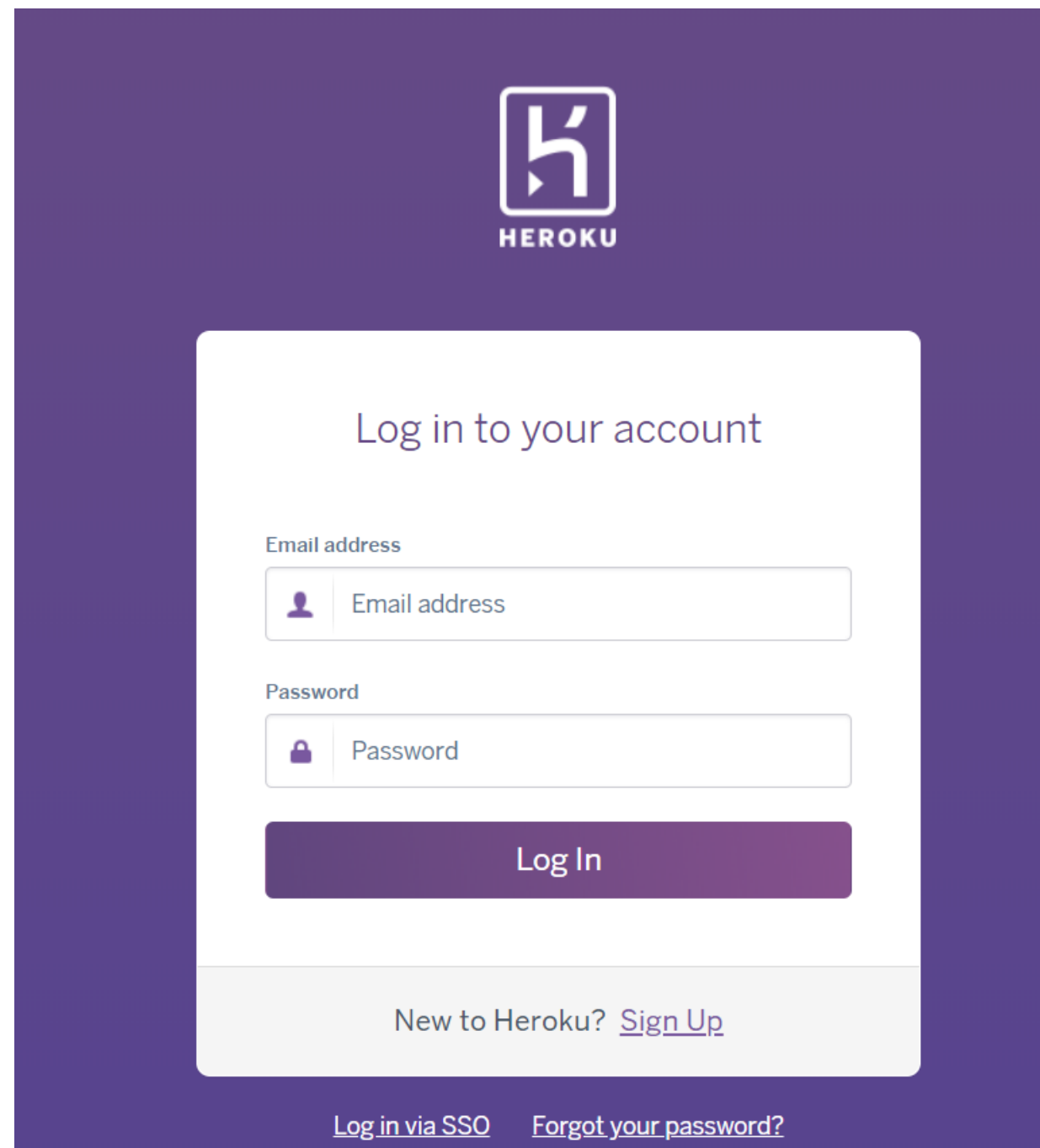
Releases

No releases published

Create a new release

Packages

No packages published

The image shows the Heroku login page. At the top center is the Heroku logo, which consists of a stylized 'H' inside a square, with the word 'HEROKU' underneath. Below the logo, the text 'Log in to your account' is centered. There are two input fields: 'Email address' and 'Password'. Each field has a small icon on the left (a person for email, a lock for password) and a placeholder text. Below the password field is a purple 'Log In' button. At the bottom of the form, there is a link 'New to Heroku? Sign Up'. At the very bottom of the page, there are two links: 'Log in via SSO' and 'Forgot your password?'.

<https://www.heroku.com/>

Selecionar “Sign Up”, preencher todos os dados e confirmar a inscrição no e-mail enviado

Personal ▾

New ▾



Welcome to Heroku

Now that your account has been set up, here's how to get started.

- Create new app
- Create new pipeline

Dismiss

**Create a new app**

Create your first app and deploy your code to a running dyno.

[Create new app](#)**Create a team**

Create teams to collaborate on your apps and pipelines.

[Create a team](#)**Looking for help getting started with your language?**

Get started by reading one of our language guides in the Dev Center

[Node.js](#)[Ruby](#)[Java](#)[PHP](#)[Python](#)[Go](#)[Scala](#)[Clojure](#)

Create New App

App name

webappauladh



webappauladh is available

Choose a region



United States



Add to pipeline...

Create app

Personal > webappauladh



Open app

More >

Overview

Resources

Deploy

Metrics

Activity

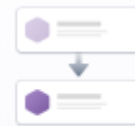
Access

Settings

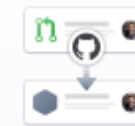
Add this app to a pipeline

Create a new pipeline or choose an existing one and add this app to a stage in it.

Add this app to a stage in a pipeline to enable additional features



Pipelines let you connect multiple apps together and **promote code** between them. [Learn more.](#)



Pipelines connected to GitHub can enable **review apps**, and create apps for new pull requests. [Learn more.](#)

Choose a pipeline

Deployment method



Heroku Git
Use Heroku CLI



GitHub
Connect to GitHub



Container Registry
Use Heroku CLI

Connect to GitHub

Connect this app to GitHub to enable code diffs and deploys.

View your code diffs on GitHub

Connect your app to a GitHub repository to see commit diffs in the activity log.

Deploy changes with GitHub

Connecting to a repository will allow you to deploy a branch to your app.

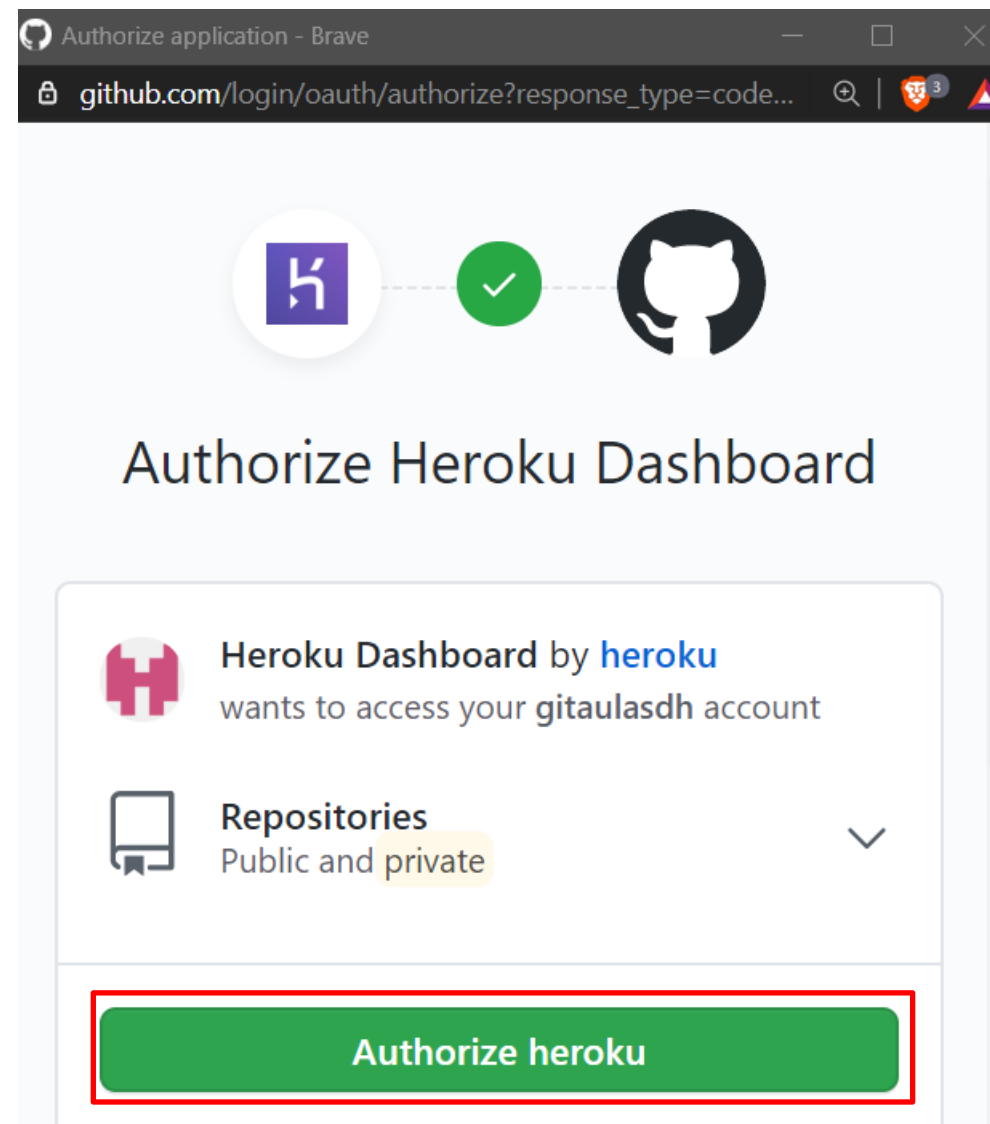
Automatic deploys from GitHub

Select a branch to deploy automatically whenever it is pushed to.

Create review apps in pipelines

Pipelines connected to GitHub can enable **review apps**, and create apps for new pull requests. [Learn more.](#)

Connect to GitHub



Personal > webappauladh

☆ Open app More

Overview Resources Deploy Metrics Activity Access Settings

Add this app to a pipeline

Create a new pipeline or choose an existing one and add this app to a stage in it.

Add this app to a stage in a pipeline to enable additional features

Pipelines let you connect multiple apps together and **promote code** between them.

[Learn more.](#)

Pipelines connected to GitHub can enable **review apps**, and create apps for new pull requests.

[Learn more.](#)

Choose a pipeline

Deployment method

Heroku Git

Use Heroku CLI

GitHub

Connect to GitHub

Container Registry

Use Heroku CLI

Connect to GitHub

Connect this app to GitHub to enable code diffs and deploys.

Search for a repository to connect to

gitaulasdh

webapp

Search

Missing a GitHub organization? [Ensure Heroku Dashboard has team access.](#)

gitaulasdh/webapp

Connect

Aguardar alguns segundos para que
seja feita a conexão / download do repo
ou dê reload na página

Personal > webappauladh

GitHub gitaualsdh/webapp

Open app More

Overview Resources Deploy Metrics Activity Access Settings

Add this app to a pipeline

Create a new pipeline or choose an existing one and add this app to a stage in it.

Add this app to a stage in a pipeline to enable additional features

Pipelines let you connect multiple apps together and promote code between them. [Learn more.](#)

Pipelines connected to GitHub can enable review apps, and create apps for new pull requests. [Learn more.](#)

Choose a pipeline

Deployment method

Heroku Git
Use Heroku CLI

GitHub
Connected

Container Registry
Use Heroku CLI

App connected to GitHub

Code diffs, manual and auto deploys are available for this app.

Connected to gitaualsdh/webapp by gitaualsdh

Disconnect...

Releases in the [activity feed](#) link to GitHub to view commit diffs

Automatic deploys

Enables a chosen branch to be automatically deployed to this app.

Enable automatic deploys from GitHub

Every push to the branch you specify here will deploy a new version of this app. **Deploys happen automatically:** be sure that this branch is always in a deployable state and any tests have passed before you push. [Learn more.](#)

Choose a branch to deploy

master

☐ Wait for CI to pass before deploy

Only enable this option if you have a Continuous Integration service configured on your repo.

Enable Automatic Deploys

Manual deploy

Deploy the current state of a branch to this app.

Deploy a GitHub branch

This will deploy the current state of the branch you specify below. [Learn more.](#)

Choose a branch to deploy

master

Deploy Branch

Acompanhar para ver se o deploy dos arquivos foi feito com sucesso

Receive code from GitHub



Build **master** `b25299e3`



Release phase



Deploy to Heroku



Your app was successfully deployed.

 [View](#)

Personal > webappauladh

☆ Open app More


GitHub gitaulasdh/webapp

Overview Resources Deploy Metrics Activity Access Settings


Add this app to a pipeline

Create a new pipeline or choose an existing one and add this app to a stage in it.

Add this app to a stage in a pipeline to enable additional features




Pipelines let you connect multiple apps together and **promote code** between them. [Learn more.](#)





Pipelines connected to GitHub can enable **review apps**, and create apps for new pull requests. [Learn more.](#)

Choose a pipeline

Deployment method



 Heroku Git
Use Heroku CLI


 GitHub
Connected

 Container Registry
Use Heroku CLI

App connected to GitHub

Code diffs, manual and auto deploys are available for this app.

Connected to  [gitaulasdh/webapp](#) by  [gitaulasdh](#) [Disconnect...](#)

 Releases in the [activity feed](#) link to GitHub to view commit diffs

Automatic deploys

Enables a chosen branch to be automatically deployed to this app.

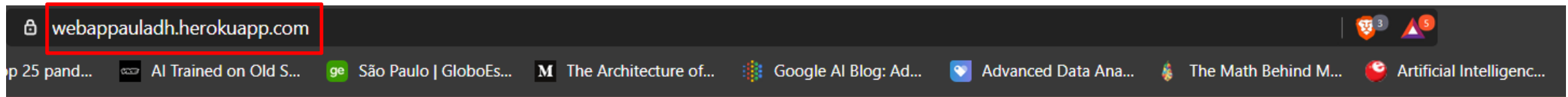
Enable automatic deploys from GitHub

Every push to the branch you specify here will deploy a new version of this app. **Deploys happen automatically:** be sure that this branch is always in a deployable state and any tests have passed before you push. [Learn more.](#)

Choose a branch to deploy

master

☐ Wait for CI to pass before deploy



Recomendação de Bandas

Escolha o país

- ☒ Estados Unidos
- ☐ Reino Unido
- ☐ Brasil

Digite o nome da Banda / Artista

megadeth

Submeter

Recommendations for megadeth:

1: black sabbath, with distance of 0.3221987029536757:

2: koЯn, with distance of 0.3742111519629977:

3: slipknot, with distance of 0.37701311363710077:

```
Procfile x
1 web: sh setup.sh && streamlit run --server.port $PORT bandrec-streamlit.py
2
```

Procfile – indica os comandos que vão ser executados

```
requirements.txt x
1 numpy==1.17.3
2 pandas==1.0.5
3 streamlit==0.62.0
4 scipy==1.4.1
5 fuzzywuzzy==0.18.0
6 sklearn
7
```

requirements.txt – libs a serem instaladas

```
setup.sh x
1 mkdir -p ~/.streamlit/
2
3 echo "\
4 [server]\n\
5 headless = true\n\
6 port = $PORT\n\
7 enableCORS = false\n\
8 \n\
9 " > ~/.streamlit/config.toml
```

setup.sh – preparação e configuração do ambiente

**VAMOS COLOCAR UM
WEB SERVICE EM PRODUÇÃO
(NA INTERNET)**



EXERCÍCIO



- Vamos rodar o o Notebook **[titanic_api_heroku_vf.ipynb](#)** para vermos a utilização de APIs com um modelo persistido com o pickle – localmente e no Heroku.



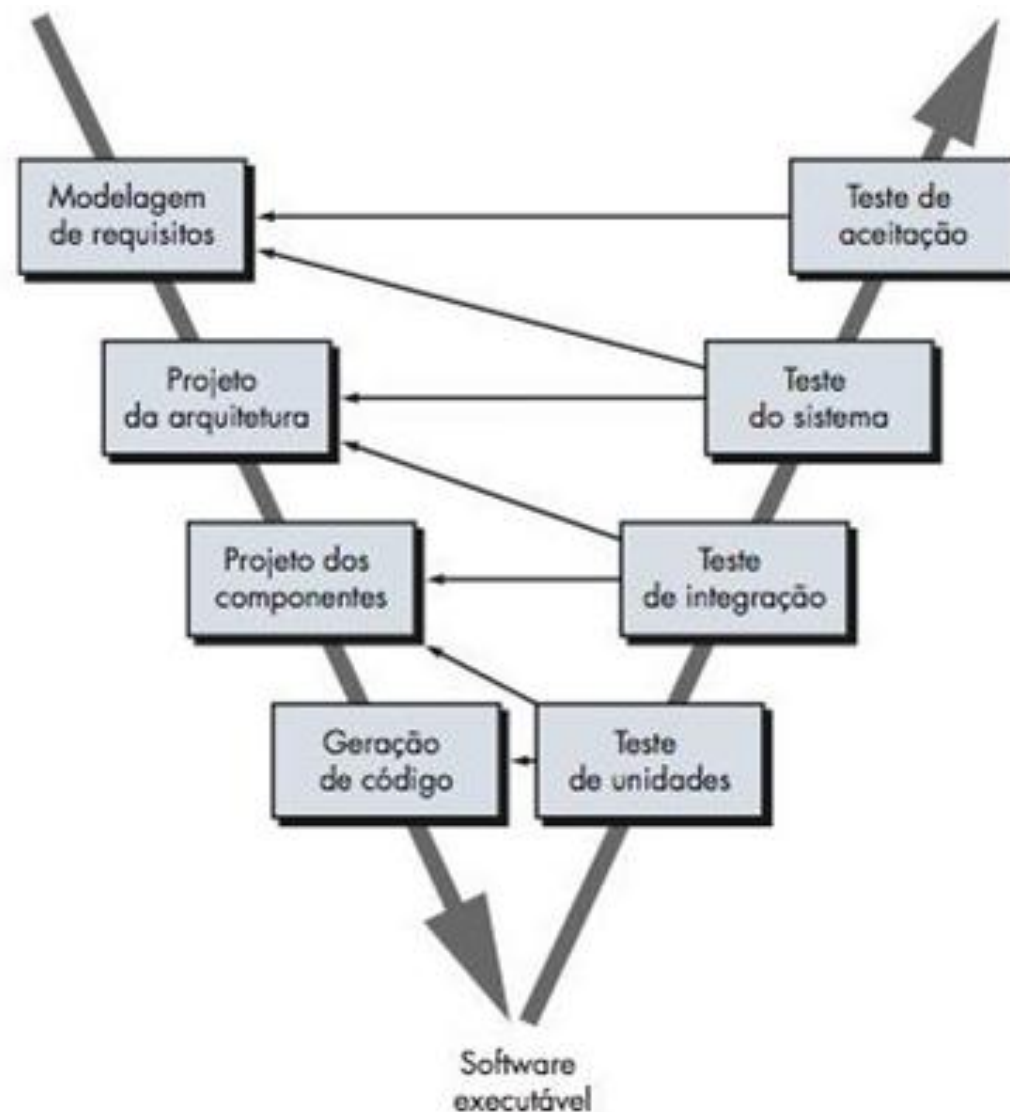
Agora vamos criar um webservice com o Flask e fazer o deploy do mesmo no Heroku.



Descompactar arquivos em webservice.zip e abrir o notebook **deploy_api_heroku_v1.ipynb** no Jupyter.



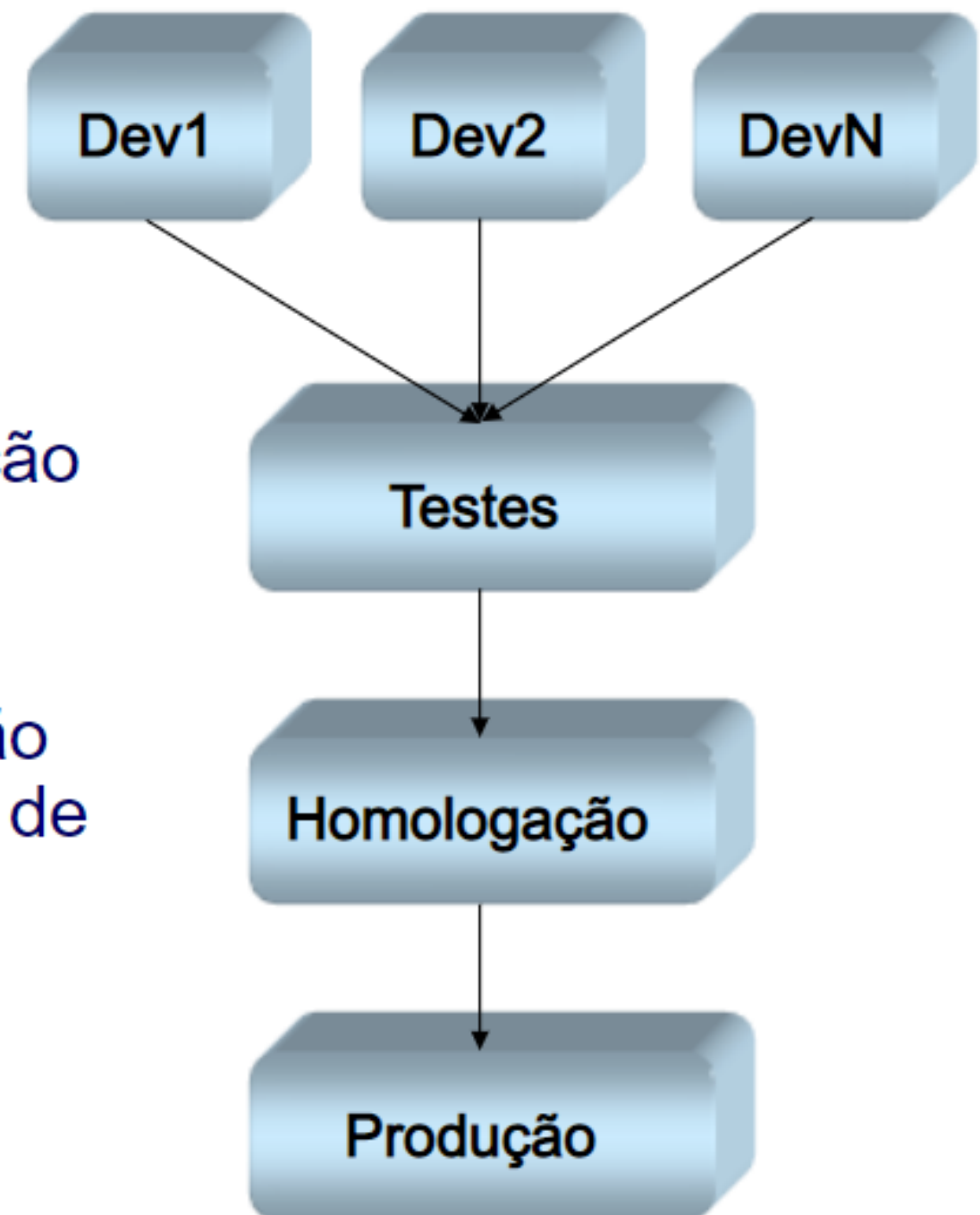
**COMO O SOFTWARE
CHEGA AO AMBIENTE
PRODUTIVO?**

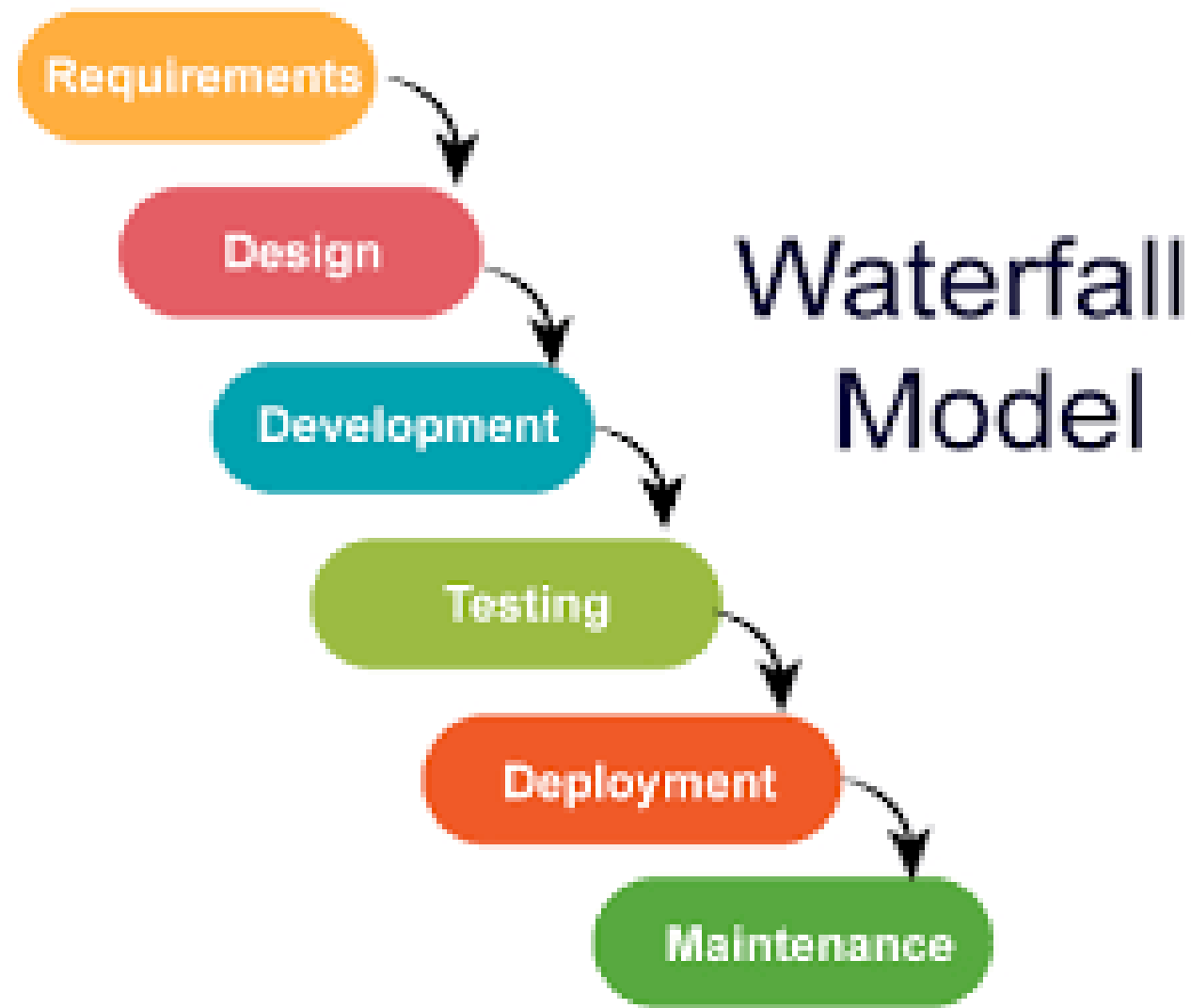


<https://www.devmedia.com.br/introducao-ao-modelo-cascata/29843>

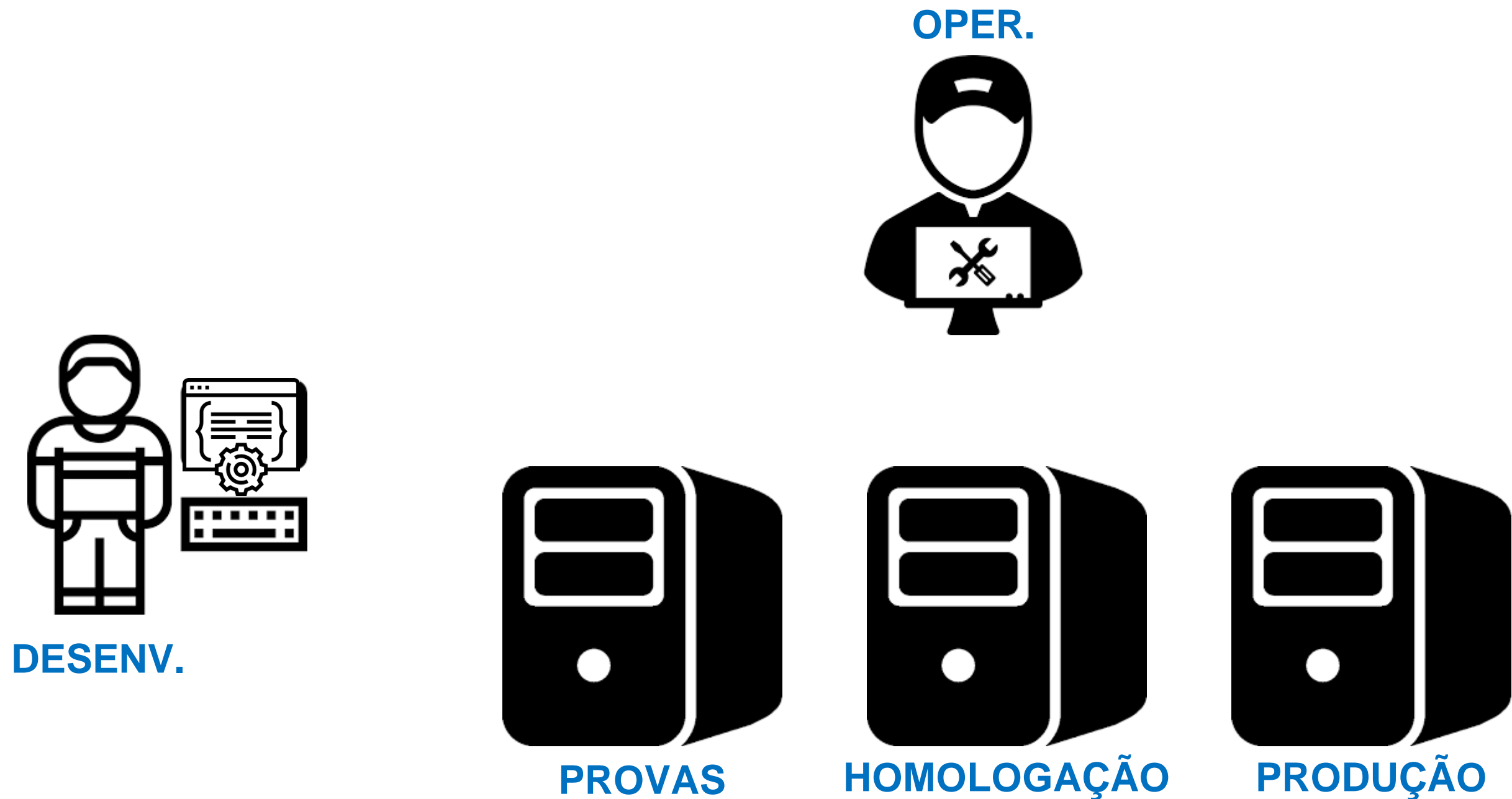
Importante lembrarmos do modelo mais tradicional de desenvolvimento de software – o “**V Model**” para entendermos sua evolução e o estágio atual dos conceitos de entrega e desenvolvimento de software.

- **Desenvolvimento**
 - Estação de trabalho dos desenvolvedores
- **Testes**
 - Ambiente para testar a integração das unidades desenvolvidas
- **Homologação**
 - Ambiente similar ao de produção utilizado para realizar os testes de aceitação
- **Produção**
 - Ambiente real de produção da aplicação

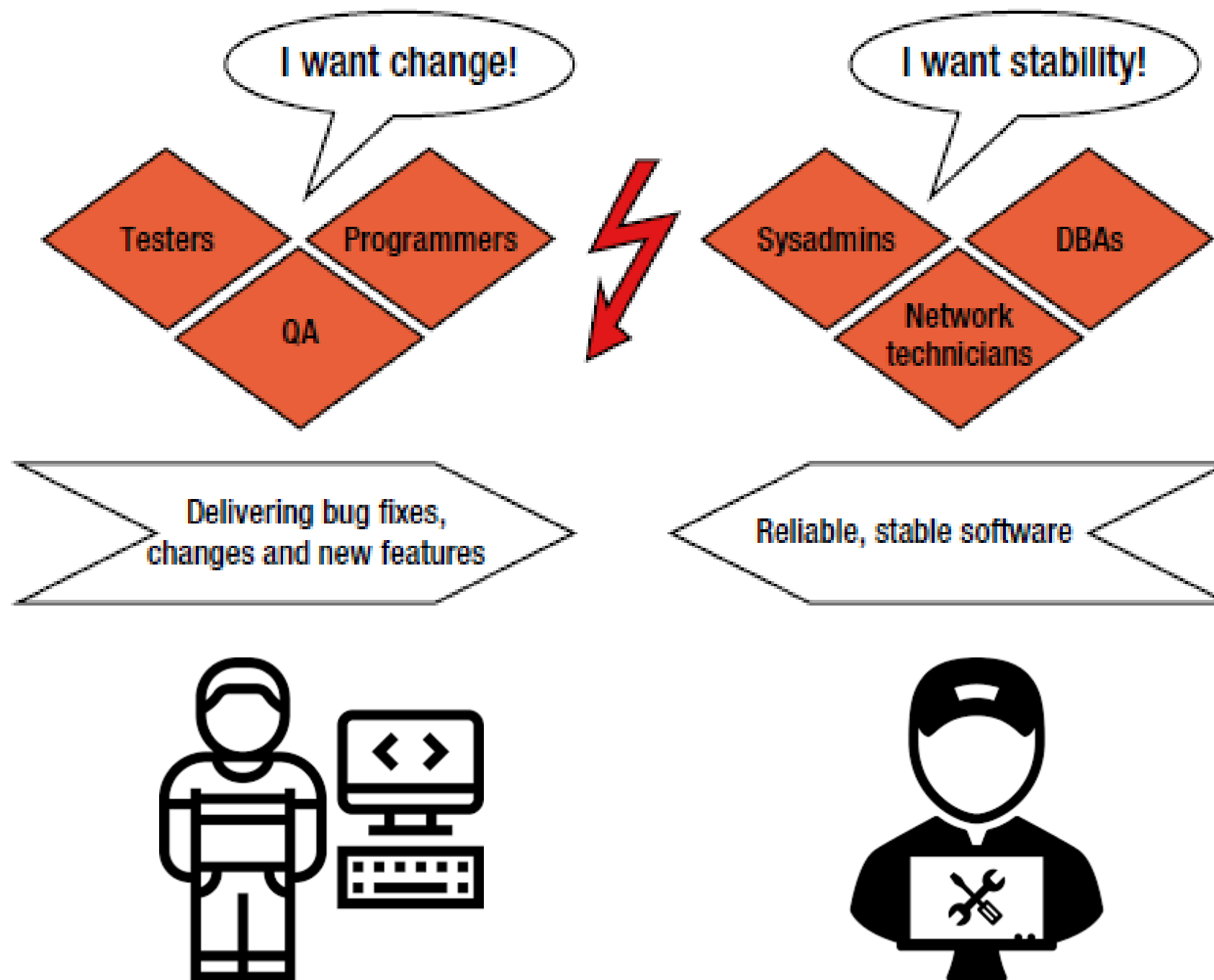


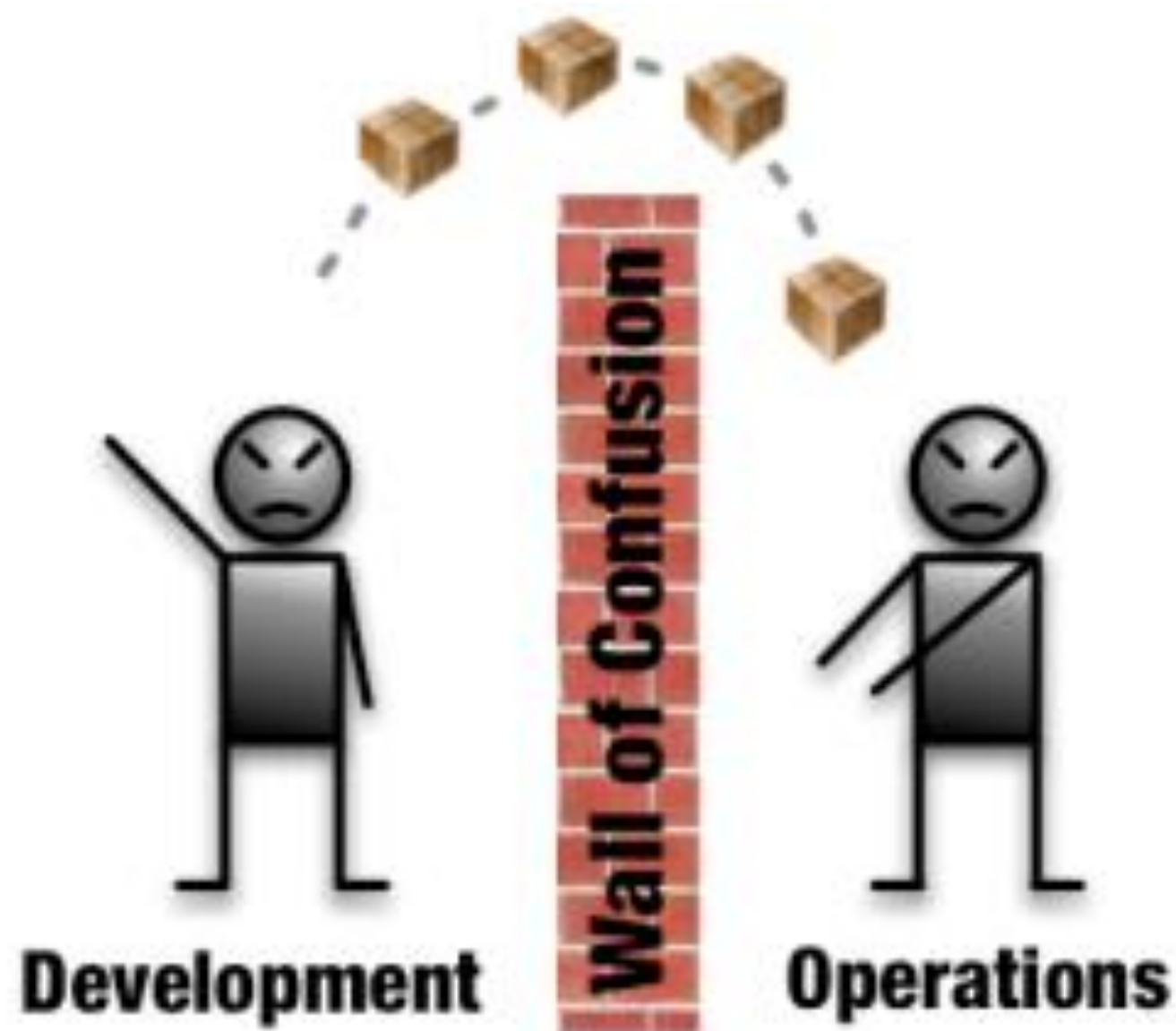


Outra denominação muito comum para o modelo tradicional de desenvolvimento de software é **Waterfall** ou Cascata em português.



No modelo tradicional de desenvolvimento o programador faz o **Build** de seu programa e entrega o executável produzido para a equipe de Operações. Esta equipe faz a **Movimentação** do programa entre os ambientes.





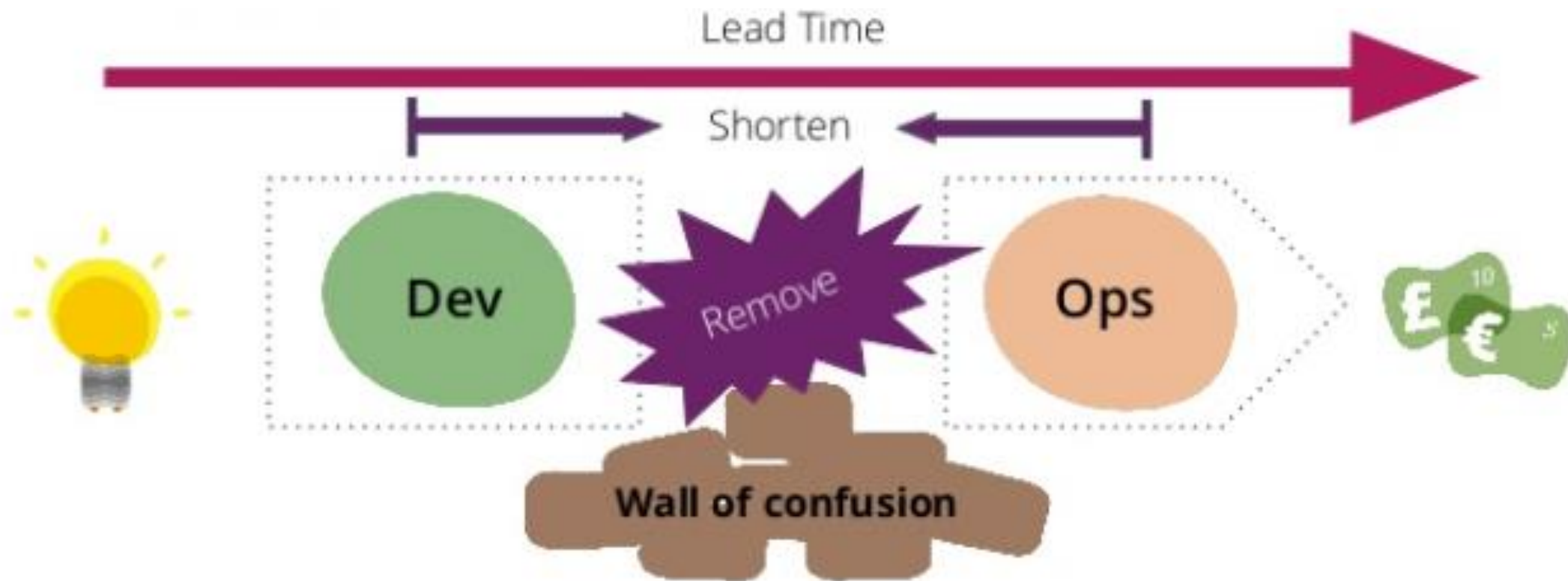
No modelo tradicional de desenvolvimento tínhamos uma divisão clara e distinta entre as equipes de **Desenvolvimento** e **Operações**. Hoje é consenso que havia entre os dois um “**Muro de Confusão**” causando uma série de problemas.

10 deploys per day
Dev & ops cooperation at Flickr

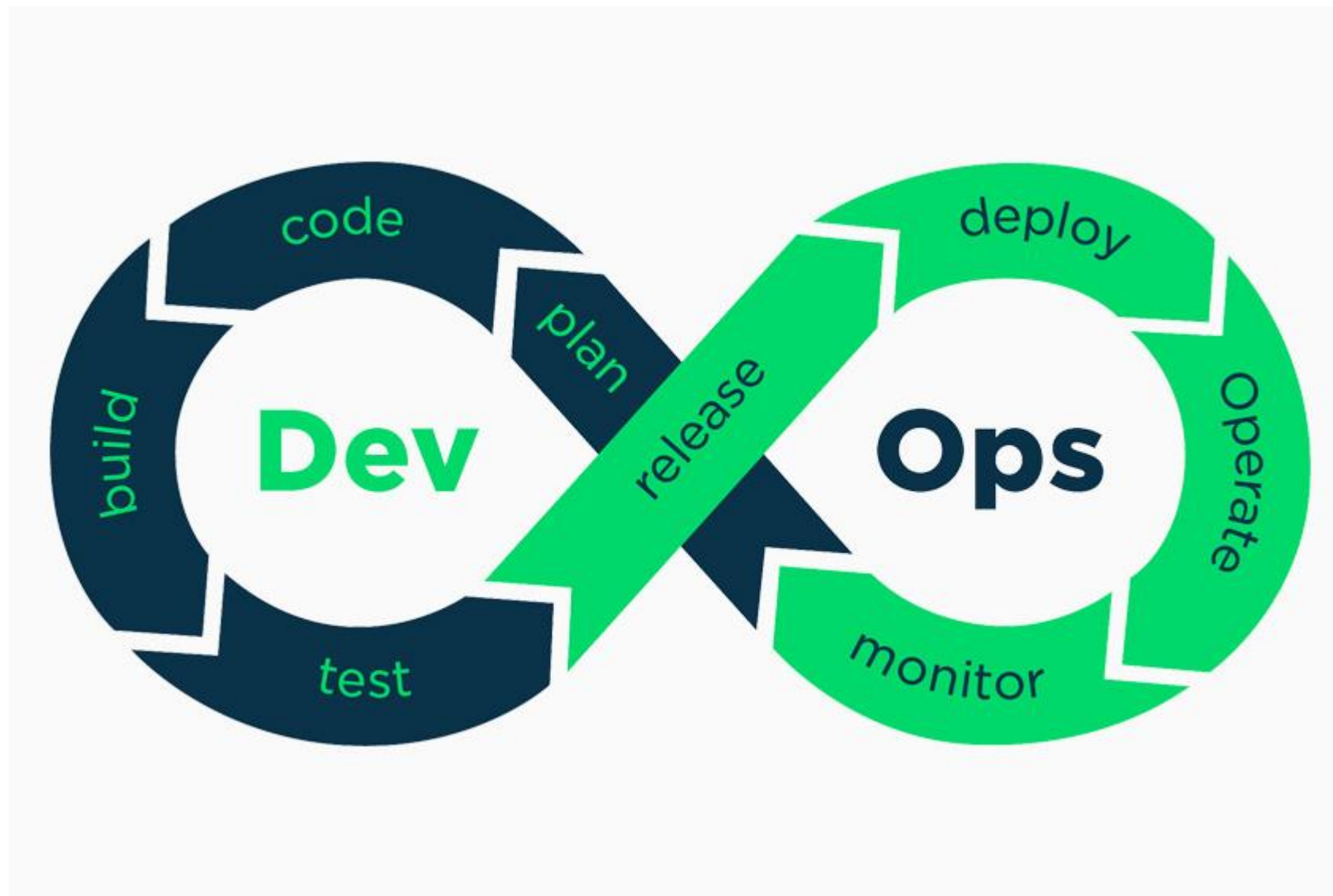
John Allspaw & Paul Hammond
Velocity 2009

<https://pt.slideshare.net/jallspaw/10-deploys-per-day-dev-and-ops-cooperation-at-flickr>

Porém em 2009 John Allspaw e Paul Hammond fizeram a apresentação “*10 deploys per day – Dev & Ops cooperation at Flickr*” – introduzindo o conceito de **DevOps**.



O conceito de DevOps propõe então eliminar esta barreira entre as duas equipes – principalmente através da **Automatização** dos processos de entrega de software ao ambiente produtivo.



E junto com a automação, além da maior integração entre as equipes, a ideia é que o processo de entrega de software com valor ao cliente possa ocorrer com uma frequência bem maior – baseada em um processo iterativo.



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1.5 18

Essa nova maneira de entregar software foi impulsionada também pelo advento das metodologias ágeis (**Agile**) de desenvolvimento de software – que também propôs a entrega de software com valor em intervalos menores – num processo iterativo.

Agile Methodology



Data Scientist

also known as Data Managers, statisticians.



A data scientist will be able to take data science projects from end to end. They can help store large amounts of data, create predictive modelling processes and present the findings.

Skills: Mathematics, Programming, Communication



Will use programmes such as:
SQL, Python, R

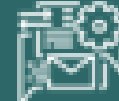
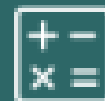
Data Engineers

also known as database administrators and data architects.



They are versatile generalists who use computer science to help process large datasets. They typically focus on coding, cleaning up data sets, and implementing requests that come from data scientists.

Skills: Programming, Mathematics, Big data



Will use programmes such as:
Hadoop, NoSQL, and Python

Data Analysts

also known as business Analysts.



They typically help people from across the company understand specific queries with charts.

Skills: Statistics, Communication, Business knowledge



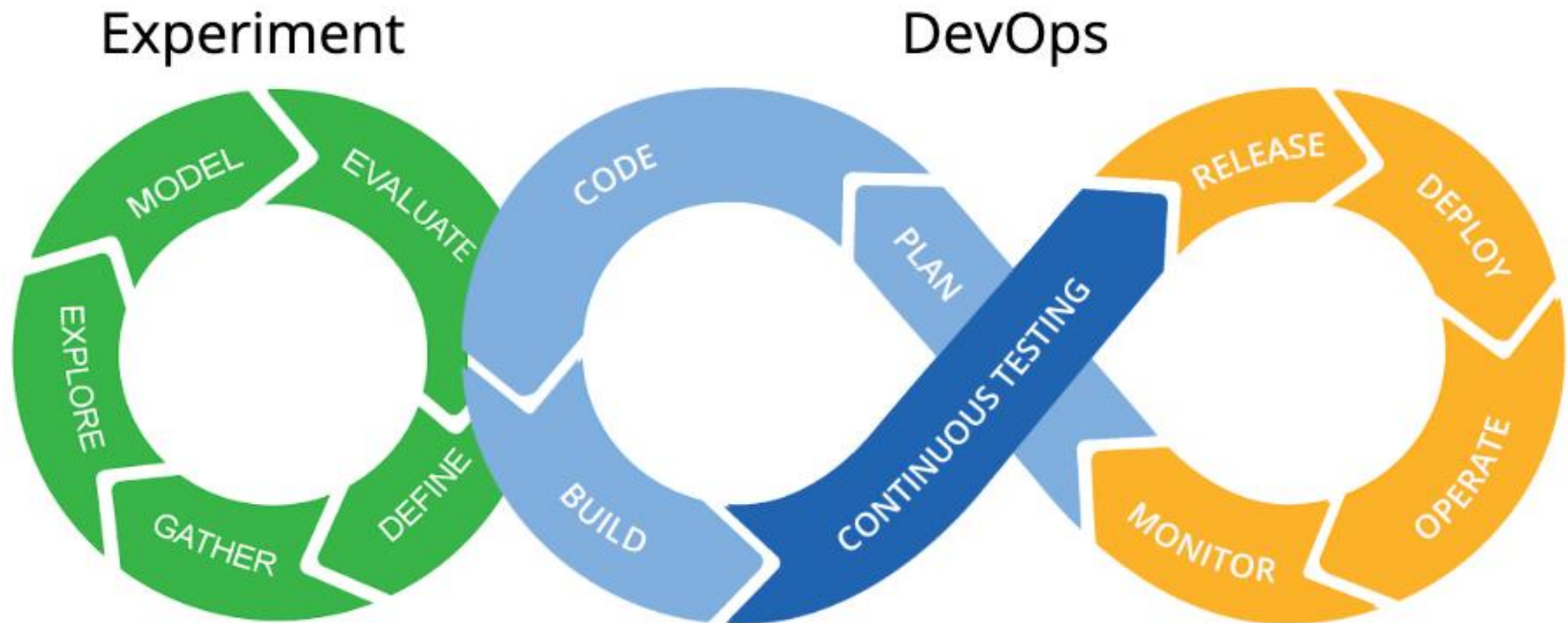
Will use programmes such as:
Excel, Tableau, SQL

DEV

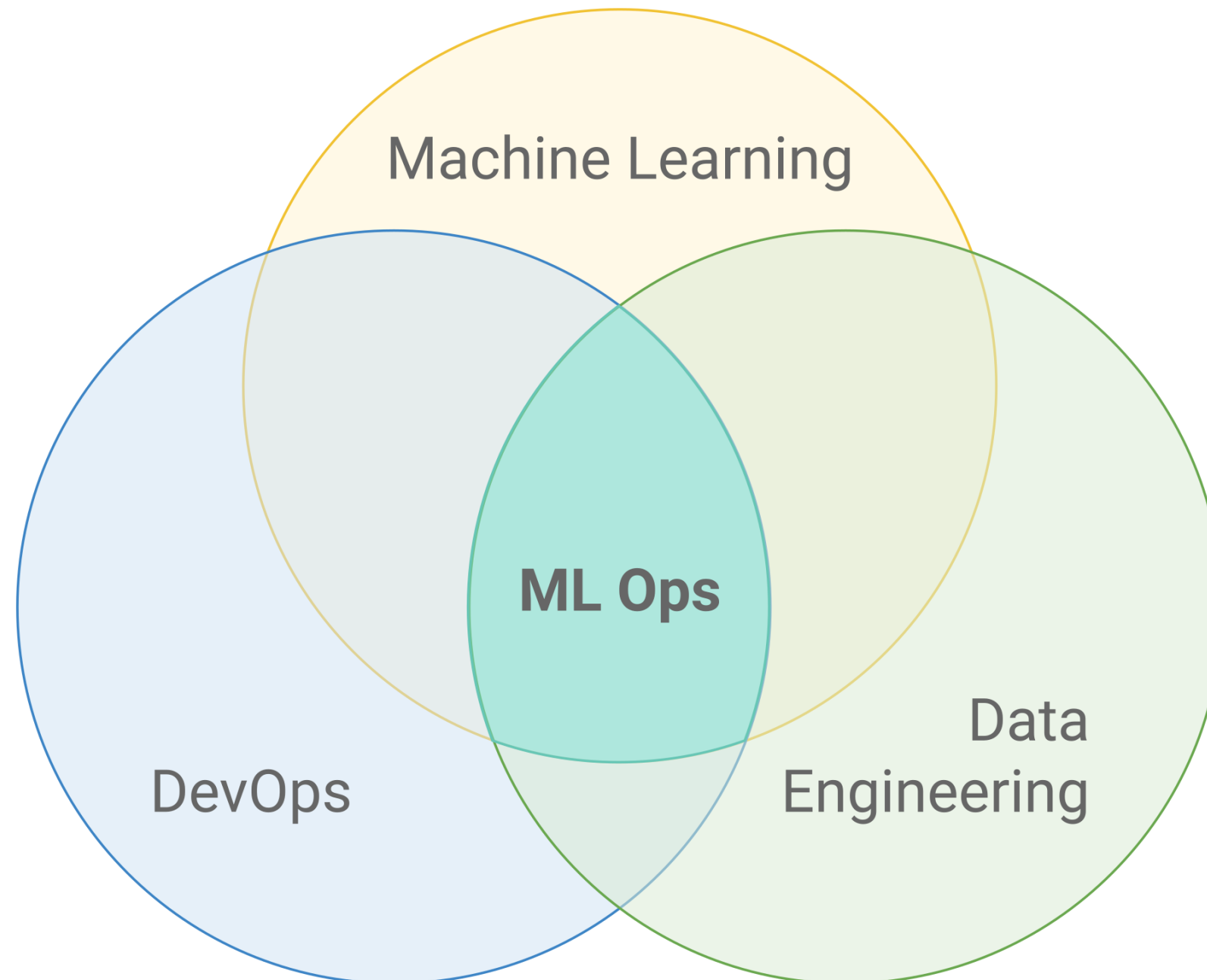
OPS

"It has been said that a data scientist is someone who is better at statistics than any software engineer, and better at software engineering than any statistician"

***MACHINE LEARNING
OPERATIONS
ML - OPS***



<https://blog.jdriven.com/2019/10/machine-learning-systems-require-paradigm-shift-in-software-engineering/>



<https://medium.com/@cbreuel/ml-ops-machine-learning-como-disciplina-de-engenharia-a058770b93dc>

O ML Ops é um conjunto de práticas que combina Machine Learning, DevOps e Engenharia de Dados, que visa implantar e manter sistemas de ML em produção de maneira confiável e eficiente.

Prática	DevOps	Engenharia de Dados	ML Ops
Controle de versões	Versionamento de código	Versionamento de código Linhagem de dados	Versionamento de código + dados + modelos (conectados)
Pipeline	n/a	Pipeline de dados/ETL	Pipeline ML de treinamento, Pipeline ML de predição
Validação de comportamento	Testes unitários	Testes unitários	Validação de modelo
CI/CD	Implanta código em produção	Implanta código do pipeline de dados	Implanta código dos pipelines de ML
Validação de dados	n/a	Validação de negócio e formato	Validação estatística
Monitoramento	Baseado em SLOs	Baseado em SLOs	SLOs + monitoramento diferencial e estatístico, em fatias

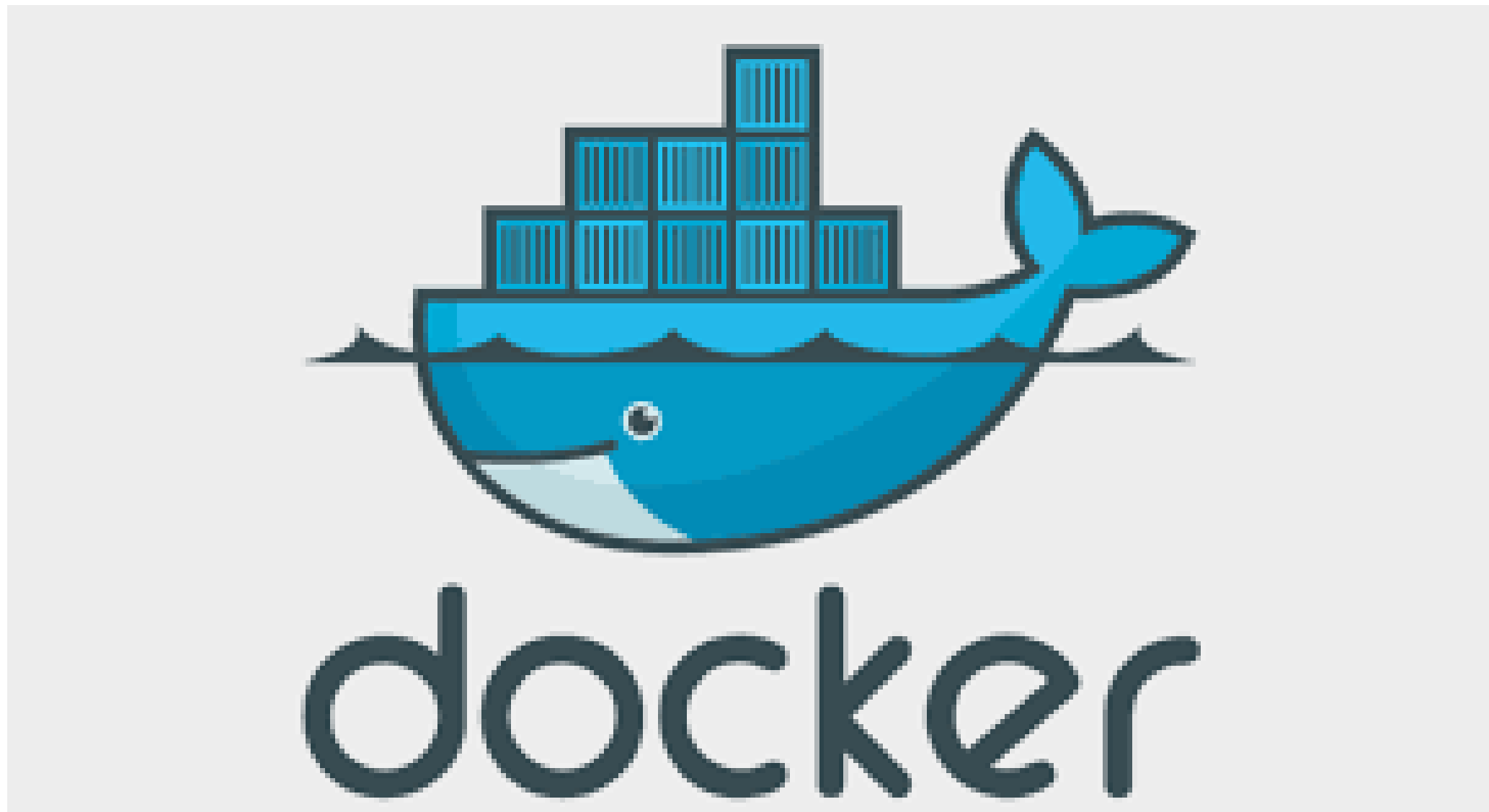
<https://medium.com/@cbreuel/ml-ops-machine-learning-como-disciplina-de-engenharia-a058770b93dc>

Como uma diferença fundamental em relação ao modelo de DevOps observamos que em ML também precisamos fazer o deploy adicional de **Dados** e **Modelos** para funcionamento e Validação da solução preditiva.

FERRAMENTAS ENVOLVIDAS

ML - OPS

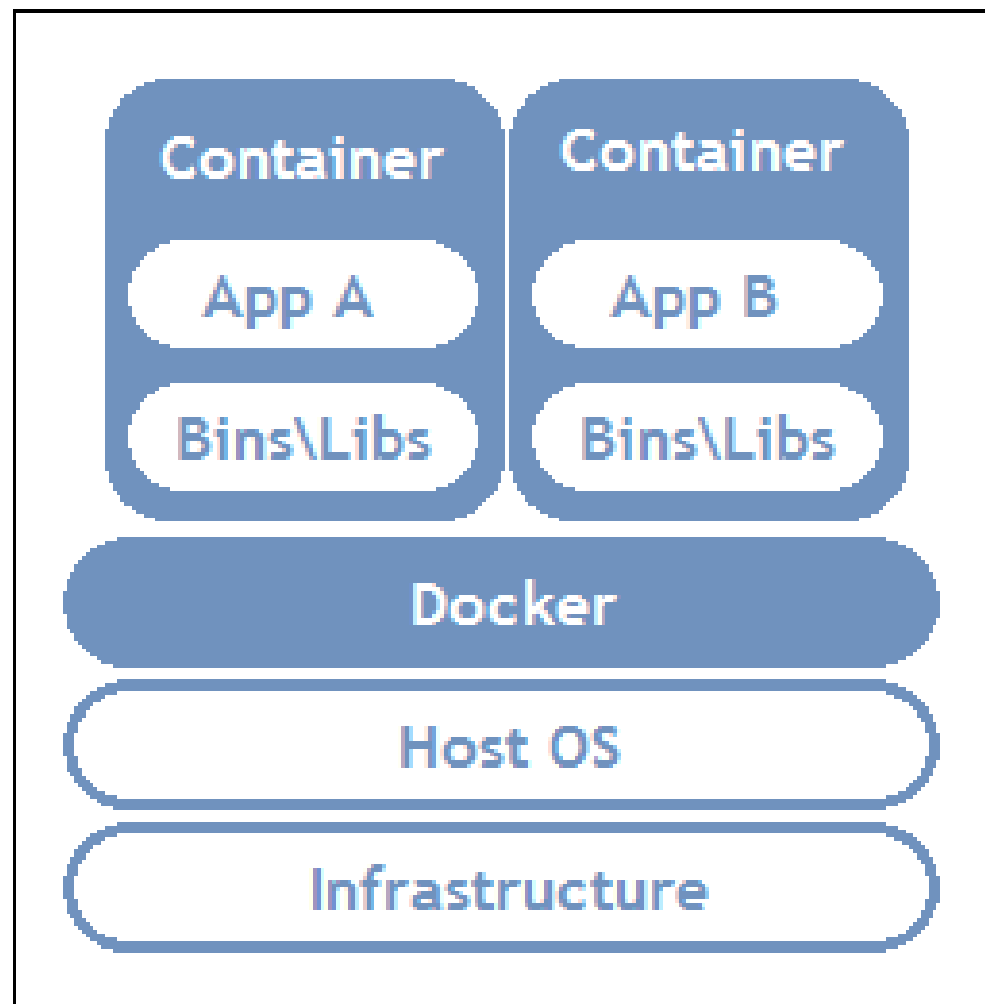
DOCKER



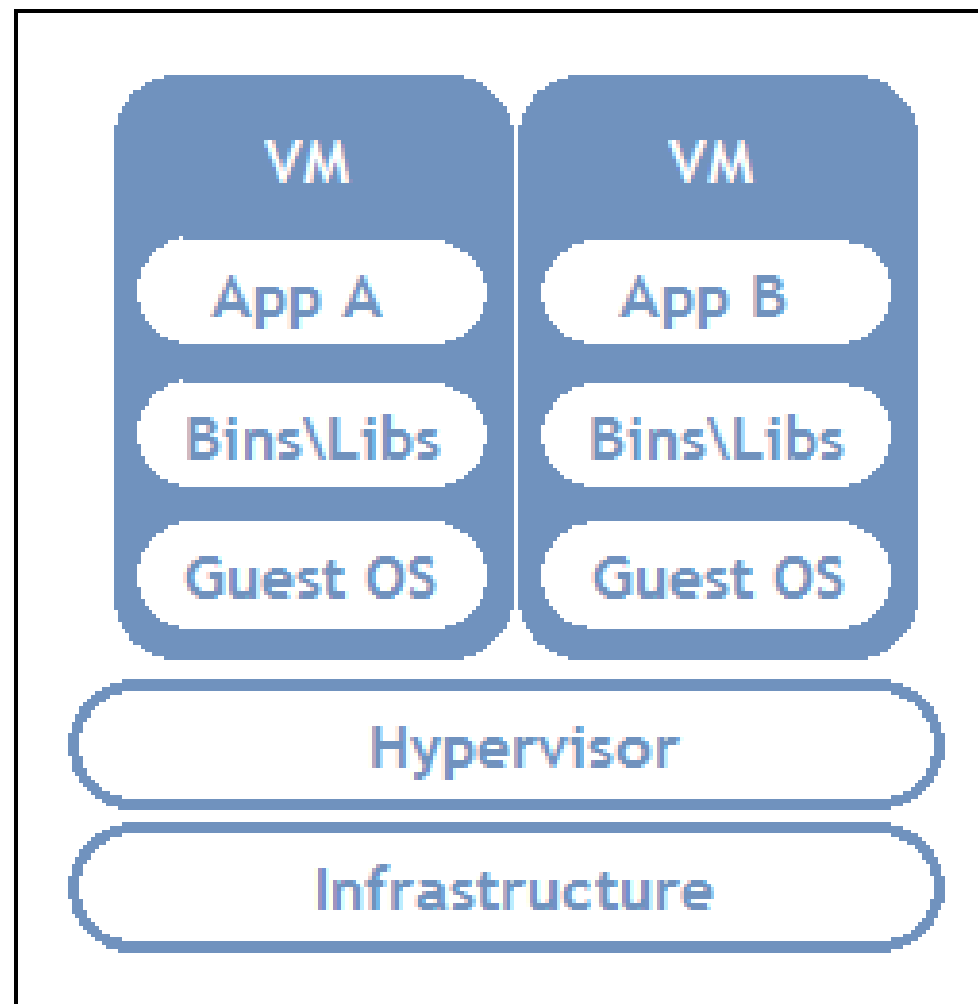
<https://stack.desenvolvedor.expert/appendix/docker/oqueue.html>

Docker é uma plataforma aberta, criada com o objetivo de facilitar o desenvolvimento, a implantação e a execução de aplicações em ambientes isolados. Foi desenhada especialmente para disponibilizar uma aplicação da forma mais rápida possível – com a possibilidade de escalonamento horizontal quase que imediato.


Container Based Implementation



Virtual Machine Implementation




O Docker se diferencia por trabalhar com **CONTAINERS** que podem ser entendidos como mini-máquinas virtuais - muito leves e simples que podem ser instanciadas com diferentes imagens (bases de dados, sistemas operacionais, etc). Por serem leves e diretamente conectadas ao kernel do sistema operacional elas podem rapidamente ser criadas e destruídas, otimizando a utilização do hardware.

 Search for great content (e.g., mysql) Explore Sign In Pricing Get Started


DOCKER EE DOCKER CE CONTAINERS PLUGINS


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Docker Certified 

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Couchbase Server is a NoSQL document database with a distributed architecture.

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Ubuntu is a Debian-based Linux operating system based on free software.

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Redis is an open source key-value store that functions as a data structure server.

Container Linux Windows x86-64 ARM ARM 64 PowerPC 64 LE 386 IBM Z Databases

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https://hub.docker.com/search?image_filter=official&type=image

KUBERNETES



<https://www.concrete.com.br/2018/02/22/tudo-o-que-voce-precisa-saber-sobre-kubernetes/>

O Kubernetes é uma ferramenta que faz o **Gerenciamento de Containers** gerados por aplicações com o Docker.

Docker + Kubernetes
Orquestrando containers e escalando
rapidamente suas aplicações

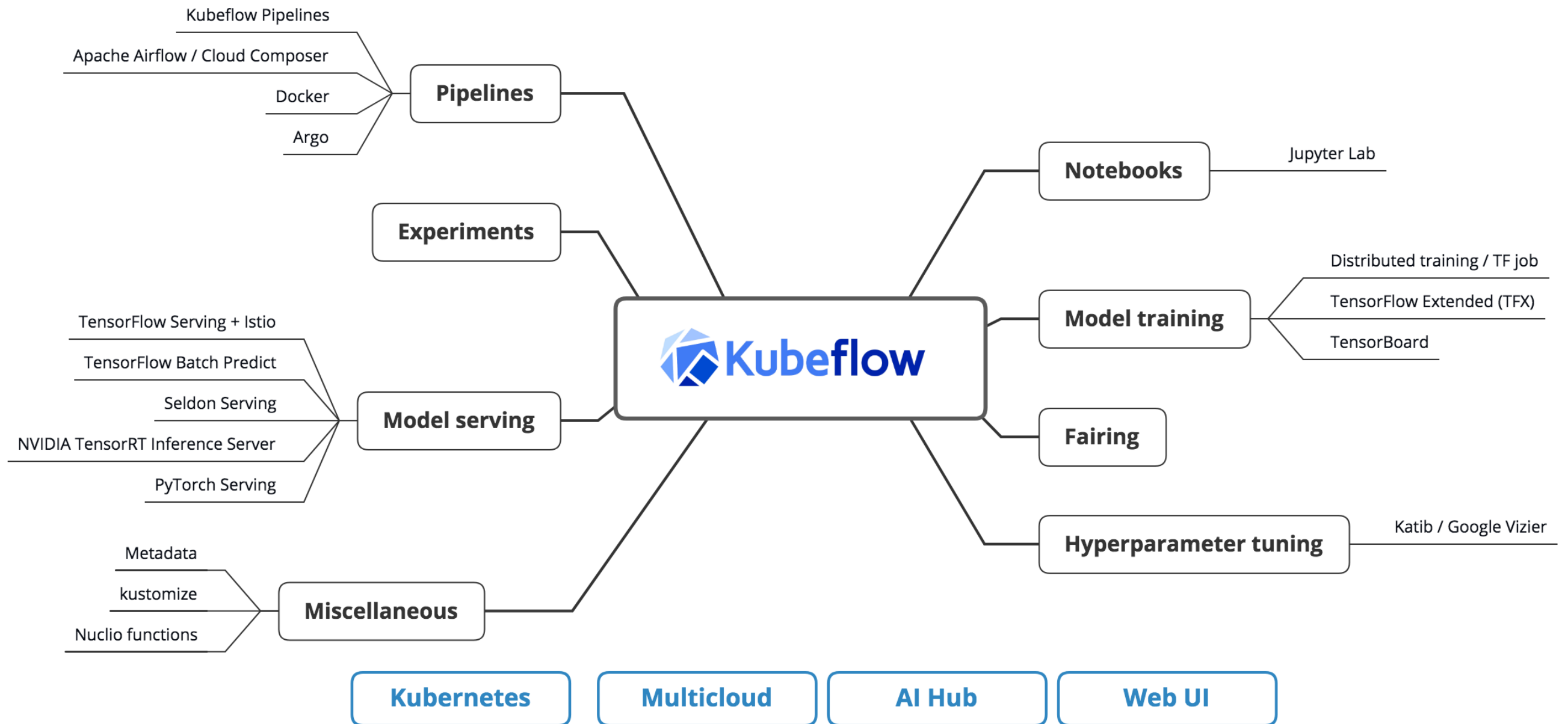


Renato Groffe
Microsoft MVP, MTAC
facebook.com/renatogroffe
medium.com/@renato.groffe/

<https://www.slideshare.net/renatogroff1/docker-kubernetes-orquestrando-containers-e-escalando-rapidamente-suas-aplicaes-devops-professionals-setembro2018>

Docker + Kubernetes: Orquestrando containers e escalando rapidamente suas aplicações - DevOps Professionals - Setembro-2018

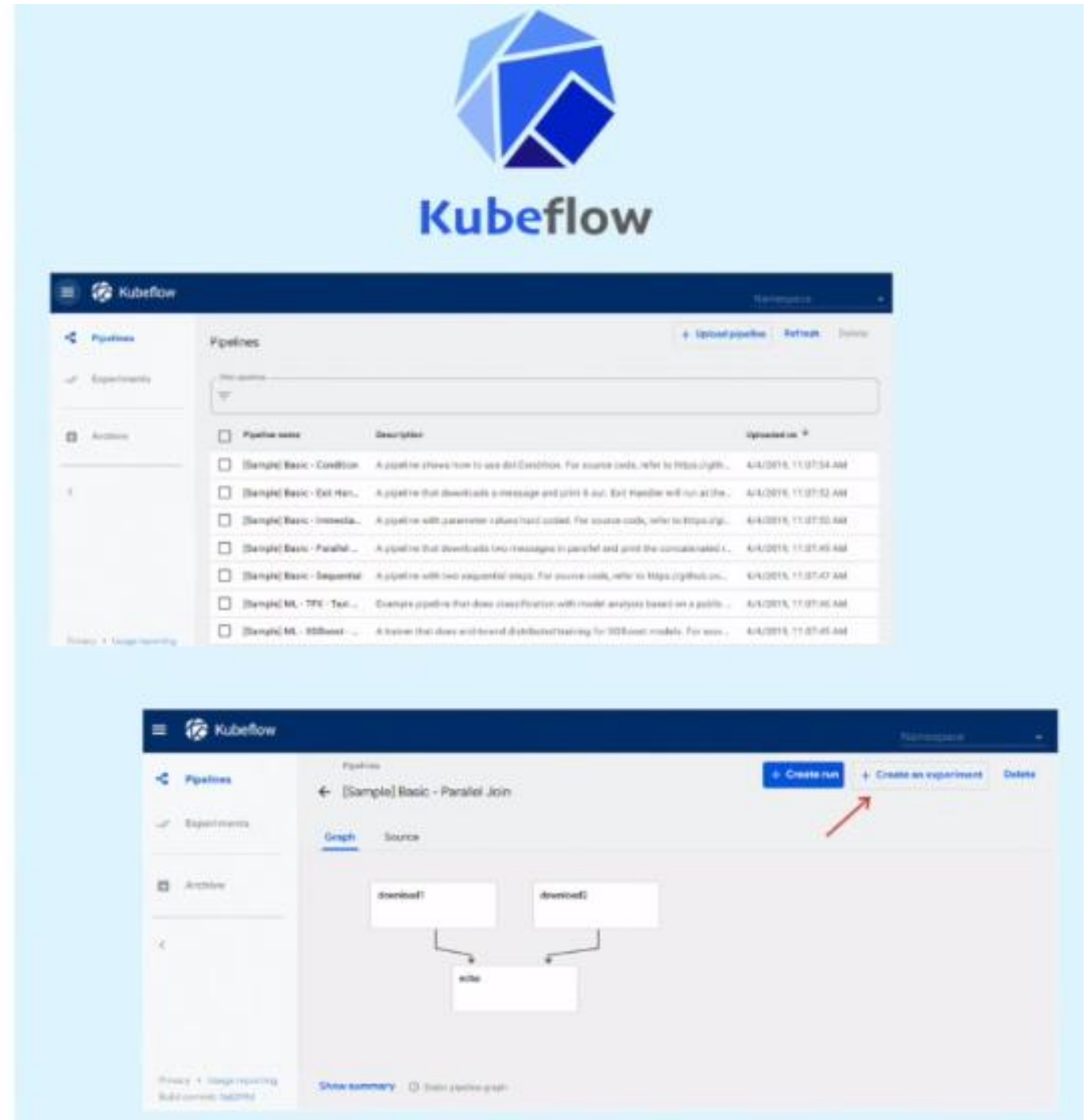
KUBEFLOW



Kubeflow Pipelines

Kubeflow Pipelines is a platform for building and deploying portable, scalable machine learning (ML) workflows based on Docker containers.

- End-to-end orchestration: enabling and simplifying the orchestration of machine learning pipelines.
- Easy experimentation: making it easy for you to try numerous ideas and techniques and manage your various trials/experiments.
- Easy re-use: enabling you to re-use components and pipelines to quickly create end-to-end solutions without having to rebuild each time.



Kubeflow Pipelines

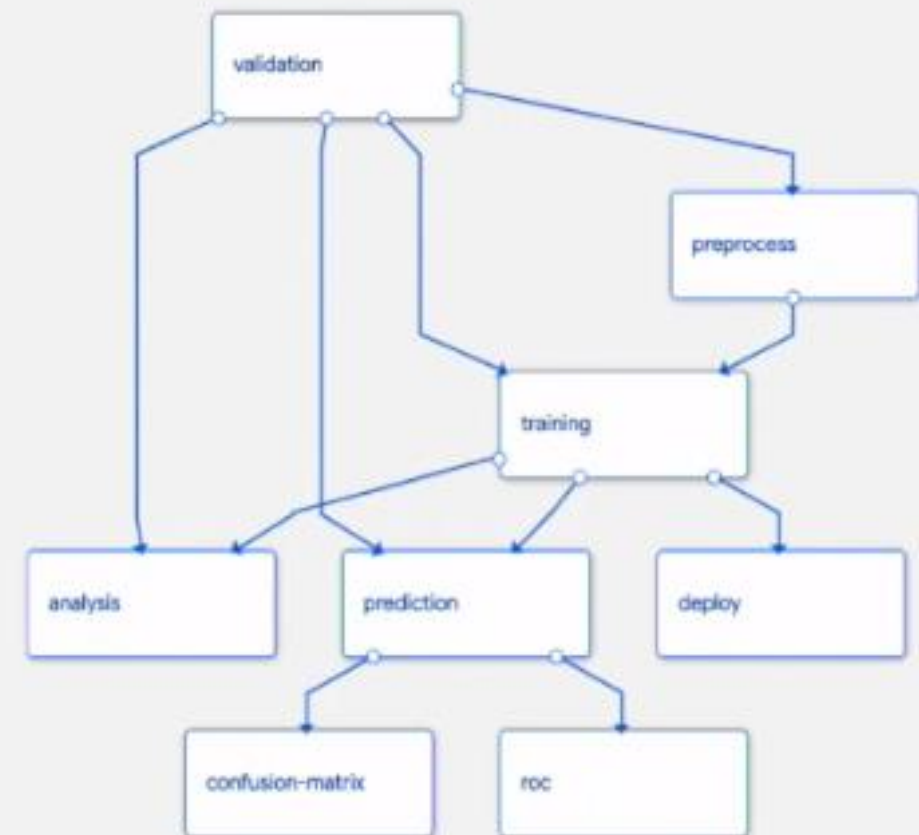
Two key takeaways : A Pipeline and a Pipeline Component

A *pipeline* is a description of a machine learning (ML) workflow, including all of the components of the workflow and how they work together.

← [Sample] ML - TFX - Taxi Tip Prediction Model Trainer

Graph

Source



Kubeflow Pipelines

Each pipeline *component* is a container that contains a program to perform the task required for that particular step of your workflow.



MODELOS NA *CLOUD*

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Conectar-se/Efetuar Log-in na cloud

Entenda os modelos de serviço IaaS, PaaS e SaaS do IBM Cloud

Qual a diferença entre IaaS, PaaS e SaaS?

A diferença principal está no tipo de serviço que está sendo oferecido. Veja:



Infraestrutura como serviço (IaaS)

Um fornecedor oferece aos clientes o acesso pago por utilização ao armazenamento, à rede, aos servidores e a outros recursos computacionais em cloud.



Plataforma como serviço (PaaS)

Um provedor de serviços oferece acesso a um ambiente baseado em cloud no qual os usuários podem construir e fornecer aplicativos. O provedor fornece infraestrutura subjacente.

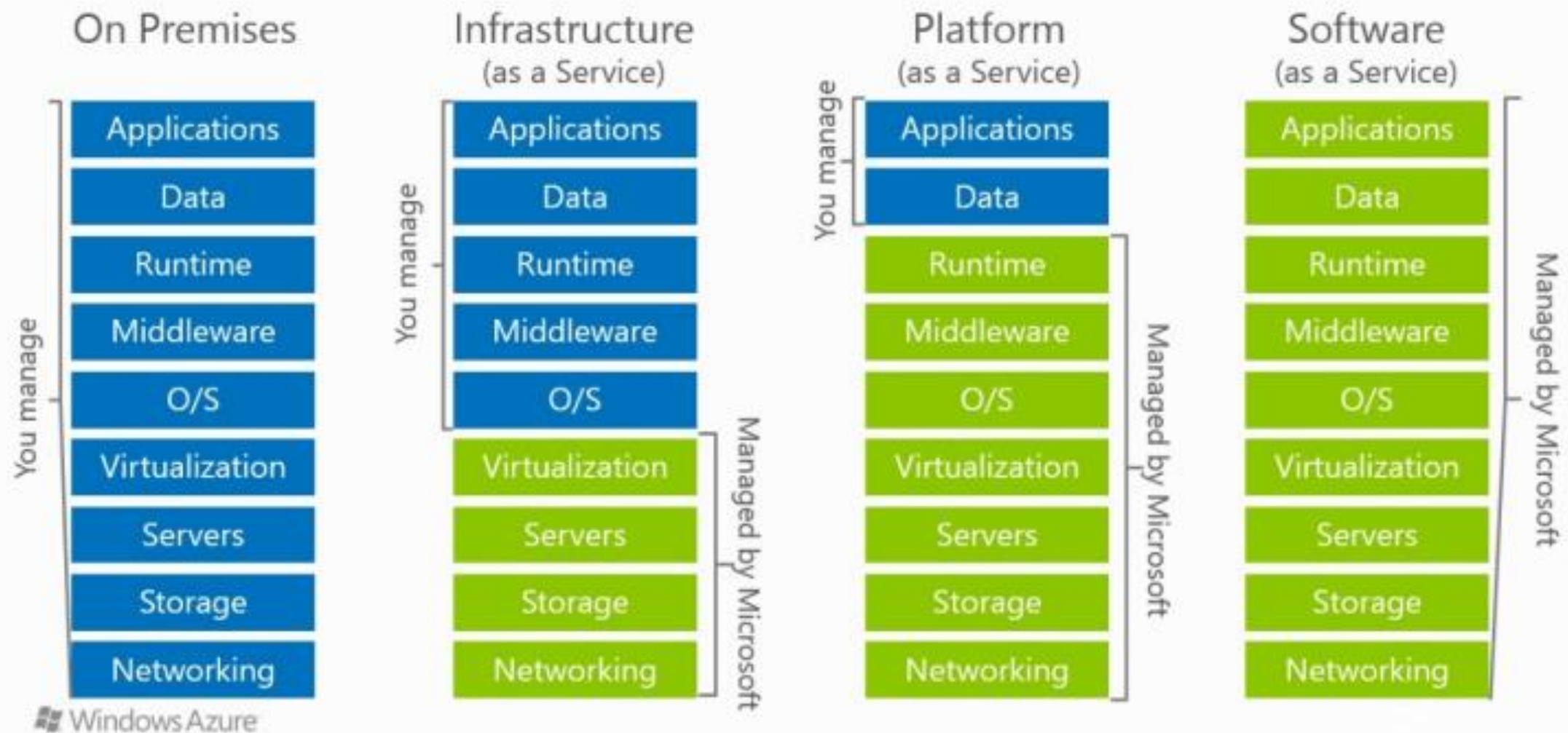


Software como serviço (SaaS)

Um provedor de serviços oferece software e aplicativos por meio da Internet. Os usuários subscrevem ao software e o acessam por meio da web ou de APIs do fabricante.

<https://www.ibm.com/br-pt/cloud/learn/iaas-paas-saas>

Cloud Models



<https://stack247.wordpress.com/2015/05/21/azure-on-premises-vs-iaas-vs-paas-vs-saas/>



IBM Watson



Google Cloud
AutoML Vision



IBM Cloud



HEROKU



Google Cloud



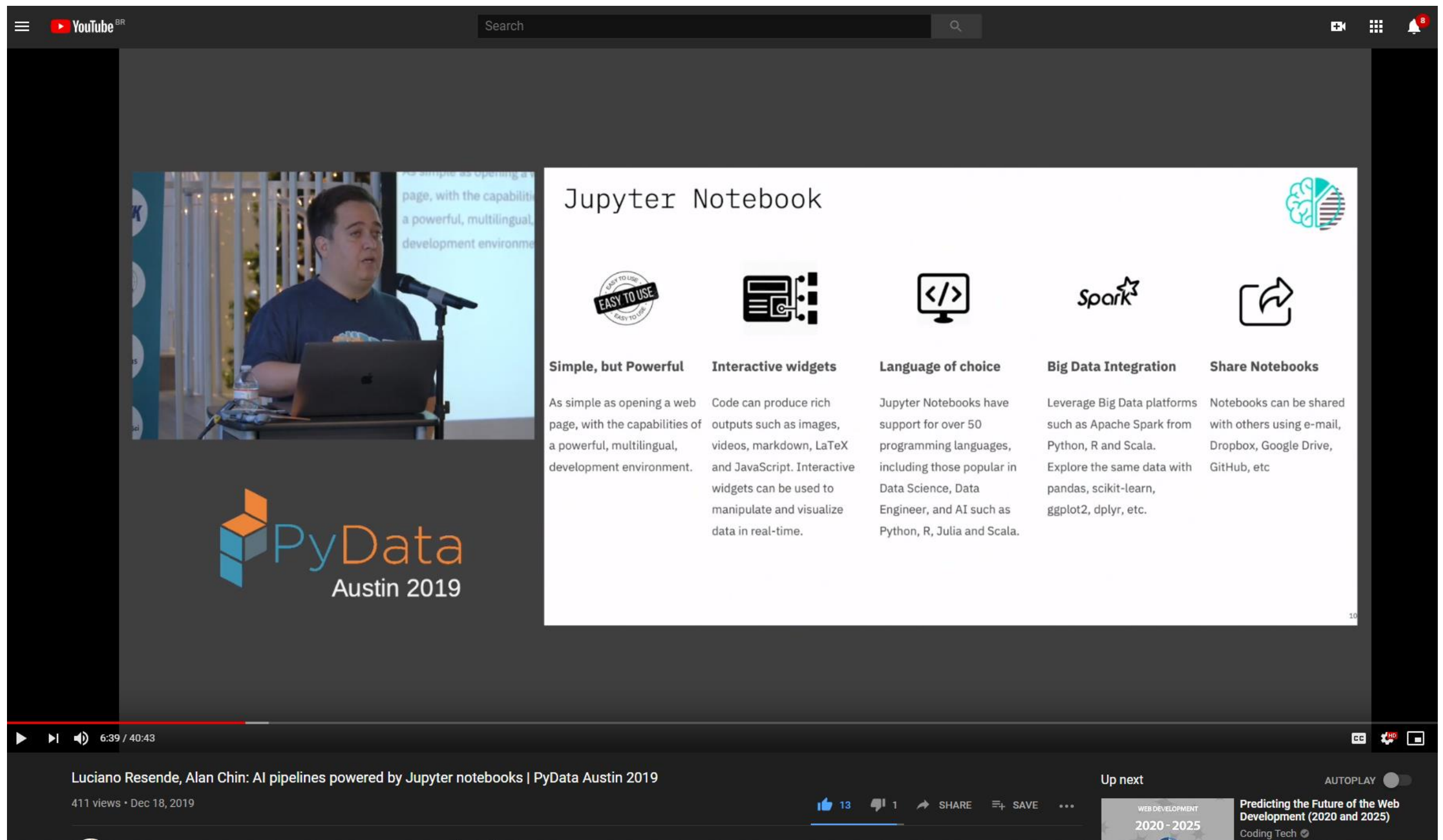
Amazon SageMaker



Azure Machine Learning








JUPYTER NOTEBOOKS
EM PRODUÇÃO



The video player shows a presentation slide titled "Jupyter Notebook". On the left, a man is speaking at a podium with a laptop. The slide content is as follows:

Jupyter Notebook

 Simple, but Powerful	 Interactive widgets	 Language of choice	 Big Data Integration	 Share Notebooks
As simple as opening a web page, with the capabilities of a powerful, multilingual, development environment.	Code can produce rich outputs such as images, videos, markdown, LaTeX and JavaScript. Interactive widgets can be used to manipulate and visualize data in real-time.	Jupyter Notebooks have support for over 50 programming languages, including those popular in Data Science, Data Engineer, and AI such as Python, R, Julia and Scala.	Leverage Big Data platforms such as Apache Spark from Python, R and Scala. Explore the same data with pandas, scikit-learn, ggplot2, dplyr, etc.	Notebooks can be shared with others using e-mail, Dropbox, Google Drive, GitHub, etc

PyData Austin 2019

Video title: Luciano Resende, Alan Chin: AI pipelines powered by Jupyter notebooks | PyData Austin 2019
Views: 411 views • Dec 18, 2019
Up next: Predicting the Future of the Web Development (2020 and 2025)

<https://youtu.be/XJAx9dS0k7I>

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nbconvert 5.6.1

`pip install nbconvert`[Latest version](#)

Released: Oct 24, 2019

Converting Jupyter Notebooks

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Project description

nbconvert

Jupyter Notebook Conversion

[Google Group](#) [build failing](#) [docs passing](#) [docs passing](#) [codecov 92%](#) [PASSED](#)

The **nbconvert** tool, `jupyter nbconvert`, converts notebooks to various other formats via [Jinja](#) templates. The nbconvert tool allows you to convert an `.ipynb` notebook file into various static formats including:

- HTML
- LaTeX
- PDF
- Reveal JS
- Markdown (md)
- ReStructured Text (rst)
- executable script

<https://pypi.org/project/nbconvert/>

Notebook Pipelines using NBConvert

Jupyter NBConvert enables executing and converting notebooks to different file formats.

Advantages

- Support notebook chaining
- Convert results to immutable formats

Limitations

- No support for parameters

Jupyter NBConvert

<https://nbconvert.readthedocs.io/en/latest/>



```
$ pip install nbconvert
```

```
$ jupyter nbconvert --to html --execute overview_with_run.ipynb
```

```
[NbConvertApp] Converting notebook overview_with_run.ipynb to html
```

```
[NbConvertApp] Executing notebook with kernel: python3
```

```
[NbConvertApp] Writing 300558 bytes to overview_with_run.html
```

```
$ open overview_with_run.html
```

Papermill

Papermill is an open source tool contributed by Netflix which enables parameterizing, executing, and analyzing Jupyter Notebooks.

Papermill lets you:

- Parameterize notebooks
- Execute notebooks



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DATA SCIENCE

Machine Learning – Modelos em Produção