

Slides That are used as screenshots in the github/statmike/vertex-ai-mlops repository

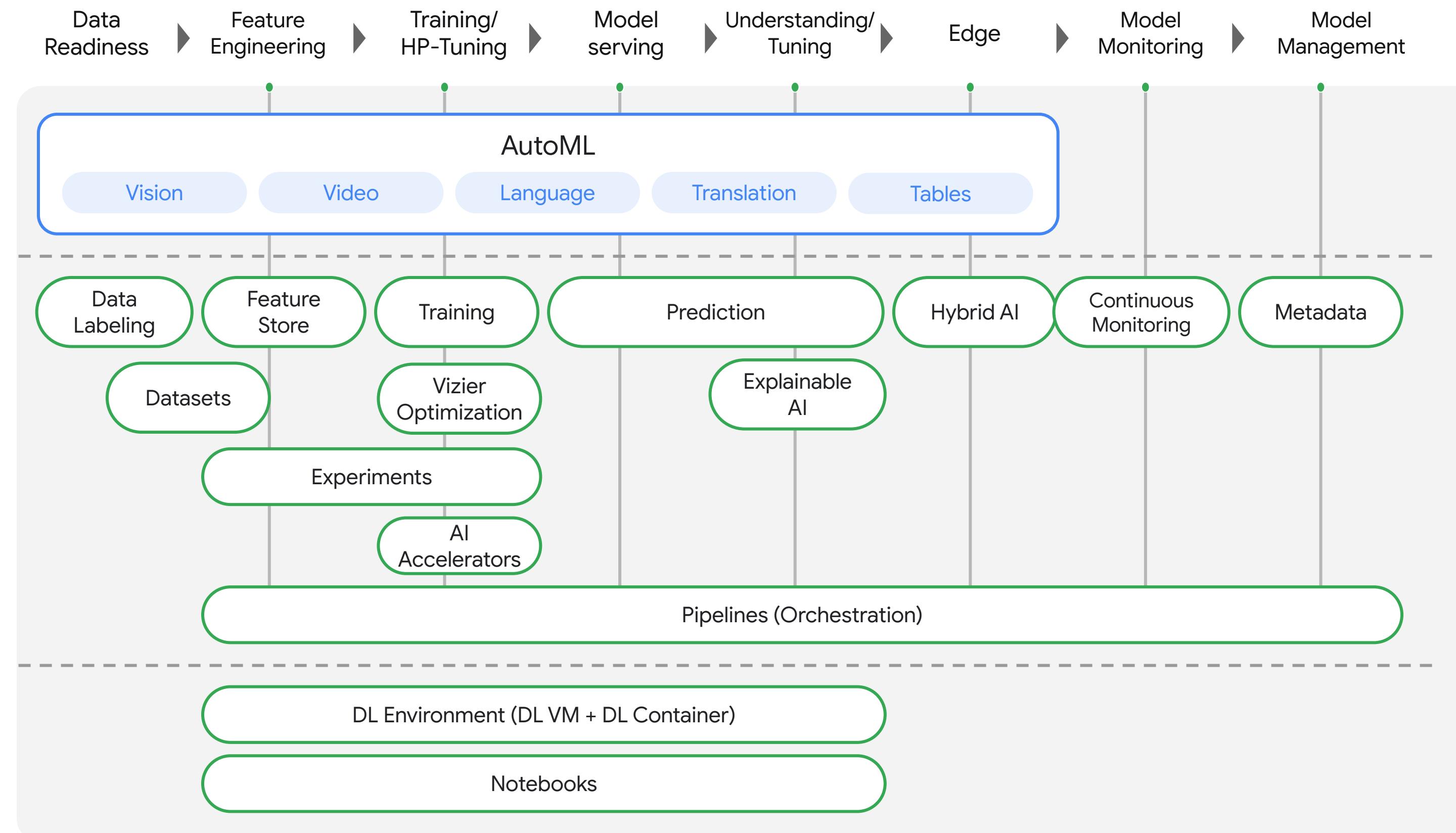
Notes:

- Do not insert new slides or reorder without updating the notebooks. The slides are exported to numbered .png files that are referenced in the notebooks

Process

- Save as PDF
- Copy to `github/statmike/vertex-ai-mlops/architectures/slides`
- Convert PDF to PNG images
 - Use Notebook: `/architectures/Create Images.ipynb`
 - OUTPUT:
 - To `/architectures/slides`

Vertex AI Overview



Vertex AI

Dashboard

Dashboard

Datasets

Features

Labeling tasks

Notebooks

Pipelines

Training

Experiments

Models

Endpoints

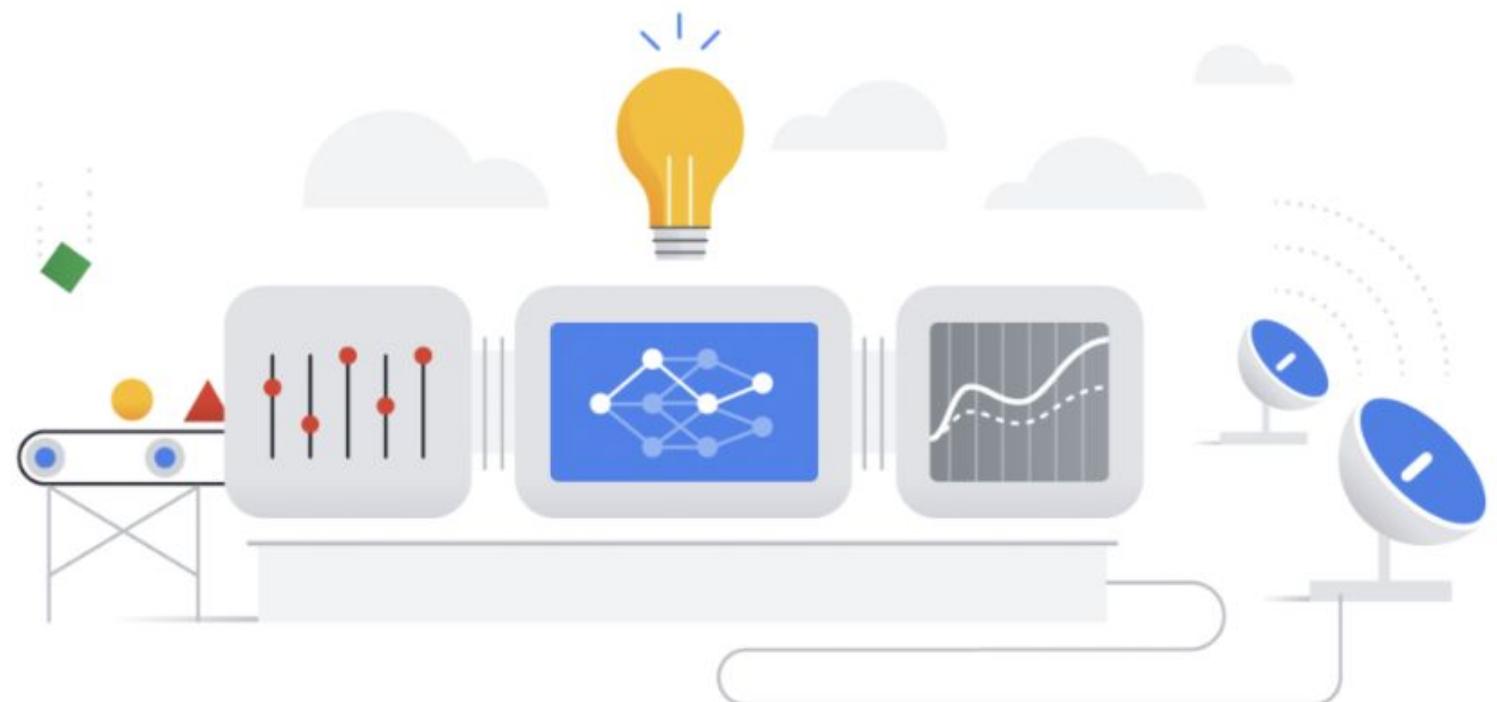
Batch predictions

Metadata

Marketplace

Get started with Vertex AI

Vertex AI empowers machine learning developers, data scientists, and data engineers to take their projects from ideation to deployment, quickly and cost-effectively. [Learn more](#)



Region

us-central1 (Iowa)



Recent datasets

- ✓ 02c_digits_20210919213805 16 hours ago
- ✓ 02b_digits_20210919205707 20 hours ago
- ✓ 02a 4 days ago
- ✓ 02b_digits_20210916141540 4 days ago
- ✓ 02c_digits_20210916004500 5 days ago

[+ CREATE DATASET](#)

Recent models

- ✓ 05f_digits_20210920145828 1 hour ago
- ✓ 05e_digits_20210920125450 3 hours ago
- ✓ 02c_digits_20210919213805 12 hours ago
Average precision: 1
- ✓ 02b_digits_20210919205707 19 hours ago
Average precision: 1
- ✓ 05c_digits_20210919214125-model 19 hours ago

[+ TRAIN NEW MODEL](#)

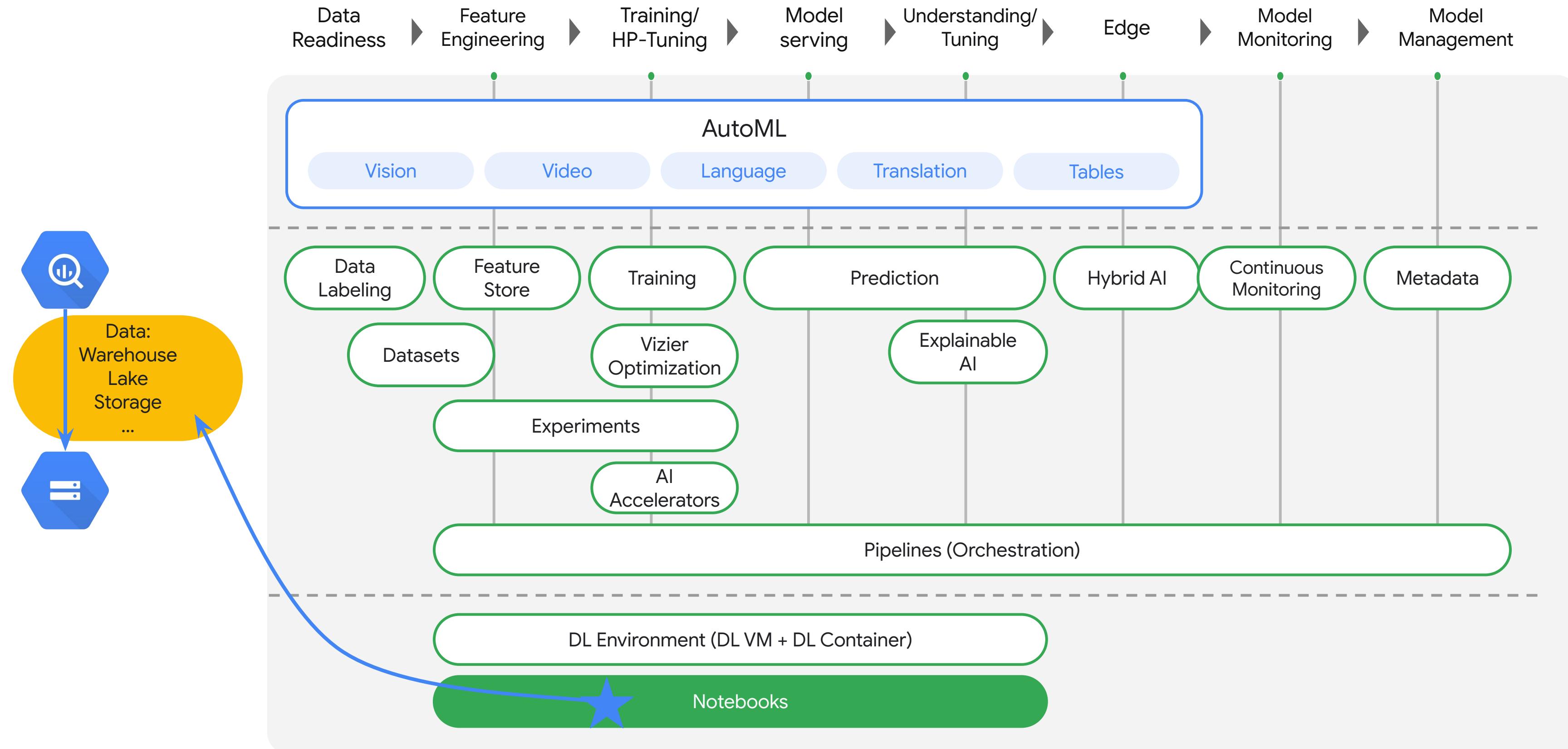
Get predictions

After you train a model, you can use it to get predictions, either online as an endpoint or through batch requests

[+ CREATE BATCH PREDICTION](#)[Show debug panel](#)

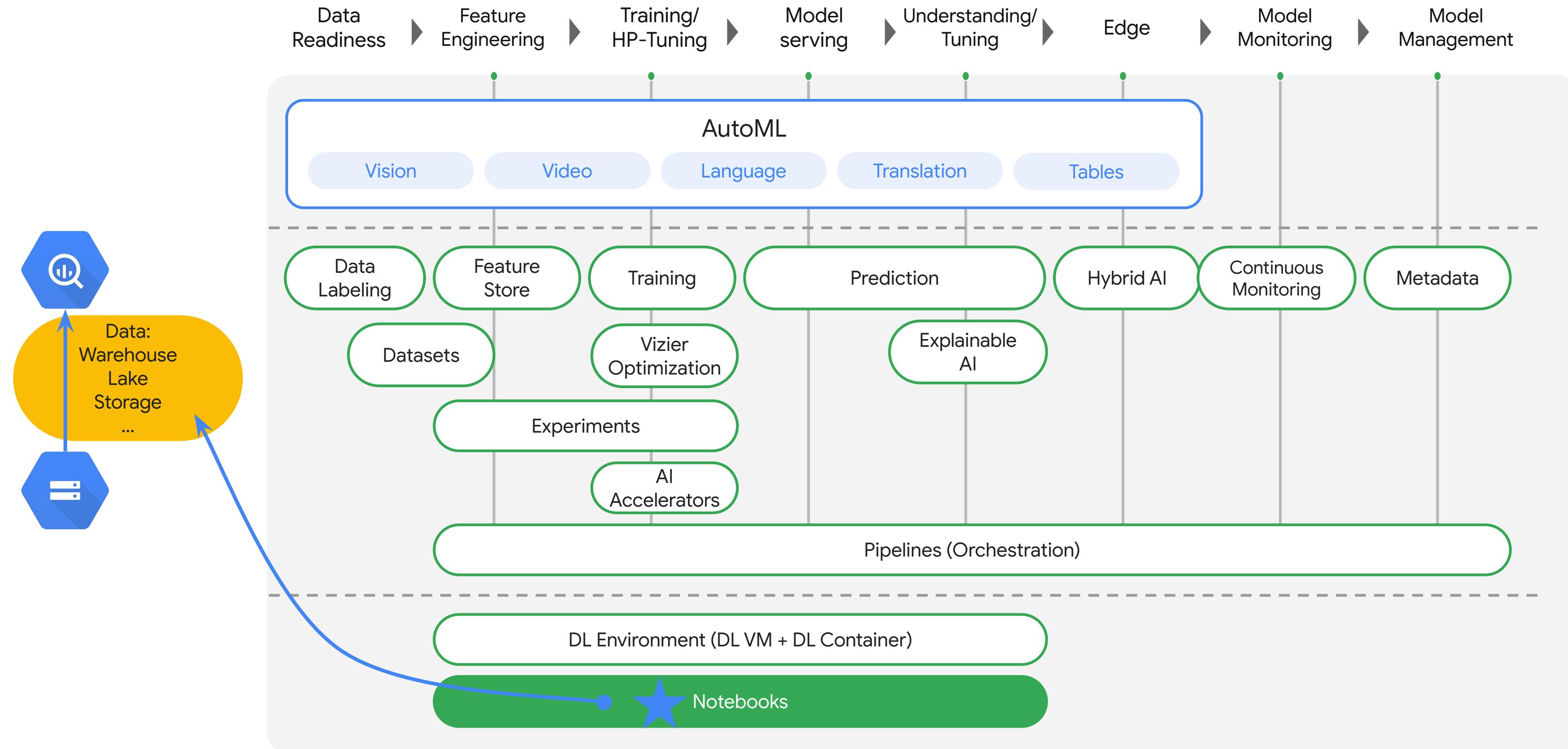
Notebook: 00

Vertex AI Overview



Notebook: 01

Vertex AI Overview



Google Cloud Platform

Vertex AI

Dashboard

Datasets

Features

Labeling tasks

Notebooks

Pipelines

Training

Experiments

Models

Endpoints

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Metadata

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The screenshot shows a Jupyter Notebook environment within Google Colab. The notebook title is "01 - BigQuery - Table Data Source". The content discusses using BigQuery to load and prepare data for machine learning, listing prerequisites (Environment Setup) and an overview of BigQuery setup, table creation, and data loading from GCS. A large yellow arrow points from the "Notebooks" menu in the sidebar to the "01 - BigQuery - Table Data Source" tab in the notebook interface.

01 - BigQuery - Table Data Source

Use BigQuery to load and prepare data for machine learning:

Prerequisites:

- 00 - Environment Setup

Overview:

- Setup BigQuery
 - Create a Dataset
 - Use BigQuery Python Client
 - Create Tables
 - Copy from another Project:Dataset
 - SQL with BigQuery
 - Load data from GCS
 - BigQuery Python
 - Prepare Data For Analysis
 - Run SQL Queries to pi

Resources:

- Python Client For Google BigQ
- Download BigQuery Data to Pa
- Query Template Notebooks

0 19 Git: idle Python 3 | Idle

File Edit View Run Kernel Git Tabs Settings Help

Launcher 01 - BigQuery - Table Data git Python 3

00 - Environme... 3 days ago

01 - BigQuery - Table Data 3 days ago

02a - Vertex AI ... 4 days ago

02b - Vertex AI ... 8 hours ago

02c - Vertex AI ... 8 hours ago

03a - BigQuery ... 4 days ago

03b - Vertex AI ... 8 hours ago

04a - Vertex AI ... 8 hours ago

05 - Vertex AI >... 20 hours ago

05a - Vertex AI ... 8 hours ago

05b - Vertex AI ... 4 hours ago

05c - Vertex AI ... 4 hours ago

05d - Vertex AI ... 4 hours ago

05e - Vertex AI ... 3 hours ago

05f - Vertex AI ... an hour ago

06 - Vertex AI >... 4 days ago

07 - Vertex AI >... 4 days ago

readme.md 5 days ago

XX - Cleanup.ip... 5 days ago

FEATURES & INFO SHORTCUT DISABLE EDITOR TABS

Explorer + ADD DATA

Type to search

Viewing pinned projects.

statmike-mlops

digits

Models (1)

digits

digits_featurestore_import

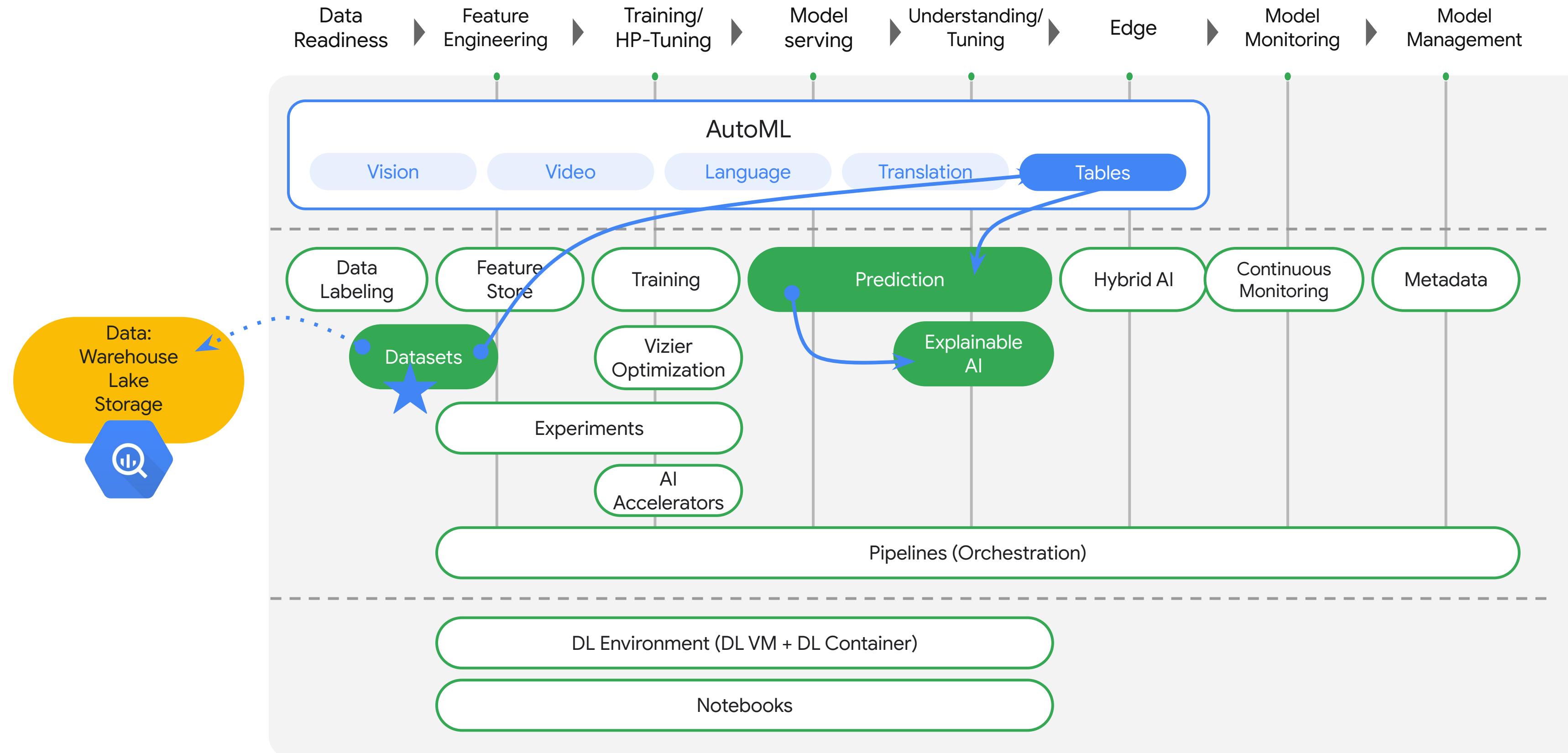
digits_fs_training

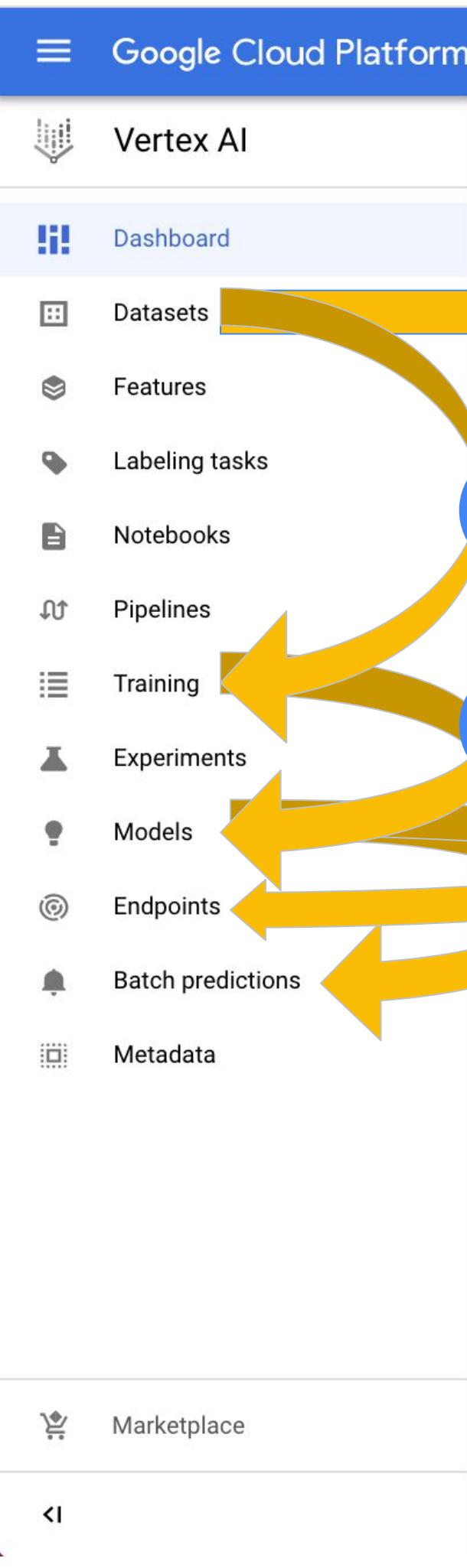
digits_prepended

Row	p0	p1	p2	p3	p4	p5	p6	p7	p8	p
1	0.0	5.0	16.0	15.0	5.0	0.0	0.0	0.0	0.0	1
2	0.0	5.0	16.0	12.0	1.0	0.0	0.0	0.0	0.0	1
3	0.0	5.0	15.0	16.0	6.0	0.0	0.0	0.0	0.0	1
4	0.0	4.0	15.0	15.0	8.0	0.0	0.0	0.0	0.0	0.0
5	0.0	6.0	16.0	16.0	15.0	10.0	0.0	0.0	0.0	0.0
6	0.0	8.0	16.0	12.0	15.0	16.0	7.0	0.0	0.0	1
7	0.0	8.0	13.0	15.0	16.0	16.0	8.0	0.0	0.0	0.0
8	0.0	7.0	12.0	14.0	16.0	8.0	0.0	0.0	0.0	0.0

Notebook: 02a

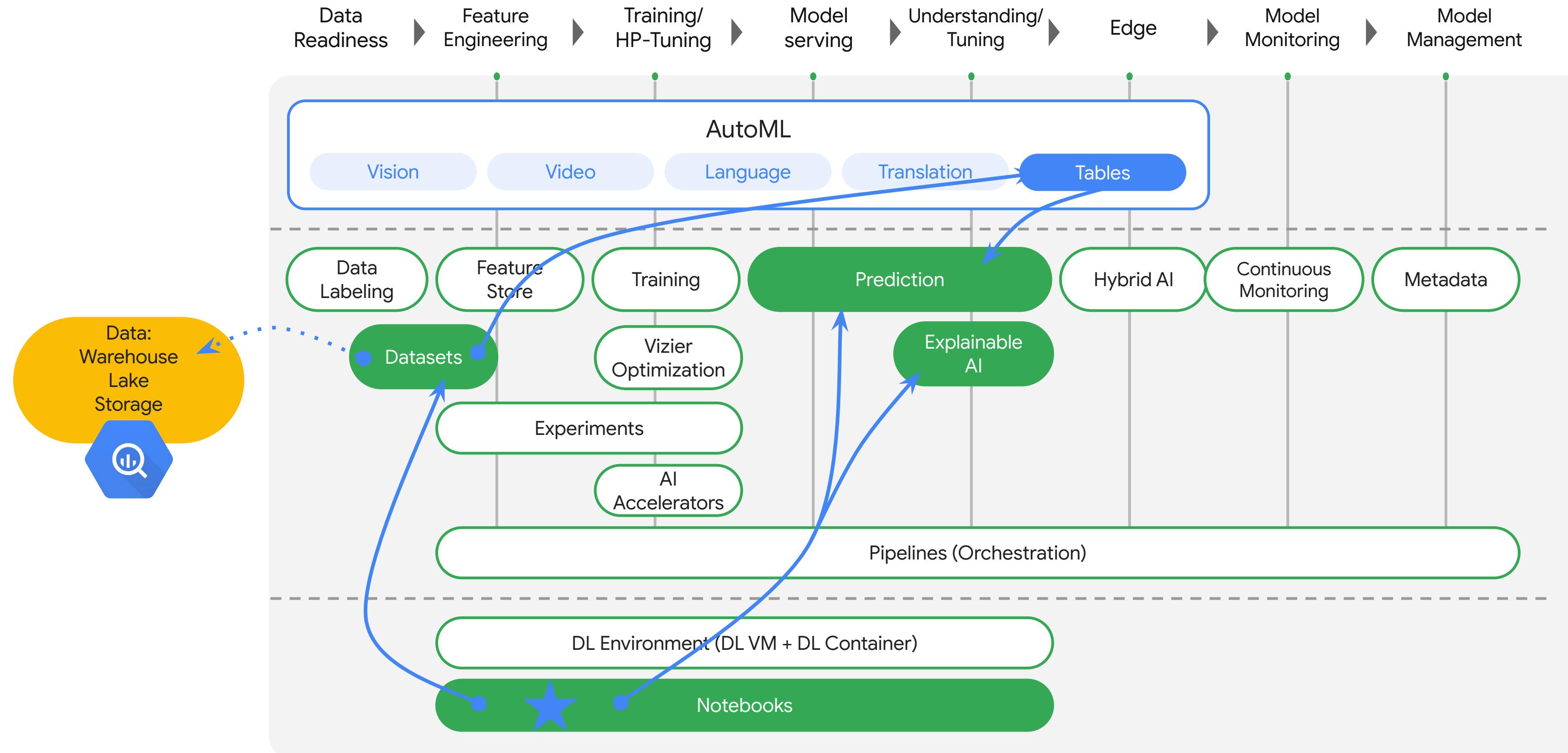
Vertex AI Overview

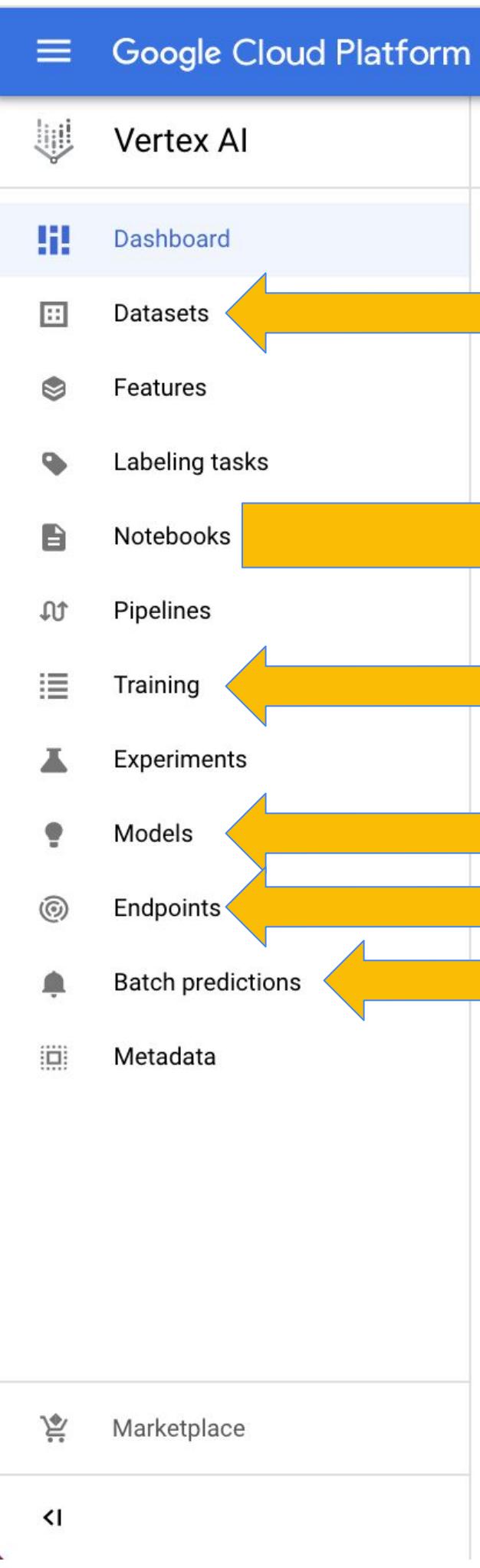




The diagram shows the Google Cloud Platform Explorer interface. At the top, there are tabs for FEATURES & INFO, SHORTCUT, and DISABLE EDITOR TABS. Below these are sections for Explorer (+ ADD DATA) and Editor (DIGITS). The Explorer section displays pinned projects under 'statmike-mlops' (including digits, Models (1), digits, digits_featurestore_import, digits_fs_training, and digits_prepended). The Editor section shows a preview of a 'digits' table with columns p0 through p8. The table data is as follows:

Row	p0	p1	p2	p3	p4	p5	p6	p7	p8	p
1	0.0	5.0	16.0	15.0	5.0	0.0	0.0	0.0	0.0	
2	0.0	5.0	16.0	12.0	1.0	0.0	0.0	0.0	0.0	
3	0.0	5.0	15.0	16.0	6.0	0.0	0.0	0.0	0.0	1
4	0.0	4.0	15.0	15.0	8.0	0.0	0.0	0.0	0.0	
5	0.0	6.0	16.0	16.0	16.0	15.0	10.0	0.0	0.0	
6	0.0	8.0	16.0	12.0	15.0	16.0	7.0	0.0	0.0	1
7	0.0	8.0	13.0	15.0	16.0	16.0	8.0	0.0	0.0	
8	0.0	7.0	12.0	14.0	16.0	8.0	0.0	0.0	0.0	





File Edit View Run Kernel Git Tabs Settings Help

Launcher 02b - Vertex AI - AutoML v ×

Markdown git Python 3

02b - Vertex AI - AutoML with clients (code)

Use the Vertex AI Python Client to recreate the no-code approach of (02a) with code (Python). This builds a custom model with AutoML and deploys it to an Endpoint for predictions and explanations.

Prerequisites:

- 01 - BigQuery - Table Data Source

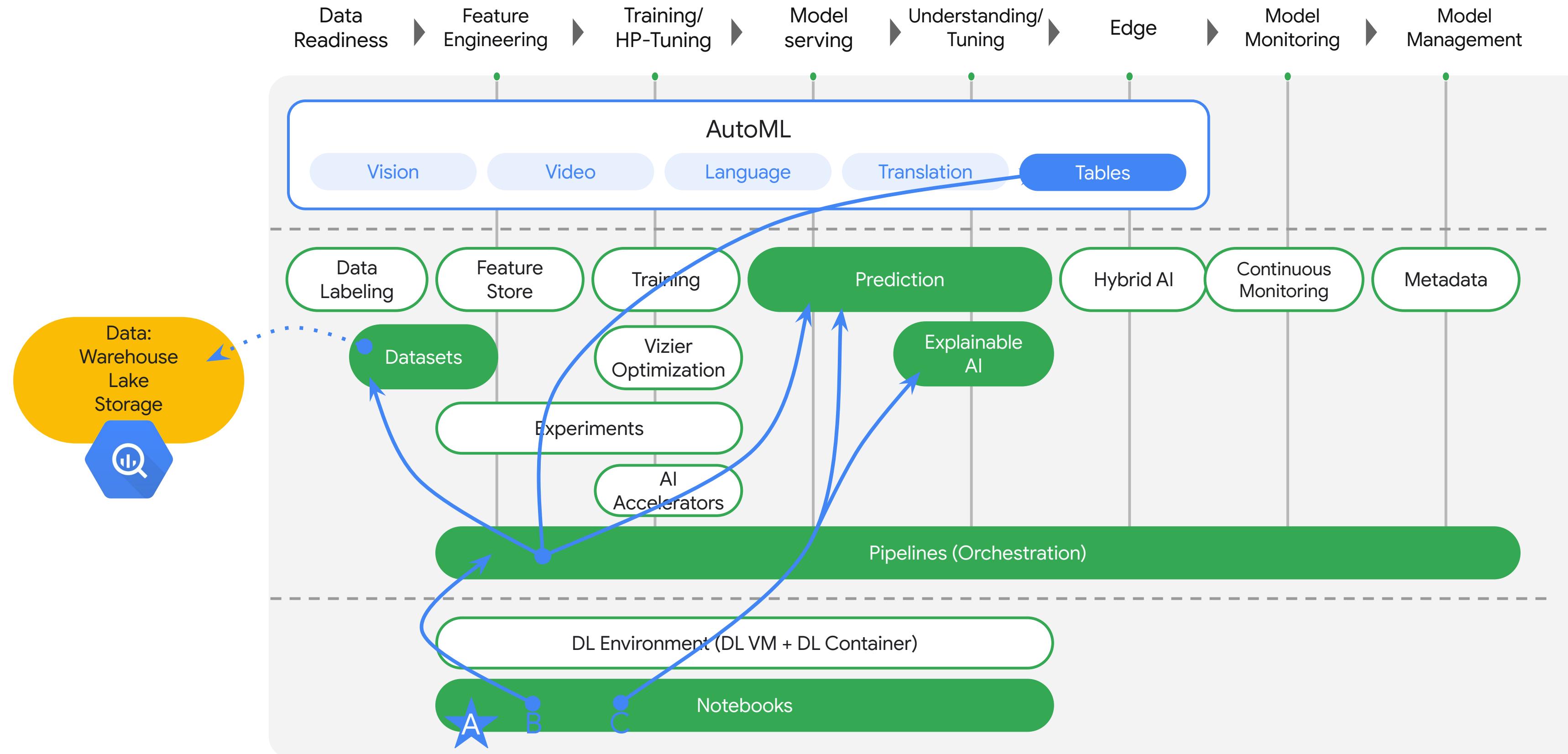
Overview:

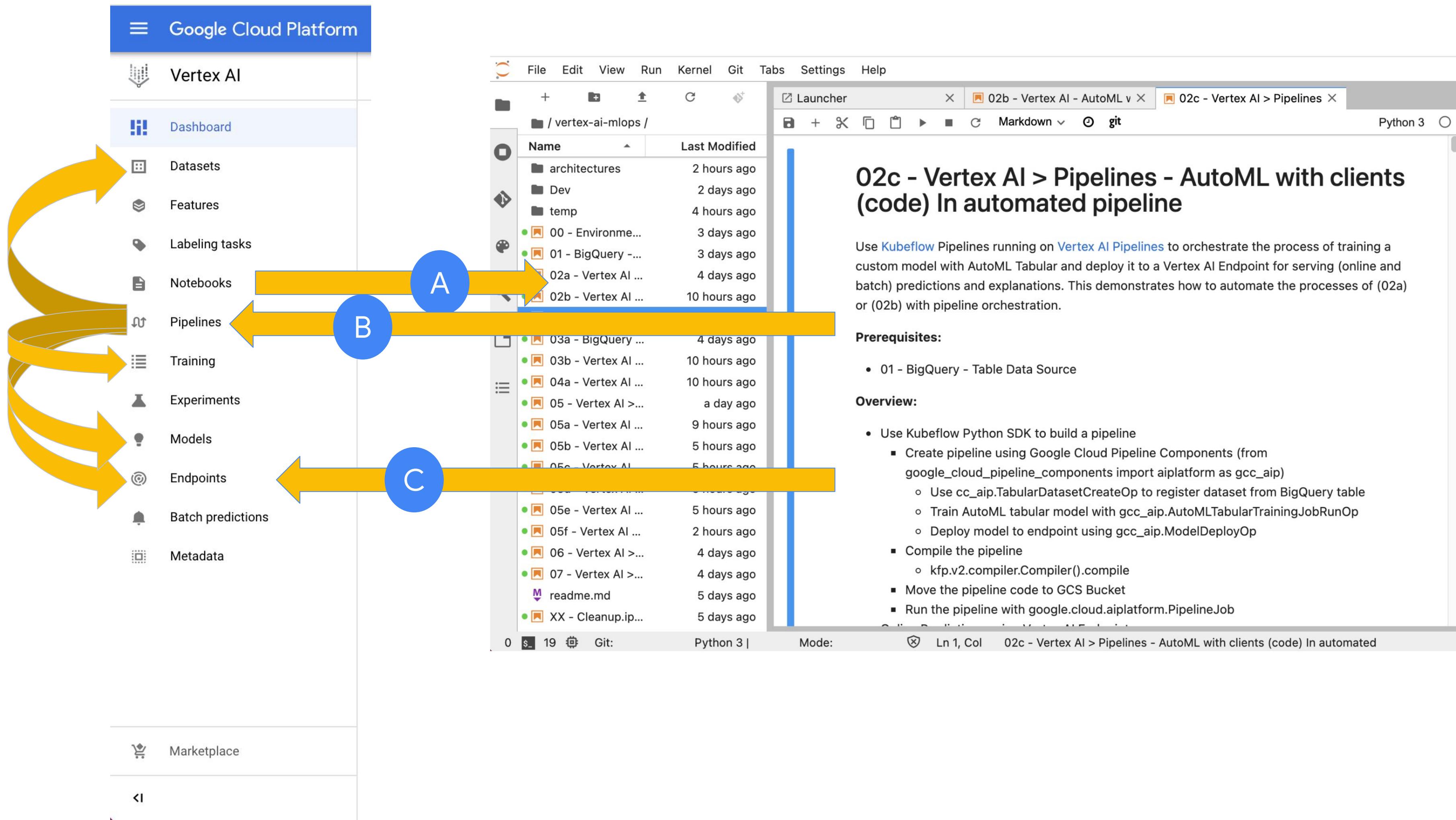
- Use Python client `google.cloud.aiplatform` for Vertex AI
 - Create a dataset
 - `aiplatform.TabularDataset`
 - Link BigQuery table
 - Train Model with AutoML
 - `aiplatform.AutoMLTabularTrainingJob`
 - Evaluate
 - Review the model in GCP Console > Vertex AI > Models
 - Deploy to Endpoint
 - `Endpoint = aiplatform.Endpoint`
 - `Endpoint.deploy`
 - Online Predictions
 - `Endpoint.predict`

Mode: Command Ln 1, Col 1 02b - Vertex AI - AutoML with clients (code).ipynb

Name	Last Modified
architectures	2 hours ago
Dev	2 days ago
temp	4 hours ago
01 - BigQuery - ...	3 days ago
02a - Vertex AI ...	4 days ago
02b - Vertex AI ...	9 hours ago
02c - Vertex AI ...	9 hours ago
03a - BigQuery ...	4 days ago
03b - Vertex AI ...	9 hours ago
04a - Vertex AI ...	9 hours ago
05 - Vertex AI >...	a day ago
05a - Vertex AI ...	9 hours ago
05c - Vertex AI ...	5 hours ago
05d - Vertex AI ...	5 hours ago
05e - Vertex AI ...	4 hours ago
06 - Vertex AI >...	2 hours ago
readme.md	4 days ago
requirements.ip...	4 days ago
M README.md	5 days ago
run.ipynb	5 days ago

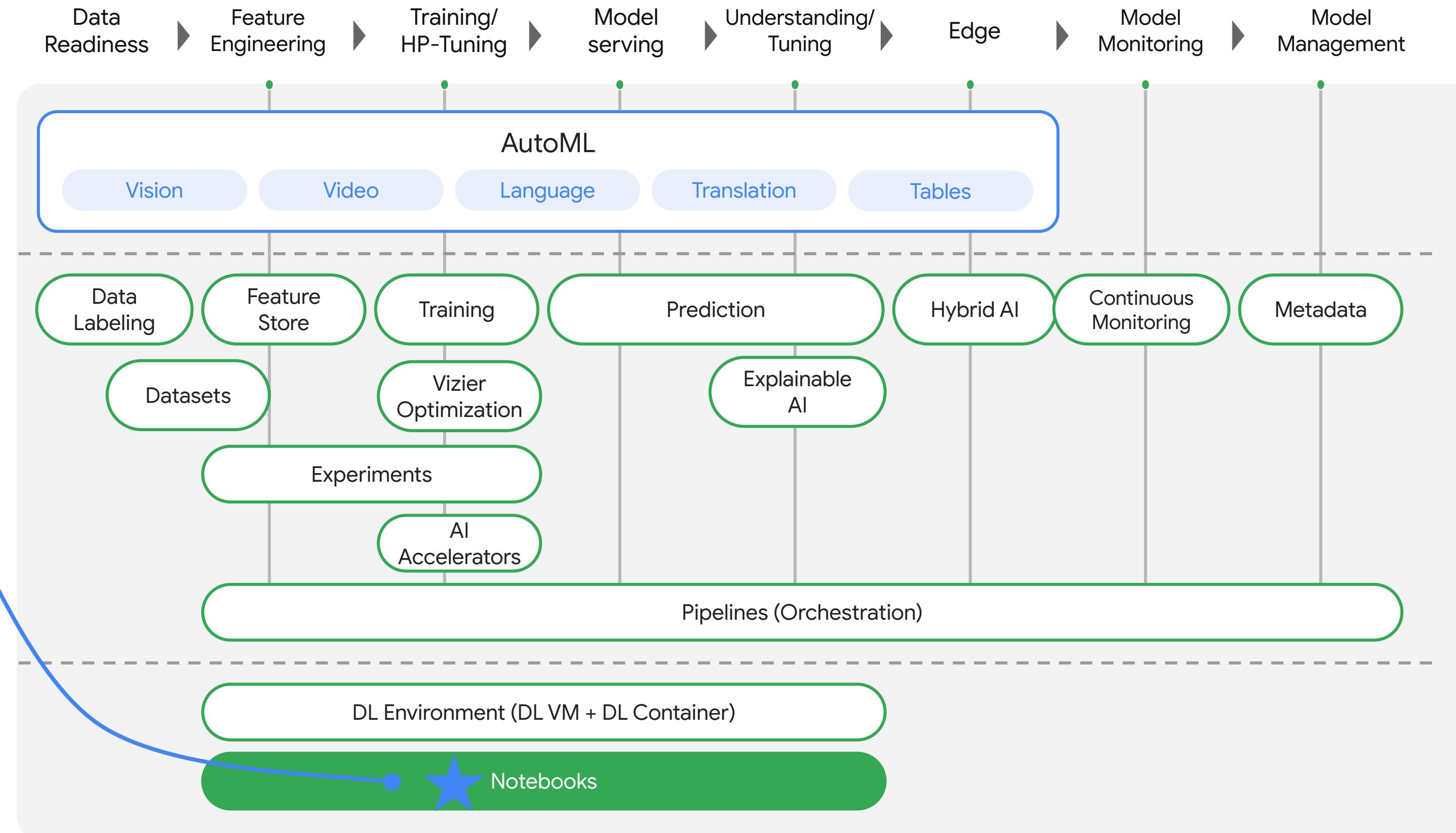
0 \$ 19 Git: idle Python 3 | Idle





Notebook: 03a

Vertex AI Overview



Google Cloud Platform

Vertex AI

- Dashboard
- Datasets
- Features
- Labeling tasks
- Notebooks
- Pipelines
- Training
- Experiments
- Models
- Endpoints
- Batch predictions
- Metadata

Marketplace

Google Cloud Platform statmike-mlops Search products and resources

FEATURES & INFO SHORTCUT DISABLE EDITOR TABS

Explorer + ADD DATA EDITOR DIGITS DIGITS_LR

Type to search

Viewing pinned projects.

statmike-mlops digits Models (1) digits_lr digits digits_featurestore_import digits_fs_training digits_prepred

DETAILS TRAINING EVALUATION SCHEMA

Loss Duration (sec)

10 Training loss: 0.011 Evaluation loss: 0.014

Duration (seconds)

File Edit View Run Kernel Git Tabs Settings Help

/ vertex-ai-mlops /

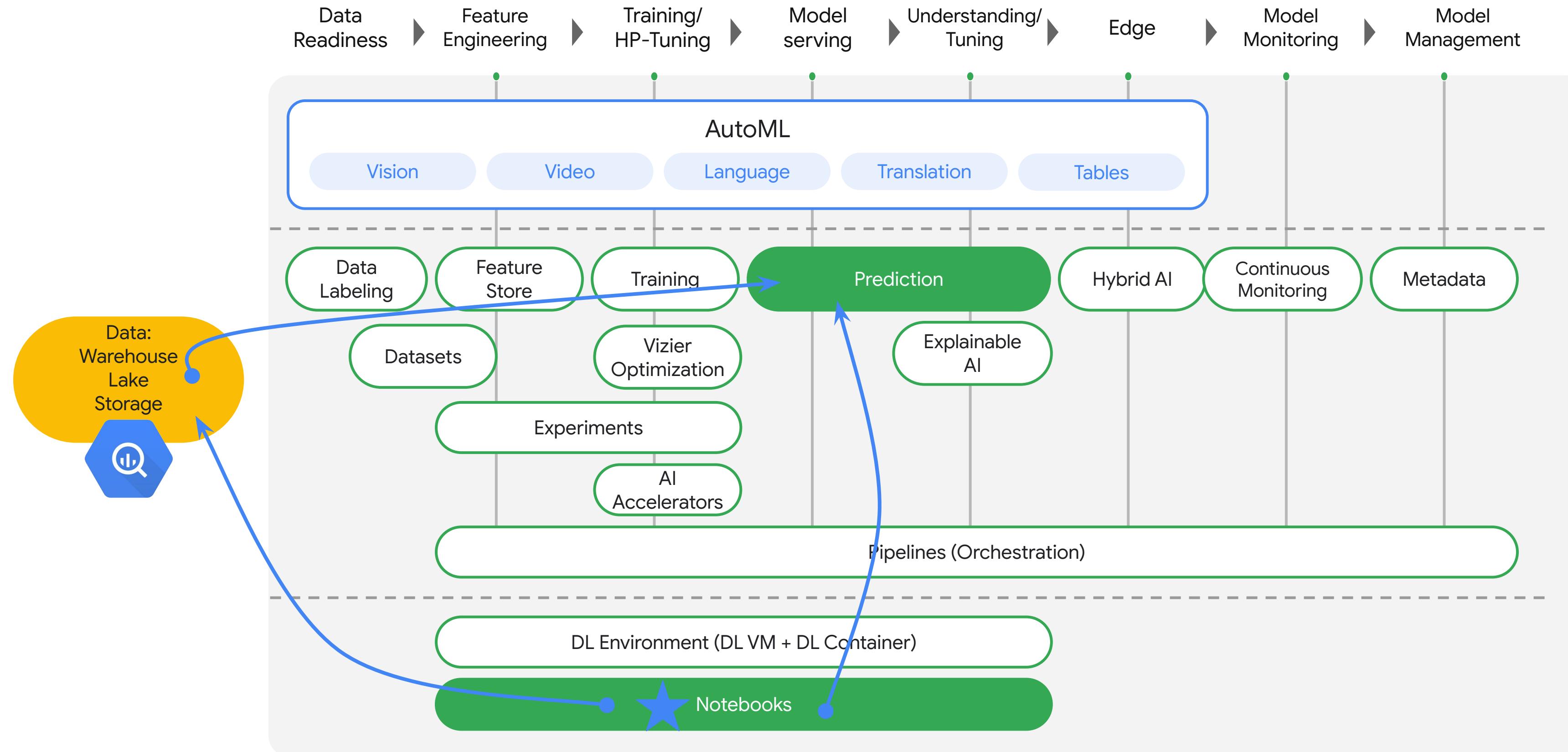
Name	Last Modified
architectures	3 hours ago
Dev	2 days ago
temp	5 hours ago
00 - Environment...	3 days ago
01 - BigQuery -...	3 days ago
02a - Vertex AI ...	4 days ago
02b - Vertex AI ...	10 hours ago
02c - Vertex AI ...	10 hours ago
03a - BigQuery Machine Learning (BQML) - Machine Learning with SQL	4 days ago

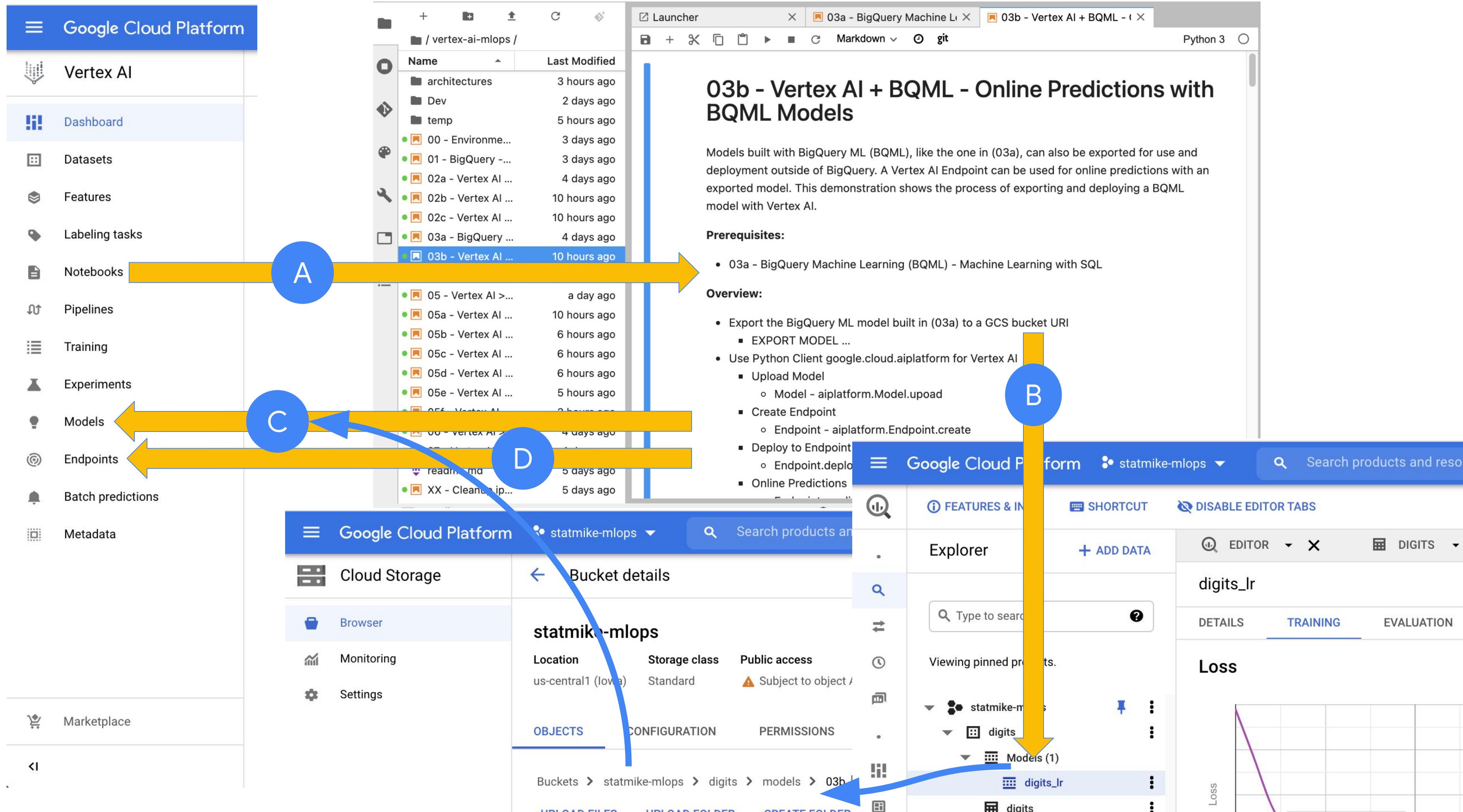
03a - BigQuery Machine Learning (BQML) - Machine Learning with SQL

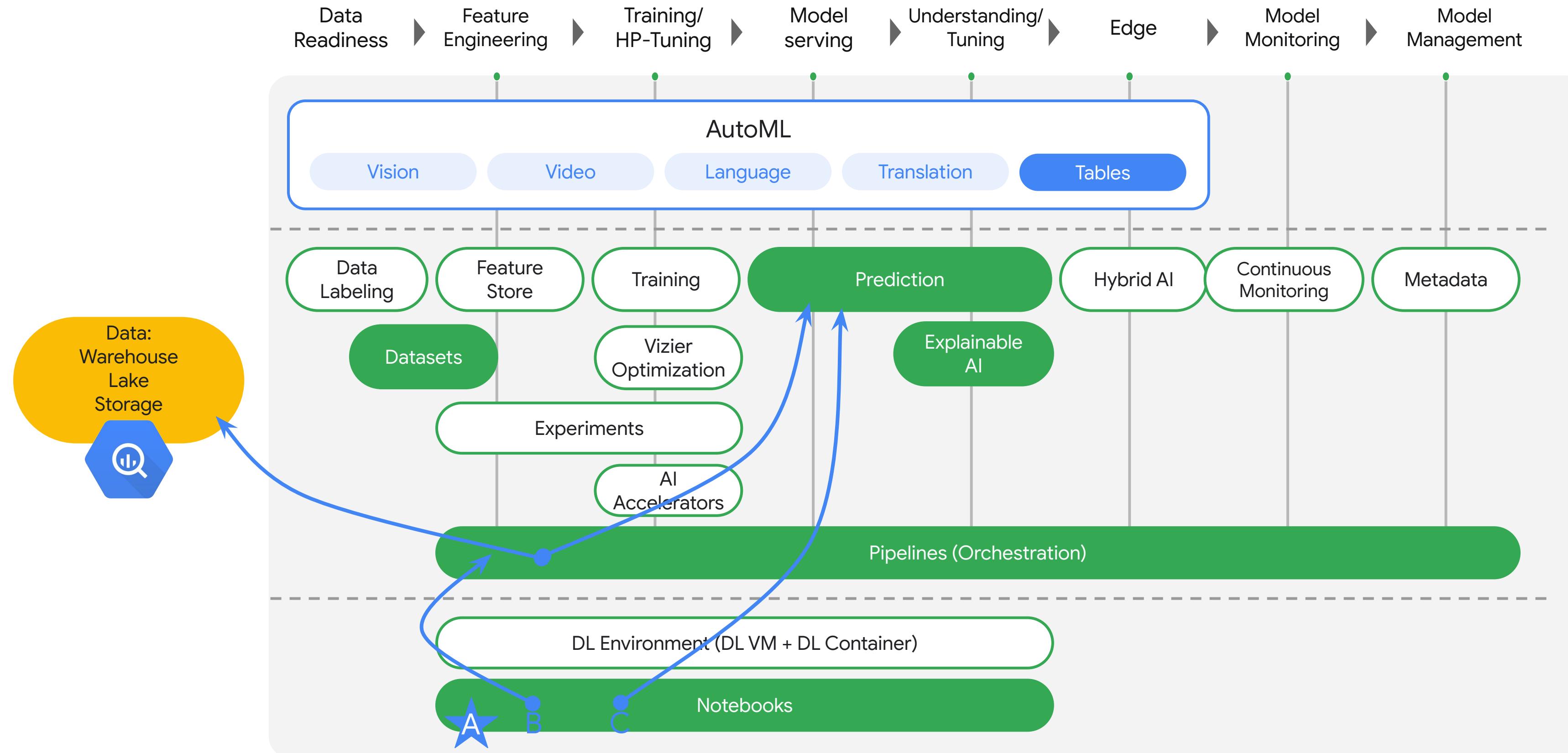
BigQuery has a number of machine learning algorithms callable directly from SQL. This gives the convenience of using the common language of SQL to "CREATE MODEL ..."). The library of available models is constantly growing and covers supervised, unsupervised, and time series methods as well as functions for evaluation - even anomaly detection from results, explainability and hyperparameter tuning. A great starting point for seeing the scope of available methods is [your journey for models](#).

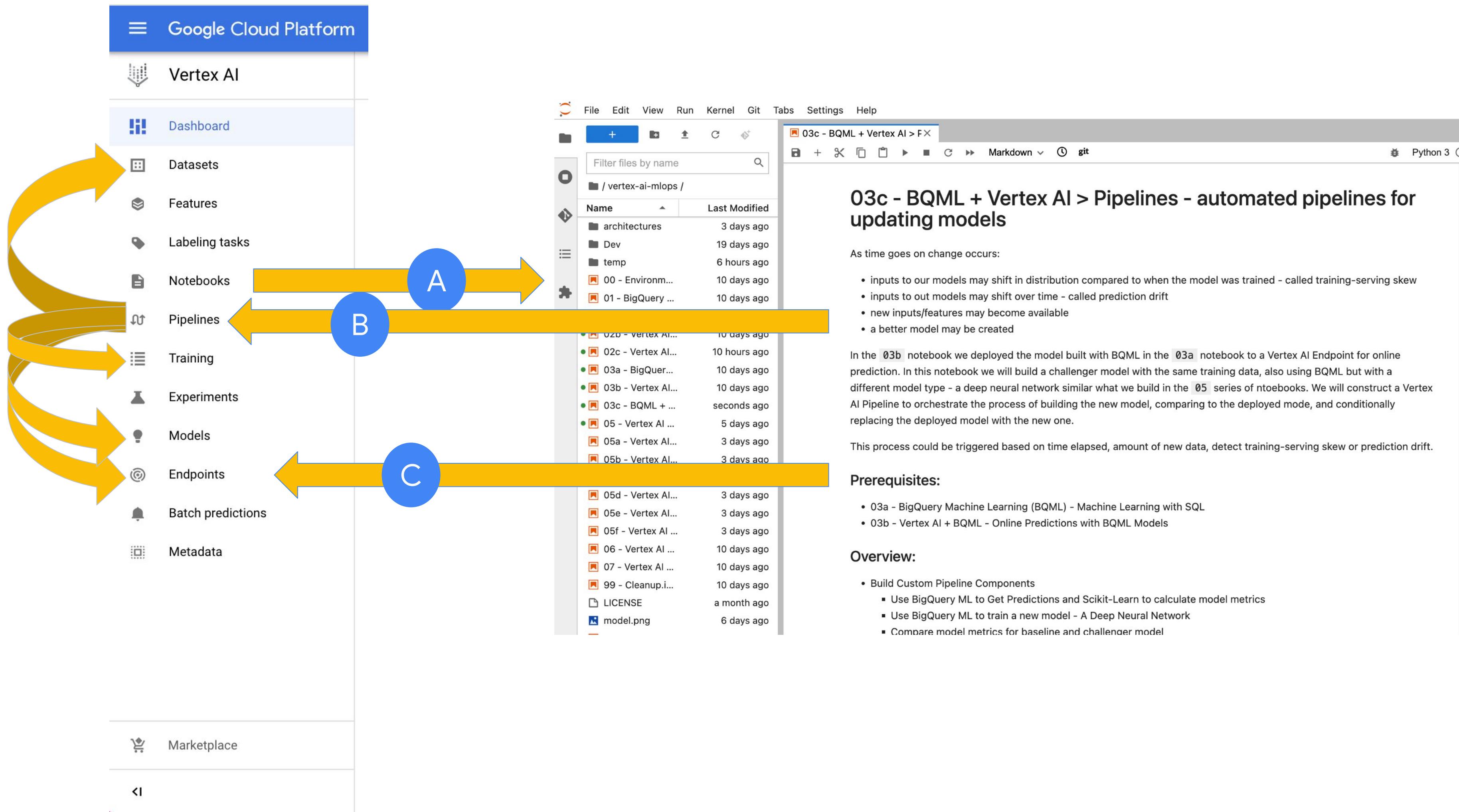
Notebook: 03b

Vertex AI Overview



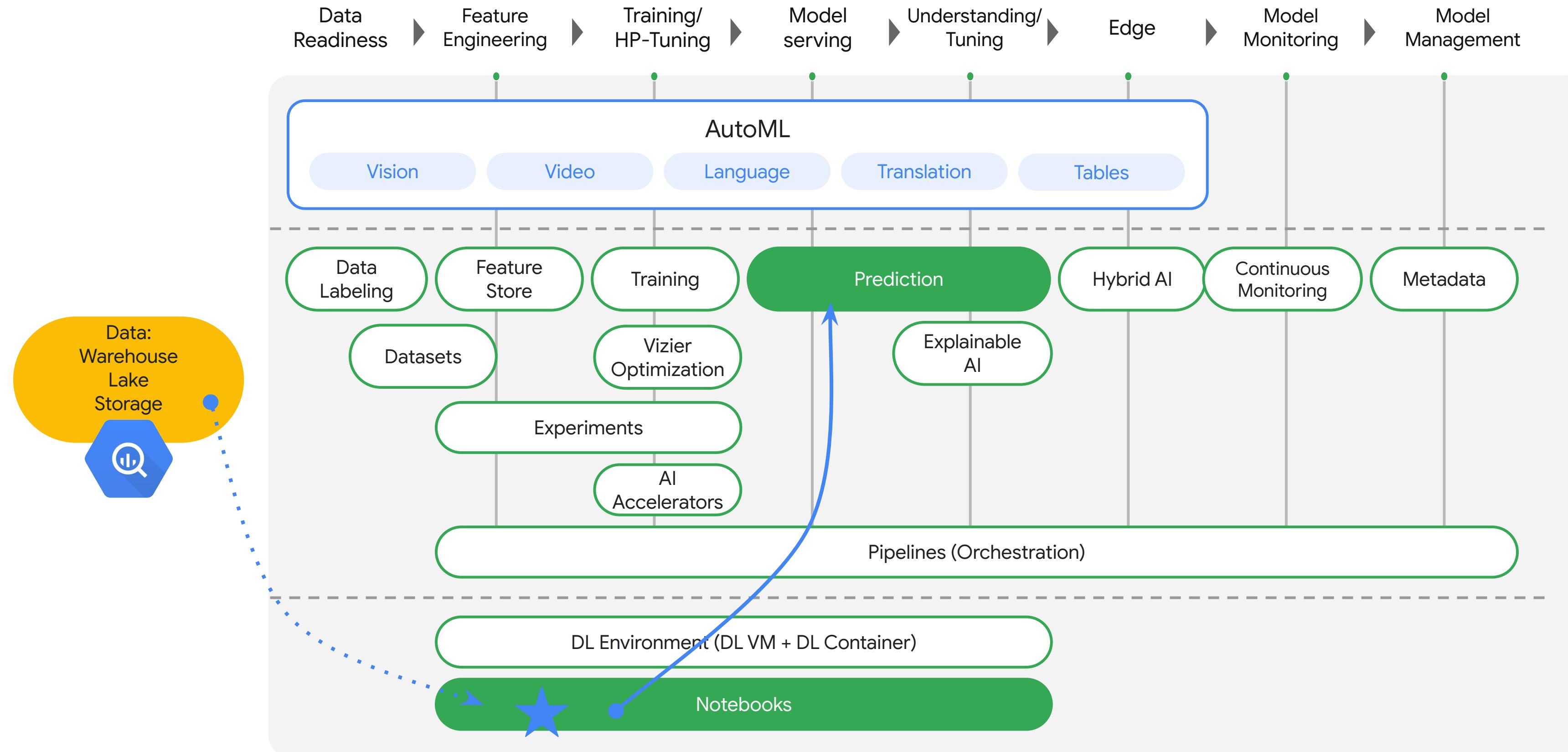






Notebook: 05

Vertex AI Overview



A

B

C

D

05 - Vertex AI > Notebooks - Models Built in Notebooks with Tensorflow

Where a model gets trained is where it consumes computing resources. With Vertex AI, you have choices for configuring the computing resources available at training. This notebook is an example of an execution environment. When it was set up there were choices for machine type and accelerators (GPUs).

This notebook shows training a model directly within the runtime of the notebook environment. Then the model is saved and moved to GCS for deployment to a Vertex AI Endpoint for online predictions. The model training is done with [Tensorflow](#), [Keras](#), and was designed to show a neural network approach to logistic regression. Training data batches are read from BigQuery using [Tensorflow I/O](#).

Prerequisites:

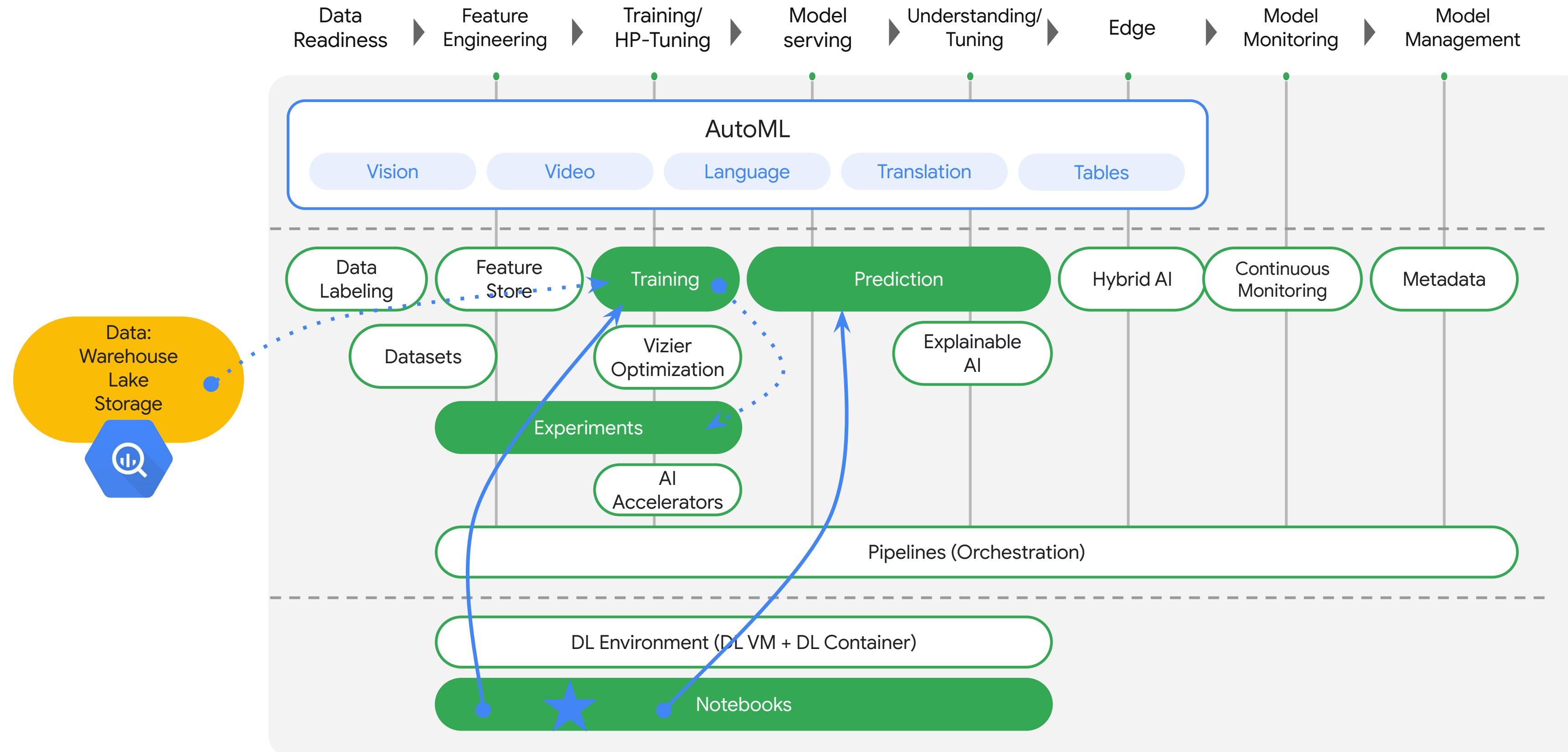
- 01 - BigQuery - Table Data Source

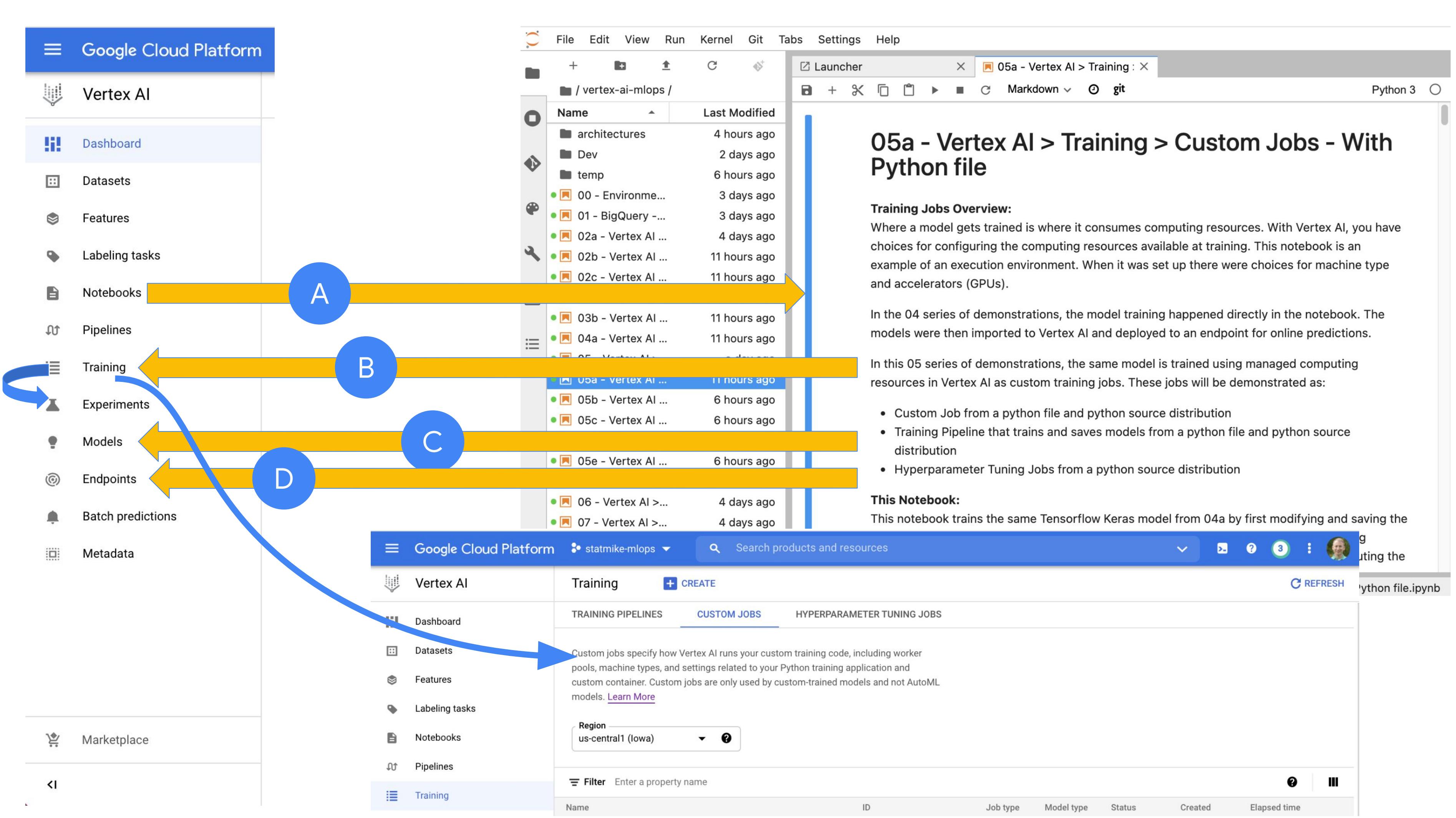
Overview:

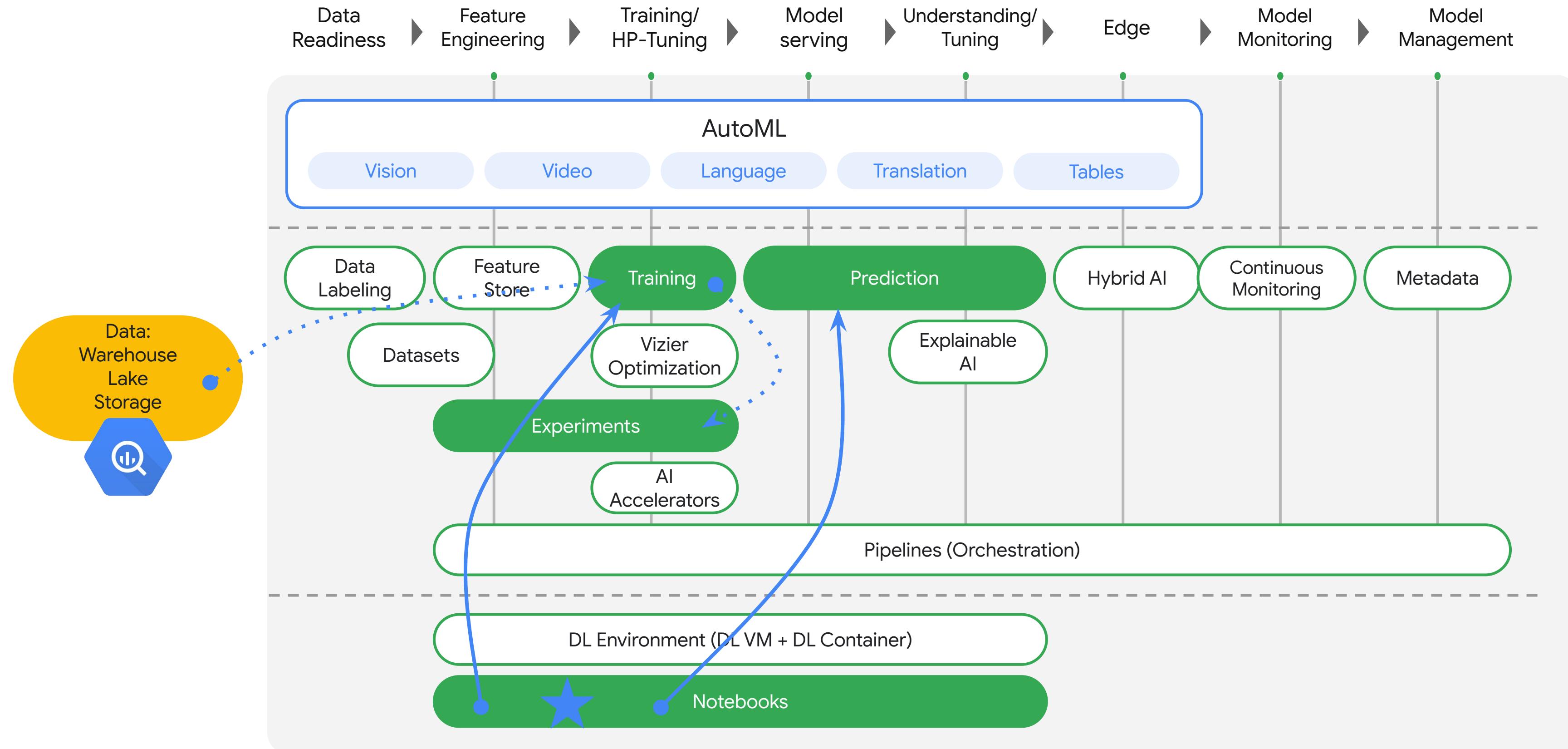
- Use Python Client for BigQuery
 - Read the tables schema from BigQuery INFORMATION_SCHEMA
 - Prepare the feature information for Tensorflow
- Define a function that remaps the input data into features and target variables where target is one-hot encoded (classification model with 10 classes)
- Set Tensorflow I/O read session
- Demonstrate reading a single batch
- Train a Tensorflow model
 - Define the model layers

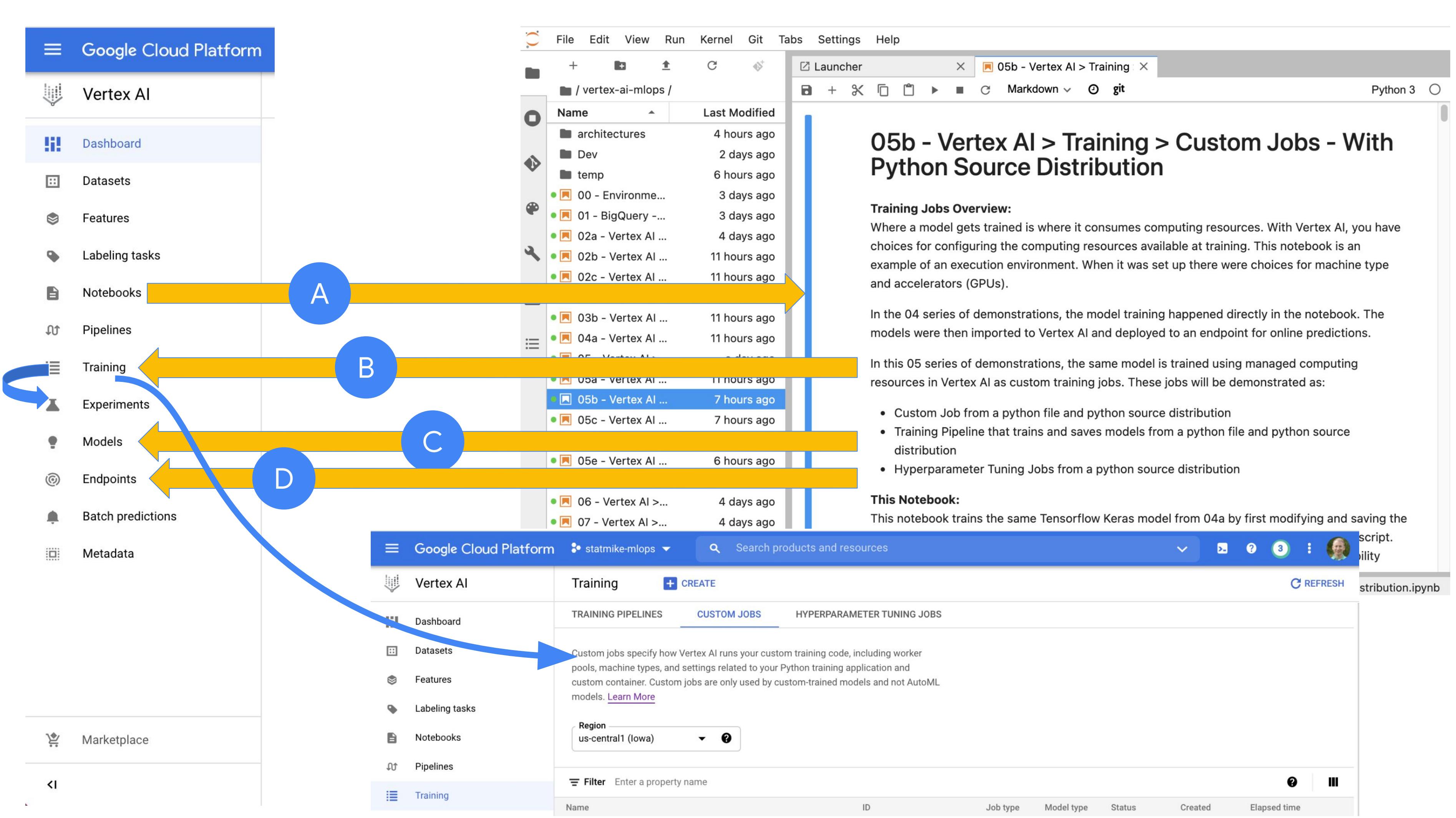
Notebook: 05a

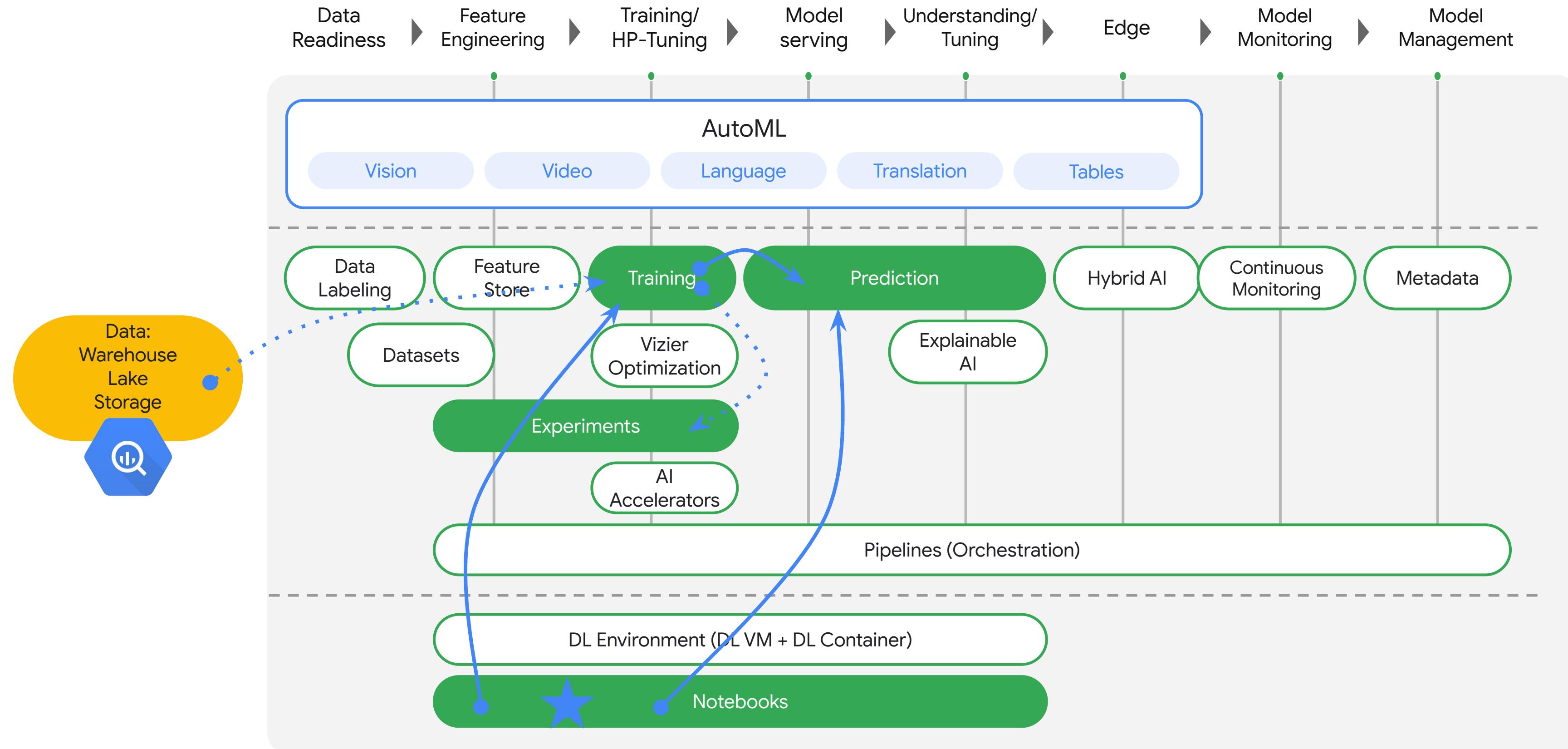
Vertex AI Overview

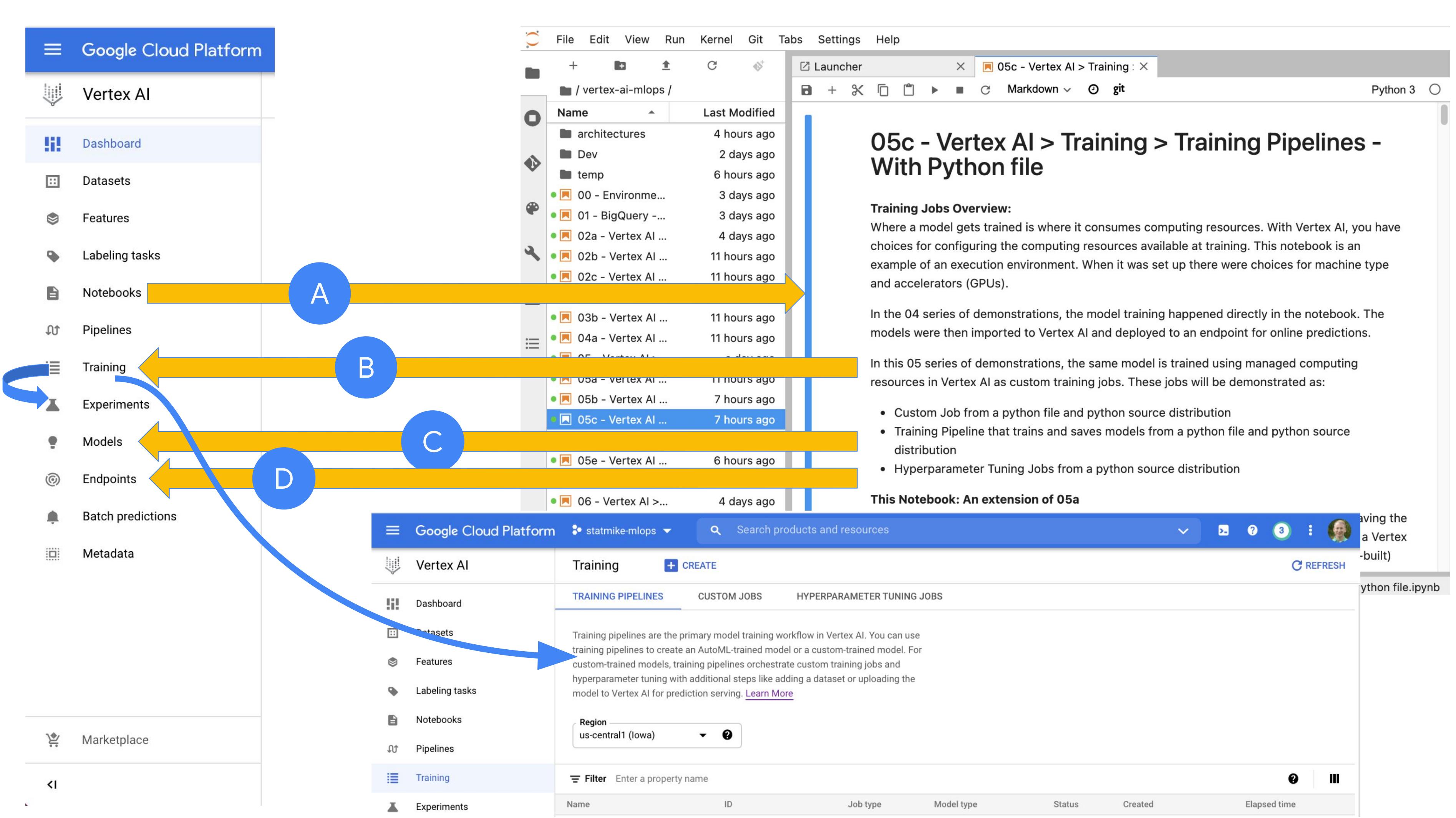


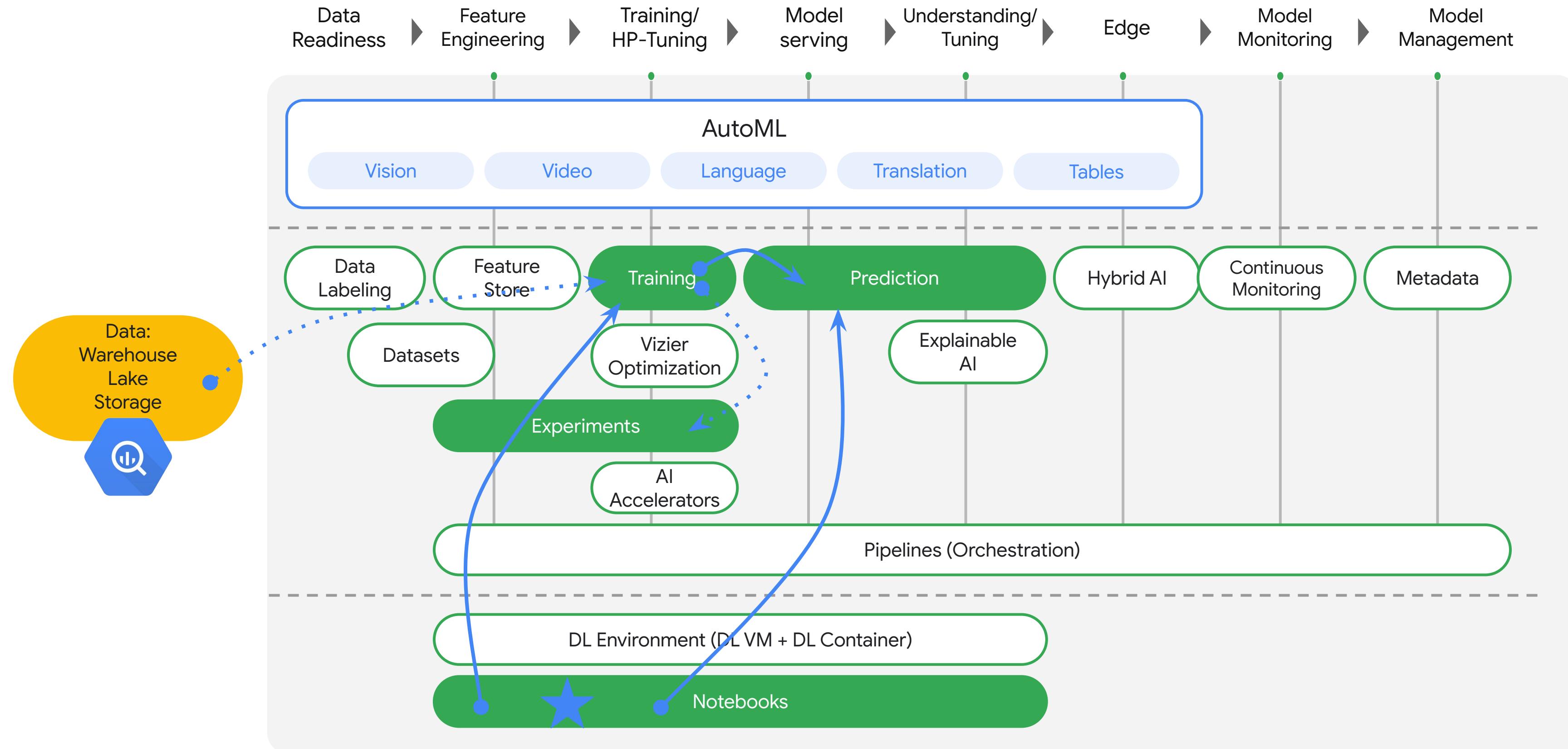


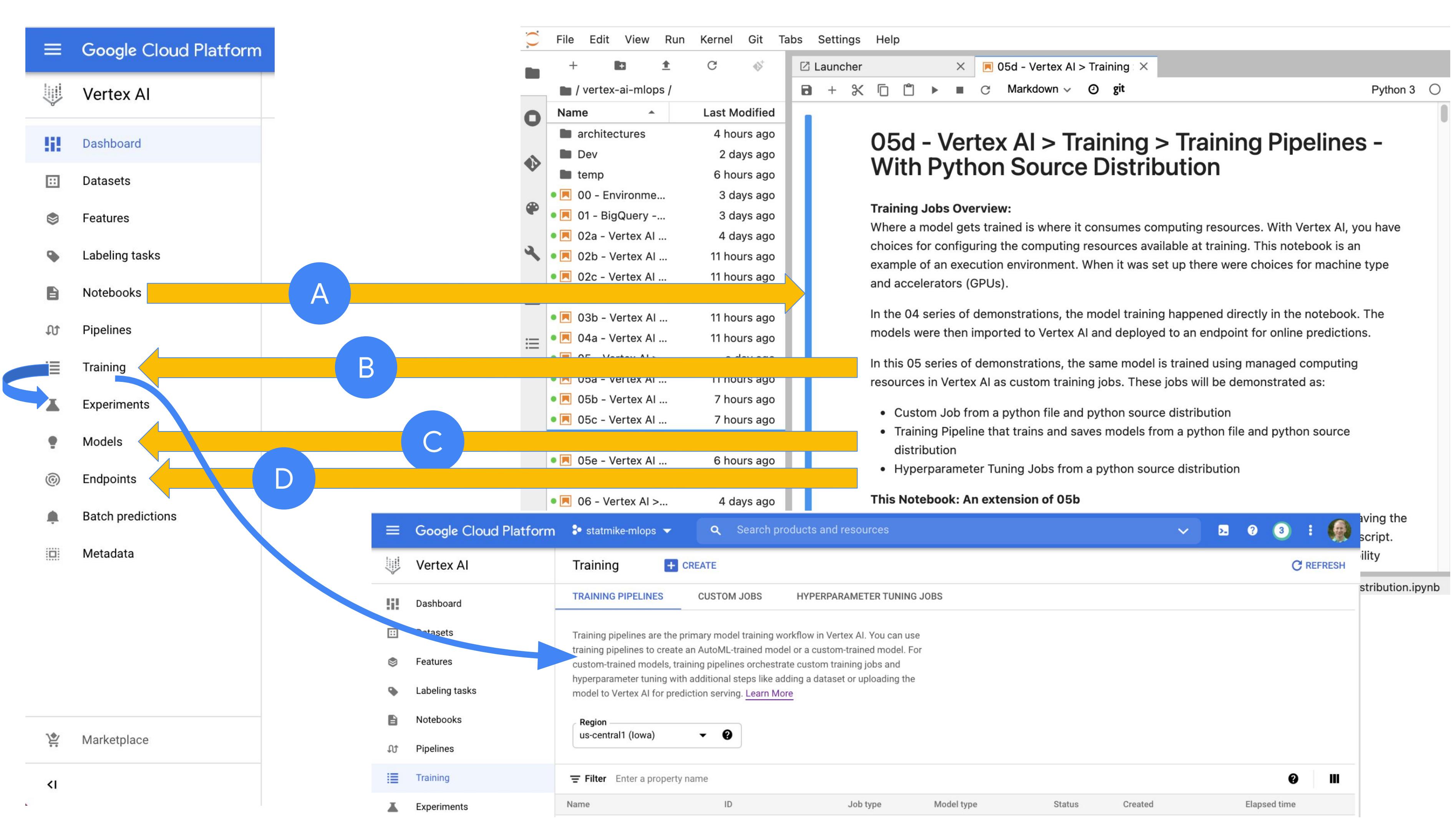


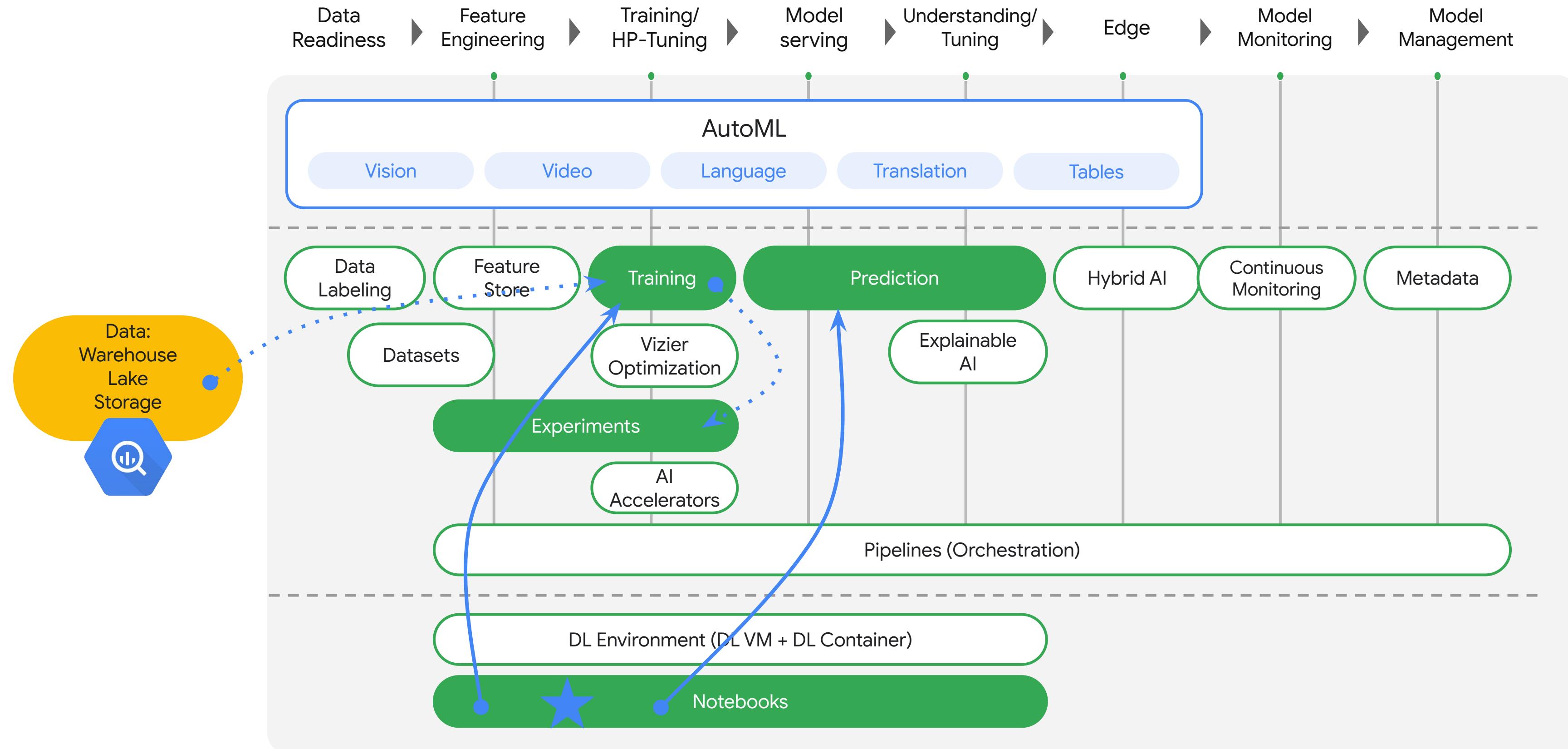


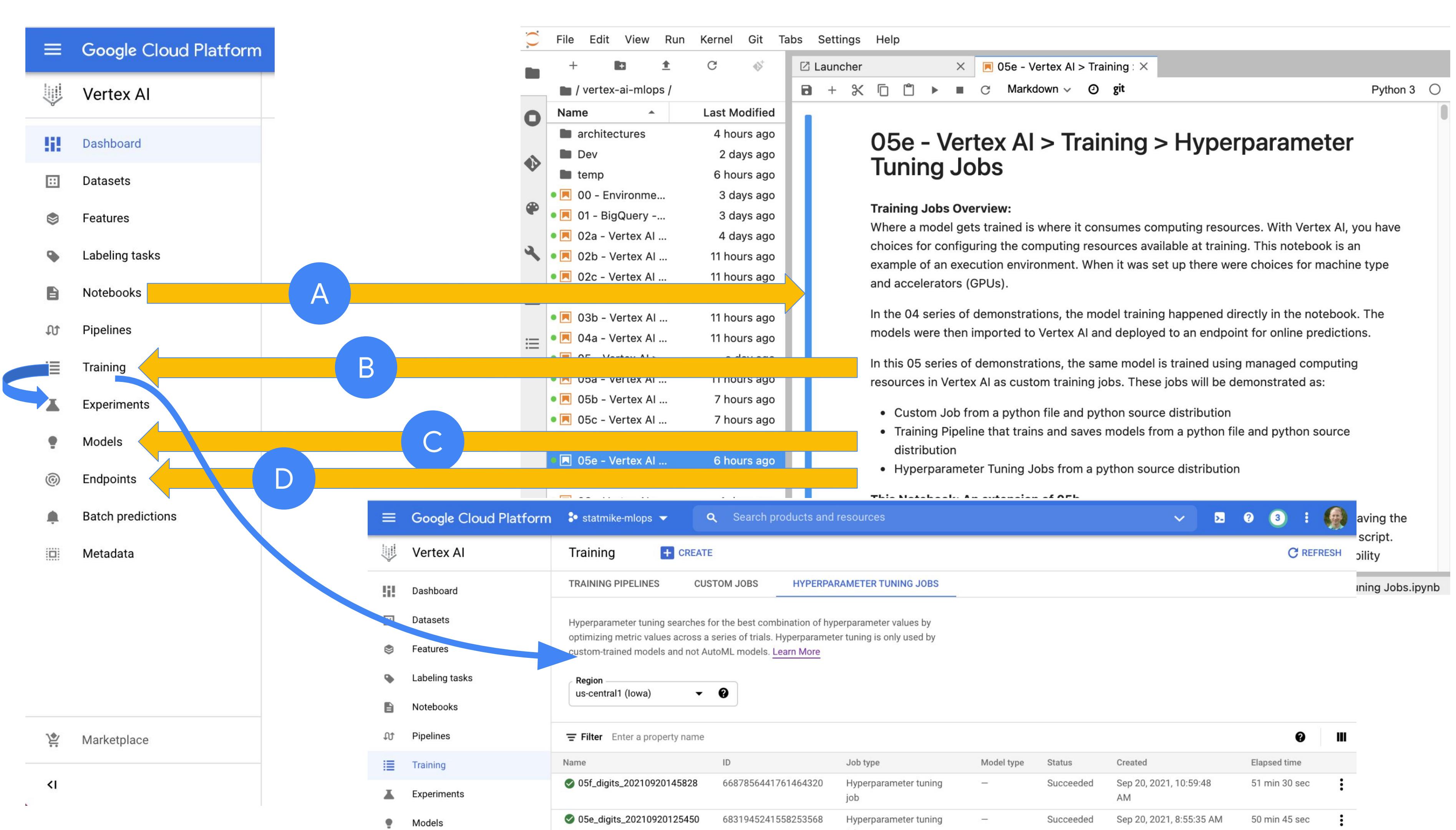






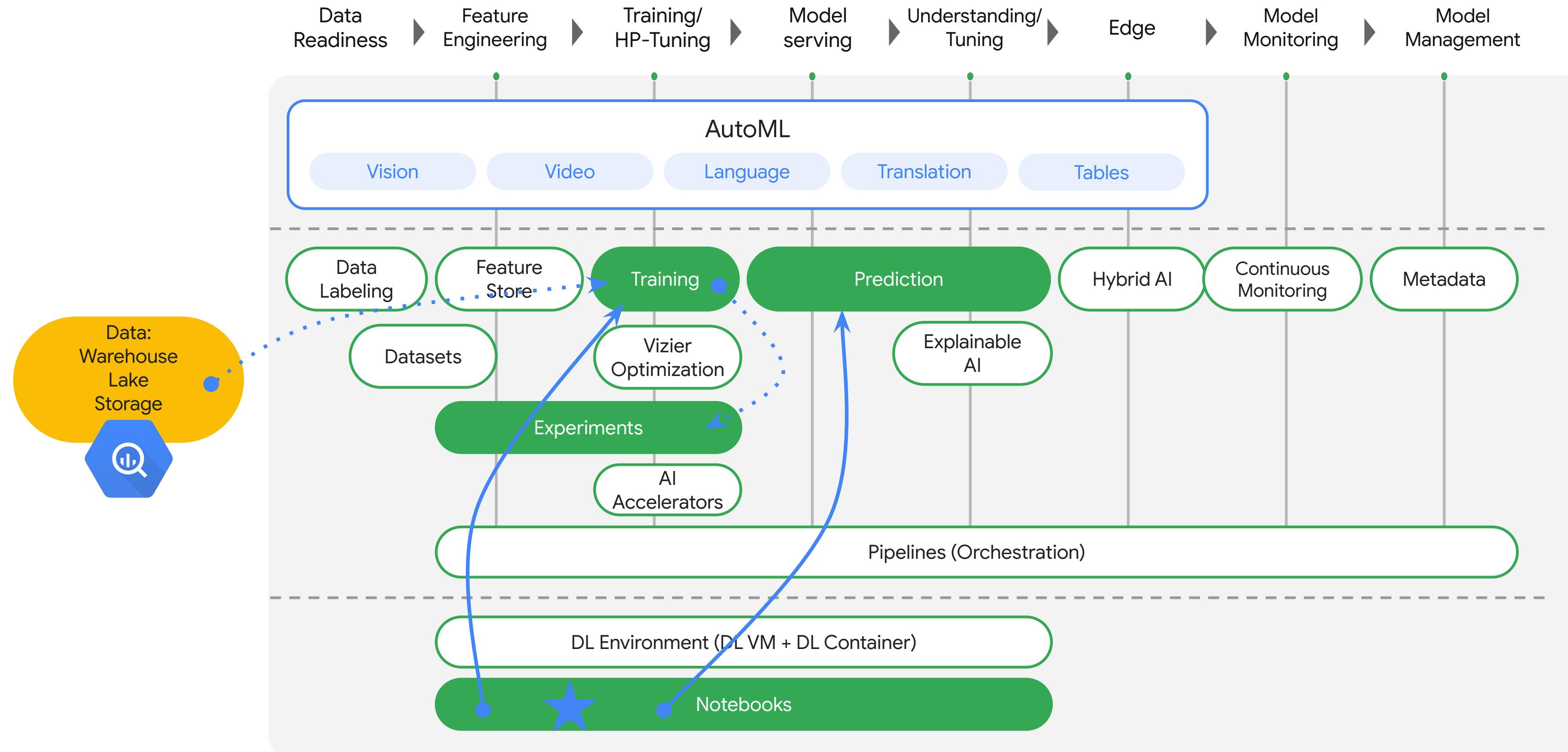


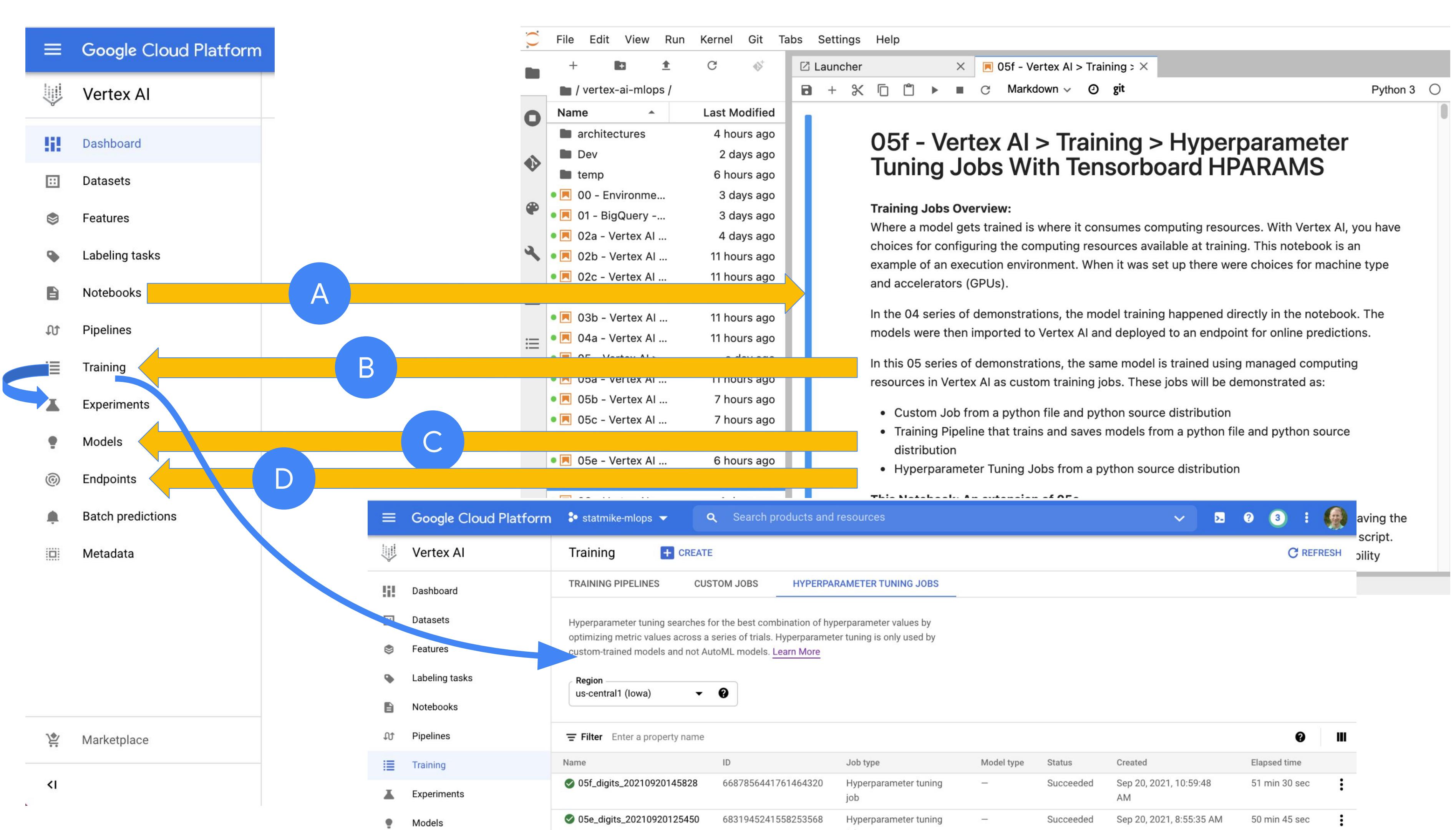




Notebook: 05f

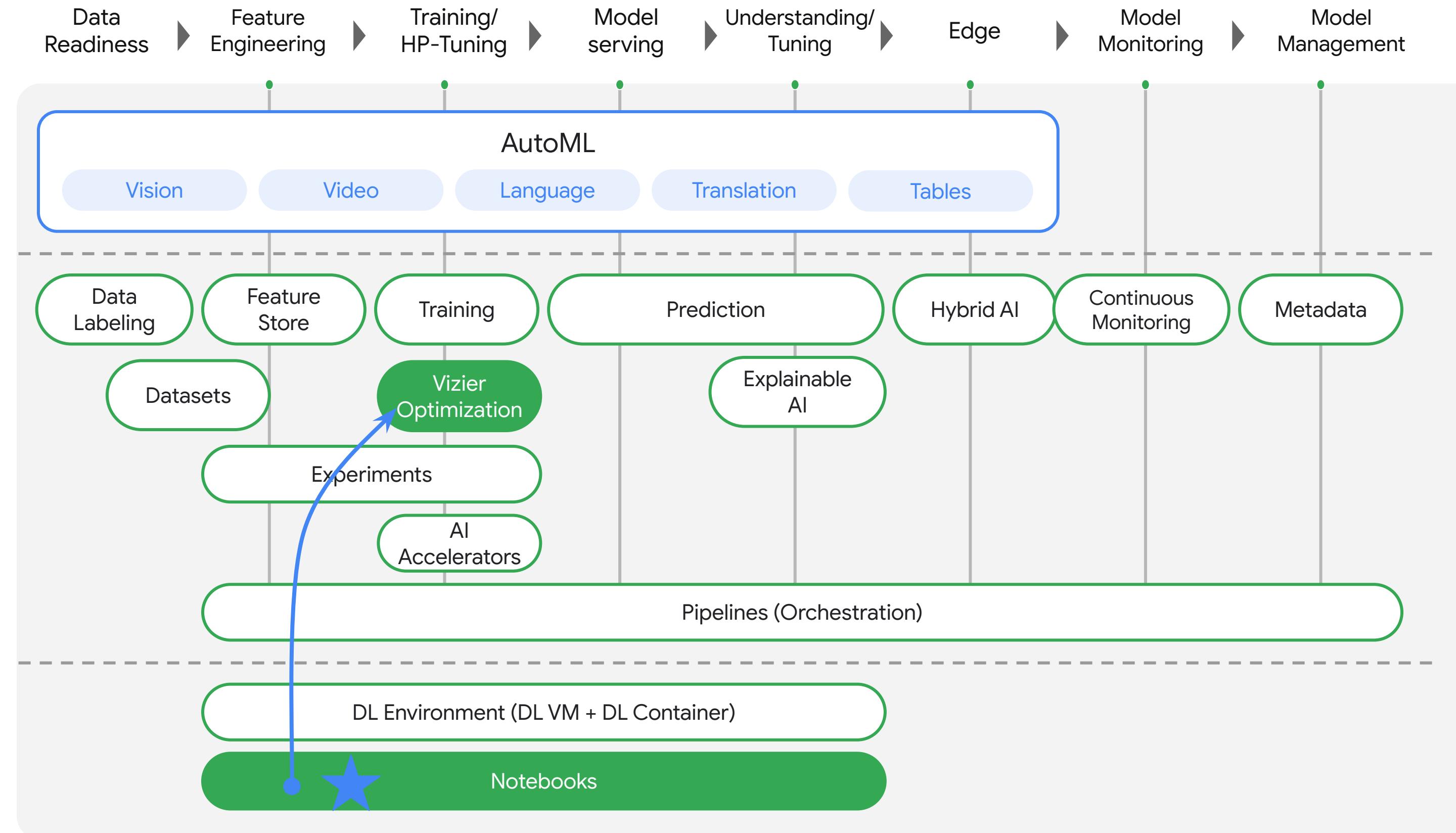
Vertex AI Overview





Notebook: 06

Vertex AI Overview



The diagram illustrates the workflow for setting up and managing experiments using Vertex AI Vizier. It starts with the Google Cloud Platform Vertex AI dashboard, where the 'Notebooks' section is highlighted (A). A yellow arrow points from this section to a Jupyter Notebook interface titled '06 - Vertex AI > Experim...'. In the Jupyter notebook, the 'Notebooks' directory is shown, containing various Vertex AI-related notebooks. A blue arrow labeled 'B' points from the Jupyter notebook back to the Google Cloud Platform Vertex AI dashboard. A curved blue arrow also points from the Jupyter notebook towards the 'Studies' section of the Vertex AI dashboard.

Google Cloud Platform Vertex AI Dashboard:

- Vertex AI
- Dashboard
- Datasets
- Features
- Labeling tasks
- Notebooks
- Pipelines
- Training
- Experiments
- Models
- Endpoints
- Batch predictions
- Metadata
- Marketplace

Jupyter Notebook Content:

06 - Vertex AI > Experiments > Studies - Vizier Optimization Service

Vertex AI Vizier is an optimization service. It is used to optimize hyperparameters for machine learning models - called hyperparameter tuning. It can also optimize any system that can be evaluated. Even systems with multiple objectives.

In this demonstration, multiple objectives are set and the Vizier service is used to conduct a random search and a default search (Bayesian Optimization) for comparison.

To see an example of hyperparameter tuning see notebook 05e or 05f. Those notebooks use the `aiplatform.HyperparameterTuningJob()` to manage the process rather than interacting with the Vertex AI Vizier service directly. Also see [this example](#).

Prerequisites:

- None

Overview:

Google Cloud Platform Vertex AI Studies Page:

Studies

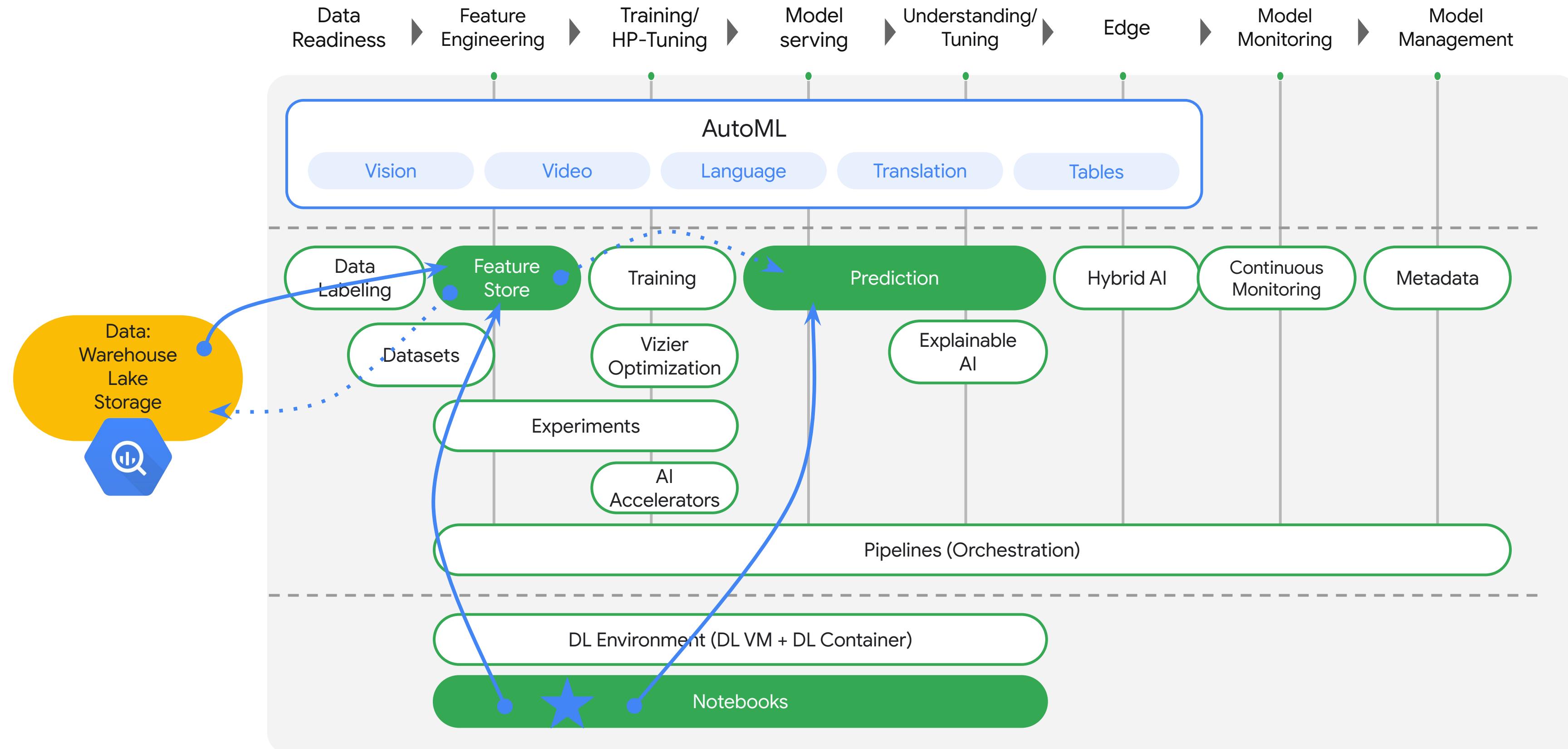
EXPERIMENTS PREVIEW STUDIES PREVIEW TENSORBOARD INSTANCES PREVIEW

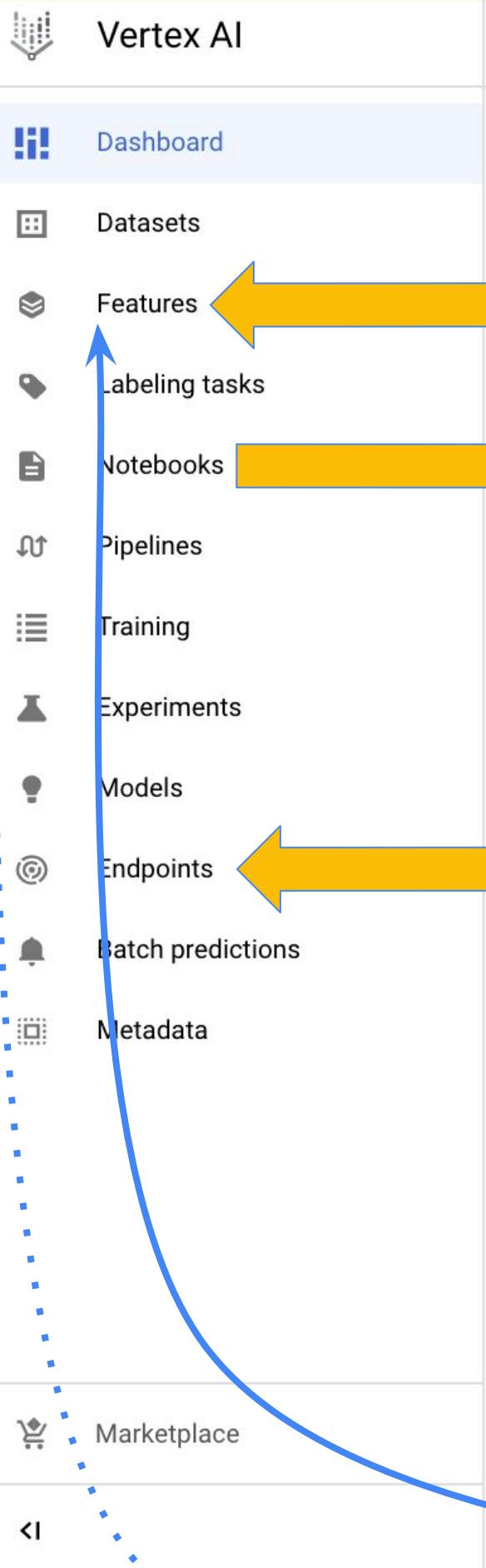
Vertex Vizier is an optimization service that helps you tune hyperparameters in complex machine learning models. [Learn more](#)

Region: us-central1 (Iowa)

Filter: Enter property name or value

Study name	ID	Objective	Created
Study_06_Bayesian_Optimization	4214226082825	Minimize "blue" and Maximize "green"	Sep 16, 2021, 11:51:29 AM
Study_06_Random	639592116037	Minimize "blue" and Maximize "green"	Sep 16, 2021, 11:44:46 AM





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/ vertex-ai-mlops /

Name	Last Modified
architectures	4 hours ago
Dev	2 days ago
temp	6 hours ago
01 - BigQuery ...	3 days ago
02a - Vertex AI ...	4 days ago
02b - Vertex AI	12 hours ago
02c - Vertex AI ...	12 hours ago
03a - BigQuery ...	4 days ago
03b - Vertex AI ...	11 hours ago
04a - Vertex AI ...	11 hours ago
05 - Vertex AI >...	a day ago
05a - Vertex AI ...	11 hours ago
05b - Vertex AI ...	7 hours ago
05c - Vertex AI ...	7 hours ago
05d - Vertex AI ...	7 hours ago

Launcher 07 - Vertex AI > Features - X

Markdown git Python 3

07 - Vertex AI > Features - Feature Store

This is a demonstration of [Vertex AI Feature Store](#). A feature store is a central repository for organizing, storing, and retrieving features. This is a fully managed service that scales the underlying compute and storage resources. The feature store becomes a central location for serving features for training and prediction with low-latency. It stores feature values at points-in-time:

- Point-in-time lookups for retrieving features for model training. Retrieve feature values prior to a prediction to prevent data leakage.
- Manage training-serving skew

Prerequisites:

- 01 - BigQuery - Table Data Source
- Any of 02-05 That Deploy A Model To An Endpoint
 - Used to demonstrate online predictions with feature store serving features

Overview:

Google Cloud Platform statmike-mlops Search products and resources

FEATURES & INFO SHORTCUT DISABLE EDITOR TABS

EDITOR DIGITS DIGITS_LR DIGITS_F...

COMPOSE NEW QUERY

Store.ipynb

Explorer + ADD DATA digits_fs_training

Type to search

SCHEMA DETAILS PREVIEW TABLE EXPLORER

Row timestamp entity_type_drawing target p0 p32 p16 p48 p8 p40 p24 p56 p4 p36 p20 p52 p12

1701	2021-09-14 21:04:52 UTC	a0c826c2-520d-46c1-aaef-461277eda3fa	6	0.0	0.0	0.0	0.0	0.0	0.0	15.0	16.0	2.0	6.0	11.0
1702	2021-09-14 21:04:52 UTC	226aaaf8b-d8ff-43c7-89ca-b289f4fa7f12	6	0.0	0.0	0.0	0.0	0.0	0.0	15.0	16.0	0.0	1.0	8.0
1703	2021-09-14 21:04:52 UTC	eefdf8f1f-3d1d-420c-a434-67cb01a6b8c0	6	0.0	0.0	0.0	0.0	0.0	0.0	16.0	16.0	0.0	8.0	10.0
1704	2021-09-14 21:04:52 UTC	40e40f54-7f9d-4ad1-a68b-3e7723008894	8	0.0	0.0	0.0	0.0	0.0	0.0	15.0	16.0	0.0	8.0	4.0
1705	2021-09-14 21:04:52 UTC	a7cd4041-fde9-4146-b1cc-299ea383545e	8	0.0	0.0	0.0	0.0	0.0	0.0	16.0	14.0	7.0	4.0	5.0
1706	2021-09-14 21:04:52 UTC	c4e06400-bdad-4267-85e7-d1eb5d24d1f5	8	0.0	0.0	0.0	0.0	0.0	0.0	14.0	15.0	1.0	4.0	10.0
1707	2021-09-14 21:04:52 UTC	cbfb03781-98be-4fbe-9d5c-bc8d71fc9a1	8	0.0	0.0	0.0	0.0	0.0	0.0	11.0	16.0	0.0	0.0	12.0
1708	2021-09-14 21:04:52 UTC	f6aab929-cc5b-407d-87a4-10a503df4d0b	8	0.0	0.0	0.0	0.0	0.0	0.0	14.0	14.0	4.0	1.0	5.0

digits_prepended