Kubeflow:
Bring your ML project into Production

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OpenSUSE Member
Open-Source Advocator(KY OSS)

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Interests:
• Virtualization
• SysML/Distributed ML
• Infrastructure build and optimization
• ARM64 board Enthusiast
• DevOps

https://xryan.net
Outline

- Prologue
- Kubeflow
- Kubeflow Components
- Demo
- Beyond
- Q&A
Prologue

Prologue

Flight Delay Predictor:
https://github.com/xrlyan/Flight-Delay-Prediction-Based-on-Neural-Networks

Input:
• Flight no
• Flight date

Output:
• Delay possibility

Features:
• Depart/Arrive airport
• Depart/Arrive time
• Depart/Arrive city weather
• Flight model
• Flight History delay rate

Prologue

As a Software Engineer:

As a Data Scientist/Engineer:

Eventually, it becomes:
Kubeflow-Central-dashboard
Kubeflow is:

- K8S + TensorFlow
- Application Toolkit
- Orchestration
- Cloud Native
- DevOps/MLOps

Kubeflow is not:

- K8S + TensorFlow
- Application
- Scheduler
- Machine Learning Algorithm
- Machine Learning Framework
Kubeflow

Machine Learning Orchestration Platform:

1. Orchestrate pipeline
2. Orchestrate ML task

Great mind think alike!

Pic: https://codeantenna.com/a/tSKAKL3Yku
Kubeflow components
Jupyter-notebook
An implementation for AutoML: tune hyperparameter automatically

Three CRDs:
- experiment
- suggestion
- trial

The experiment creates multiple trials based on different suggestion algorithms.

https://zhuanlan.zhihu.com/p/133391977
Training Operator

Operator = Controller + CRD + Webhook
Tool: kubebuilder
Chief coordinate training job
PS server, parameter
Worker
Evaluator
KF Serving

The last mile!
KFP DAG

mnist_pipeline 2019-11-19 02-07-07

Graph

- kubeflow-launch...
- convert-mnist-ex...
- train
- inference
- modelpvc
KFP Architecture

https://shikanon.com/2019/%E8%BF%90%E7%BB%B4/kubeflow%E4%BB%8B%E7%BB%8D/
Kubeflow

**Experiment Platform:**

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<tr>
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<tr>
<td>Linux Distro</td>
<td>Debian 10</td>
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**Demo:**

```bash
while ! kustomize build example | kubectl apply -f -; do echo "Retrying to apply resources"; sleep 10; done
kubectl --kubeconfig=/Users/lyan/kubeflow-kubeconfig.yaml port-forward svc/istio-ingressgateway -n istio-system 8080:80
```

**Local Setup:**

<table>
<thead>
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<th>Juju + microk8s</th>
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https://charmed-kubeflow.io/docs/quickstart
Beyond

Distributed Machine Learning(*)

Why?
Scalability, we really do not need it if it is a small dataset or model or customer base.

What?
Training Operator Scheduling
Inference Model Optimization

How?
Simulate/predict for scheduler
Model compiler

https://wallpaperaccess.com/to-be-continued
https://zhuanlan.zhihu.com/p/548219786
Beyond

Embedded Model

https://tvm.apache.org/
Lesson learned

1. Deployment
   1. Kubevirt 1.22 + kustomize
   2. Disable TLS
   3. Setup/Enable StorageClass

2. Running
   1. docker runtime re-size
   2. docker repository setup

3. Training model
   1. ML training requests a lot resources
   2. Need to do a lot of experiments
   3. Setup environment is time consuming
   4. Needs automation/pipeline

4. System Failure / Efficiency
   Monitor large scale machine clusters are difficult
   Resource Competition
Q & A

Thanks!

Claim:
All the information is based on personal using experience, no preference or commercial advertising. If there are any conflicts, please refer to the statement from providers.
AI Cloud Providers

- Alibaba Cloud
- Amazon Web Services (AWS)
- Baidu AI Cloud
- Google Cloud
- IBM Cloud
- Microsoft Azure
- Oracle Cloud Infrastructure
- Tencent Cloud
- linode
- Paperspace
- Lambda
- Vultr

## Support Matrix

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### NVIDIA Data Center Products

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AI Cloud Service

• IAAS
  • ML VM Image
  • Container:
    • Docker
    • NGC
  • Conda/pip3

• PaaS
  Help manage data and model
  (paperspace, Colaboratory)

• SaaS
  Help consume AI solution
  (IBM Watson, Google voice)