

05



Stock Price Prediction Use Case - Prophet

mlangles Predictive Al





REVENUE OPERATIONS

COMMERCIAL INSIGHTS





COMMERCIAL ASSET MANAGEMENT

COMMERCIAL ENABLEMENT

About mlangles Predictive Al

8 32%

mlangles is a comprehensive AI platform designed to manage the lifecycle of data and models, offering streamlined solutions for every stage of the process.

Through its Predictive AI component, mlangles provides a suite of tools to navigate efficiently through each phase of AI project development, encompassing data engineering, development, deployment, and monitoring. It facilitates continuous integration, continuous deployment, continuous training, continuous monitoring (CI-CD-CT-CM), enabling enterprises to effectively manage their AI initiatives.

2,45%







Objective of the Use Case

We are trying to create a machine learning model that can accurately forecast future stock prices based solely on historical stock price data. The objective is to aid investors in making statistically informed trades.





Overview of Dataset and Use Case

The dataset was sourced from Kaggle, but the data was originally acquired from The Investor's Exchange API. The dataset contains five year's worth of stock data, from 2013 to 2018, and contains the following features: Date, Opening Price, Highest Price, Lowest Price, Closing Price, and Volume of Stocks Traded.

(03)





Working of the Use Case

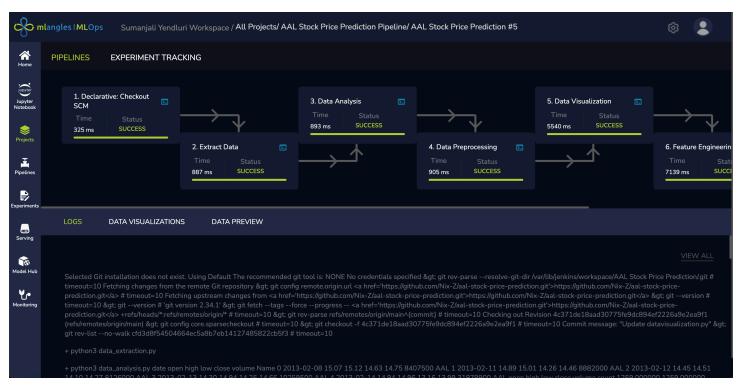
Step 1: Data Pipeline

Extract Data: Loaded data from the source (source was in GitHub Repository)

Data Analysis: Performed an analysis of the data to get an overview of the data and determine whether there were any issues with the data.

Data Preprocessing: Prepared data for model development and feature engineering. Dropped redundant data column: name. Data Visualization: Displayed two graphs, a line graph and a candlestick graph. The line graph focused on the closing price performance of the stock and the candlestick graph showed the entire price movement of the stock.

Feature Engineering: Final preparation of data before experiments are run. In this case, not much was done, just dropped a few more feature columns: Open, High, Low, and Volume.



Data Versioning:

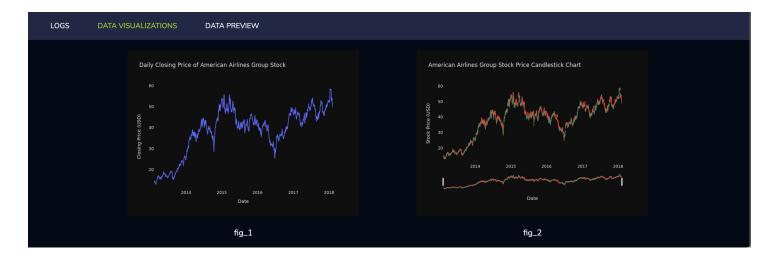
- Various processed data versions can be generated through different transformations applied to the same raw dataset, such as deleting columns or applying various transformations on specific columns.
- Throughout the data pipeline, diverse transformations can be executed at each iteration. Consequently, the resulting data at the pipeline's end is systematically versioned.
- Given that each version of the final data is distinct, models trained on these different versions will exhibit varying behaviors.



CloudAngles

ŝ	nlangles i MLOps	Sumanjali Yendluri Workspace	2 / All Projects/ AAL Stock Price Pred	diction Pipeline/ AAL Stock Price	Prediction #5	\$
A Home	PIPELINES	EXPERIMENT TRACKING				
Jupyter Jupyter Notebook	7	3. Data Analysis 💽 Time Status 893 ms SUCCESS	$\rightarrow \gamma$	5. Data Visualization Time Status 5540 ms SUCCESS	$\rightarrow \gamma$	7. Declarative: Post Actions Time Status 297 ms SUCCESS
	: Data 🕞 Status SUCCESS		4. Data Preprocessing 5 Time Status 905 ms SUCCESS	→_ ^	6. Feature Engineering 🖸 Time Status 7139 ms SUCCESS	
Experiments	LOGS	DATA VISUALIZATIONS DATA	A PREVIEW			
Serving		stallation does not exist. Using Defau	It The recommended git tool is: NONE No	o credentials specified > git rev-par	seresolve-git-dir /var/lib/jenkins/wor	VIEW ALL
Monitoring	prediction.git <br timeout=10 &g prediction.git <br (refs/remotes/o	/a> # timeout=10 Fetching upstream c jt; gitversion # 'git version 2.34.1' & /a> +refs/heads/*:refs/remotes/origin/*		/Nix-Z/aal-stock-price-prediction.git'>ł <a href="https://github.com/Nix-Z/aal-s
notes/origin/main^{commit} # timeout=</th><th>https://github.com/Nix-Z/aal-stock-price
tock-price-prediction.git">https://githul 10 Checking out Revision 4c371de18	e-prediction.git > gitversion # b.com/Nix-Z/aal-stock-price-	
		a_extraction.py				
			e volume Name 0 2013-02-08 15.07 15. 94 14 25 14 66 10259500 AAL 4 2013			

An overview of the data Pipeline



Fig_1 is a line graph displaying the performance of the AAL stock's closing price over a 5-year period. Fig_2 is a candlestick graph displaying the entire price movement of the AAL stock.



ŝ	nlangles MLOps	Sumanjali Yendluri Wo	orkspace / All Projects/ AAL Stock Price Predict	ion Pipeline/ AAL Stock Price Prediction #3	® 😩
Ame Home	PIPELINES	EXPERIMENT TRACKING			
Jupyter Notebook	LOGS	DATA VISUALIZATIONS	DATA PREVIEW		
	DATE			CLOSE	
Projects	2013-02-08			14.75	
Pipelines	2013-02-11			14.46	
₽	2013-02-12			14.27	
Experiments	2013-02-13			14.66	
Serving	2013-02-14			13.99	
Model Hub	2013-02-15			14.5	
٣	2013-02-19			14.26	
Monitoring	2013-02-20			13.33	
	2013-02-21			13.37	
	2013-02-22			13.57	

CloudAngles

Preview of the data after the data pipeline has been run to completion.

Step2: Experiment Tracking

Multiple experiments were run using the Prophet machine learning model. After comparing the accuracy and RMSE of each experimental run, it was observed that the best results were from using Prophet without any hyperparameters. In the end, the best RMSE was 4.31 with a score of 0.92.

cfor m	lang	les IMLOps Sumanjali Yendluri Workspa	ICE / Projects / AAL Stock Price Prediction E	xperiment Tracking			¢				
A Home	PIPELINES EXPERIMENT TRACKING										
jupyter					+ New Run	🗶 Run Configuration	Clear Filter 📋 Delete				
Jupyter Notebook		RUN ID	RUN NAME	STATUS	CREATED BY	START TIME	END TIME				
Projects		3a430e5be81f417b99f8d03ff3fd37b6	AAL Stock Price Prediction Prophet #10	Success	Sumanjali Yendluri	3/19/2024, 10:35:28 AM	3/19/2024, 10:35:32 AM				
H		5b992877579a447ab21f5cd73ecf7f00	AAL Stock Price Prediction Prophet #9	Success			3/19/2024, 10:34:46 AM				
Pipelines		30e64009215e40aa8532f1312e86d662	AAL Stock Price Prediction Prophet #7	Success	Sumanjali Yendluri	3/19/2024, 10:33:26 AM	3/19/2024, 10:34:05 AM				
Experiments		67ba3a69dd3a4ccab36556855e8b836f	AAL Stock Price Prediction Arima #1		Sumanjali Yendluri	3/19/2024, 10:33:09 AM	3/19/2024, 10:33:10 AM				
Serving		920af031149f4b9d995327d71010564a	AAL Stock Price Prediction Prophet #6	Success	Sumanjali Yendluri	3/19/2024, 10:31:49 AM	3/19/2024, 10:31:53 AM				
		67ae28c6950a4dfc9e0f772e8d67017e	AAL Stock Price Prediction Prophet #4	Success	Sumanjali Yendluri	3/19/2024, 10:31:23 AM	3/19/2024, 10:31:29 AM				
Model Hub		86953f37584c40369f225a048882b324	AAL Stock Price Prediction Prophet #5	Success	Sumanjali Yendluri	3/19/2024, 10:31:23 AM	3/19/2024, 10:31:28 AM				
Monitoring		77ce7f71ba9d45fdad942e4e7786a3e0	AAL Stock Price Prediction Prophet #3	Success	Sumanjali Yendluri	3/19/2024, 10:17:26 AM	3/19/2024, 10:17:32 AM				
		f135ad3e07a54f4e88e8904c2b8d35ff	AAL Stock Price Prediction #2	Success	Sumanjali Yendluri		3/19/2024, 10:16:49 AM				
		e10c6c260e7e4dc8ac39cd475a7c0b68	AAL Stock Price Prediction ALL #1		Sumanjali Yendluri		3/19/2024, 10:15:39 AM				
		17994601cd7245ec84a0cc8c517ce0bb	AAL Stock Price Prediction Prophet #1	Success	Sumanjali Yendluri	3/19/2024, 10:15:29 AM	3/19/2024, 10:15:35 AM				



CloudAngles

Sumanjali Yendluri Workspace / Projects / AAL Stock Price Prediction Experiment Tracking								
A Home	PIPELINES EXPERIMENT TRACKING						Go to Serving	
Jupyter Notebook	Experimen Search Experiment Q 📄 🖿	オ Run Name :AA	L Stock Price Prediction Prophet #8	E Run ID : 86955ee2fa334e00870663	34006333296		11:05:50 PM	
۲	🔹 💩 Exp Name: AAL Stock Price Success		Parameters	Metrics		Artifacts		
Projects	86955ee2fa334e008706634006333296	NAME	VALUE					
E Pipelines								
Experiments								
Serving								
Model Hub								
Monitoring								
c‰ ™	langles I MLOps Sumanjali Yendluri Workspac	e / Projects / AAL S	Stock Price Prediction Experim	ent Tracking		1	¢	
r m	langles I MLOps Sumanjali Yendluri Workspac PIPELINES EXPERIMENT TRACKING	e / Projects / AAL S	Stock Price Prediction Experim	ent Tracking			Go to Serving	
Ame Home	PIPELINES EXPERIMENT TRACKING						Go to Serving	
			L Stock Price Prediction Prophet #8	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Home	PIPELINES EXPERIMENT TRACKING Experimen Search Experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment Image: Comparison of the search experiment Image: Comparison of the search experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment <th></th> <th>L Stock Price Prediction Prophet</th> <th>🖽 Run ID :</th> <th>4006333296</th> <th></th> <th>Go to Serving</th> <th></th>		L Stock Price Prediction Prophet	🖽 Run ID :	4006333296		Go to Serving	
Home Home Jupyter Notebook Projects	PIPELINES EXPERIMENT TRACKING		L Stock Price Prediction Prophet #8	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Home Home Jupyter Notebook Projects Pipelines	PIPELINES EXPERIMENT TRACKING Experimen Search Experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment Image: Comparison of the search experiment Image: Comparison of the search experiment Q Image: Comparison of the search experiment Image: Comparison of the search experiment <th>才 Run Name :AA</th> <th>L Stock Price Prediction Prophet #8 Parameters</th> <th>聞 Run ID : 86955ee2fa334e00870663</th> <th>4006333296</th> <th>葡 Created AT :3/18/2024,</th> <th>Go to Serving</th> <th></th>	才 Run Name :AA	L Stock Price Prediction Prophet #8 Parameters	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Home Home Jupyter Notebook Projects	PIPELINES EXPERIMENT TRACKING	☆ Run Name :AA NAME	L Stock Price Prediction Prophet #8 Parameters VALUE	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Home Home Jupyter Notebook Projects Pipelines	PIPELINES EXPERIMENT TRACKING	A Run Name :AA NAME MAE	L Stock Price Prediction Prophet #8 Parameters VALUE 3.6674483024537405	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Kerning Kerning Kerning Kerning	PIPELINES EXPERIMENT TRACKING	Image: Manual Science Name: AA NAME MAE MSE	L Stock Price Prediction Prophet #8 Parameters VALUE 3.6674483024537405 17.56179961950371	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Home Jupter Notebook Projects Projects Experiments Serving Model Hub	PIPELINES EXPERIMENT TRACKING	A Run Name :AA NAME MAE MAE MSE RMSE Image: I	VALUE 3.6674483024537405 17.56179961950371 4.190680090331844	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Kerning Kerning Kerning Kerning	PIPELINES EXPERIMENT TRACKING	A Run Name :AA NAME MAE MAE MSE RMSE Image: I	VALUE 3.6674483024537405 17.56179961950371 4.190680090331844	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	
Kerving Serving Model Hub	PIPELINES EXPERIMENT TRACKING	A Run Name :AA NAME MAE MAE MSE RMSE Image: I	VALUE 3.6674483024537405 17.56179961950371 4.190680090331844	聞 Run ID : 86955ee2fa334e00870663	4006333296	葡 Created AT :3/18/2024,	Go to Serving	

Model Versioning:

- Models are sensitive to a plethora of hyperparameters and parameters, including learning rate, loss function, and optimizers.
- Consequently, a model selected for training, with both the model and final data versions remaining constant but changes in parameters, may yield differing performance metrics.
- These diverse model versions can be uploaded to the model hub, facilitating the management of multiple iterations and variations.





Step 3: Serving

Performed an online prediction using a random date from within the timeline of our data. The forecasted closing price for the stock on October 10, 2017, is \$53.09, while the actual closing price for that day was \$53.03. Our prediction was off six cents.

co mla	ngles <mark>ML</mark> Ops		jali Yendluri Wo	rkspace / Servir	ng / Online Serving					•
Ame Home	ONLINE PRED	DICTIONS								
Jupyter Notebook	Select Project N	lame			Select Experiment Nar			Select Model		
Projects	AAL Stock F	Price Prediction	on		AAL Stock Price P	rediction Prophet #8		Prophet		
Pipelines	Enter the	inputs								
Experiments	Date	10		Month	10	Year	2017			
Model Hub										
Monitoring										
	Predict	Result	45.7958760	5000928						

Model Hub:

- Trained models are uploaded to the model hub, whereupon deployment, a REST API endpoint is automatically generated.
- Data is transmitted to this endpoint as a request, triggering the model to execute a prediction and return the output as the response to the request.

c c c m	langles IMLOps Jennyfer Labadie Workspace / Model Hub						ø 😩
A Home	Model Hub						
Jupyter Notebook						Tr Clear Filter	🖞 Delete
Projects	MODEL NAME	CREATED BY	CREATED AT	VERSION	STATUS		
							>
Pipelines							
₽							
Experiments							
Serving							>
Model Hub							
۳							
Monitoring							>
							>
	GradientBoostingRegressor	Jennyfer Labadie	15:5:15 5-2-2024	V1	Staging	View Details	





Step 4: Monitoring

Data drift is the gradual or abrupt change in the statistical properties of training data in a machine learning model. There are three types of data drift: sudden drift, gradual drift, and seasonal drift. Sudden drift occurs when there is a sudden and abrupt change in the distribution of data. Gradual drift, the opposite of sudden drift, is a slow, steady change in the distribution of data. Finally, seasonal drift is when shifts in the data distribution are linked to time-based patterns. Data drift can cause several issues with machine learning models, including reduced model performance, loss of generalization, and model degradation.

We can see here in the monitoring screen that all the features have drifted. Since these features are related to financial matters, which are dependent on a multitude of extraneous factors including seasonality, the data features are prone to data drift. In the future, we can control this issue with continuous monitoring and model retraining.

	nlangles I	MLOps S	Gumanjali Yendluri Wo	rkspace / Monitori i	ng				¢	
A Home		器 General	/ MIAngles Data Dri	ft Dashboard				🕘 Last 30 r	minutes ~ ල යි 10s	~ -
	Q,	dataset_name	AAL Stock Price Predic	ction ~						
Jupyter Jupyter Notebook	☆	Evidently Data Drift Monitoring								
	88	Here can be y	our information about da	ashboard and its usag	ge.					
Projects		~ General ir	formation							
Ŧ		• General II				Da	taset Drift			
Pipelines										
Experiments										
en Serving		dataset drift					Data Drift Detected			
Model Hub			20:	40	20:45	2	0:50 20:5	5 21:00	0 21:	05
Monitoring				Share of drifted fea	tures		# of drifted fea	itures	# of features	
		100%								
		80%								
		60%					1 2		2	
		40%					J		\mathbf{O}	
	€	20%								
		0%	20:40 20:45	20:50	20:55	21:00 21:05				

Conclusion

In conclusion, we can see that the Prophet model is effective at forecasting stock prices. However, the model is also prone to data drift, requiring continuous monitoring and retraining of the model. Still, with care, this model holds excellent potential for use in the investment market.

