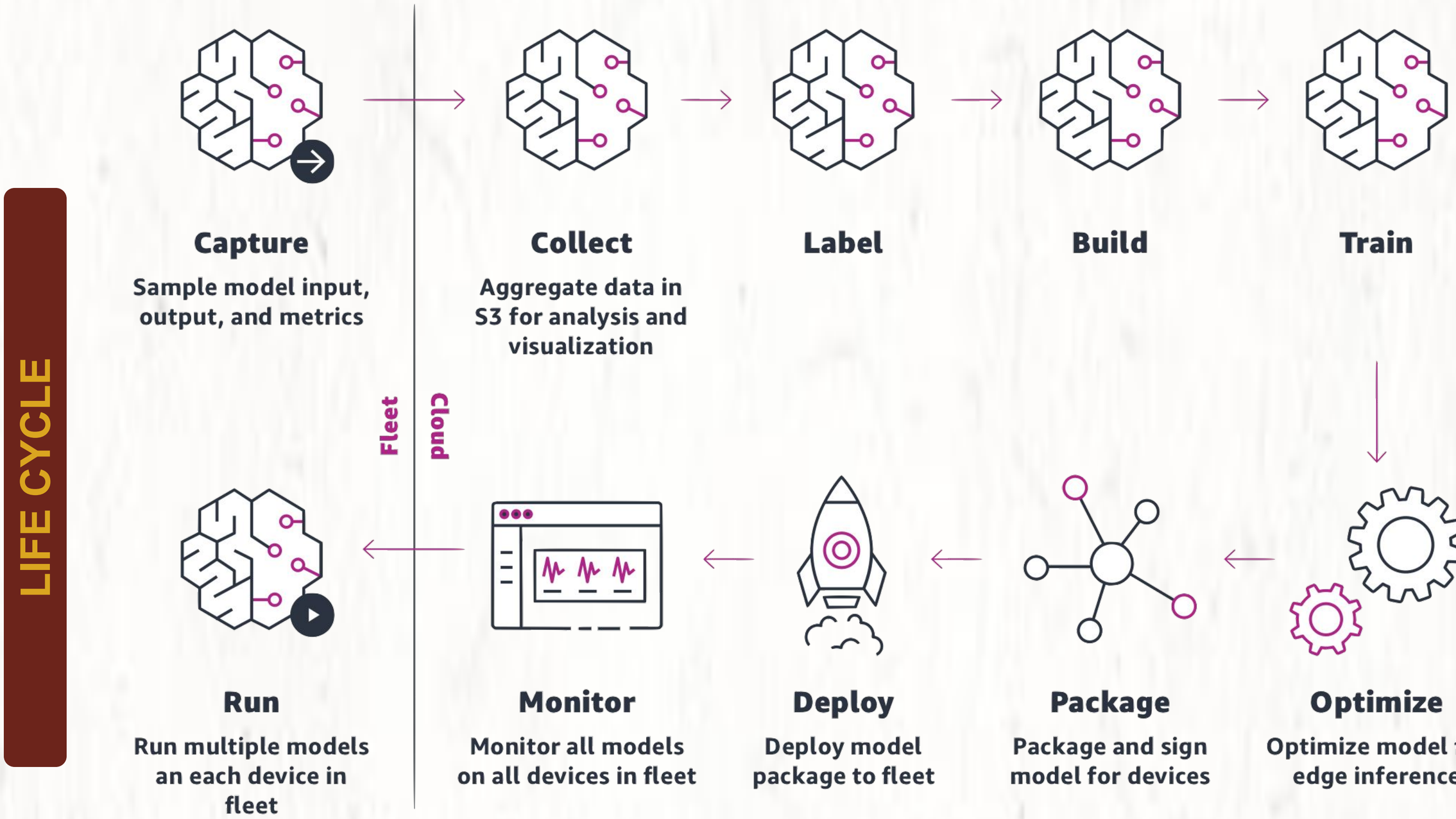
MLOps – Amazon Web Services (AWS)

Source:

- https://startup-resources.awscloud.com/campaign-assets-machine-learning/mlops-emerging-trends-in-data-code-and-infrastructure



MATURITY LEVEL

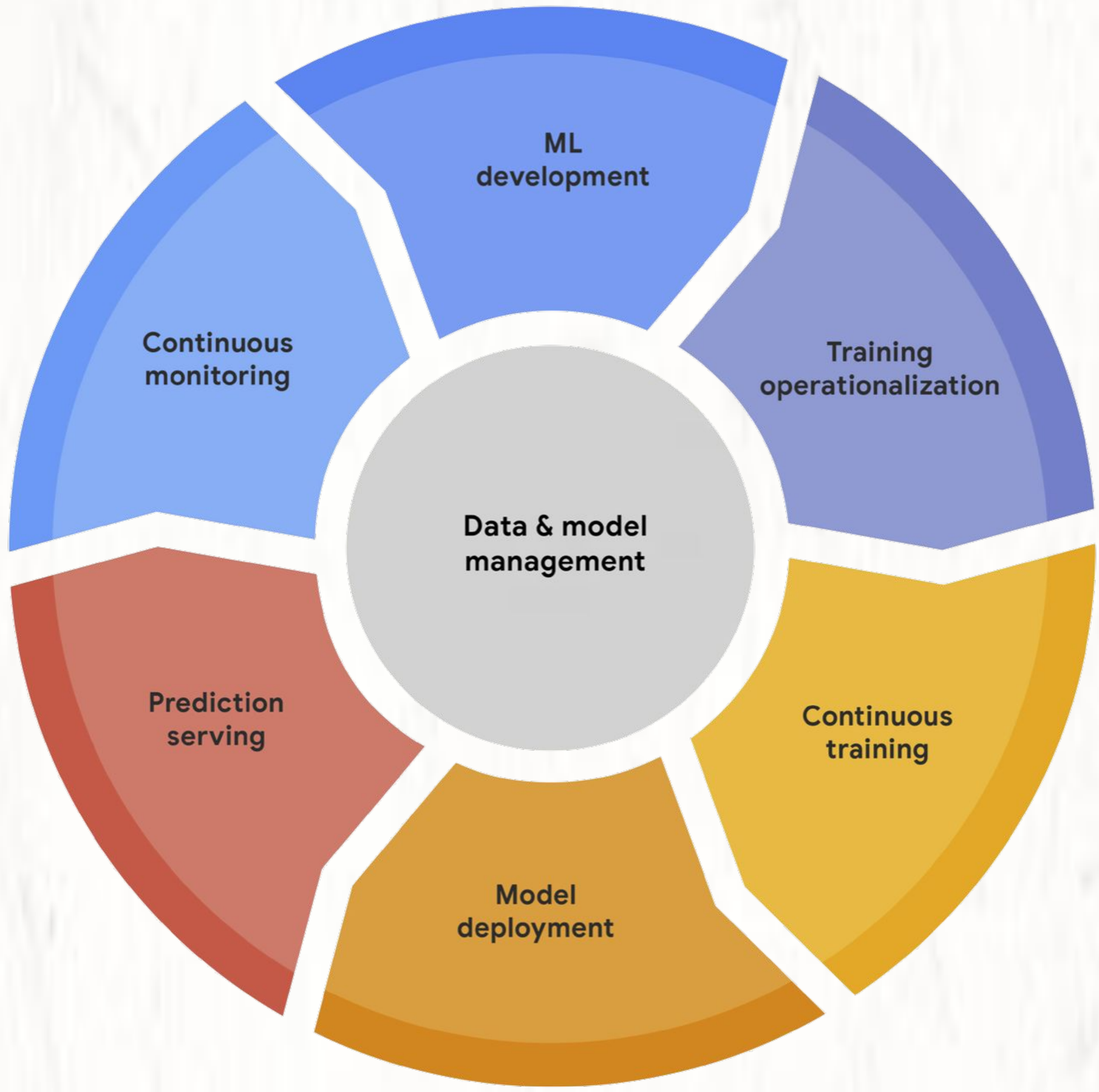
	People	Data	Train	Deploy
Initial	• Disconnected data science & IT teams • Limited cross-training	• Ad-hoc data collection and preparation	• Manual training & retraining • No clear path to deployment	• Manual deployment
Repeatable	• Improved collaboration with stakeholders • Shared project goals	• Automated data pipelines	• Defined path for experimentation • Automated training pipelines • Manual Model Validation	• Automated deployment pipelines • Limited monitoring measuring
Reliable	• Cross-functional project teams • Cross-training	• Automated ML Pipelines • Data Governance	• Experiment Management • Automated ML Pipelines • Model Governance • Automated Model Validation	• Automated MLPipelines • Monitoring & Logging (Model, Workload, Pipeline)
Scalable	• Cross-functional project teams • Cross-training	• CI/CD • Policy-as-Code • Configuration-as Code • Automated Validation	• CI/CD • Policy/Config-as-Code • Automated Model Validation • Automated Integration Validation	• CI/CD • Policy/Infra/ Config-as Code • Model Monitoring • Dashboard & Transparency

MLOps – Google Cloud Platform (GCP)

Sources:

- https://cloud.google.com/resources/mlops-whitepaper
- https://cloud.google.com/architecture/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning

LIFE CYCLE



MATURITY LEVEL

Level 0: Manual Process

- Manual, script-driven, and interactive process
- Disconnection between ML and operations
- Infrequent release iterations
- No CI, No CD
- Prediction service deployment
- No monitoring

Level 1: ML Pipeline Automation

- Rapid experiment
- Continuous Training of the model in production
- Experimental-operational symmetry
- Modularized code for components and pipelines
- Continuous delivery of models
- Training Pipeline deployment

Level 2: CI/CD Pipeline Automation

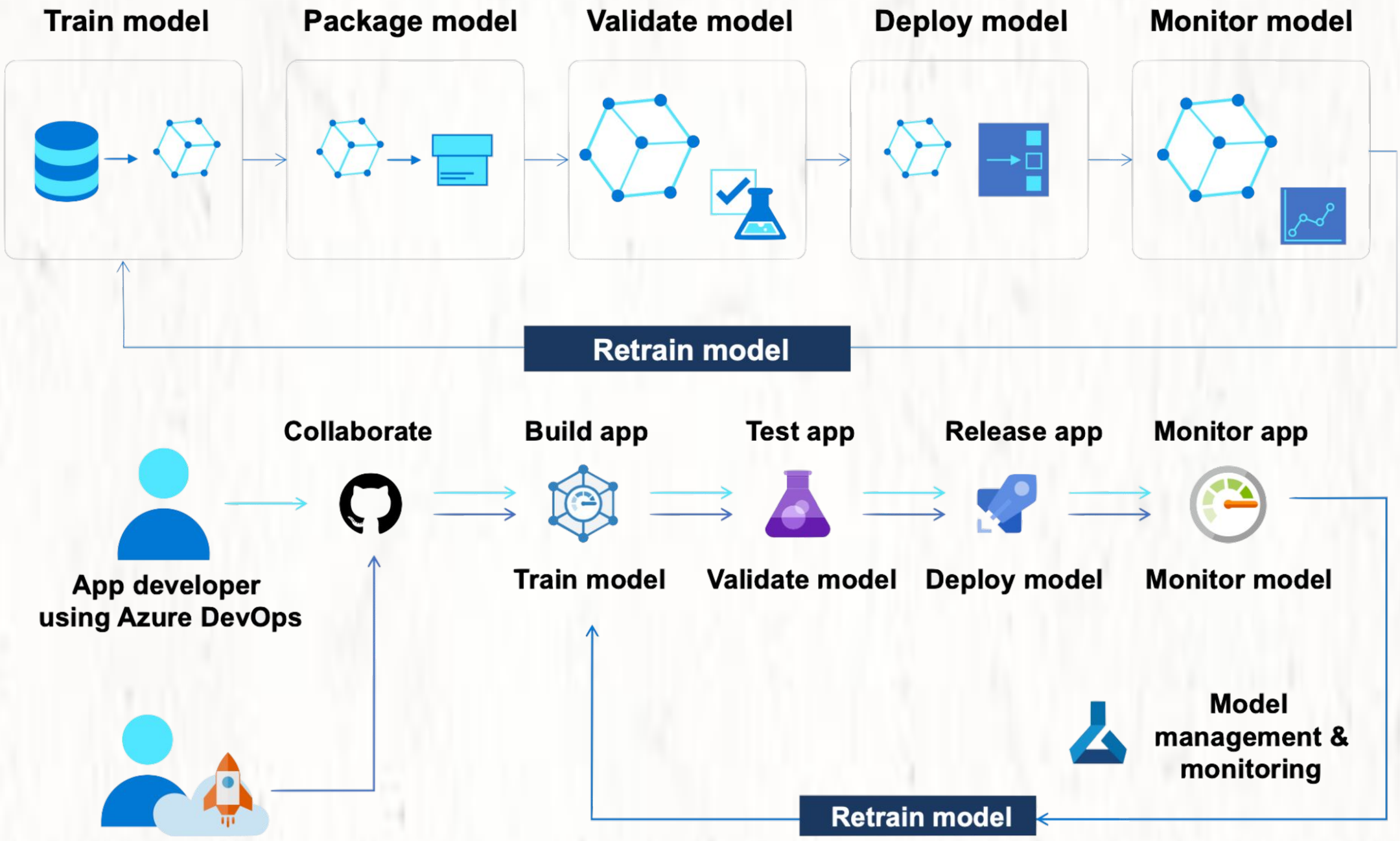
- Development and experimentation
- Continuous Integration of pipeline
- Continuous Delivery of pipeline
- Automated triggering of model retraining
- Continuous Delivery of model
- Monitoring

MLOps – Microsoft Azure

Sources:

- https://azure.microsoft.com/resources/mlops-with-azureml/
- https://docs.microsoft.com/en-us/azure/architecture/example-scenario/mlops/mlops-maturity-model

LIFE CYCLE



Data scientist using Azure Machine Learning

Model performance analysis

MATURITY LEVEL

	1 DevOps, No MLOps	2 Automated Training	3 Automated Model Deployment	4 Full MLOps Automated Retraining
Training	Untracked, file is provided for handoff	Tracked, run results and model artifacts are captured in a repeatable way	Tracked, run results and model artifacts are captured in a repeatable way	Tracked, run results and model artifacts are captured in a repeatable way, retraining set up based on metrics from app
Release	Manual, hand-off	Manual release, clean handoff process, managed by SWE team	Automated, CI/CD pipeline set up, everything is version controlled	Automated, CI/CD pipeline set up, everything is version controlled, A/B testing has been added
Integration	Manual, heavily DS driven	Manual, heavily DS driven, basic integration tests added	Semi-automated, unit and integration test added, still needs human signoff	Semi-automated, unit and integration test added, may need human signoff
People	Siloed	Mix of siloed and cooperative	Mostly cooperative with some siloing	Fully cooperative