# Cluster Serving:

## Distributed and Automated Model Inference on Big Data Streaming Frameworks

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# Agenda

- Analytics Zoo: Software Platform for Big Data AI
- Cluster Serving on Analytics Zoo
- Summary

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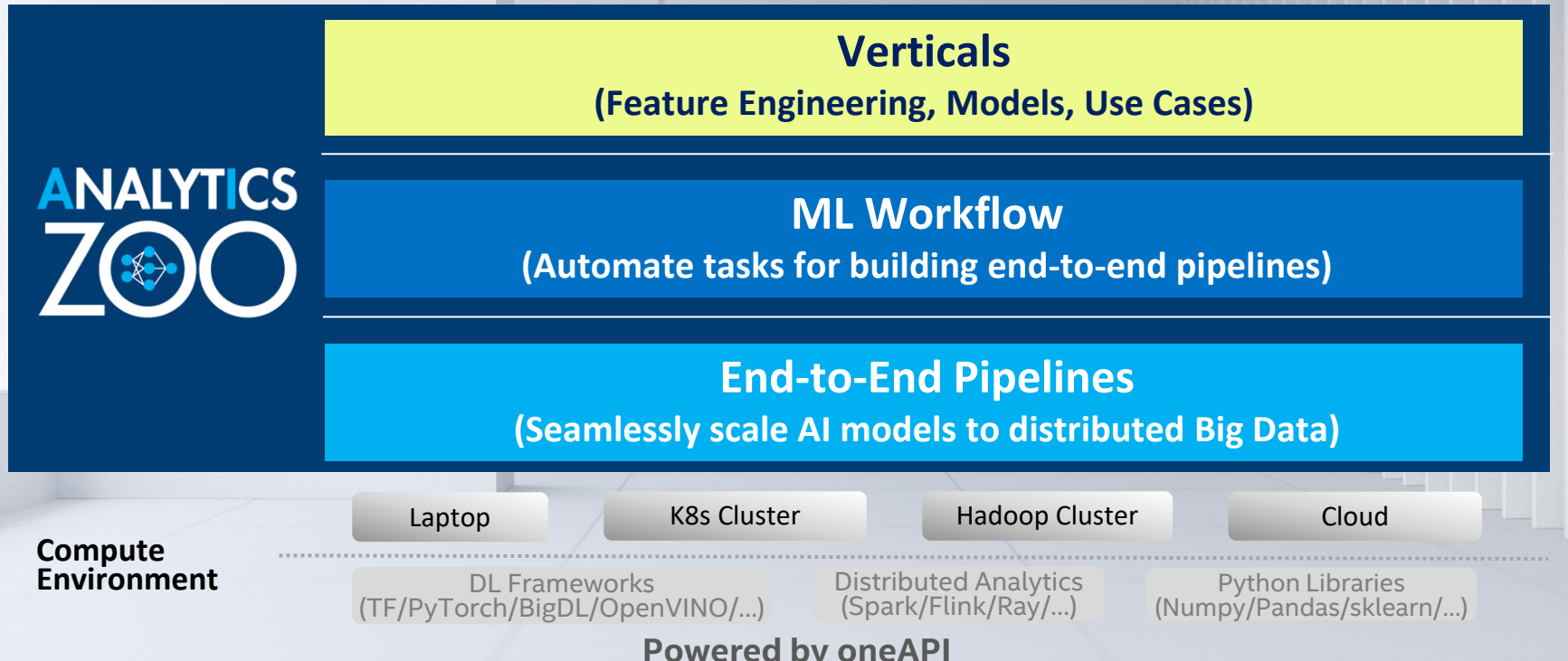
# Analytics Zoo: Software Platform for Big Data AI




https://github.com/intel-analytics/analytics-zoo

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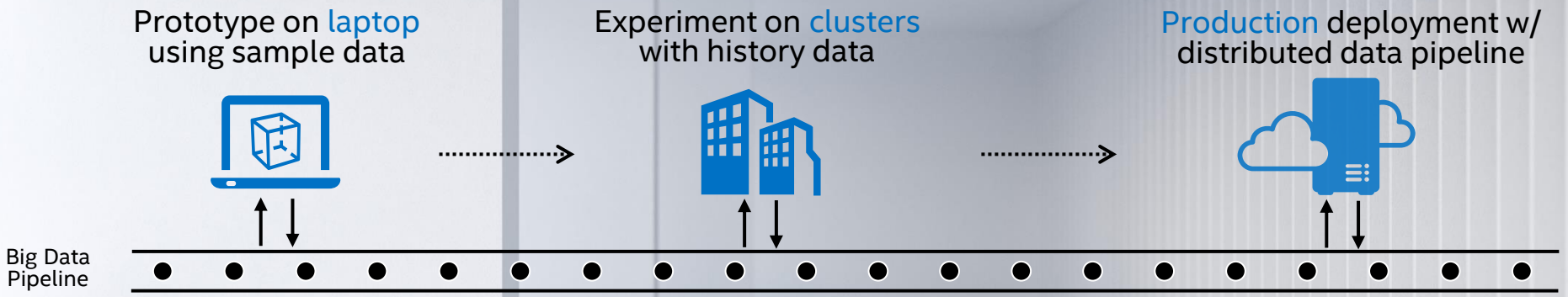
# End-to-End Big Data Analytics and AI

## Seamless Scaling from Laptop to Distributed Big Data




- Easily prototype end-to-end pipelines that apply AI models to big data
- "Zero" code change from laptop to distributed cluster
- Seamlessly deployed on production Hadoop/K8s clusters
- Automate the process of applying machine learning to big data

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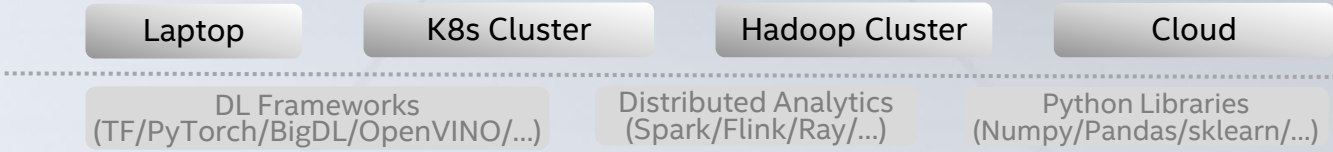
# Analytics Zoo: Open Source Platform for Big Data AI

## Scaling End-to-End AI to Distributed Big Data

| | |
|---|---|
| **PPML** | Privacy Preserving Data Analytics & ML on SGX |
| **Zouwu** | Scalable time series analysis pipeline w/ AutoML |
| **RayOnSpark** | Run Ray programs directly on Big Data platform |
| **Cluster Serving** | Distributed real-time model serving on Flink |
| **Orca** | Seamlessly scale out TF & PyTorch on Spark & Ray |




**Powered by oneAPI**

https://github.com/intel-analytics/analytics-zoo

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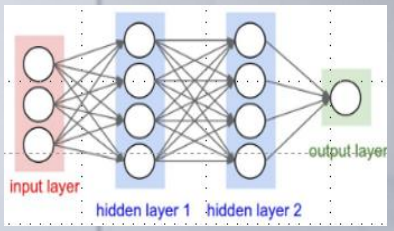
# Serving

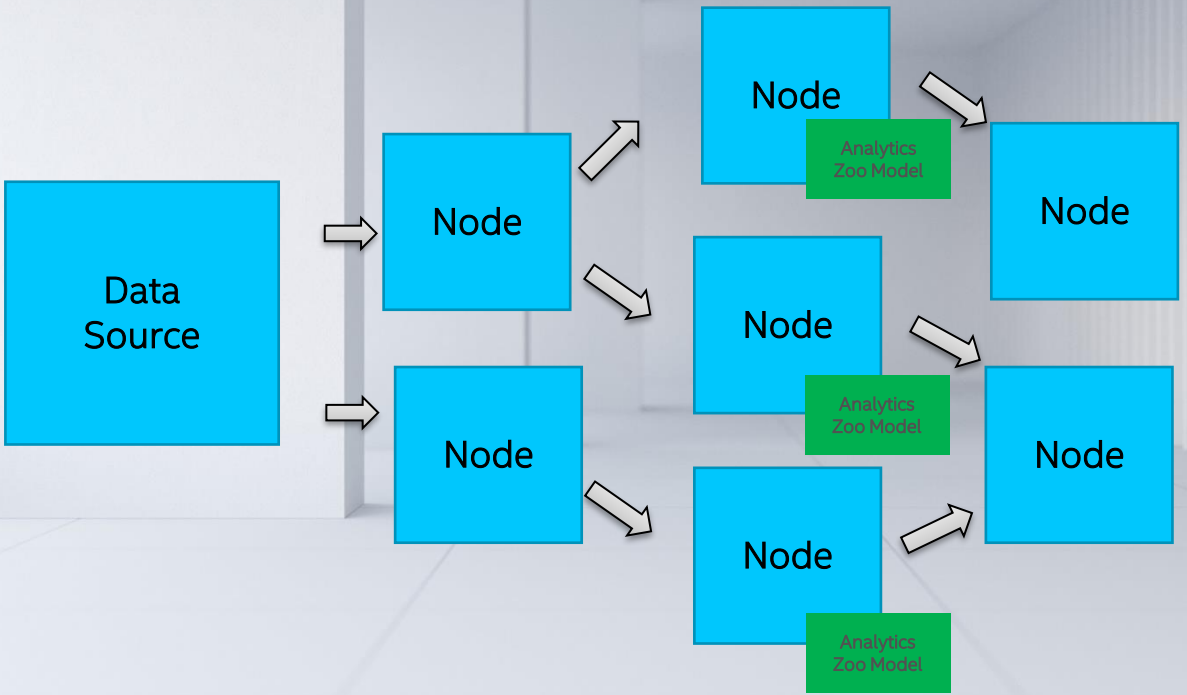
Use trained model to serve end-to-end ML pipeline




model

Input Data → Preprocessing → Inference → Postprocessing → Result

# Distributed Model Serving

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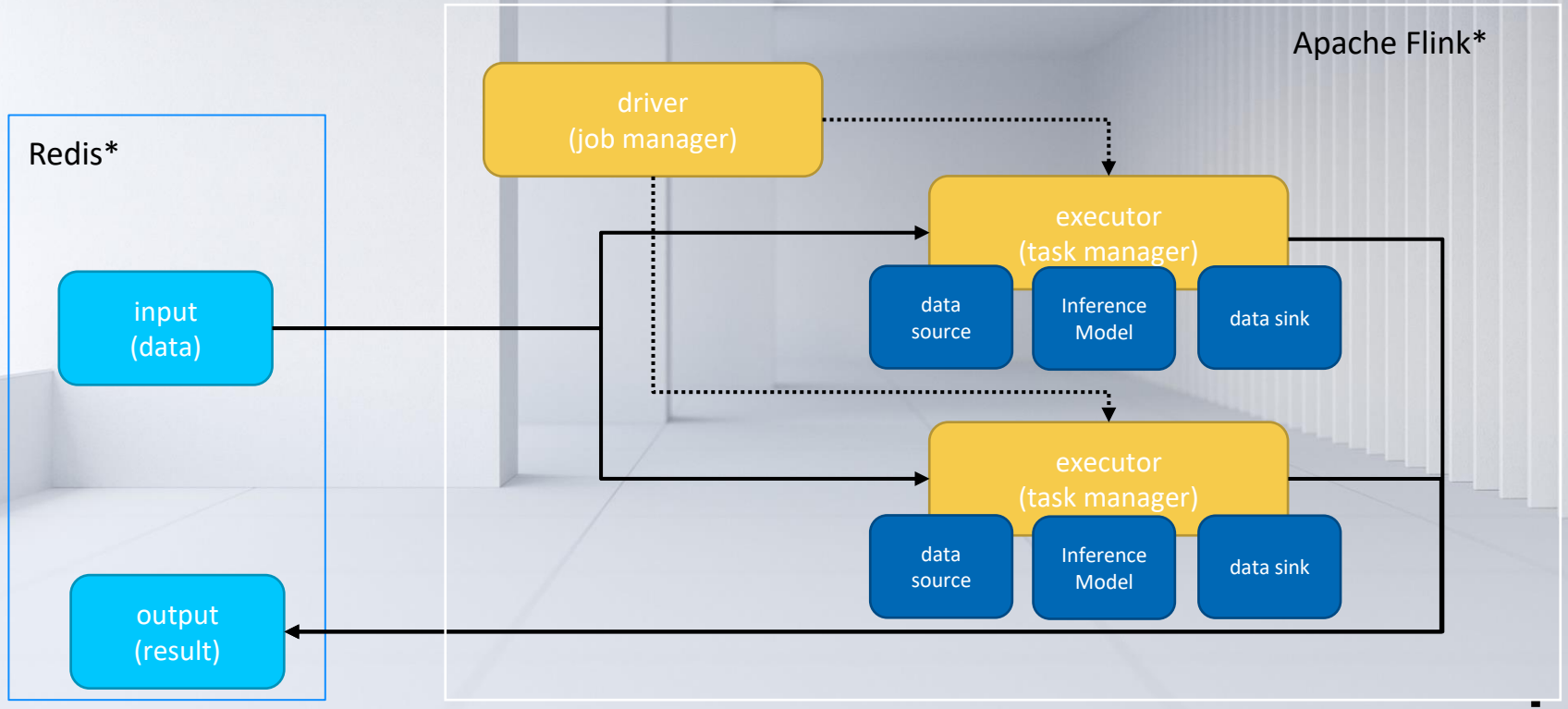
# Architecture of Cluster Serving on Analytics Zoo, Flink, Redis

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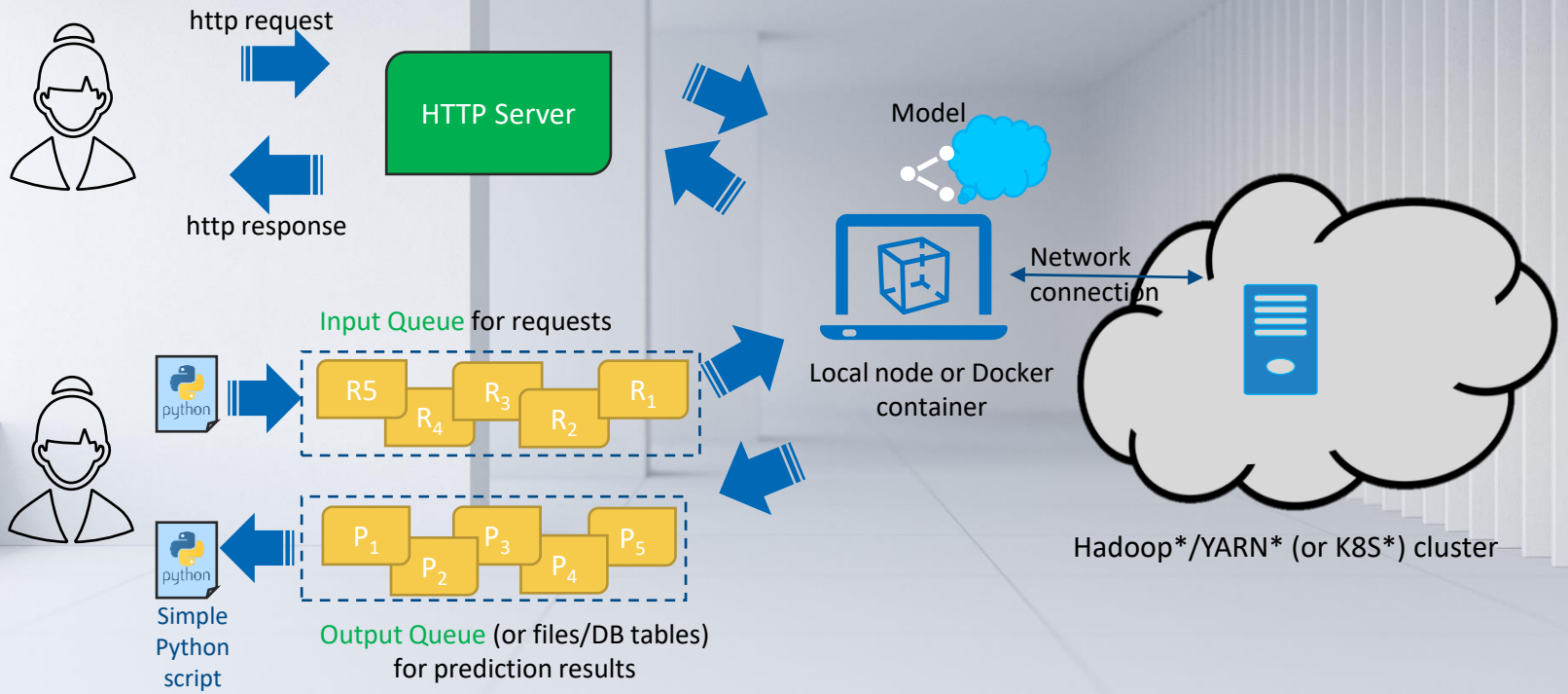
# Data pipeline User Perspective

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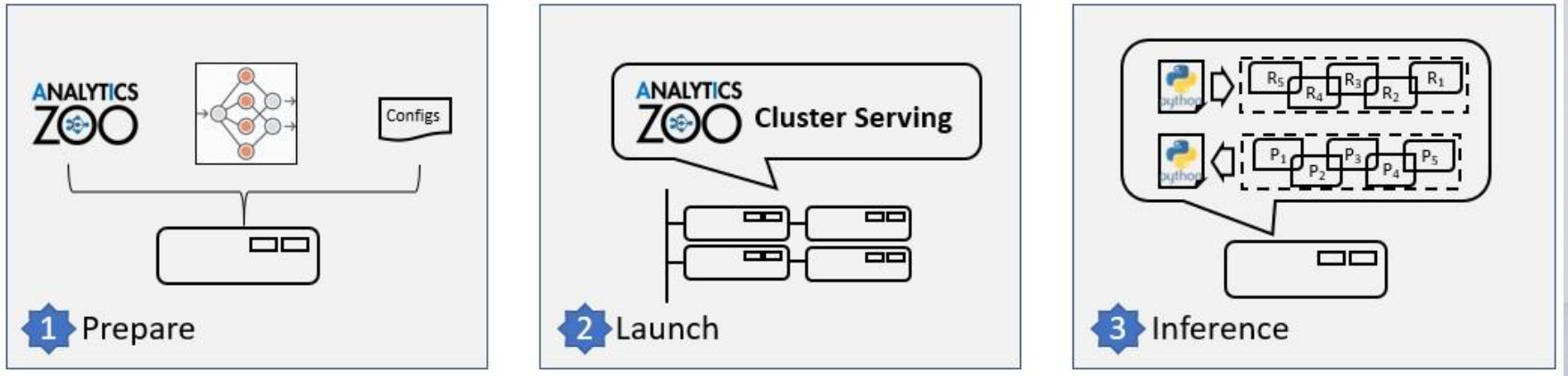
# Cluster Serving Workflow Overview

1. Install and prepare Cluster Serving environment on a local node
2. Launch the Cluster Serving service
3. Distributed, real-time (streaming) inference

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# Very Quick Start

## Start docker container

```
#docker run -itd --name cluster-serving --net=host intelanalytics/zoo-cluster-serving:0.7.0
```

## Log into container

```
#docker exec -it cluster-serving bash
```

## Start Serving

```
#cluster-serving-start
```

https://github.com/intel-analytics/analytics-zoo/blob/master/docs/docs/ClusterServingGuide/ProgrammingGuide.md

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# API Introductions

## http sync API

- data are represented by json format
- call http post method to enqueue your data into pipeline
- http API is compatible with TFServing*

## pub-sub python sync/async API

- data are represented by ndarray
- call python method to enqueue your data into pipeline

# API Examples

HTTP service

```
curl -d \
 '{
  "instances" : [ {
    "intScalar" : 12345,
    "floatScalar" : 3.14159,
    "stringScalar" : "hello, world. hello, arrow.",
    "intTensor" : [ 7756, 9549, 1094, 9808, 4959, 3831, 3926, 6578, 1870, 1741 ],
    "floatTensor" : [ 0.6804766, 0.30136853, 0.17394465, 0.44770062, 0.20275897, 0.32762378, 0.45966738, 0.30405
    "stringTensor" : [ "come", "on", "united" ],
    "intTensor2" : [ [ 1, 2 ], [ 3, 4 ], [ 5, 6 ] ],
    "floatTensor2" : [ [ [ 0.2, 0.3 ], [ 0.5, 0.6 ] ], [ [ 0.2, 0.3 ], [ 0.5, 0.6 ] ] ],
    "stringTensor2" : [ [ [ [ "come", "on", "united" ], [ "come", "on", "united" ], [ "come", "on", "united" ],
  }, {
    "intScalar" : 12345,
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  } ]
}' \
-X POST http://host:port/predict
```

```
from zoo.serving.client import InputQueue
import numpy as np
input_api = InputQueue()
t1 = np.array([1,2])
t2 = np.array([[1,2], [3,4]])
input_api.enqueue('my-instance', img={"path": 'path/to/image'}, tensor1=t1, tensor2=t2)
```

Python pub-sub

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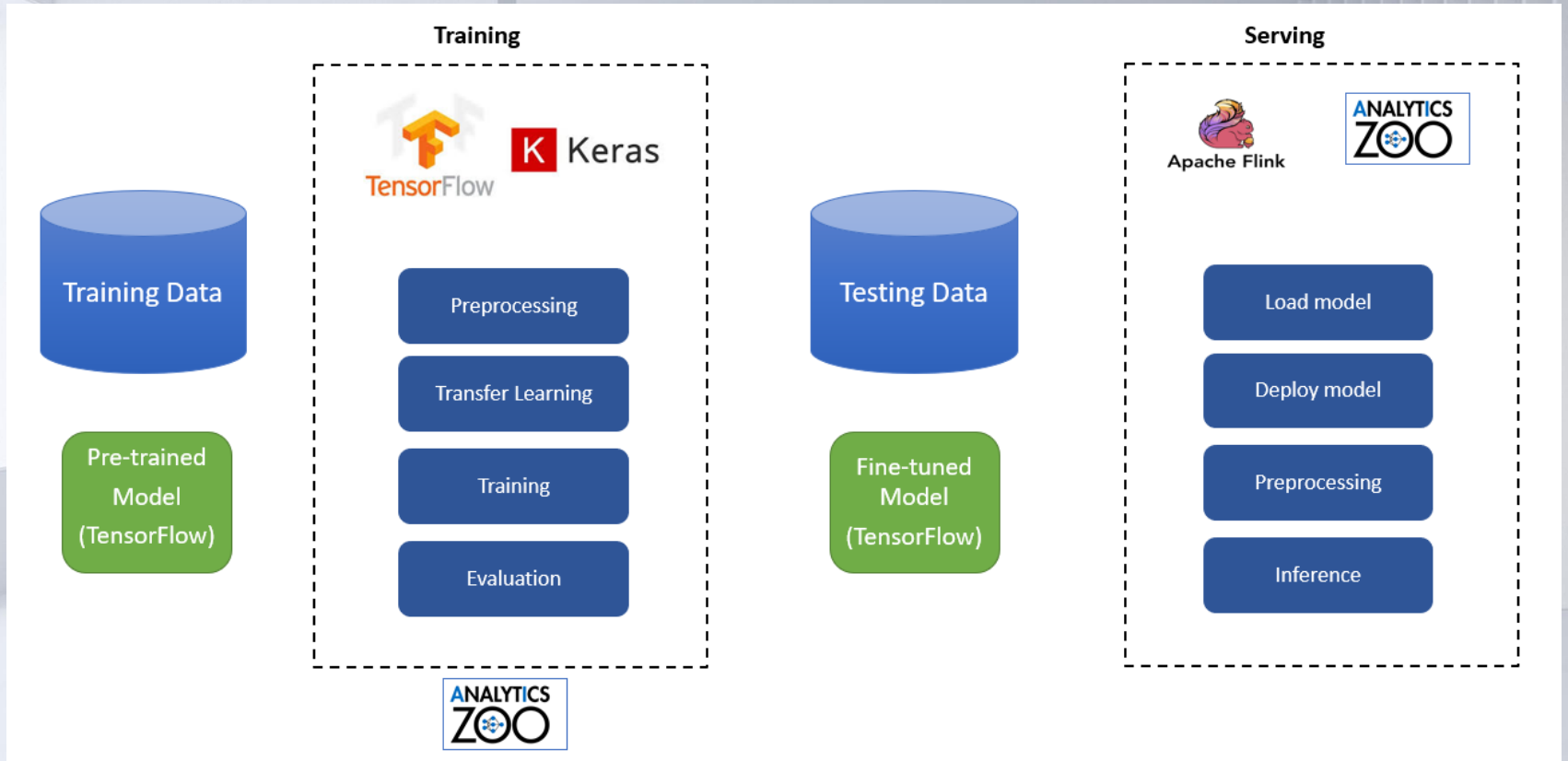
# Garbage classification on Alibaba Tianchi Competition




*Other names and brands may be claimed as the property of others.

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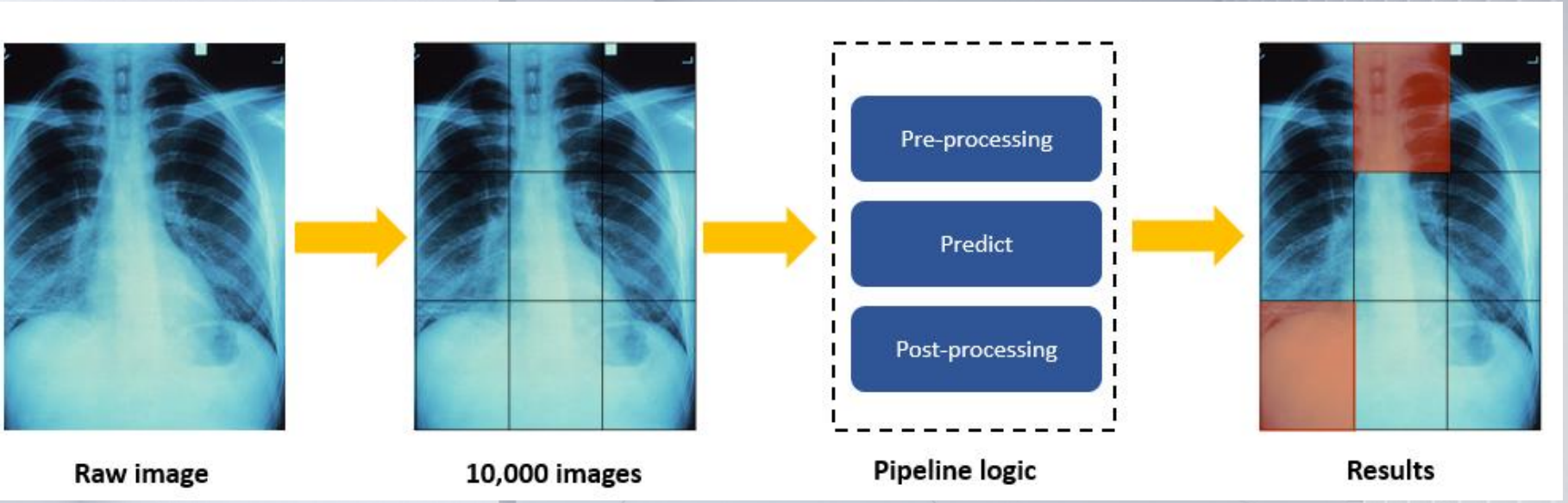
# Medical Imaging Analysis




**Bottleneck:**
**Preprocessing, inference, 10k images, up to 1-2 hours per large piece**

**scale-out the data to accelerate**

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# Advantages of Analytics Zoo Cluster Serving

## Ease of Deployment

**One container with all dependencies & leverage existed YARN/K8S cluster**

## Wide Range Deep Learning model support

**Tensorflow*, Caffe*, OpenVINO*, Pytorch*, BigDL***

## Low Latency

**Continuous Streaming pipeline is supported by Apache Flink***

## High Throughput & Scalability

**Optimization of multithread control, and could easily scale out to clusters**

# Summary

**Analytics Zoo: Software Platform for Big Data AI**

- E2E Big Data & AI pipeline (distributed TF/PyTorch/Keras/BigDL/OpenVINO/Ray on Spark)
- Vertical AI solutions (PPML, Time-Series, AutoML, etc.)

**Open Source Website**

- Project repo: https://github.com/intel-analytics/analytics-zoo
- Use cases: https://analytics-zoo.readthedocs.io/en/latest/doc/Application/powered-by.html

**Technical paper/tutorials**

- Upcoming CVPR 2021 tutorial!
- CVPR 2020 tutorial: https://jason-dai.github.io/cvpr2018/
- ACM SoCC 2019 paper: https://arxiv.org/abs/1804.05839
- AAAI 2019 tutorial: https://jason-dai.github.io/aaai2019/

# Thank You

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