Building Machine Learning Models on Databricks

Introducing Machine Learning on Databricks

Janani Ravi
Co-founder, Loonycorn

www.loonycorn.com

Overview

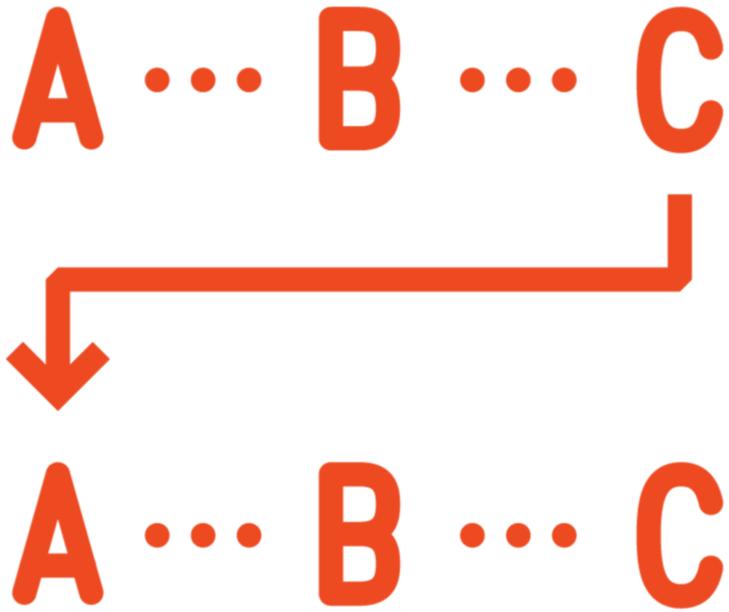
A quick introduction to Databricks

The Databricks ML runtime

MLflow to manage the machine learning workflow

Prerequisites and Course Outline

Prerequisites



Comfortable programming in Python

Comfortable with ML using scikit-learn and/or XGBoost

Familiar with the Databricks platform

Prerequisite Courses

Building Machine Learning Models in Python with scikit-learn

Machine Learning with XGBoost Using scikit-learn in Python

Prerequisite Courses

Getting Started with the Databricks Lakehouse Platform

Getting Started with Apache Spark on Databricks

Course Outline

A quick introduction to Databricks

Implementing scikit-learn Models in Databricks

Implementing XGBoost Models in Databricks

Hyperparameter Tuning for Machine Learning Models

Overview of Databricks

Databricks

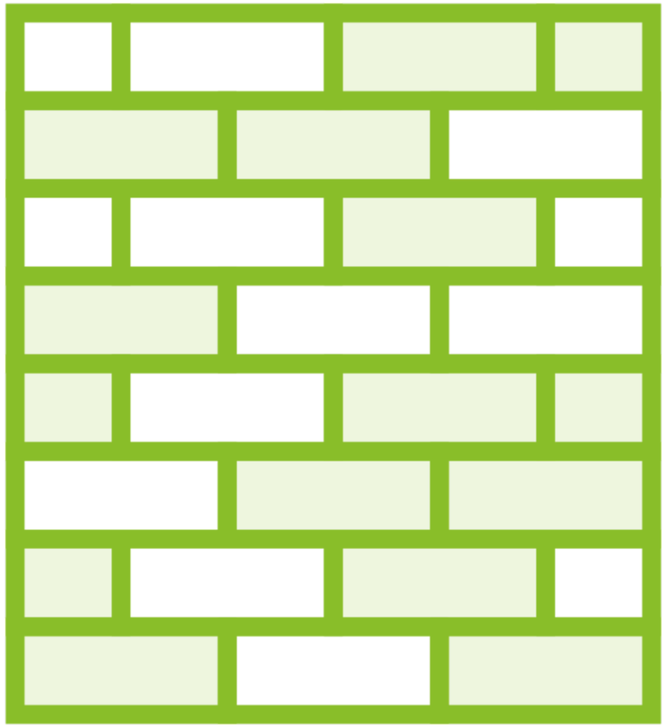
An enterprise software company founded by the creators of Apache Spark. The company has also created Delta Lake, MLflow, and Koalas, – all open source projects that span data engineering, data science, and machine learning.

https://en.wikipedia.org/wiki/Databricks

Databricks

A cloud-native platform for big data processing, machine learning, and analytics built using the Data Lakehouse architecture.

Databricks



Provides a unified set of tools for enterprise-grade solutions

Tools for building, deploying, sharing, and maintaining these solutions

Is cloud-native - manages and deploys cloud infrastructure on your behalf

Integrates with cloud storage and security in your cloud

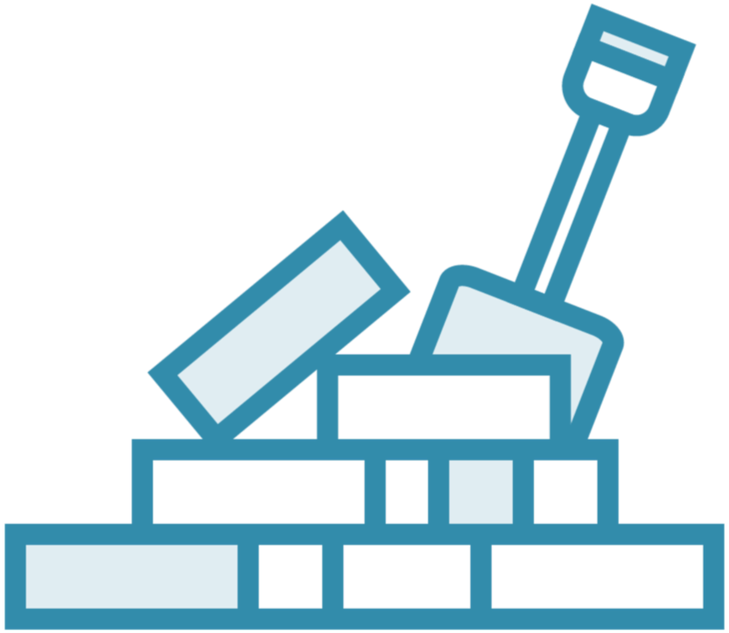
Databricks

AWS

Azure

GCP

Databricks Core Tools



Apache Spark for big data processing

Delta Lakes to allow ACID transactions, versioning on huge datasets

SQL engine to run queries and build dashboards

Popular machine learning tools for traditional and deep learning models

Databricks provides the resources and tools needed to build and maintain Spark-based applications...

...and also includes features to simplify business analytics and build ML pipelines.

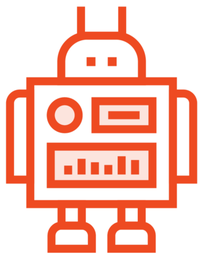
Databricks Data Analytics Platform

Databricks SQL

Platform for analysts to run SQL queries on data, create visualizations, share dashboards

Databricks Data Science and Engineering

Interactive workspace for collaboration between data engineers, data science, and ML engineers to generate insights using Spark.



Databricks Machine Learning

Integrated end-to-end machine learning environment with managed services for the ML workflow

Databricks Data Analytics Platform

Databricks SQL

Platform for analysts to run SQL queries on data, create visualizations, share dashboards

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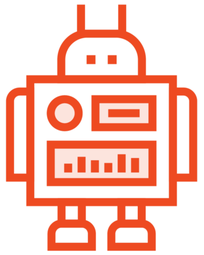
Interactive workspace for collaboration between data engineers, data science, and ML engineers to generate insights using Spark.

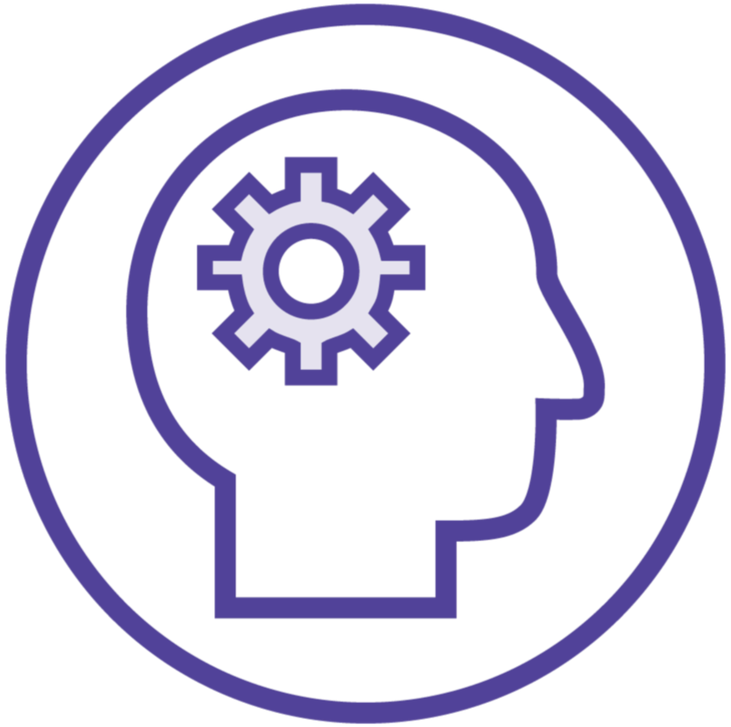


Databricks Machine Learning

Integrated end-to-end machine learning environment with managed services for the ML workflow

The Databricks Machine Learning Runtime

Databricks ML Runtime

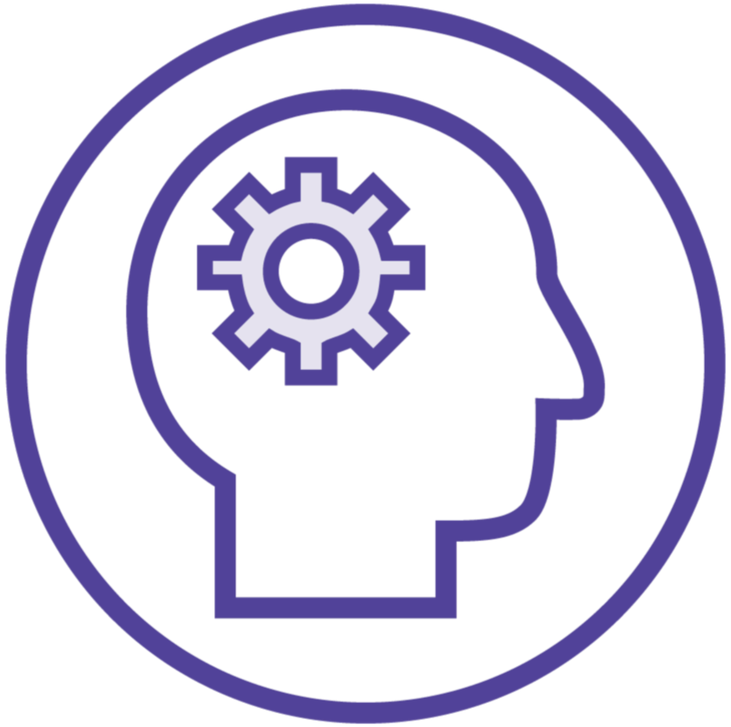


Automates the creation of a cluster optimized for machine learning

Includes popular ML libraries:

- scikit-learn
- XGBoost
- Spark ML
- TensorFlow
- PyTorch

Databricks ML Runtime



Includes support for distributed training libraries such as Horovod

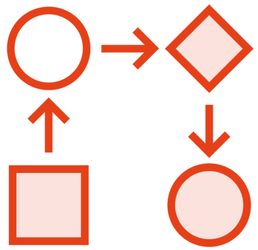
Includes tools to automate the model development process

Performs hyperparameter tuning to find the best model

Automate Machine Learning

AutoML

Automatically creates, tunes, and evaluates models.



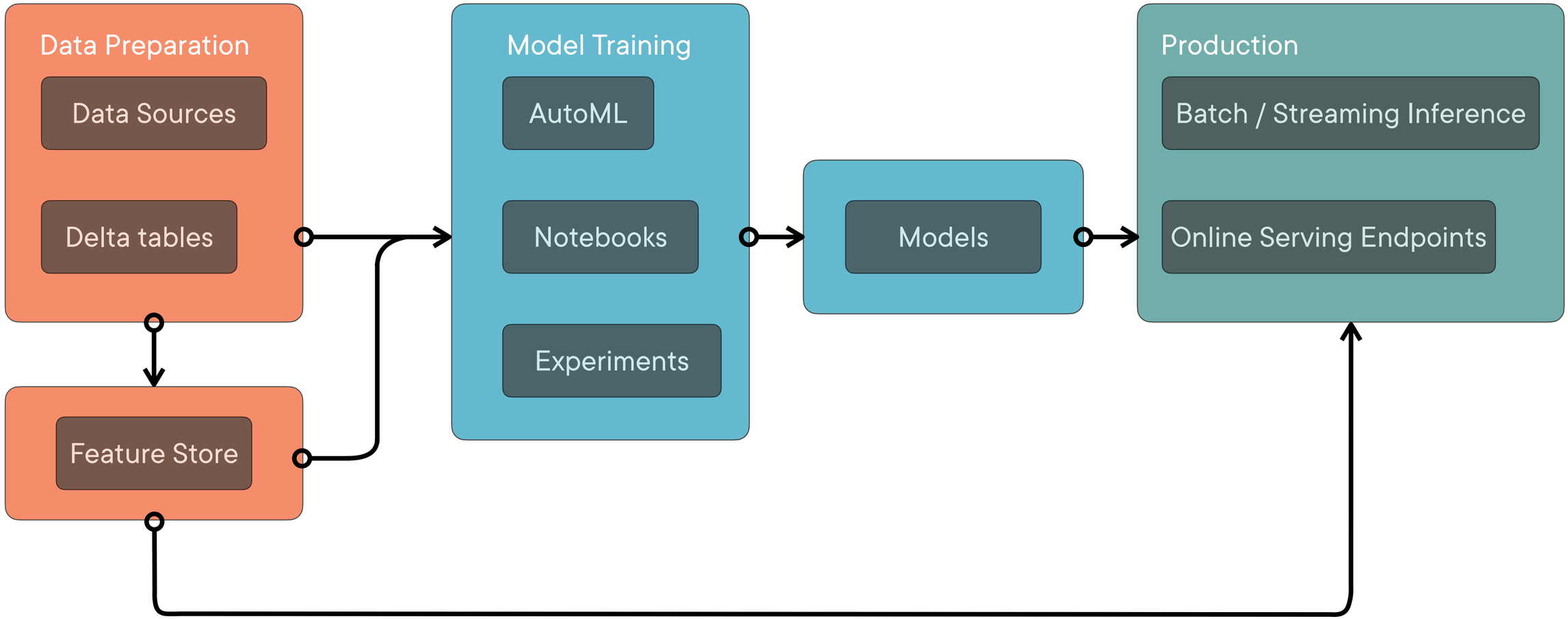
Managed ML Flow

Manages the end-to-end model lifecycle, including tracking experiment runs, deploying, registering, and sharing models

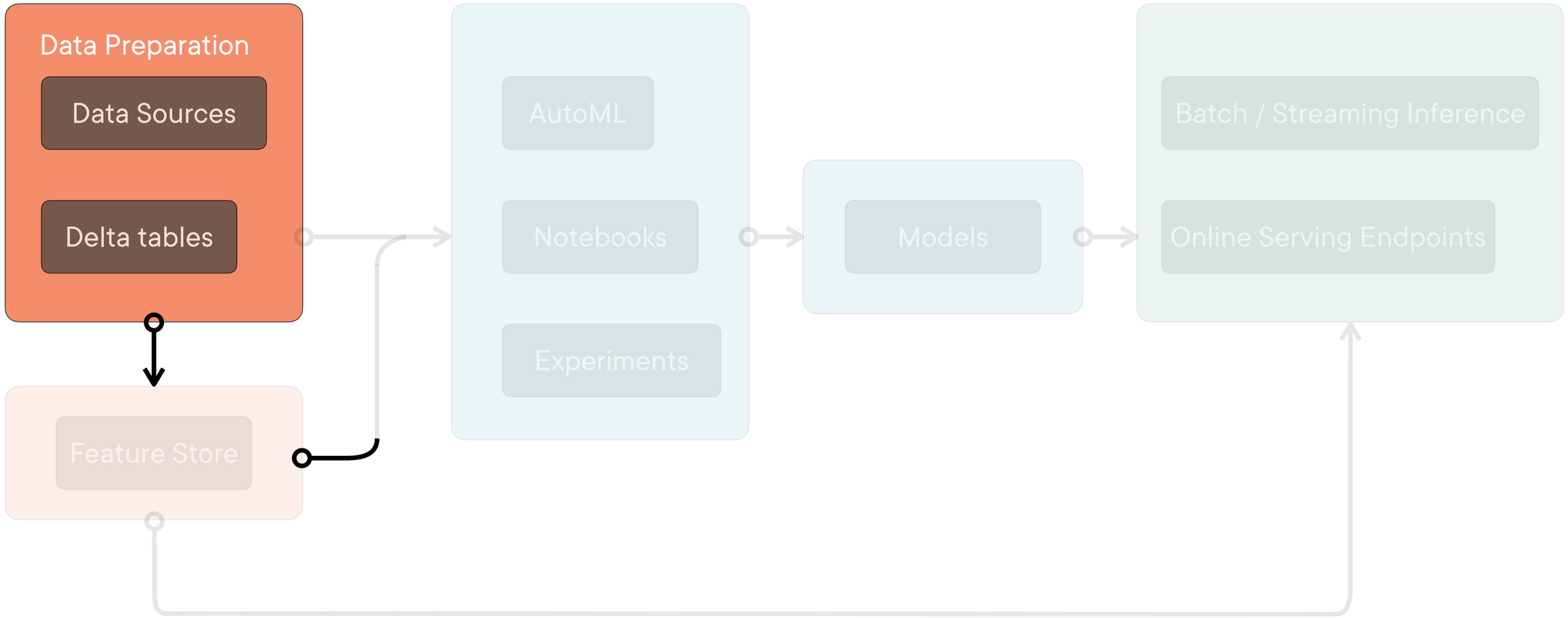
Hyperopt

Uses the SparkTrials class to simplify hyperparameter tuning by automating and distributing model tuning runs

End-to-end Machine Learning Environment

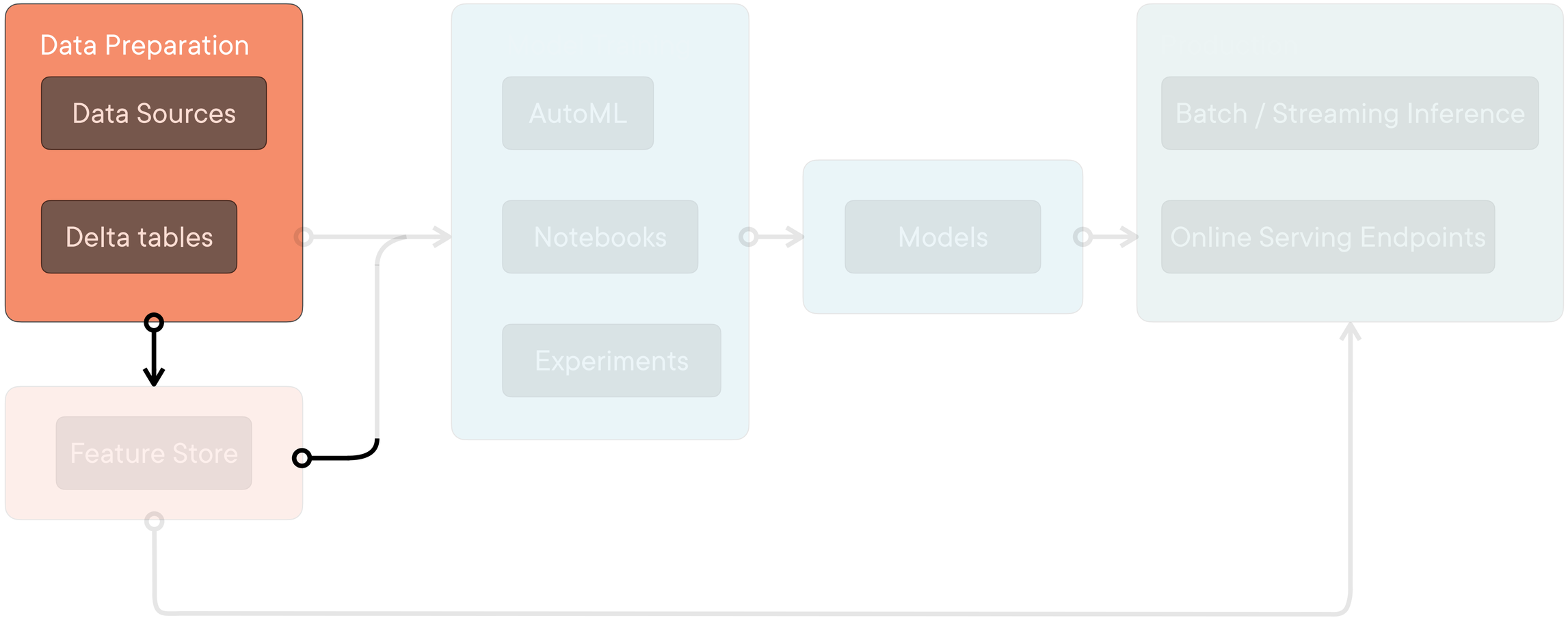


Data Preparation



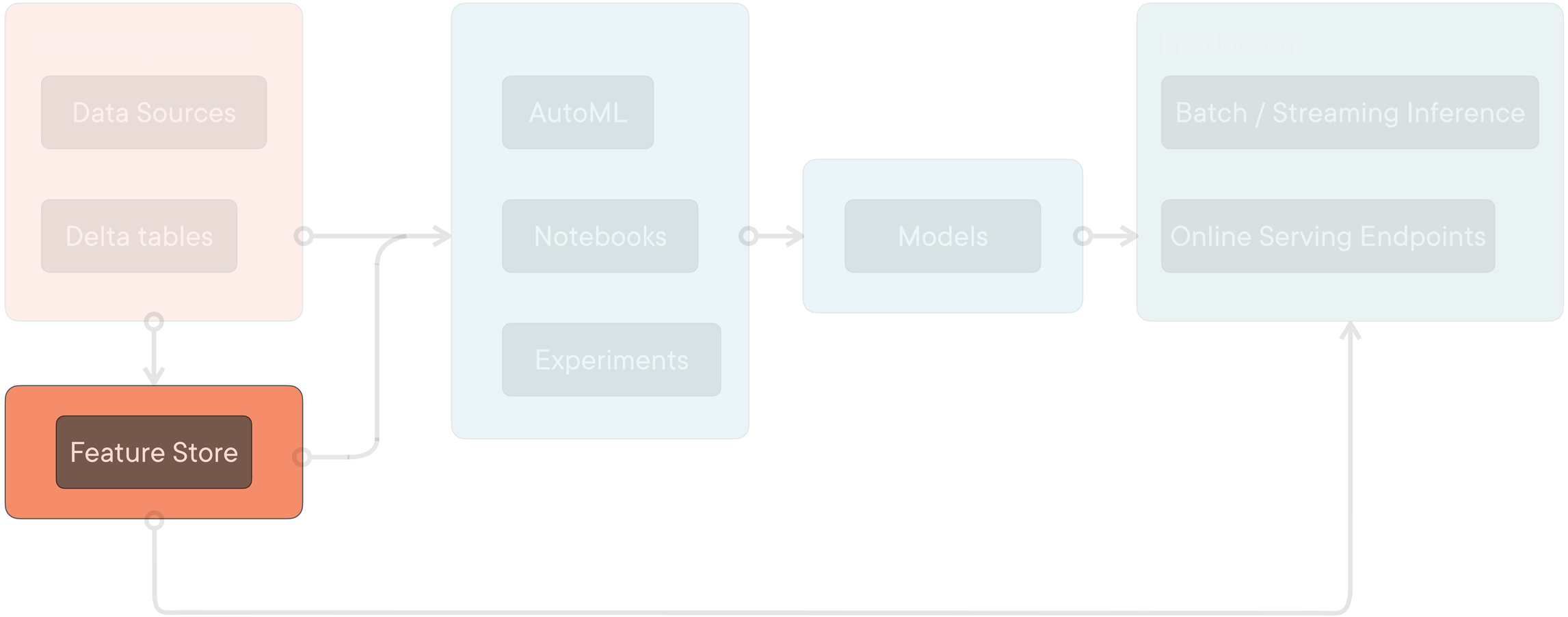
Use Spark or native programming language libraries to connect to data sources

Data Preparation



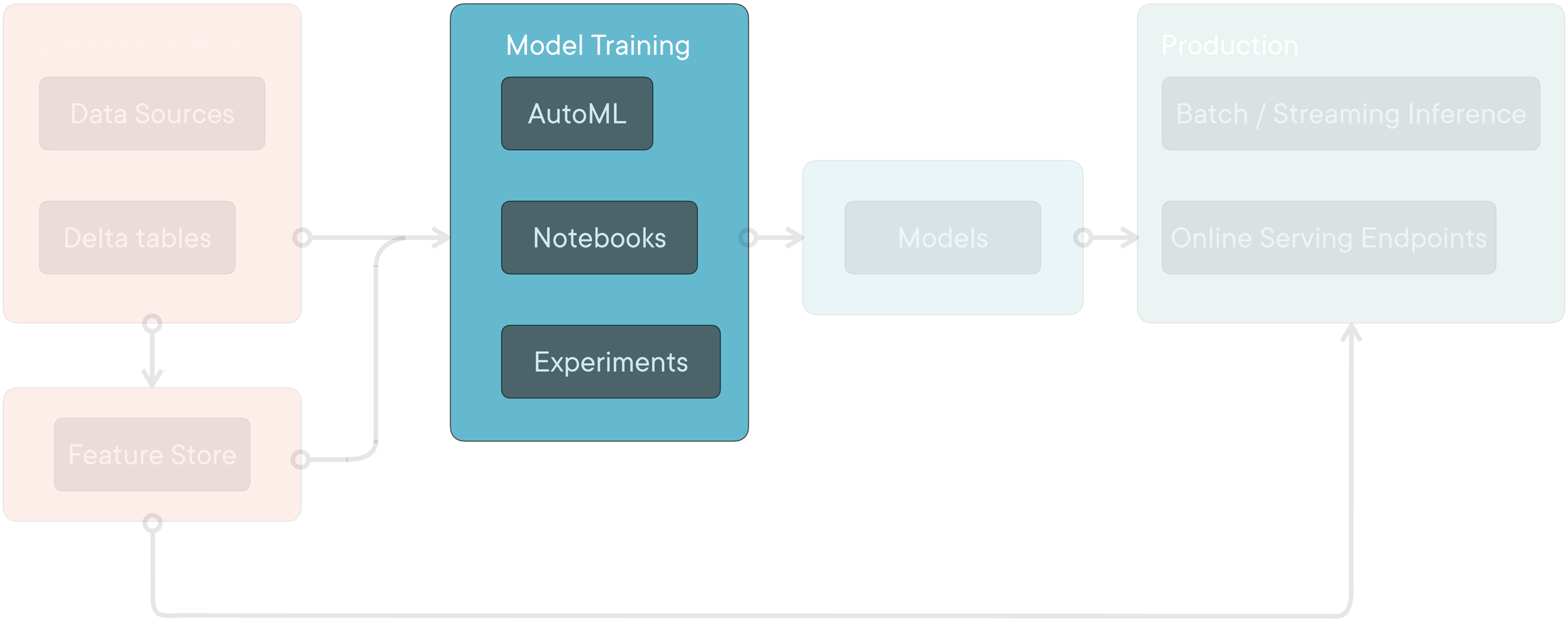
Delta tables offer transaction support, version control, and revision history for huge datasets

Feature Store



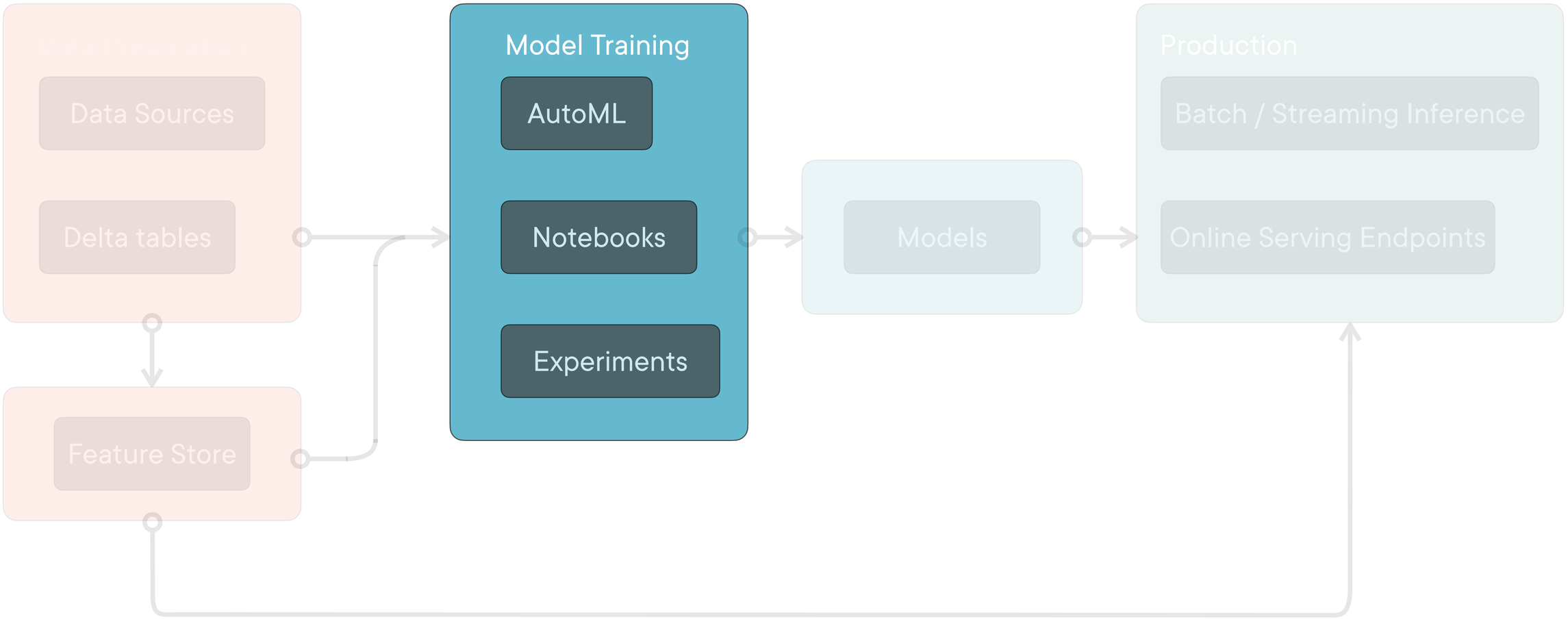
Feature tables in the feature store allows you to store processed features for model training and inference

Model Training



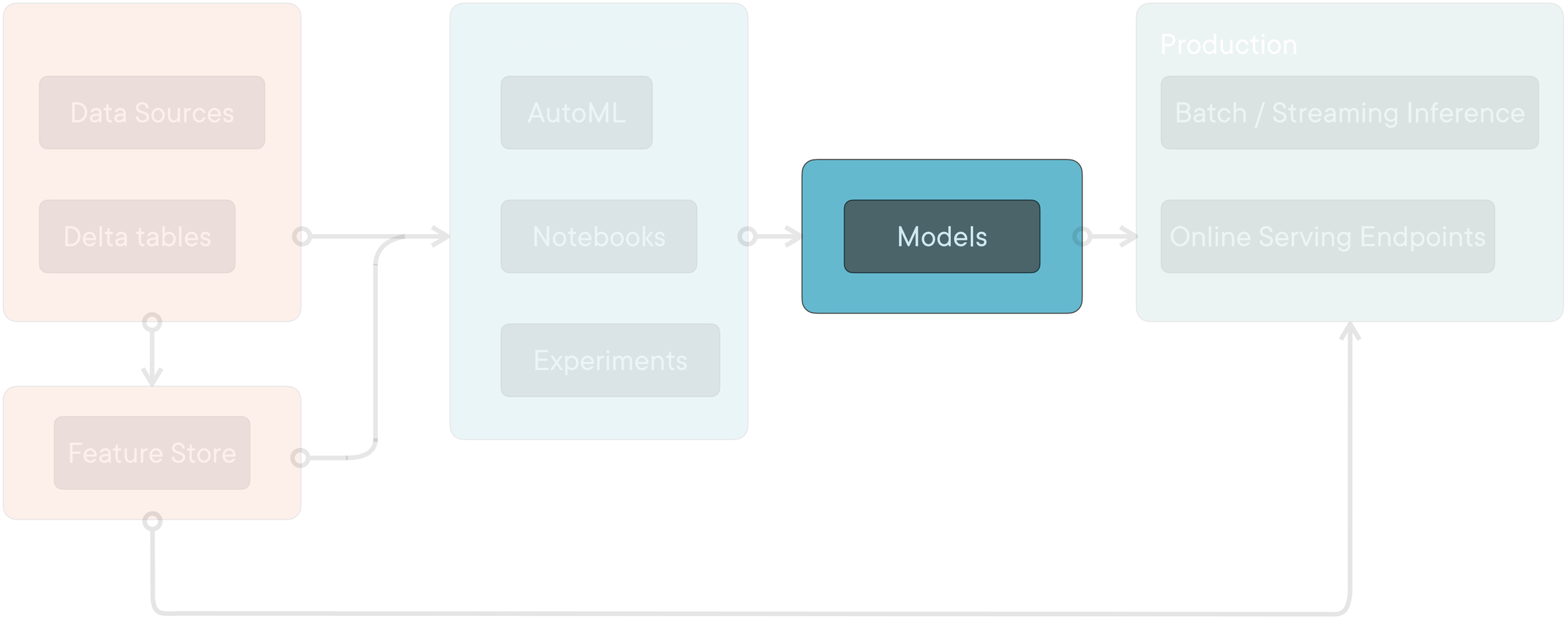
Model training can be performed using custom code or with AutoML

Model Training



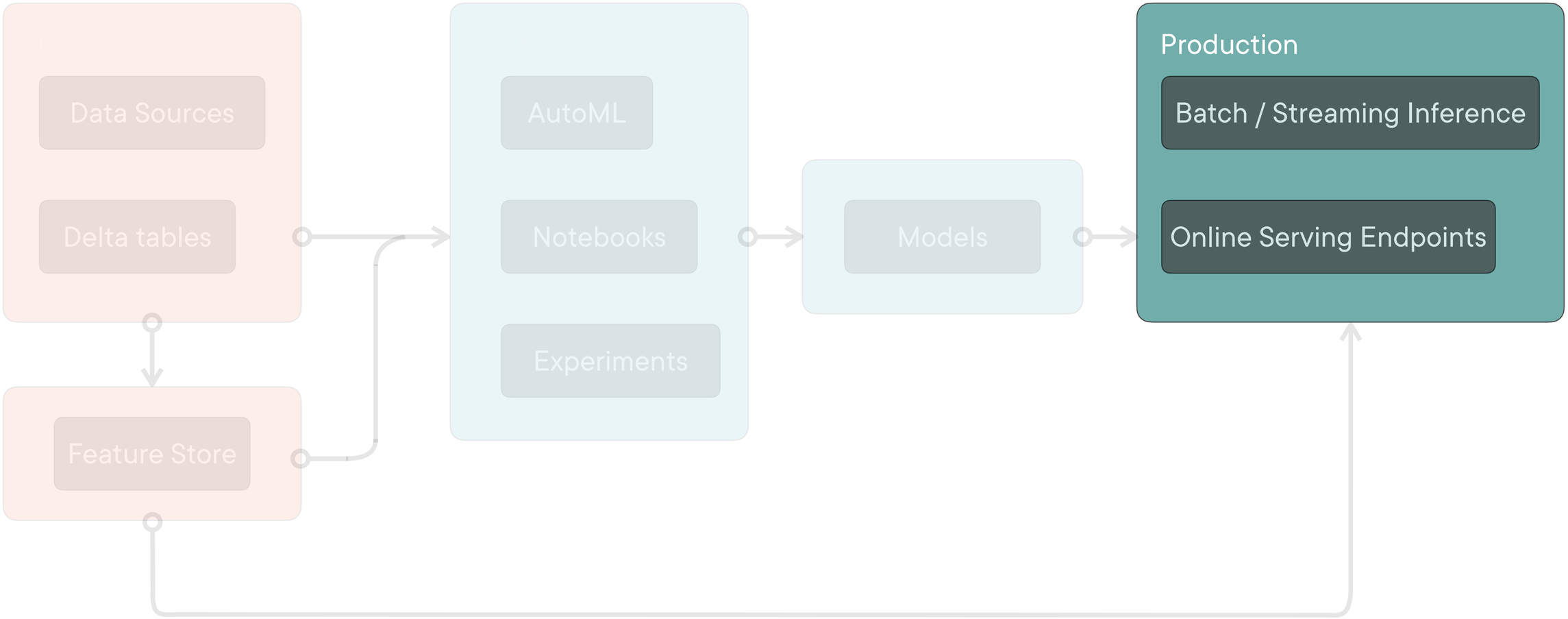
Track parameters and models using experiments with MLflow tracking

Model Registry



Share, manage, and serve models using the Model Registry

Model Inference



Deploy models to production and perform inference on batch as well as streaming data

Introducing MLflow

MLflow

Open-source platform for managing the end-to-end machine learning lifecycle which includes model tracking, a model registry, model serving and inference.

https://docs.databricks.com/mlflow/index.html

MLflow Components

Tracking

Models

Projects

Model Registry

Model Serving

MLflow Components

Tracking

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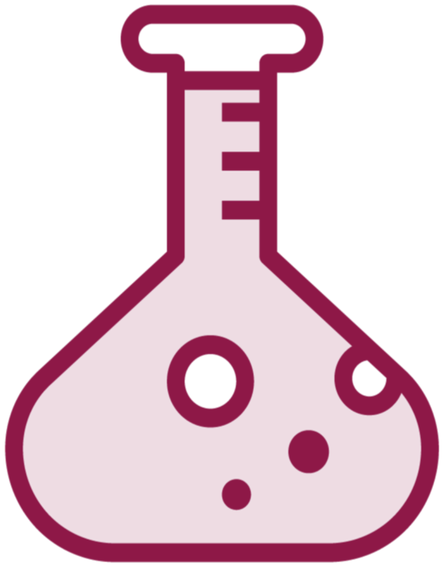
Model Tracking

API and UI for logging parameters, code versions, metrics, and output files

Tracking lets you log and query experiments

Supported technologies and languages include Python, REST, R API, and Java APIs

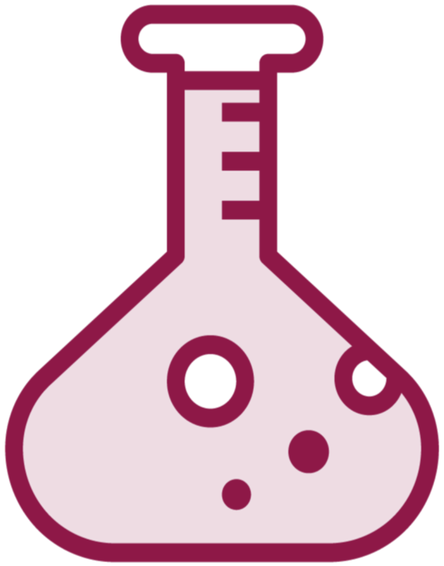
MLflow Tracking Concepts



Experiments

Runs

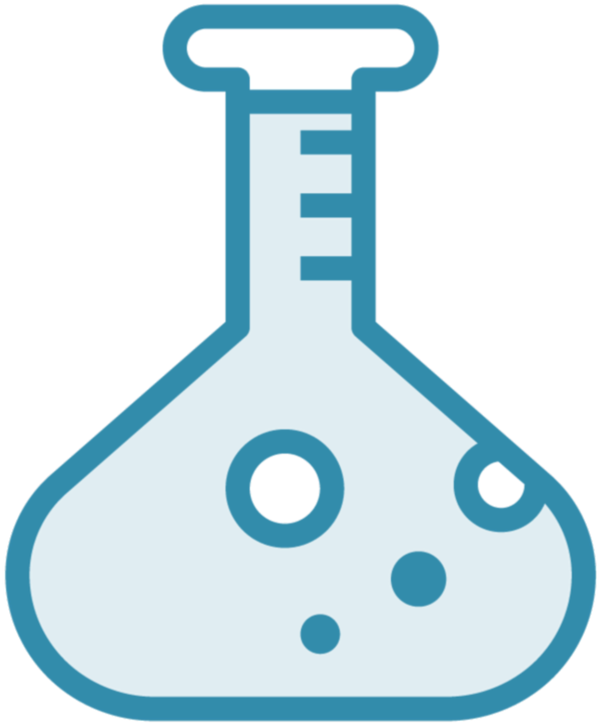
MLflow Tracking Concepts



Experiments

Runs

Experiments



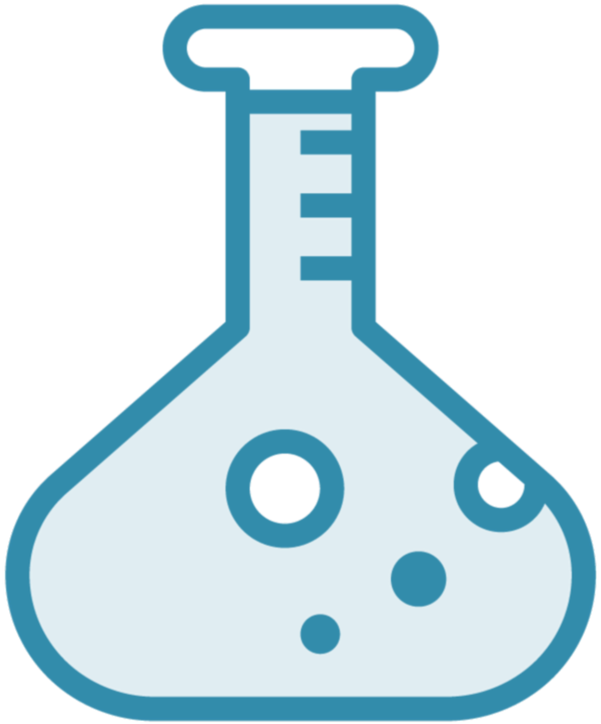
Primary unit of organization and access control for runs

Allows you to visualize, search for, and compare runs

Two types of experiments:

- Workspace experiment
- Notebook experiment

Experiments



Workspace experiment:

- Belongs to the workspace
- Not associated with a notebook
- Runs in any notebook can log to them

Notebook experiment:

- Associated with a specific notebook
- Automatically created if no active experiment for a run

MLflow Tracking Concepts

Experiments

Runs

Runs

Single execution of model code

Contains the following information:

- Notebook
- Version
- Start and end time
- Metrics
- Tags
- Artifacts

MLflow Components

Tracking

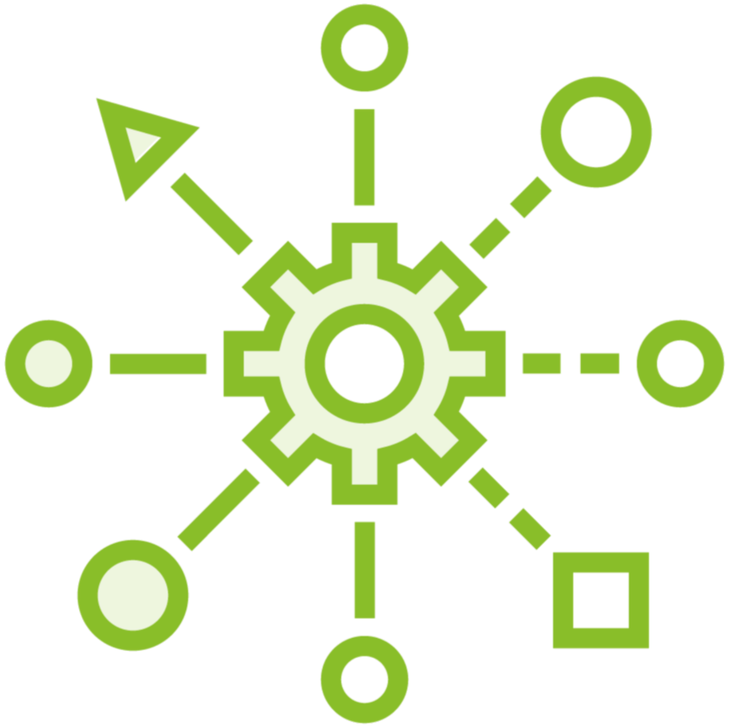
Models

Projects

Model Registry

Model Serving

Models and Model Serving



Manage and deploy models built using popular machine learning libraries

Supports multiple model serving and inference platforms

- Classic MLflow model serving using REST endpoints
- Serverless real-time inferencing allows scalable REST endpoints

MLflow Components

Tracking

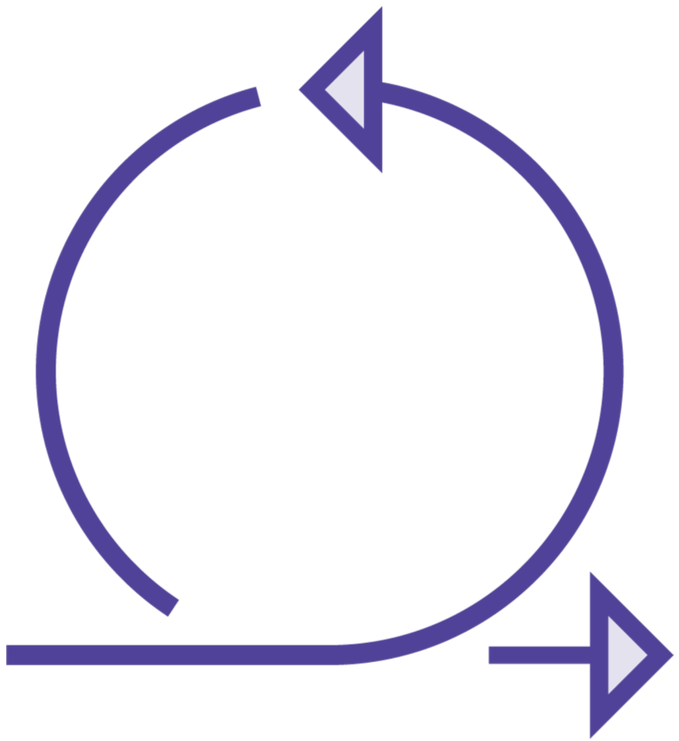
Models

Projects

Model Registry

Model Serving

Projects



Package ML code in a reusable and reproducible form

Allows sharing with other data scientists or transfers to production

MLflow Components

Tracking

Models

Projects

Model Registry

Model Serving

Model Registry

Centralized model store where models can be registered and managed

Manage lifecycle stage transitions from staging to production

Allows versioning and annotation of models

Demo

Getting set up with the Machine Learning environment on Databricks

Summary

A quick introduction to Databricks

The Databricks ML runtime

MLflow to manage the machine learning workflow

Up Next:
Implementing scikit-learn Models in Databricks