



# An introduction to AI/MLOps

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Part 1:

# Introduction

# Objectives

## 01

MLOps is an ML engineering culture and practice that aims at unifying

- **ML system development (Dev)** and
- **ML system operation (Ops)**

# Objectives

## 02

Techniques for implementing and automating -

- **continuous integration (CI),**
- **continuous delivery (CD), and**
- **continuous training (CT)**

for machine learning (ML) systems.

# Objectives

02

## 03

MLOps advocates for -

- **automation** and
  - **monitoring**
- at all stages of the ML system development process, including -
- **integration,**
  - **testing,**
  - **releasing,**
  - **deployment, and**
  - **infrastructure management.**

# Challenges

01

Building an integrated ML system and continuously operate it in production with a vast array of the surrounding infrastructure.

# Challenges

02

To automate the process from beginning to end while managing -

- **different teams**
- using **different technologies** and
- follow **different routines**.

And also make them -

- **auditable** and
- **reproducible**.

# Challenges

03

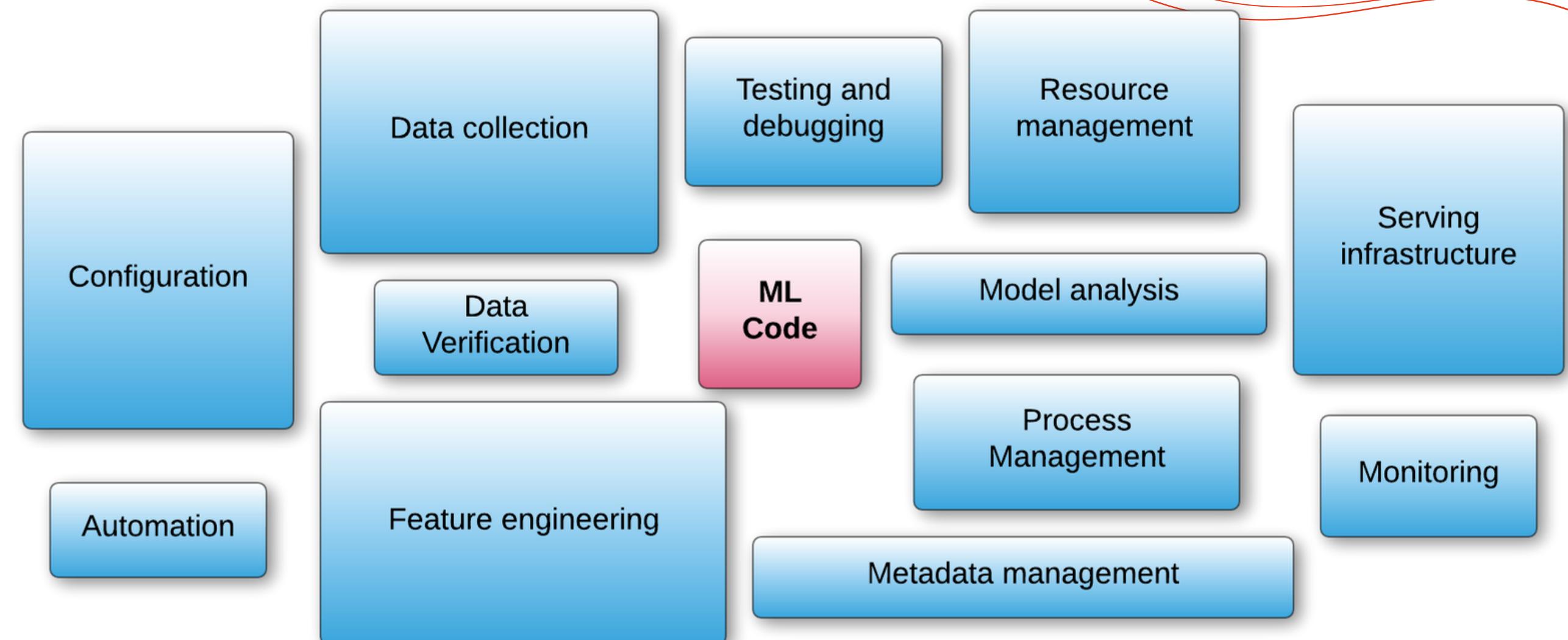
Various dependencies like -

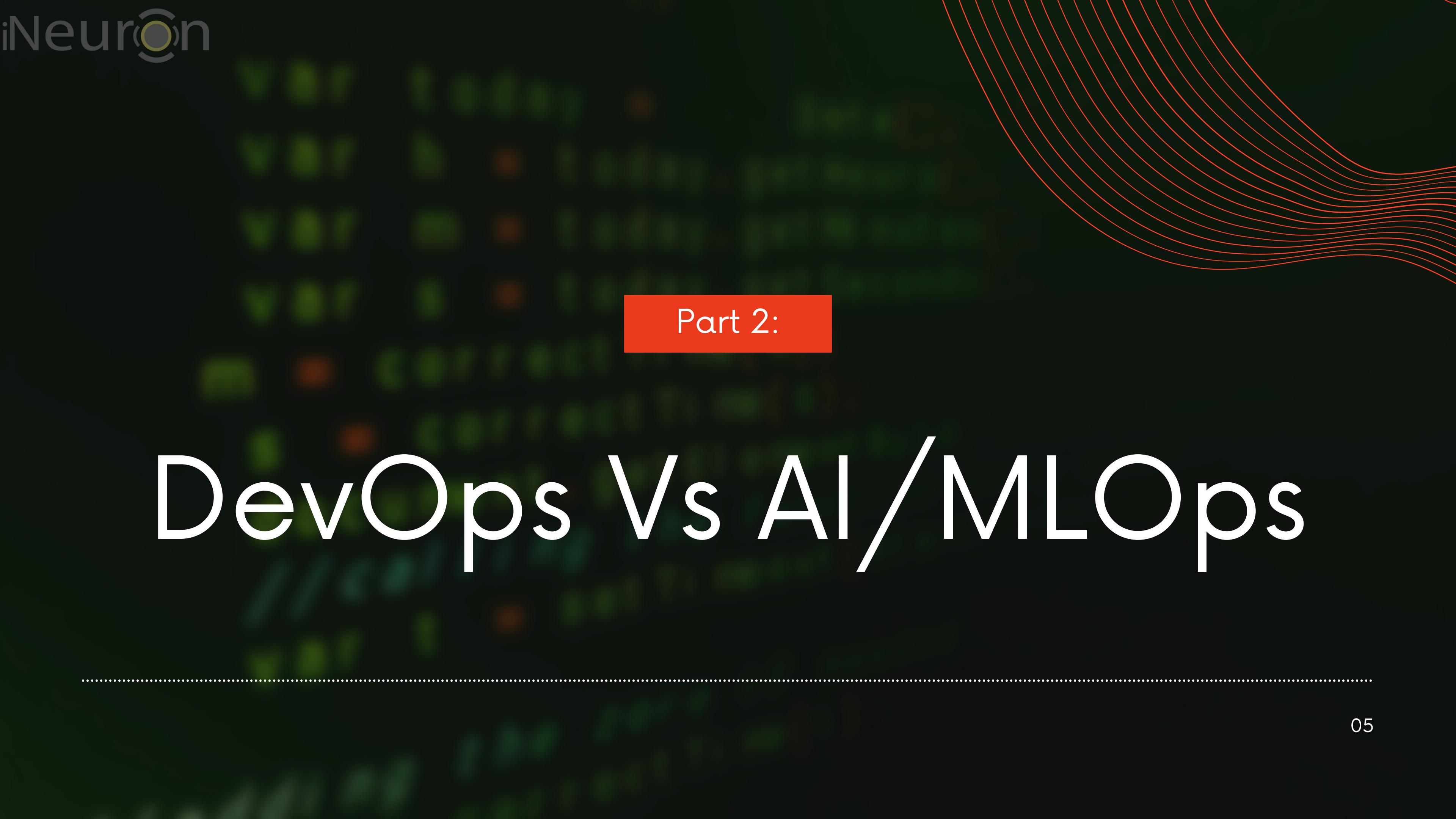
- **data dependency,**
- **model complexity,**
- **reproducibility,**
- **testing,**
- **monitoring etc**

These changes and dependencies in addition to code must be controlled and integrated into the software delivery process.

# Hidden Technical **Debt** in Machine Learning Systems.

-Sculley et al. in 2015



The background of the slide features a dark green gradient with a subtle texture. In the upper right quadrant, there is a series of thin, orange, wavy lines that curve from the top right towards the center. A horizontal dotted line runs across the bottom of the slide.

Part 2:

# DevOps Vs AI/MLOps



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# DevOps

In the development and operation of large-scale software systems, DevOps is a widespread approach. Shortening development cycles, boosting deployment velocity, and ensuring reliable releases are all advantages of this strategy.

It uses two concepts in software system development to get these benefits:

1. Continuous Integration (CI)
2. Continuous Delivery (CD)

# ML systems differ from other software systems

## Continuous Integration (CI) .....

It's no longer only about testing and validating code and components; data, data schemas, and models must also be tested and validated.

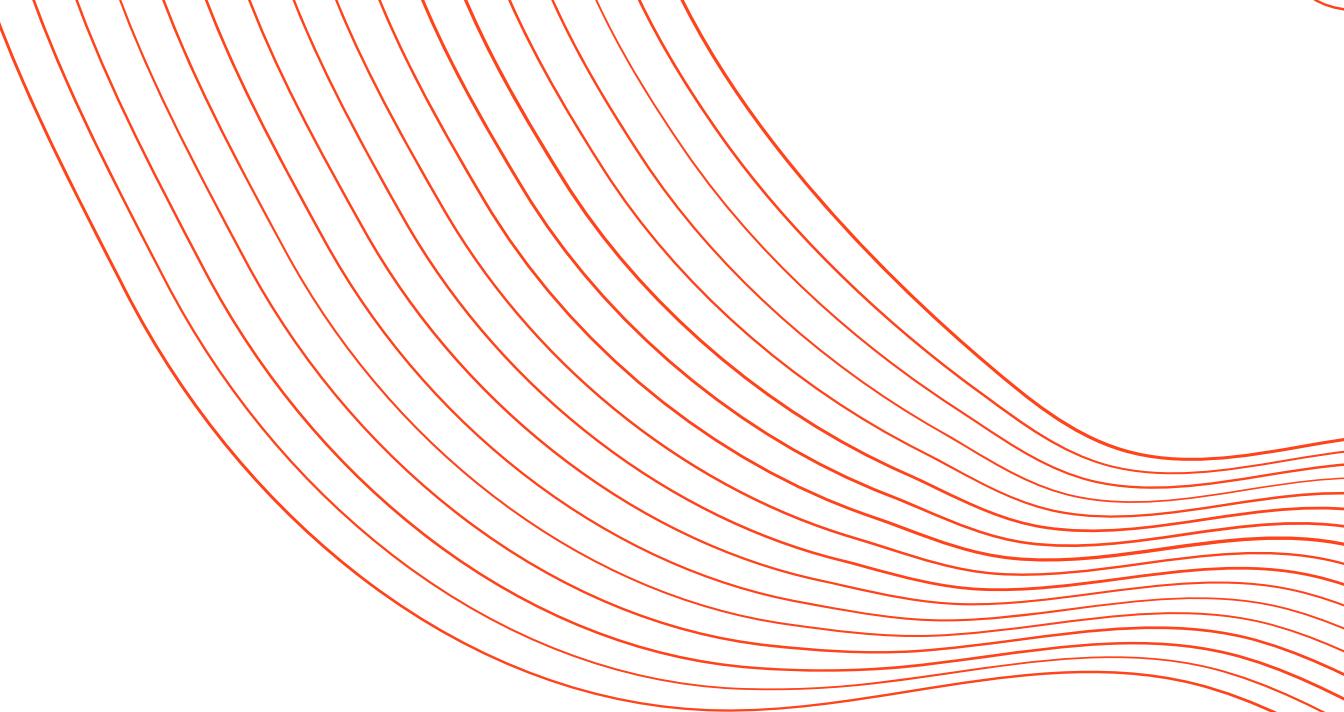
# ML systems differ from other software systems

## Continuous Delivery (CD) .....

It's no longer about a single software package or service, but about a system (an ML training pipeline) that automatically deploys another service (model prediction service).

# ML systems differ from other software systems

## Continuous training (CT)



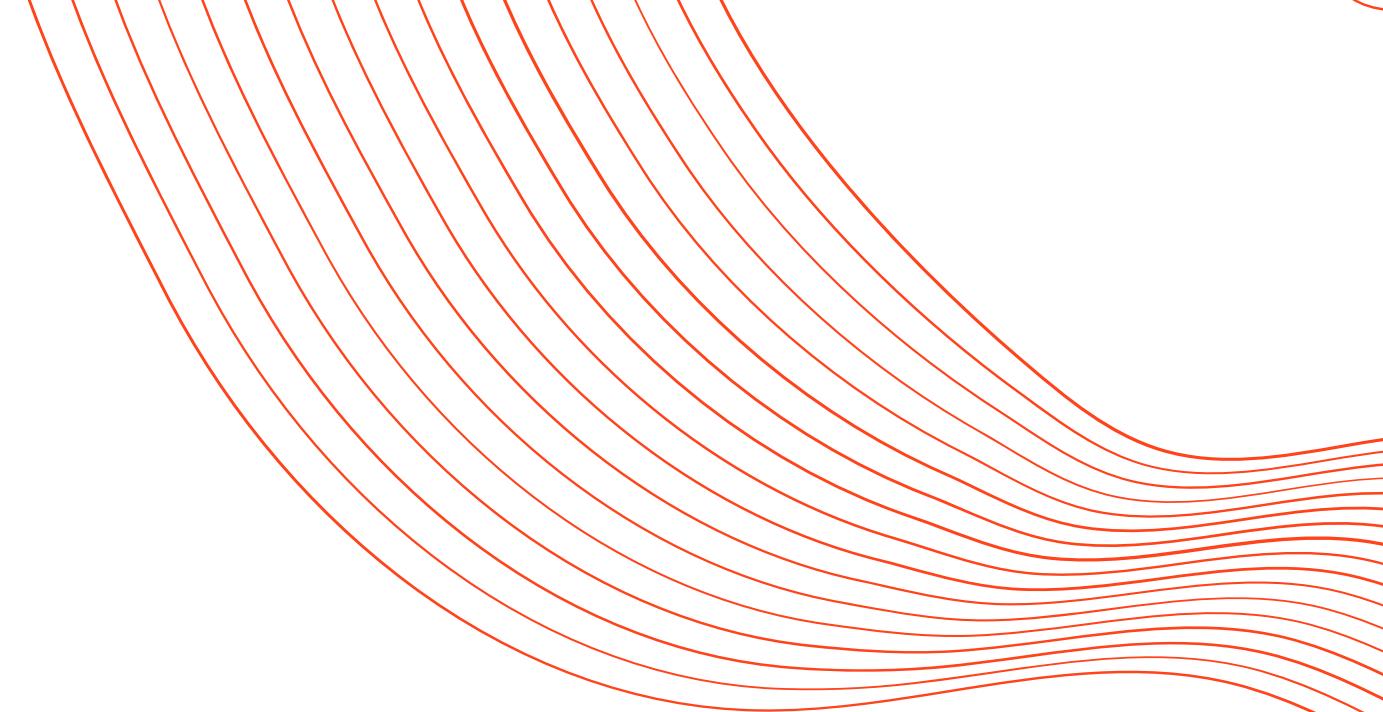
It's a novel attribute specific to machine learning systems that deals with automatically retraining and serving models.

Part 3:

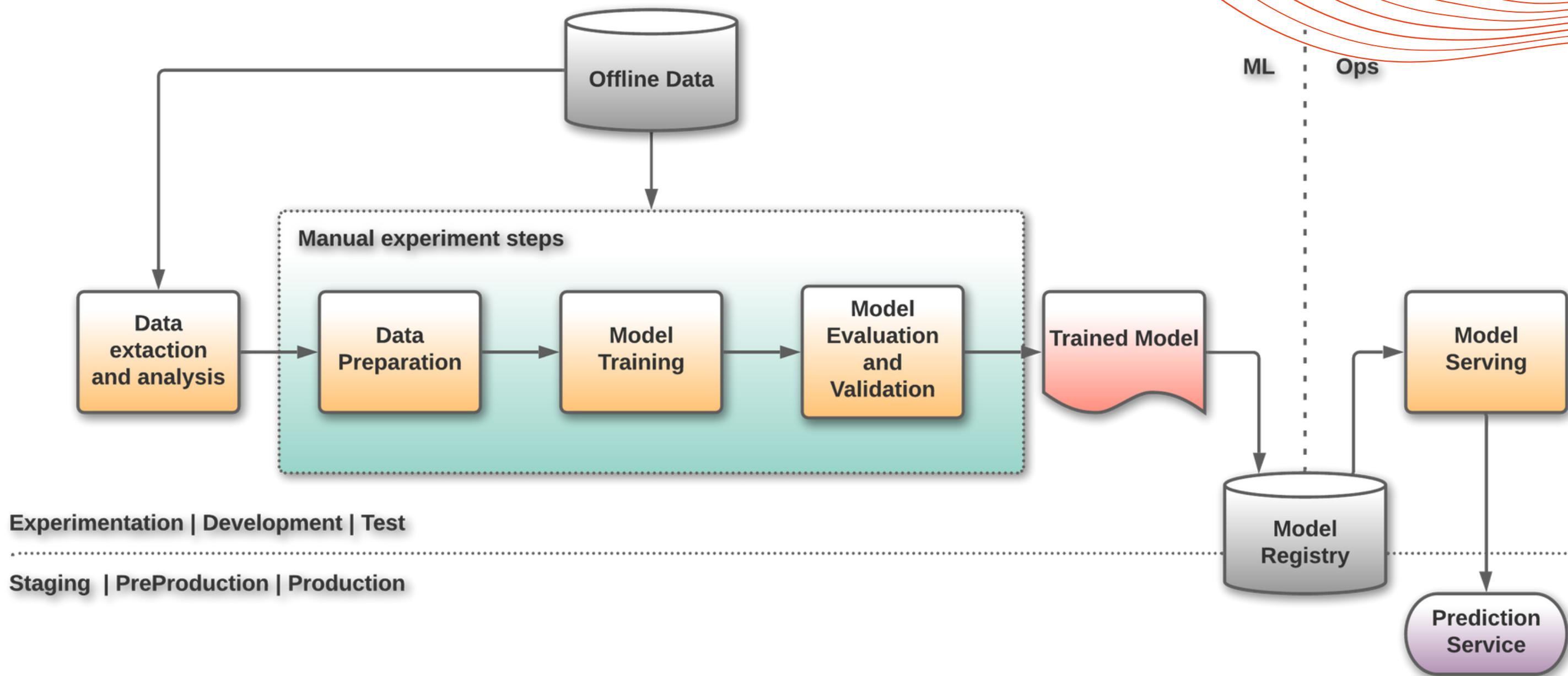
# Steps in AI/MLOps



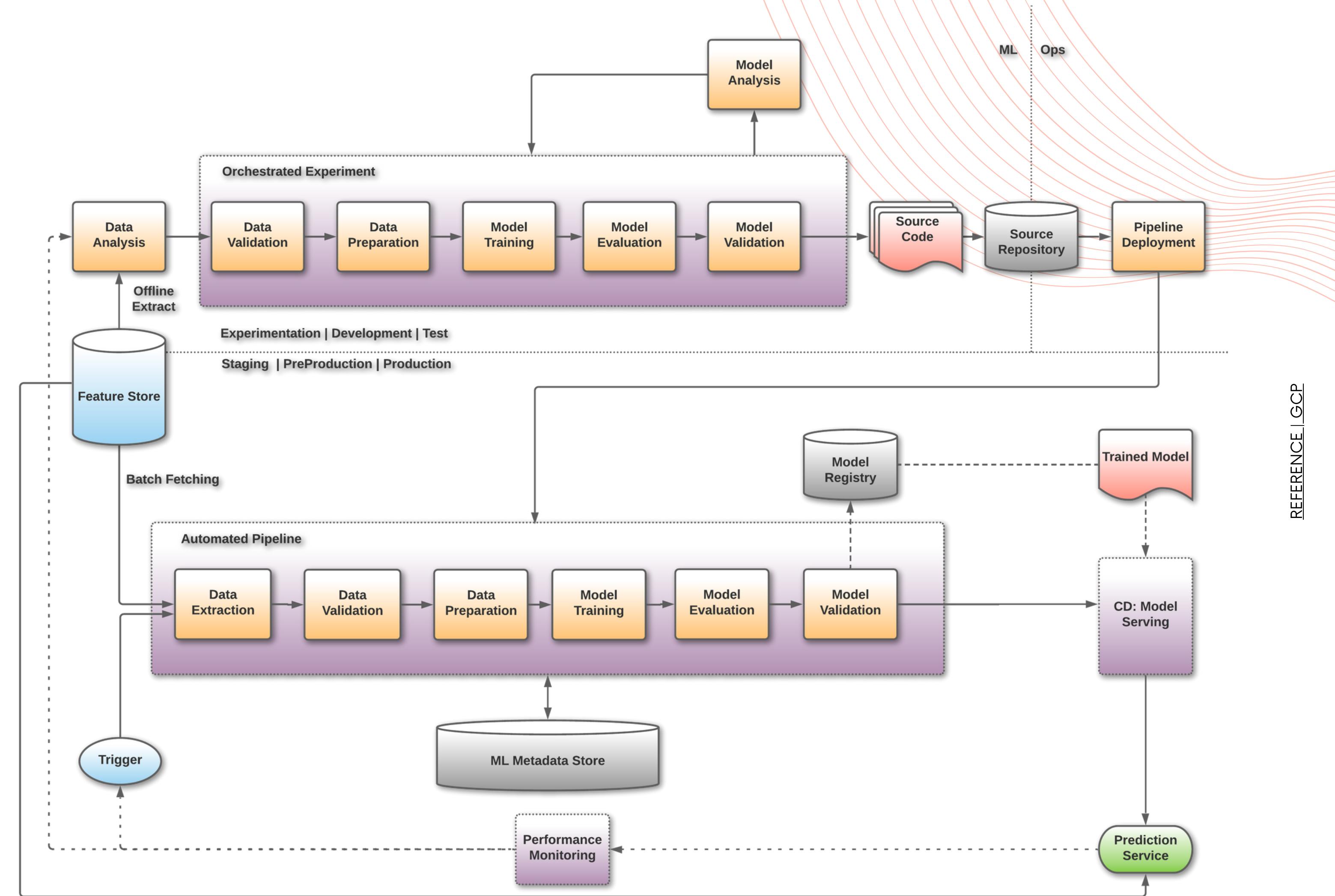
# Generic steps in AI/ML systems

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- A decorative element consisting of several thin, red, wavy lines that curve upwards from the bottom right corner towards the top left.
- 1 Data extraction
  - 2 Data analysis
  - 3 Data preparation
  - 4 Model training
  - 5 Model evaluation
  - 6 Model validation
  - 7 Model serving
  - 8 Model monitoring

Level 0

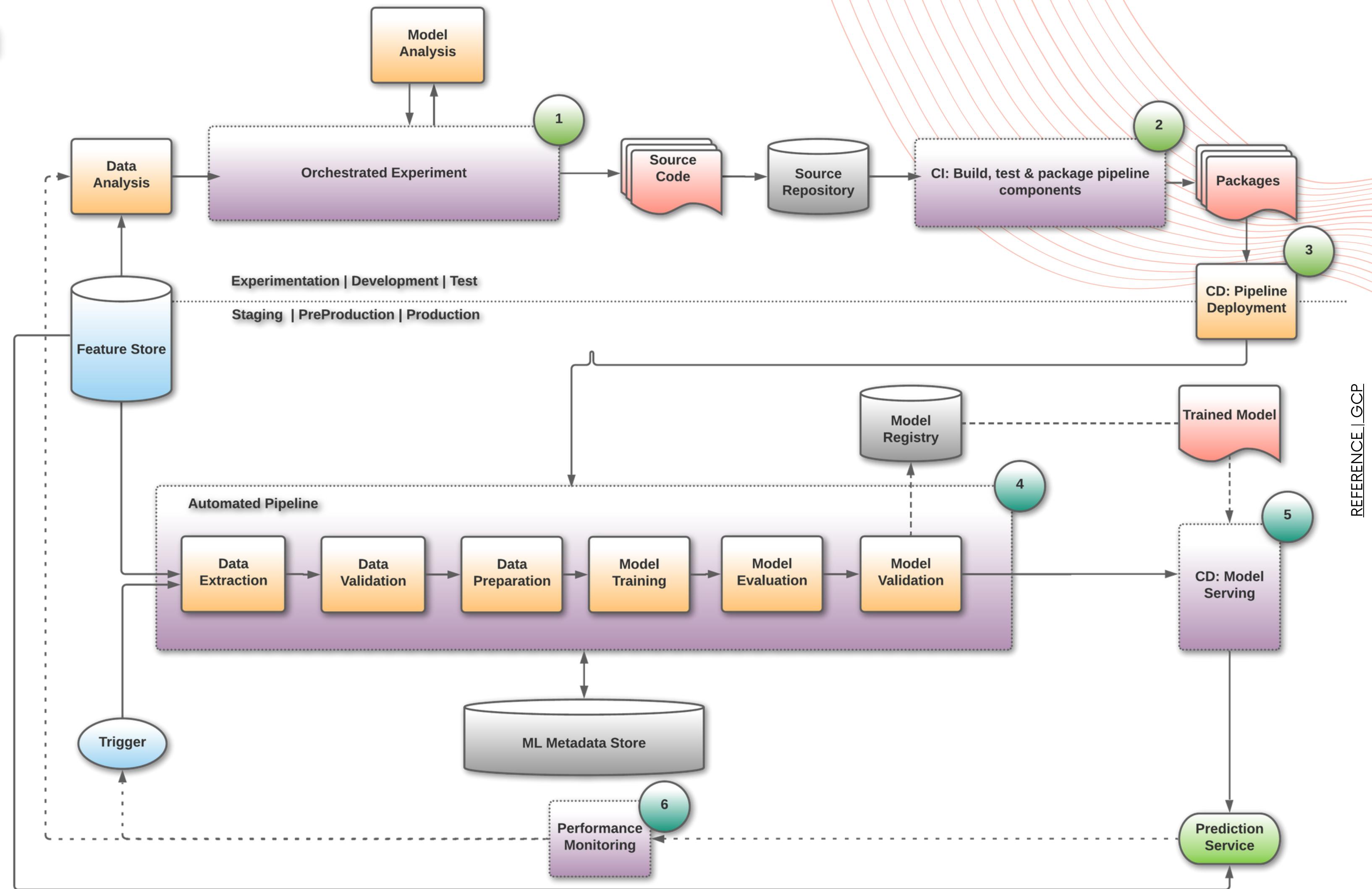


# Level I

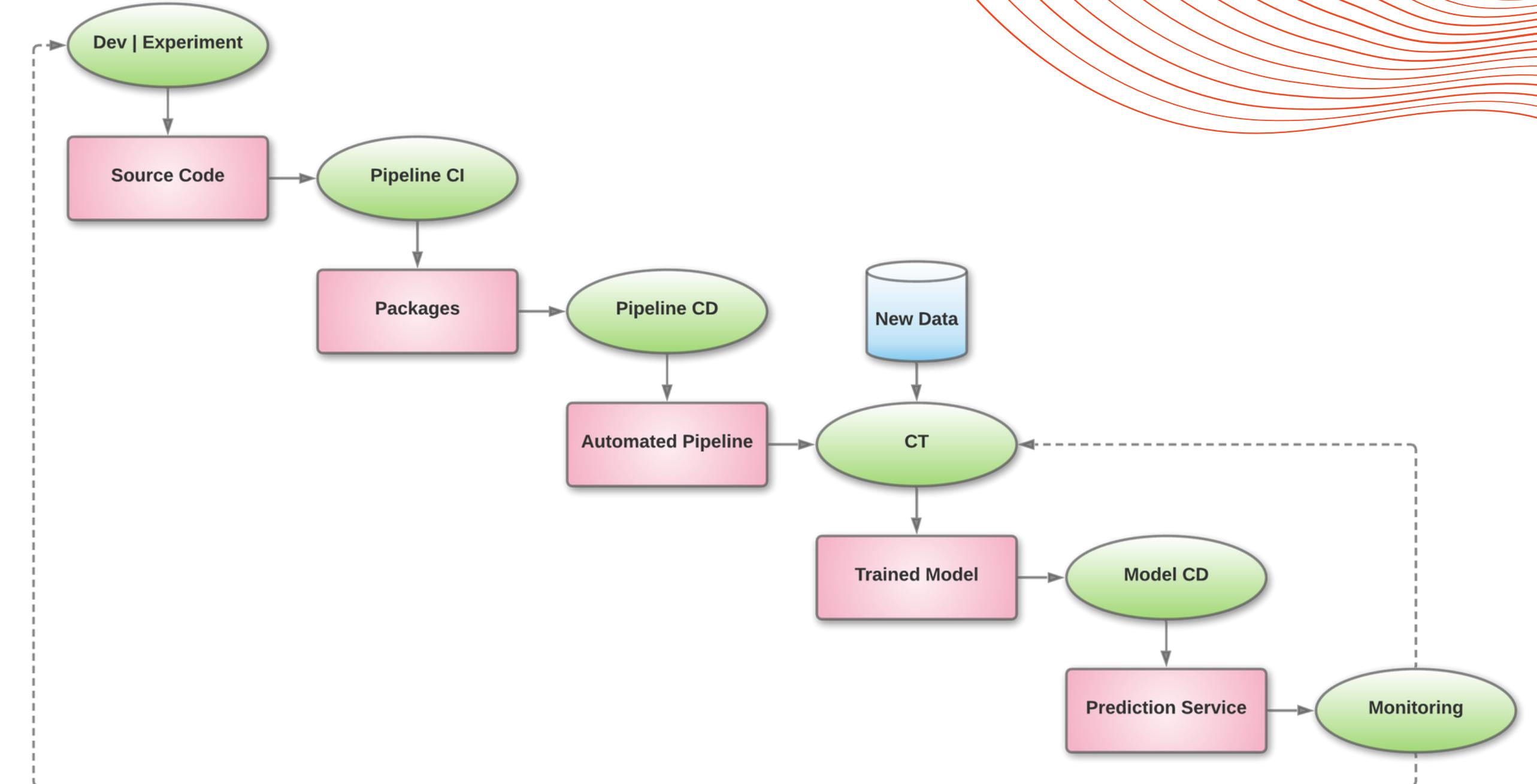


# Level 2

12



# Stages of CI/CD



# References

1

GCP

MLOps: Continuous delivery  
and automation pipelines in  
machine learning

2

[martinFowler.com](http://martinFowler.com)

Continuous Delivery for  
Machine Learning

# Thank you!

Contact us if there are any questions.



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