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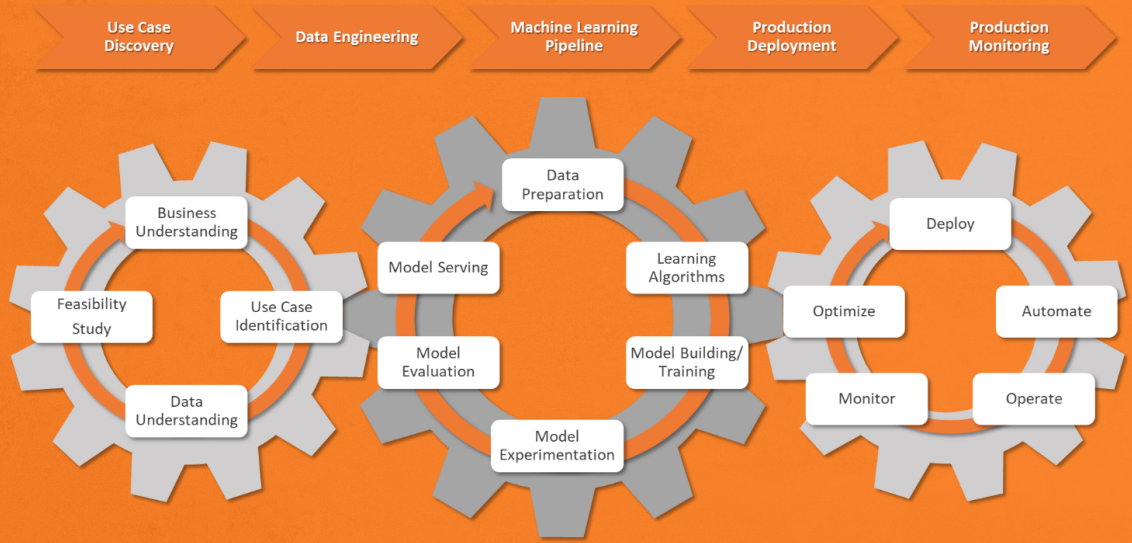
A quick walkthrough of MLOps



Manoj Kumar.
Lead Cloud Architect – Data Engineering.

Manoj Kumar

- 14+ years in Consulting and Training spanning across various industries like HealthCare, Retail, Telecom, Insurance and IT on Cloud Data Engineering, Tableau, Informatica, Python, PySpark, Power BI and K2view.

- **Microsoft Certified Trainer.**
- **Informatica Certified and Authorize Trainer.**
- **K2view Certified SME.**
- **Pentaho Hitachi Certified Trainer.**
- **Azure Cloud Certified Architect.**
- **Azure Data Engineering Certified Professional.**
- **Azure Data Science Certified Professional.**
- **Amazon Authorize Instructor.(Ongoing)**
- **Cloud Security Certification | CCSP | (ISC)² - ISC2(Perusing)**

- Supported 2560 Technocrats from AT&T US and Verizon US.
- I am Graduated in Electronics and Communication Engineering.
- Did my Masters in AI & Machine Learning.
- **Fun Fact:** There was a store nearby my house in US, Named 7/11. I come from a small town in Bihar, where Dr. Rajendra Prasad was born and studied.

Lead Cloud Architect – Data Engineering.

Agenda

- Story about MLOps!
- What is MLOps?
- What is the use of MLOps?
- Why do we need MLOps?
- What are the benefits of MLOps?
- What are the components of Mlops?
- MLOps Flow.
- DevOps Vs MLOps.
- Cloud Computing in 10 min
- Azure MLOps
- Q&A

Batch 1 - 10:00 AM to 11:00 AM

Batch 2 - 3:00 PM to 4:00 PM

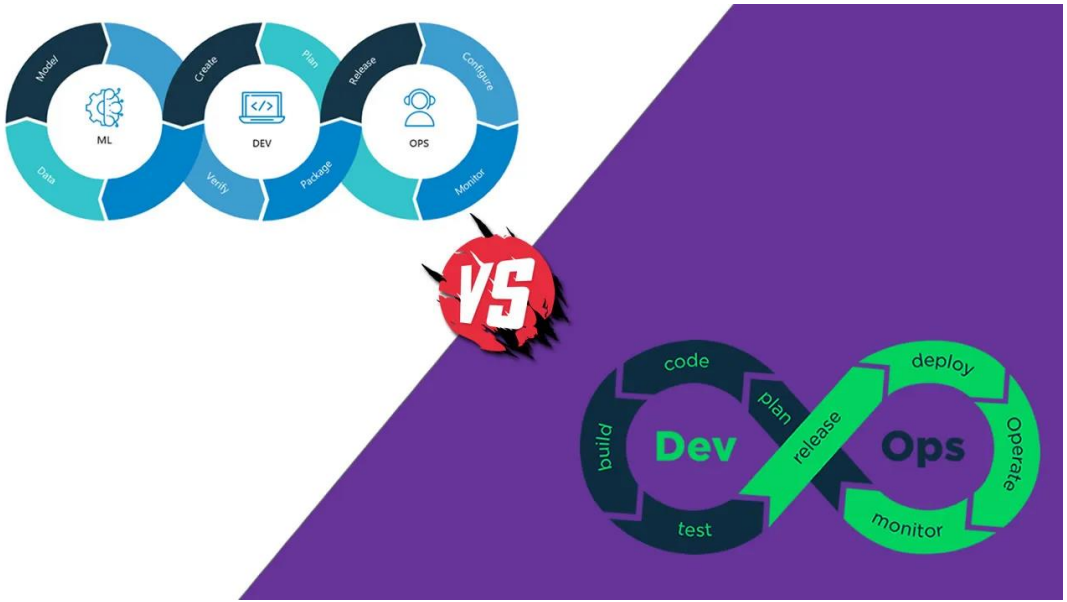
- **Story about MLOps**

Walmart Real Time Use Case of MLOps

Sam is a data scientist working for Walmart. The company recently started using machine learning to provide timely and accurate recommendations, improving both customer satisfaction and sales.

After a catalog update, Sam was asked to update the brand recommendation model—but nobody knows where the current model came from. He turns to Azure Machine Learning to build a reproducible and traceable workflow.

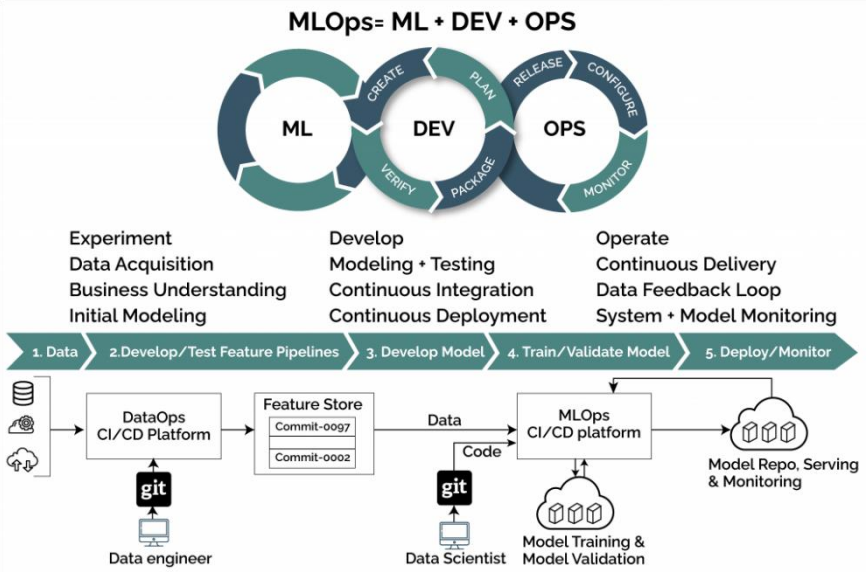
What is the difference between MLOps and DevOps?



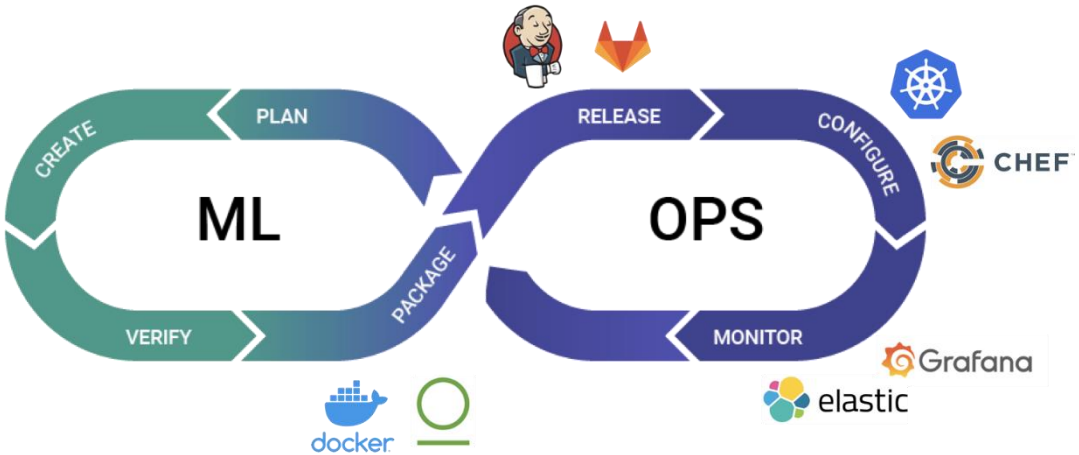
- ✓ MLOps is a set of engineering practices specific to machine learning projects that borrow from the more widely-adopted DevOps principles in software engineering.
- ✓ While DevOps brings a rapid, continuously iterative approach to shipping applications, MLOps borrows the same principles to take machine learning models to production.

In both cases, the outcome is higher software quality, faster patching and releases, and higher customer satisfaction.

What is MLOps?



What is MLOps?

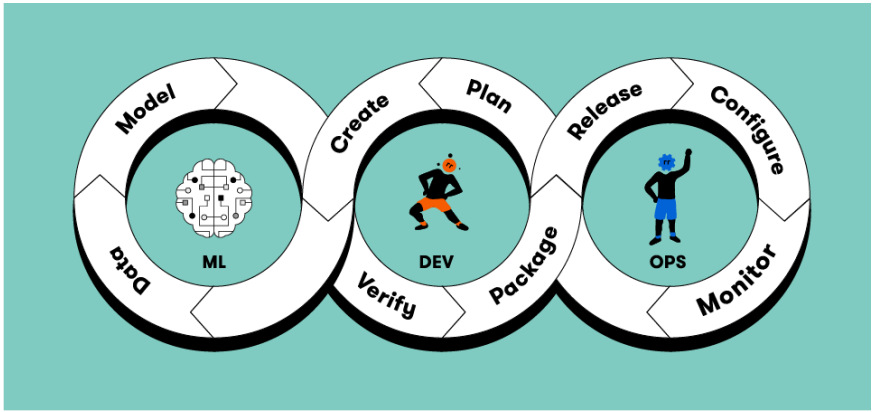


This talk!

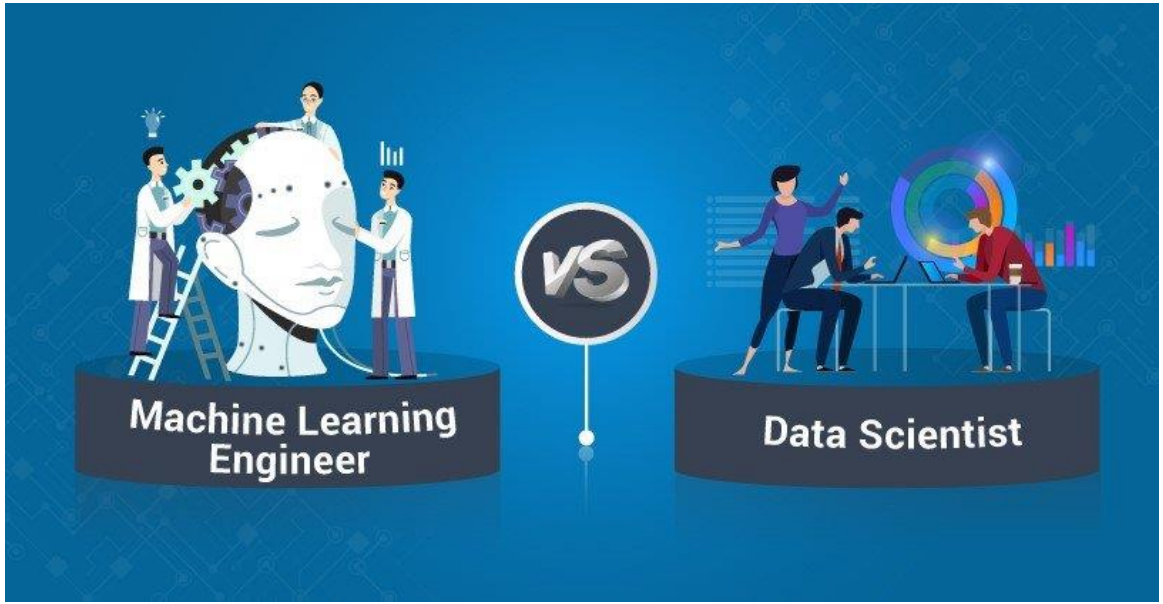
MLOps stands for Machine Learning Operations.

- MLOps is a core function of Machine Learning engineering, focused on streamlining the process of taking machine learning models to production, and then maintaining and monitoring them.
- MLOps is a collaborative function, often comprising data scientists, devops engineers, and IT.

What is the use of MLOps?



What is the use of MLOps?

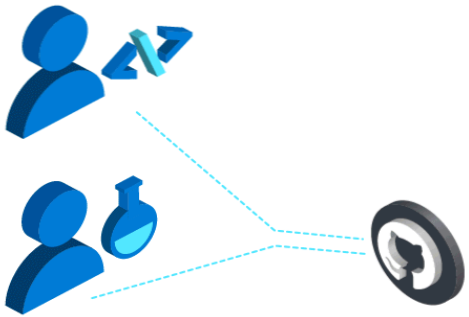


MLOps stands for Machine Learning Operations.

- MLOps is a useful approach for the creation and quality of machine learning and AI solutions.
- By adopting an MLOps approach, data scientists and machine learning engineers can collaborate and increase the pace of model development and production, by implementing continuous integration and deployment (CI/CD) practices with proper monitoring, validation, and governance of ML models.

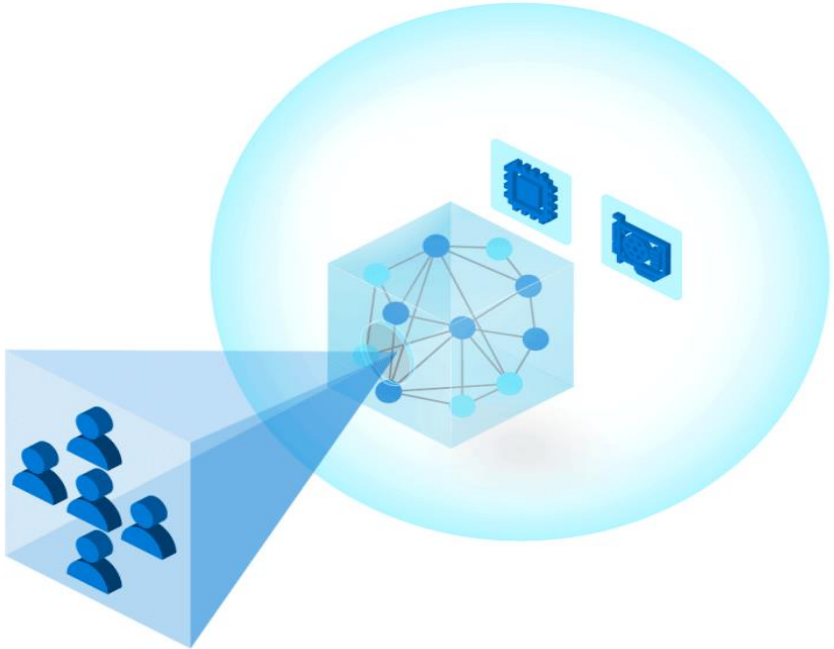
MLOps in Nutshell

Build reproducible machine learning models



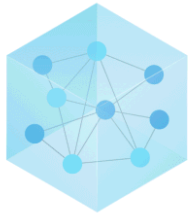
MLOps in Nutshell

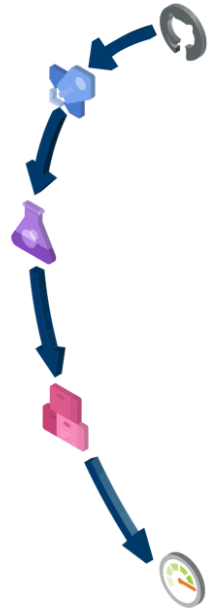
Deploy models for scalable inferencing



MLOps in Nutshell

Bring models to your CI/CD pipelines





MLOps in Nutshell

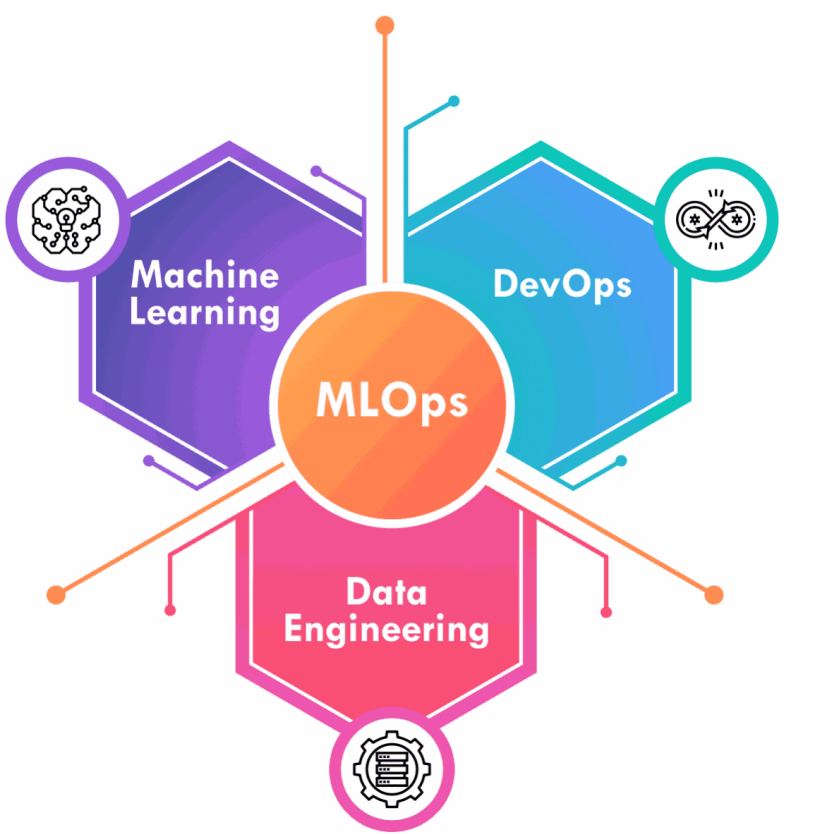
Create governance for machine learning projects



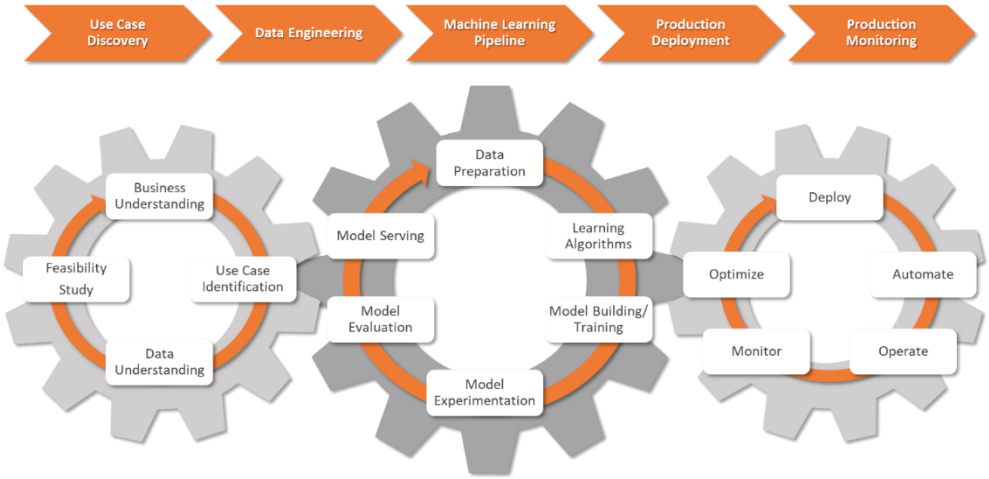




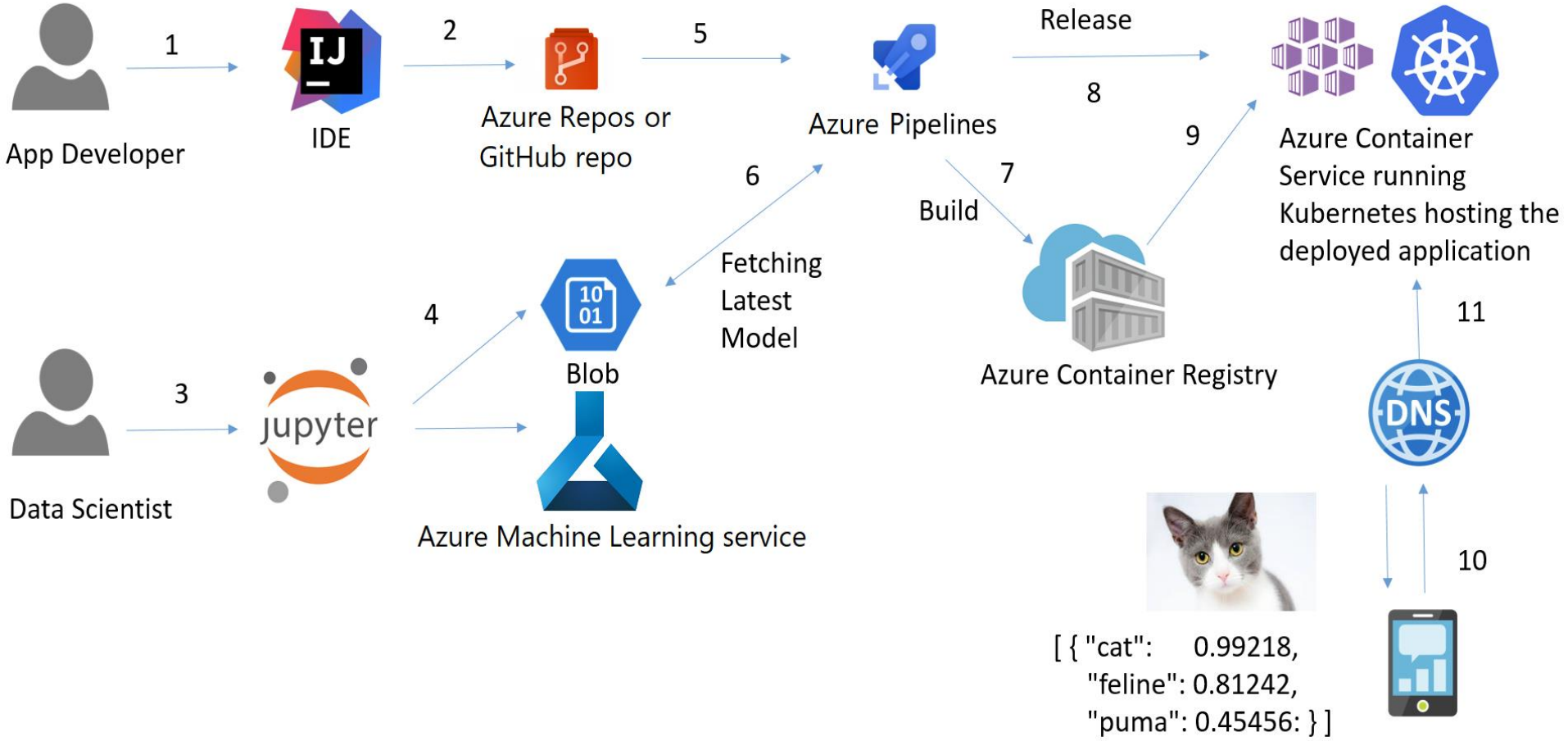
Why do we need MLOps?



Why do we need MlOps?



- Productionizing machine learning is difficult. The machine learning lifecycle consists of many complex components such as data ingest, data prep, model training, model tuning, model deployment, model monitoring, explainability, and much more.
- It also requires collaboration and hand-offs across teams, from Data Engineering to Data Science to ML Engineering.
- Naturally, it requires stringent operational rigor to keep all these processes synchronous and working in tandem.
- MLOps encompasses the experimentation, iteration, and continuous improvement of the machine learning lifecycle.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Release
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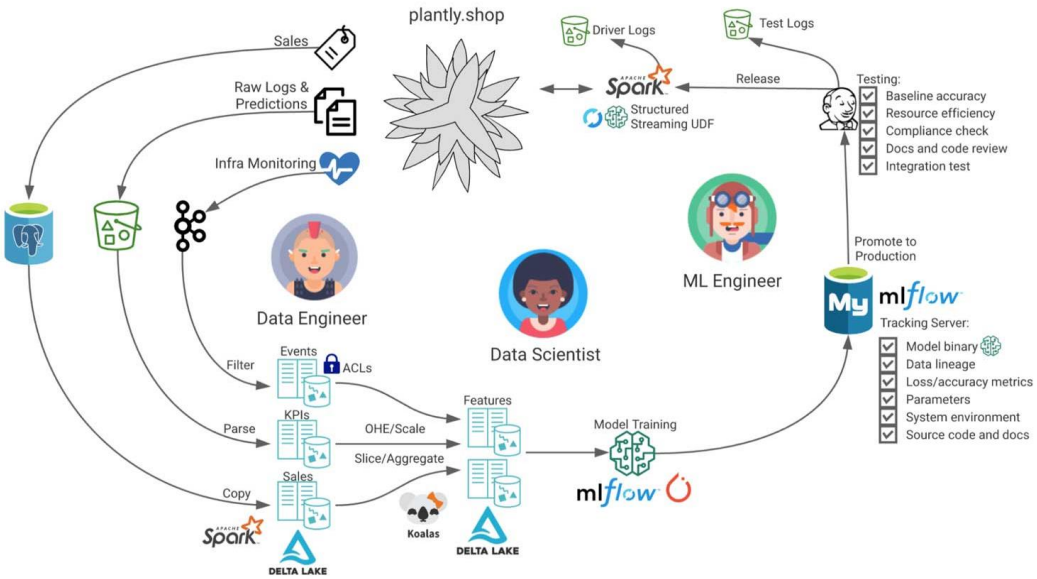
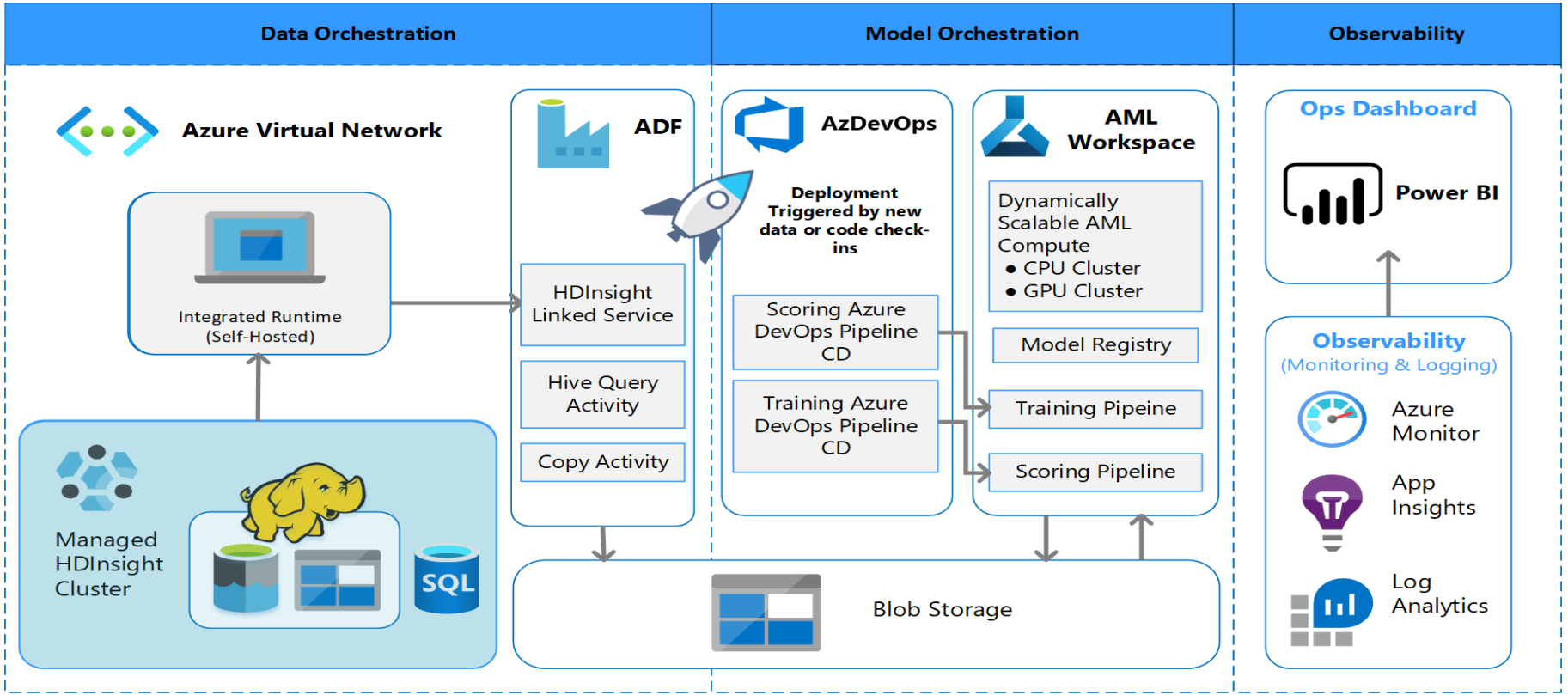
11
App Developer
IDE
Azure Repos or
GitHub repo
Azure Pipelines
Azure Container
Service running
Kubernetes hosting the
deployed application
Build
Fetching
Latest
Model
Blob
Azure Container Registry
Data Scientist
Azure Machine Learning service
[{ "cat": 0.99218,
"feline": 0.81242,
"puma": 0.45456: }]

MLOps Flow?


plantly.shop
Sales
Raw Logs & Predictions
Infra Monitoring
Driver Logs
Test Logs
Release
Testing:
Baseline accuracy
Resource efficiency
Compliance check
Docs and code review
Integration test
Structured Streaming UDF
Data Engineer
Data Scientist
ML Engineer
Promote to Production
mlflow
Tracking Server:
Model binary
Data lineage
Loss/accuracy metrics
Parameters
System environment
Source code and docs
Filter
Events
ACLs
Parse
KPIs
OHE/Scale
Slice/Aggregate
Features
Model Training
Copy
Sales
Koalas
DELTA LAKE
DELTA LAKE

MLOps Flow

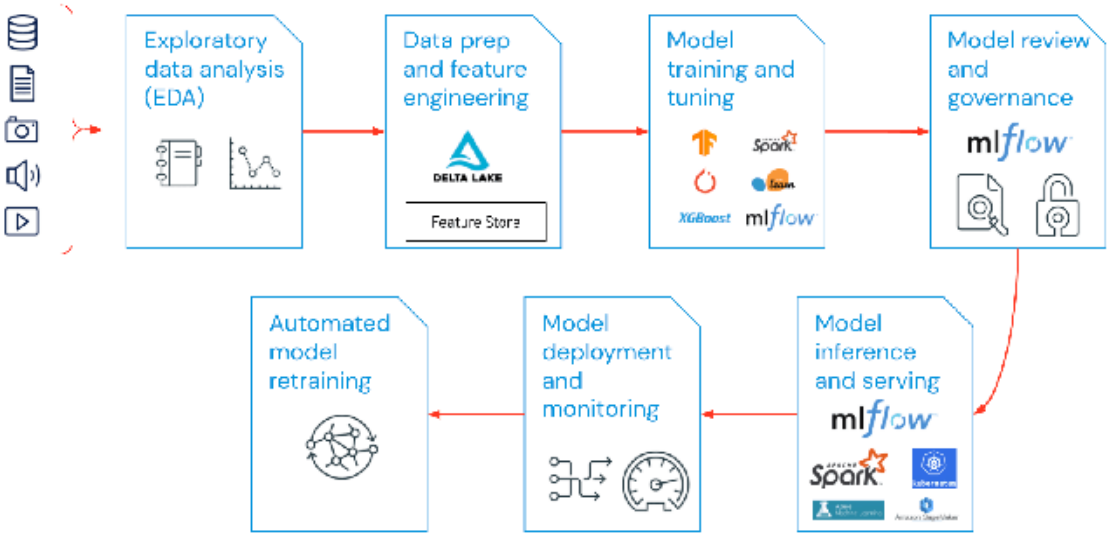

Data Orchestration
Model Orchestration
Observability
Azure Virtual Network
ADF
AzDevOps
AML Workspace
Ops Dashboard
Power BI
Integrated Runtime (Self-Hosted)
Deployment Triggered by new data or code check-ins
Dynamically Scalable AML Compute
• CPU Cluster
• GPU Cluster
HDInsight Linked Service
Hive Query Activity
Copy Activity
Scoring Azure DevOps Pipeline CD
Training Azure DevOps Pipeline CD
Model Registry
Training Pipeine
Scoring Pipeline
Observability
(Monitoring & Logging)
Azure Monitor
App Insights
Log Analytics
Managed HDInsight Cluster
SQL
Blob Storage

What are the benefits of MLOps?

The primary benefits of MLOps are efficiency, scalability, and risk reduction. Efficiency:

- MLOps allows data teams to achieve faster model development, deliver higher quality ML models, and faster deployment and production.
- Scalability: MLOps also enables vast scalability and management where thousands of models can be overseen, controlled, managed, and monitored for continuous integration, continuous delivery, and continuous deployment.
- Specifically, MLOps provides reproducibility of ML pipelines, enabling more tightly-coupled collaboration across data teams, reducing conflict with devops and IT, and accelerating release velocity.
- Risk reduction: Machine learning models often need regulatory scrutiny and drift-check, and MLOps enables greater transparency and faster response to such requests and ensures greater compliance with an organization's or industry's policies.

What are the components of MLOps?

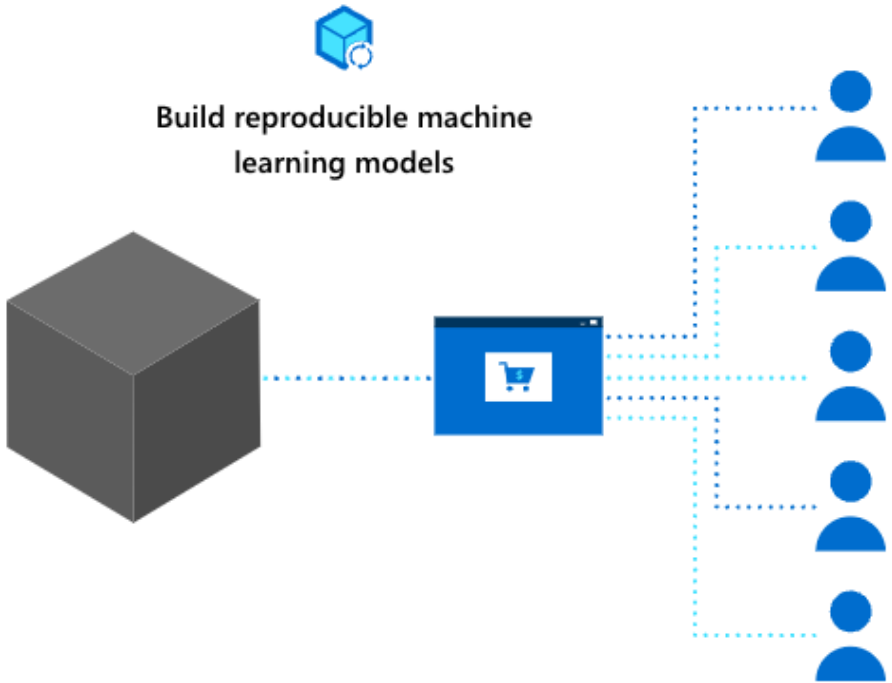


The span of MLOps in machine learning projects can be as focused or expansive as the project demands. In certain cases, MLOps can encompass everything from the data pipeline to model production, while other projects may require MLOps implementation of only the model deployment process. A majority of enterprises deploy MLOps principles across the following:

- Exploratory data analysis (EDA)
- Data Prep and Feature Engineering
- Model training and tuning
- Model review and governance
- Model inference and serving
- Model monitoring
- Automated model retraining

Cloud Computing in 10 min

Azure MlOps



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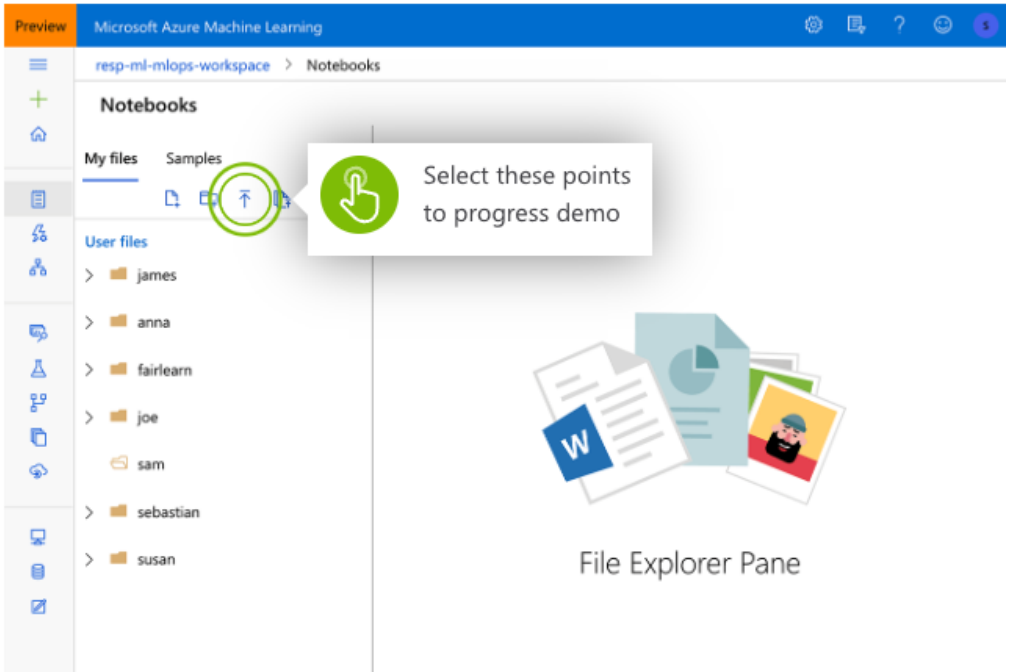
After a catalog update, Sam was asked to update the brand recommendation model—but nobody knows where the current model came from. He turns to Azure Machine Learning to build a reproducible and traceable workflow.

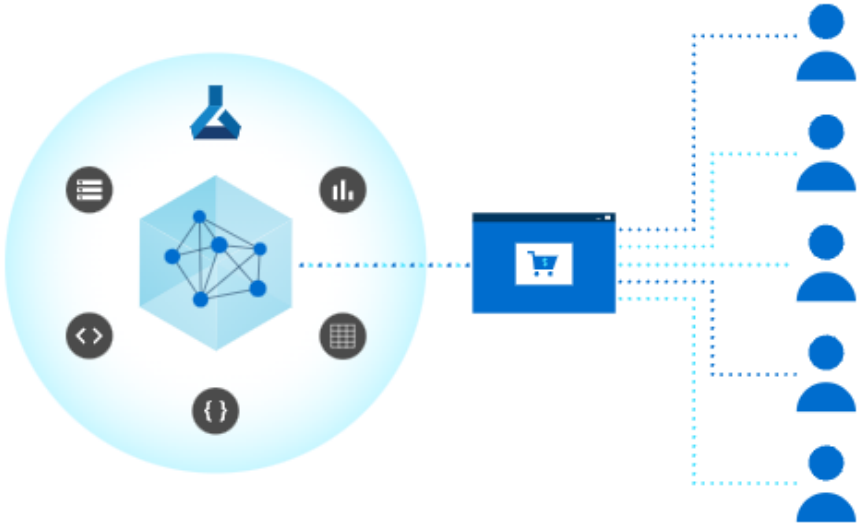
Azure MlOps



Sam uses the Azure Machine Learning SDK to move his Jupyter Notebook–based work to Azure Machine Learning, taking advantage of its scale and collaboration capabilities.

Using his choice of framework, he versions his training code and datasets and links them to a traceable experiment.

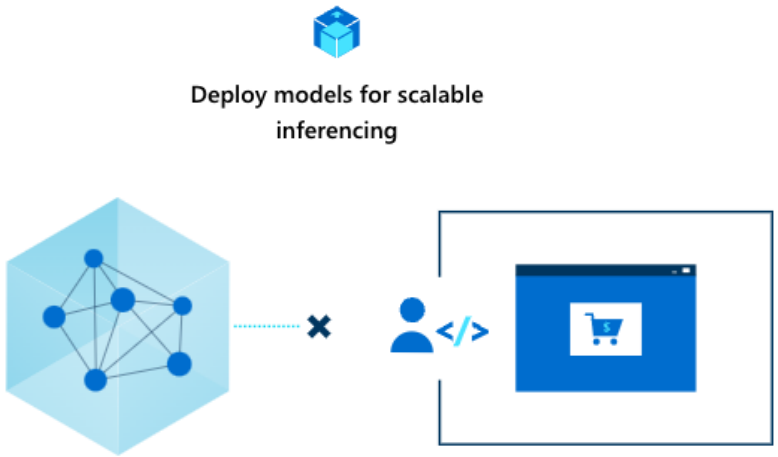
Azure MlOps



Sam has built a reproducible and traceable workflow using Azure Machine Learning. Each model that the team produces is now tied to an experiment run for review and iteration. With a reproducible pipeline, Sam lets Azure Machine Learning automate retraining while he focuses on the next big thing.

Azure Machine Learning helps you build enterprise-grade machine learning pipelines through reproducibility and traceability. This leads to more consistent model delivery with less variability and increased fault tolerance.

Azure MlOps

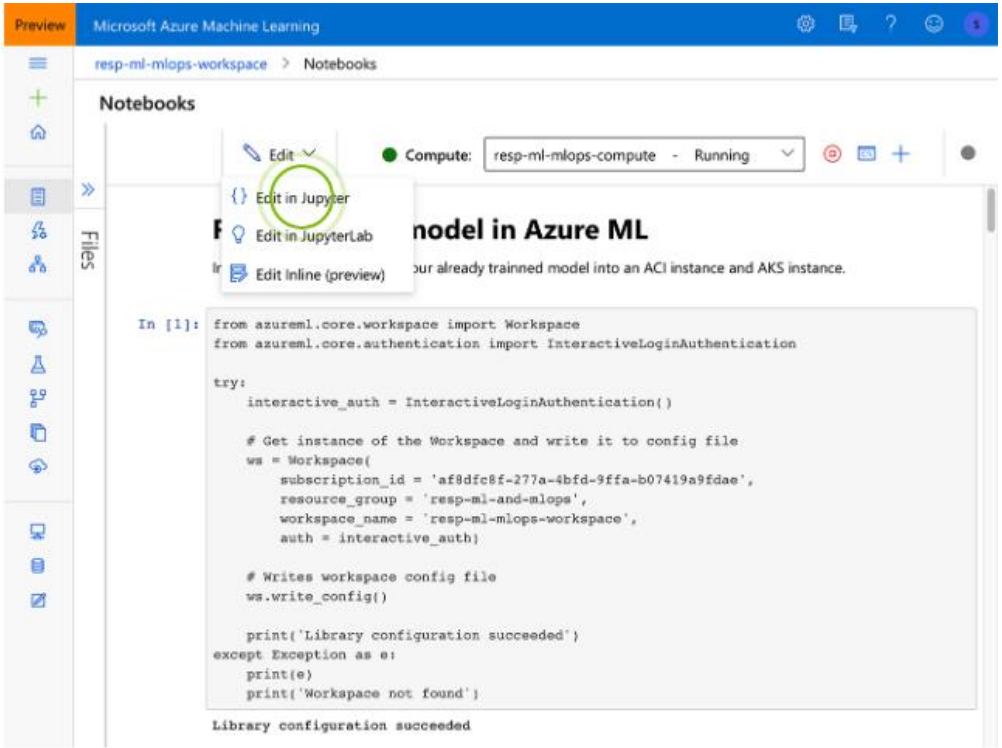


Sam, a data scientist working for Walmart, has added Azure Machine Learning to his workflow to build better models. His automated pipeline just registered a final model with attached experimental results showing improved performance.

The web development team isn't sure how to embed a machine learning model in the web app and has asked for a web service instead.

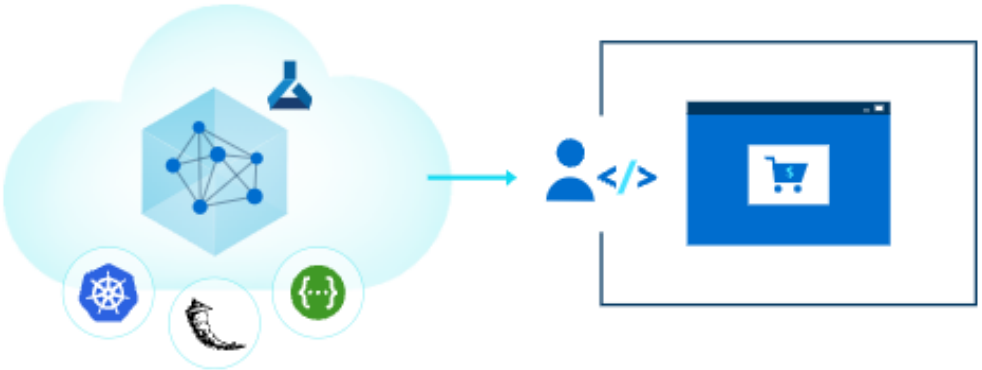
Sam turns to Azure Machine Learning for help adding a web service endpoint to his model.

Azure MlOps



Sam fetches the latest model from the registry and profiles it to see what kind of resources it might need in production.

Azure MlOps

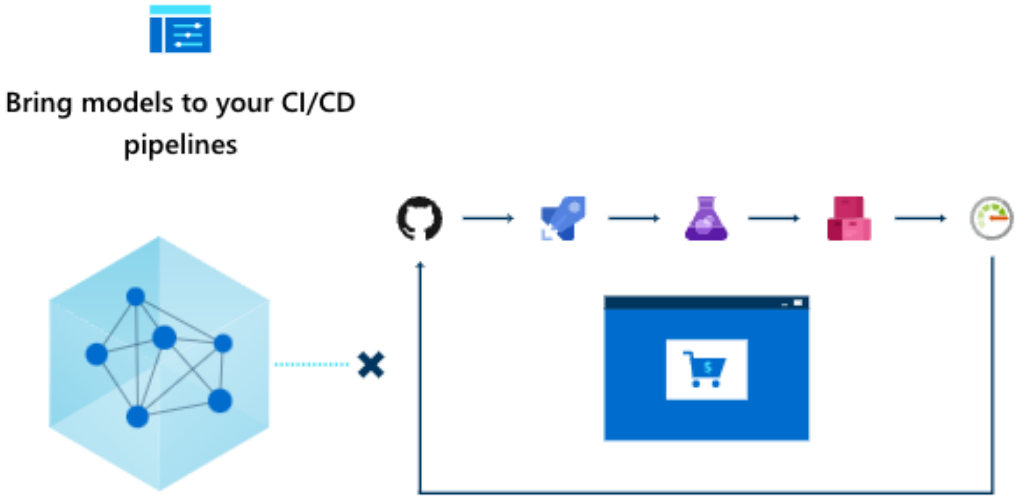


Sam turned his open-source model into a production-ready web service for his development team.

He kept his focus on model development rather than learning the many technologies needed for service hosting, including Kubernetes, Flask, and Swagger.

Azure Machine Learning helps you seamlessly transition your models into mature and fully featured web services, enabling them to be rapidly adopted in applications.

Azure MlOps

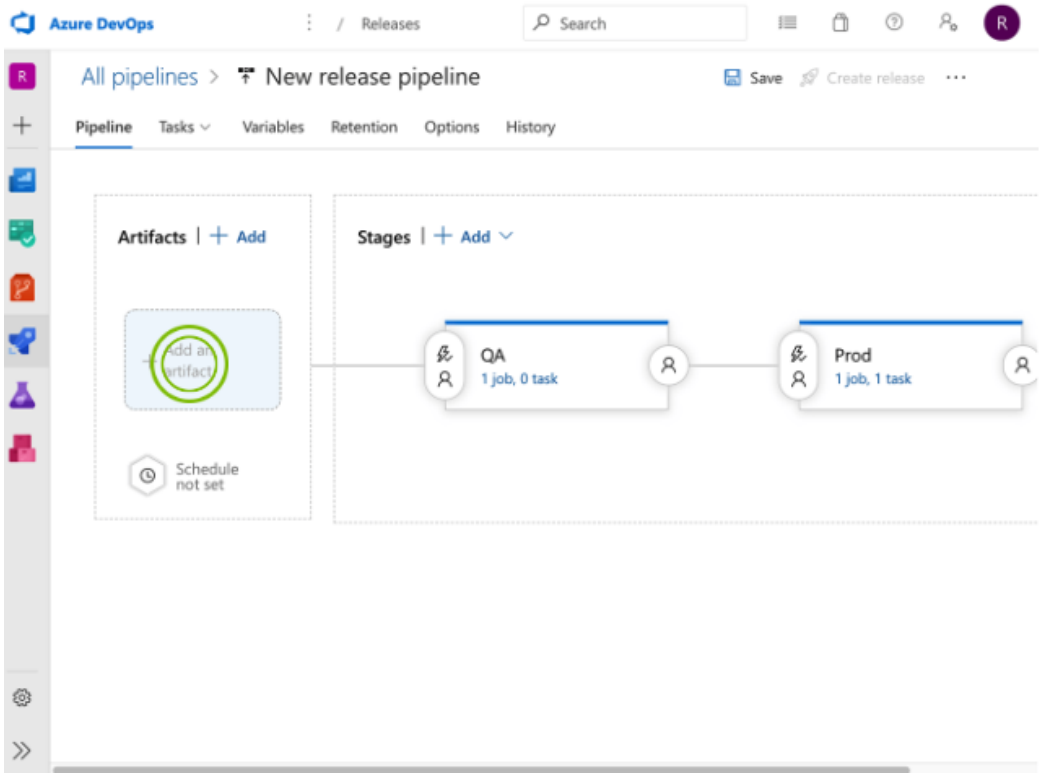


Sam, a data scientist working for Walmart used Azure Machine Learning to build and deploy his models. He recently released his model to a production instance of Azure Kubernetes Service (AKS), and the web team has integrated it into the web app with promising results.

Rebecca, who's on the operations team, wants to ensure that model build and deployment is part of the DevOps workflows.

Sam isn't sure how to incorporate it, so he trains Rebecca on Azure Machine Learning and works with her to determine how it can satisfy both their requirements.

Azure MlOps

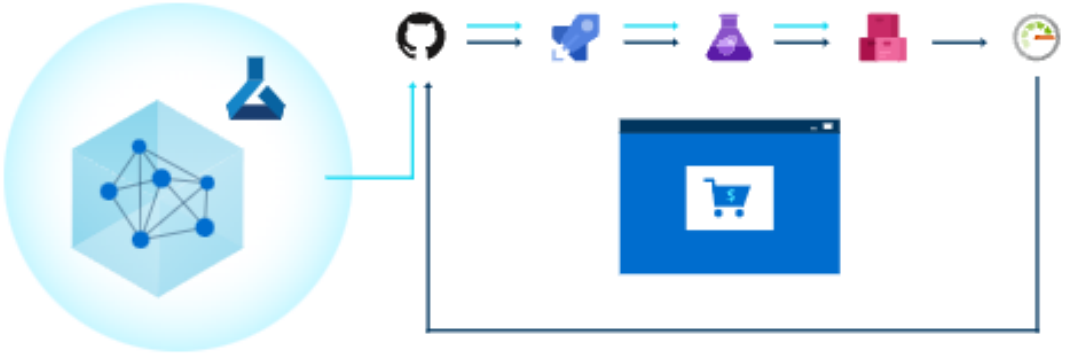


Rebecca creates a pipeline in Azure Pipelines to automate the deployment process.

The first step of the pipeline accomplishes tasks like building the model with all dependencies and checking for errors.

To automatically trigger this pipeline, Rebecca connects it to the Azure Machine Learning model registry, ensuring that it starts whenever a new model or a new version of the model is registered.

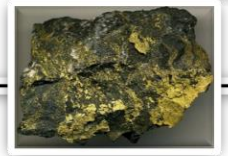
Azure MlOps



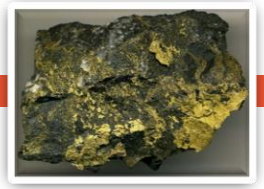
Rebecca incorporated Azure Machine Learning into her DevOps workflow, from release automation through production monitoring. While she keeps an eye on service operations, Sam monitors and manages model performance and optimizes as necessary.

Azure Machine Learning helps elevate data science in your organization's DevOps process, leading to more reliable and robust machine learning projects.

Golden Nuggets



The golden nuggets of coaching



To extract gold from Golden nuggets we need to smelt – Same applies here. Some **action** is needed from MLOps using MLFlow and their understanding.

Golden Nugget (What is MLFlow and How it is effective solution for MLOps?)

You are going to find and understand “**What is MLFlow and How it is effective solution for MLOps?”**

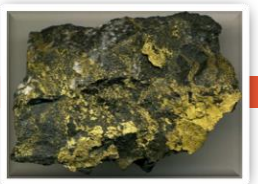
- Explore details on the same and Solve a and deploy a Model using resources given below.

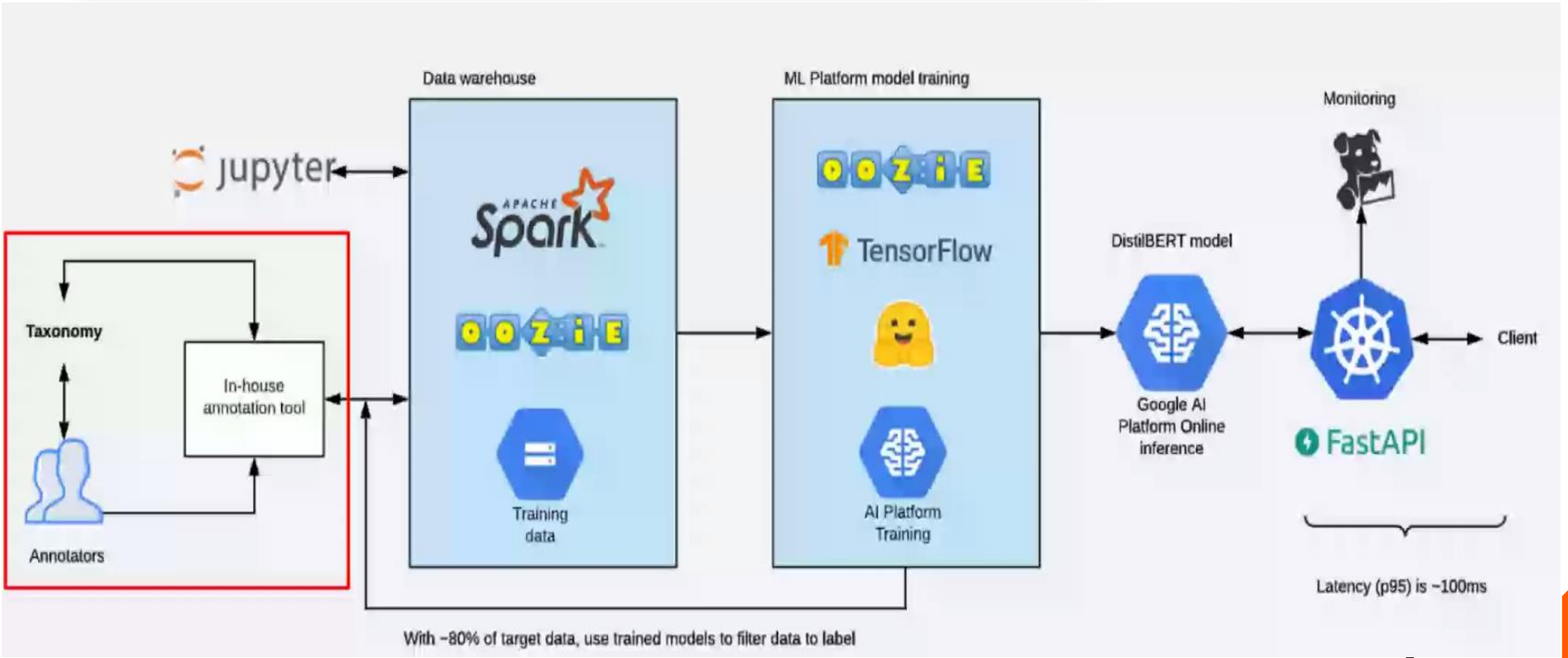
Reference Link:
https://www.youtube.com/watch?v=8SfZ1ElgpdU

https://www.youtube.com/watch?v=ek4mJnDw8eE

https://www.datacamp.com/resources/webinars/practical-guide-to-mlops

Golden Nugget






Q
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THANK
YOU !