BQ ML . 1 . RAW DATA

SCHEMA | DETAILS | PREVIEW | LINEAGE | DATA PROFILE | DATA QUALITY

Field name	Type	Mode	Key	Collation	Default Value
ga_pageviews	INTEGER	NULLABLE	-	-	-
ga_deviceCategory	STRING	NULLABLE	-	-	-
ga_pagePath	STRING	NULLABLE	-	-	-
ga_dimension9	STRING	NULLABLE	-	-	-
ga_date	DATE	NULLABLE	-	-	-
ga_uniquePurchases	INTEGER	NULLABLE	-	-	-
ga_itemRevenue	FLOAT	NULLABLE	-	-	-
ga_productAddsToCart	INTEGER	NULLABLE	-	-	-
ga_productListClicks	INTEGER	NULLABLE	-	-	-
ga_productListViews	INTEGER	NULLABLE	-	-	-
ga_productListName	STRING	NULLABLE	-	-	-

Fig. 1. Original data schema

Storage info

Number of rows	34,328,166
Total logical bytes	5.07 GB
Active logical bytes	5.07 GB
Long term logical bytes	0 B
Total physical bytes	88.14 MB
Active physical bytes	88.14 MB
Long term physical bytes	0 B
Time travel physical bytes	0 B

Fig. 2. Original table size and properties

BQ ML . 2 . VIEW

SQL

```
SELECT
  SUM(ga_pageviews) AS views,
  ga_date AS `date`,
  SUBSTRING(ga_dimension9, 6, 2) AS country,
FROM `savvy-camp-345623.data_2024.wr_data`
GROUP BY `date`, country
```

SCHEMA | DETAILS | LINEAGE | DATA PROFILE | DATA QUALITY

Filter Enter property name or value

Field name	Type	Mode	Key	Collation	Default Value
views	INTEGER	NULLABLE	-	-	-
date	DATE	NULLABLE	-	-	-
country	STRING	NULLABLE	-	-	-

Fig. 3. Blended data schema

Storage info

Number of rows	0
Total logical bytes	0 B
Active logical bytes	0 B
Long term logical bytes	0 B
Total physical bytes	0 B
Active physical bytes	0 B

Fig. 4. Blended data properties

BQ ML . 3 . MODEL

DOC

https://cloud.google.com/bigquery/docs/reference/standard-sql/bigqueryml-syntax-create-time-series

SQL

```
CREATE OR REPLACE MODEL
  `savvy-camp-345623.data_2024.wr_model_vbdac`
OPTIONS(
  model_type = 'ARIMA_PLUS',
  time_series_data_col = 'views',
  time_series_timestamp_col = 'date',
  time_series_id_col = ['country'],
  data_frequency = 'daily'
)
AS
  SELECT `date`, country, views
  FROM `savvy-camp-345623.data_2024.wr_views_by_date_and_country`
  WHERE `date` < "2024-06-01"
```

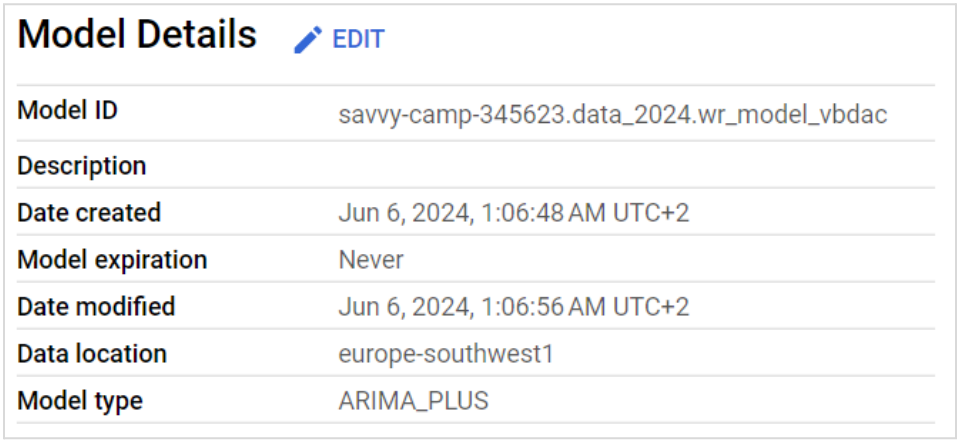
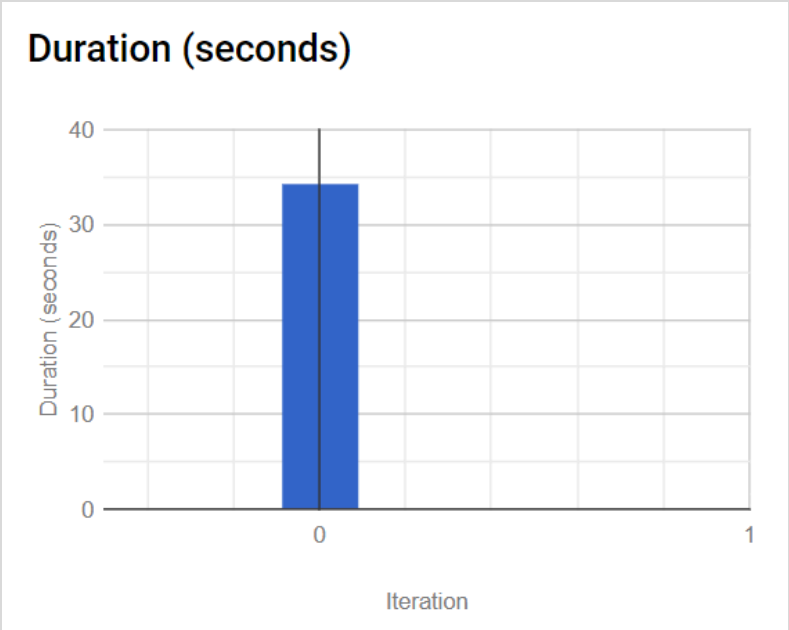


Fig. 5. Model properties



6. Model training

Non Seasonal P	Non Seasonal D	Non Seasonal Q	Has Drift	Has Spikes And Dips	Has Holiday Effect	Has Step Changes
4	1	1	False	True	False	True
0	1	5	False	True	False	True
1	1	4	False	True	False	True
0	1	5	False	True	False	True
2	1	3	False	True	False	False
2	1	2	False	True	False	False
1	0	4	False	True	False	True
2	1	3	False	True	False	True
2	1	3	False	True	False	True

Fig. 7. Model tuning

BQ ML . 4 . ANOMALIES

SQL

```
SELECT *
FROM ML.DETECT_ANOMALIES(
  MODEL `savvy-camp-345623.data_2024.wr_model_vbdac`,
  STRUCT(0.95 AS anomaly_prob_threshold)
)
```

JOB INFORMATION | RESULTS | CHART | JSON | EXECUTION DETAILS | EXECUTION GRAPH

Row	country	date	views	is_anomaly	lower_bound	upper_bound	anomaly_probability
1	AE	2022-01-01 00:00:00 UTC	2707.0	false	2039.828121898...	3374.171878101...	0.0
2	AE	2022-01-02 00:00:00 UTC	2760.0	true	2854.789337116...	4189.133093319...	0.974626395109...
3	AE	2022-01-03 00:00:00 UTC	3957.0	false	2862.389393989...	4196.733150193...	0.789653276136...
4	AE	2022-01-04 00:00:00 UTC	4049.0	false	3296.192607936...	4630.536364139...	0.198214662495...
5	AE	2022-01-05 00:00:00 UTC	5019.0	false	3745.854910514...	5080.198666718...	0.924891458427...
6	AE	2022-01-06 00:00:00 UTC	7361.0	true	5630.896296558...	6965.240052761...	0.997740133518...
7	AE	2022-01-07 00:00:00 UTC	6588.0	false	6363.045790460...	7697.389546663...	0.805063924401...
8	AE	2022-01-08 00:00:00 UTC	6118.0	false	5183.820048237...	6518.163804440...	0.566302146651...
9	AE	2022-01-09 00:00:00 UTC	5679.0	false	4845.553787242...	6179.897543446...	0.374628249795...
10	AE	2022-01-10 00:00:00 UTC	5431.0	false	4530.430499462...	5864.774255665...	0.506477573266...
11	AE	2022-01-11 00:00:00 UTC	4093.0	false	3864.126562148...	5198.470318351...	0.801058780991...
12	AE	2022-01-12 00:00:00 UTC	4170.0	false	3712.590047802...	5046.933804005...	0.461857604482...
13	AE	2022-01-13 00:00:00 UTC	4337.0	false	4072.342975314...	5406.686731517...	0.761741253120...

Fig. 8. Anomalies detection

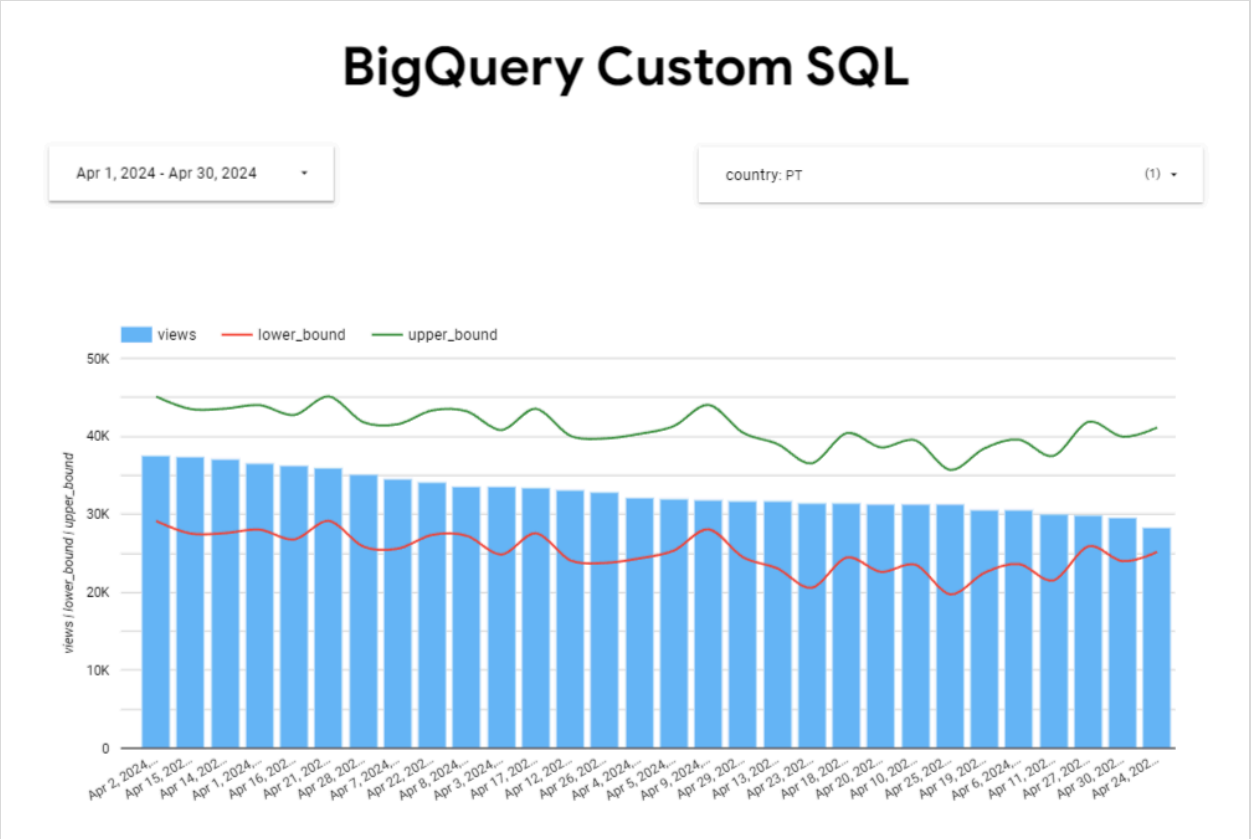


Fig. 9. Anomalies query in Looker

BQ ML . 5 . PREDICTION

SQL

```
SELECT *
FROM ML.FORECAST(
  MODEL `savvy-camp-345623.data_2024.wr_model_vbdac`,
  STRUCT (
    1 AS horizon,
    0.95 AS confidence_level
  )
)
```

JOB INFORMATION | RESULTS | CHART | JSON | EXECUTION DETAILS | EXECUTION GRAPH

Row	country	forecast_timestamp	forecast_value	standard_error	confidence_level	prediction_interval_lc	prediction_interval_u	confidence_interval_	confidence_interval_
2	AT	2024-06-01 00:00:00 UTC	6086.861022647...	400.3711789910...	0.95	5303.551589813...	6870.170455482...	5303.551589813...	6870.170455482...
3	BE	2024-06-01 00:00:00 UTC	12881.68191373...	780.9756936981...	0.95	11353.73569835...	14409.62812912...	11353.73569835...	14409.62812912...
4	BG	2024-06-01 00:00:00 UTC	4293.075090515...	363.2715825556...	0.95	3582.349463326...	5003.800717704...	3582.349463326...	5003.800717704...
5	CH	2024-06-01 00:00:00 UTC	4408.436854835...	230.3306371859...	0.95	3957.804615938...	4859.069093732...	3957.804615938...	4859.069093732...
6	CN	2022-08-06 00:00:00 UTC	8.914668615781...	112.7739286780...	0.95	-211.722796683...	229.5521339148...	-211.722796683...	229.5521339148...
7	CO	2024-06-01 00:00:00 UTC	14908.54104935...	1173.314744203...	0.95	12612.99992390...	17204.08217480...	12612.99992390...	17204.08217480...
8	CZ	2024-06-01 00:00:00 UTC	3930.238843309...	346.8482700178...	0.95	3251.644738828...	4608.832947790...	3251.644738828...	4608.832947790...
9	DE	2024-06-01 00:00:00 UTC	47456.97471252...	3175.279906255...	0.95	41244.67264641...	53669.27677864...	41244.67264641...	53669.27677864...
10	DK	2024-06-01 00:00:00 UTC	2942.807642245...	275.0119030403...	0.95	2404.758379218...	3480.856905272...	2404.758379218...	3480.856905272...
11	DZ	2024-06-01 00:00:00 UTC	4076.319765933...	409.1957171915...	0.95	3275.745493930...	4876.894037936...	3275.745493930...	4876.894037936...
12	EE	2024-06-01 00:00:00 UTC	1231.856255520...	96.88117313978...	0.95	1042.312300394...	1421.400210646...	1042.312300394...	1421.400210646...
13	EG	2024-06-01 00:00:00 UTC	3799.985573928...	548.3710252666...	0.95	2727.120644272...	4872.850503584...	2727.120644272...	4872.850503584...
14	ES	2024-06-01 00:00:00 UTC	181418.6544884...	13860.08326210...	0.95	154301.9824381...	208535.3265386...	154301.9824381...	208535.3265386...

Fig. 10. Forecasting

SQL along with Blended Data

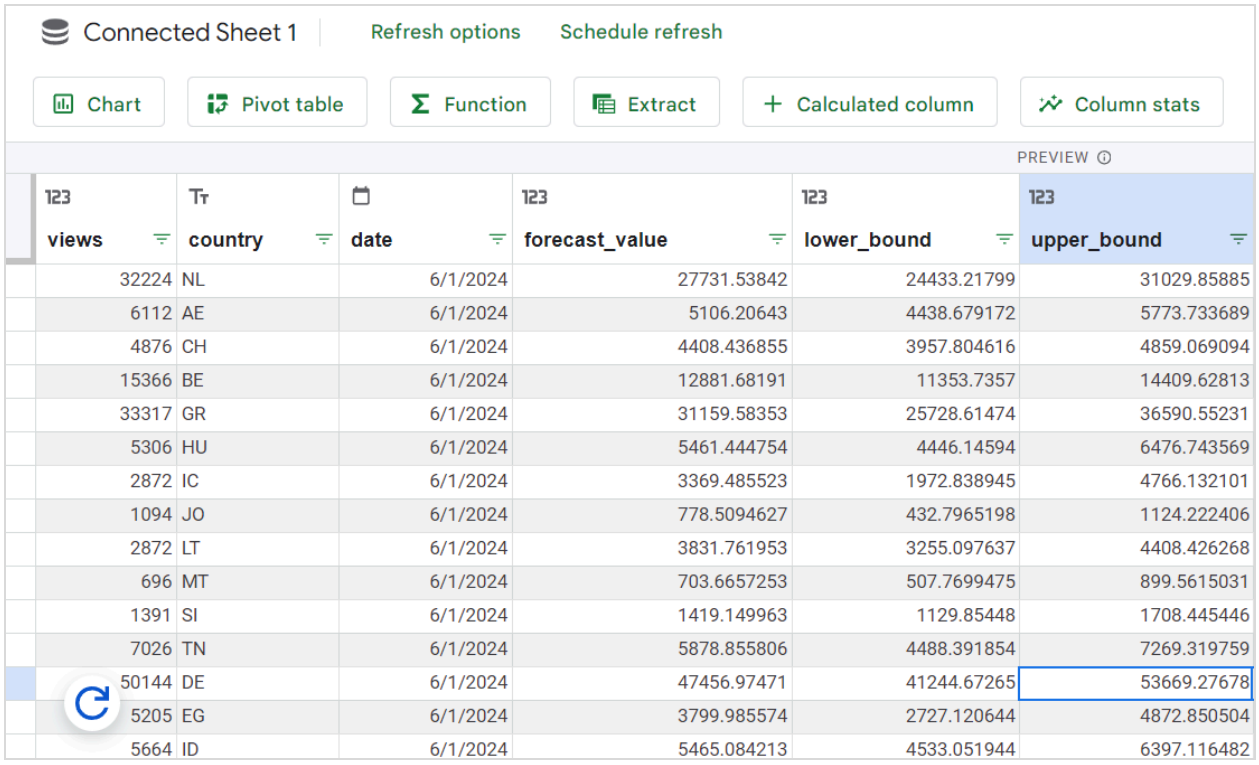
```
WITH forecast AS (
  SELECT country, DATE(forecast_timestamp) as `date`, forecast_value,
    prediction_interval_lower_bound AS lower_bound,
    prediction_interval_upper_bound AS upper_bound
  FROM ML.FORECAST(
    MODEL `savvy-camp-345623.data_2024.wr_model_vbdac`,
    STRUCT (1 AS horizon, 0.95 AS confidence_level))
)

SELECT *
FROM `savvy-camp-345623.data_2024.wr_views_by_date_and_country` v, forecast f
WHERE v.date = f.date AND v.country = f.country
```

JOB INFORMATION | RESULTS | CHART | JSON | EXECUTION DETAILS | EXECUTION GRAPH

Row	views	date	country	country_1	date_1	forecast_value	lower_bound	upper_bound
1	6112	2024-06-01	AE	AE	2024-06-01	5106.206430492...	4438.679171673...	5773.733689311...
2	15366	2024-06-01	BE	BE	2024-06-01	12881.68191373...	11353.73569835...	14409.62812912...
3	4876	2024-06-01	CH	CH	2024-06-01	4408.436854835...	3957.804615938...	4859.069093732...
4	33317	2024-06-01	GR	GR	2024-06-01	31159.58352907...	25728.61474361...	36590.55231453...
5	5306	2024-06-01	HU	HU	2024-06-01	5461.444754385...	4446.145939982...	6476.743568788...
6	2872	2024-06-01	IC	IC	2024-06-01	3369.485522826...	1972.838944985...	4766.132100667...
7	1094	2024-06-01	JO	JO	2024-06-01	778.5094627045...	432.7965198009...	1124.222405608...
8	2872	2024-06-01	LT	LT	2024-06-01	3831.761952510...	3255.097637190...	4408.426267830...
9	696	2024-06-01	MT	MT	2024-06-01	703.6657252860...	507.7699474799...	899.5615030920...
10	32224	2024-06-01	NL	NL	2024-06-01	27731.53841553...	24433.21798531...	31029.85884575...
11	1391	2024-06-01	SI	SI	2024-06-01	1419.149962521...	1129.854479524...	1708.445445518...
12	7026	2024-06-01	TN	TN	2024-06-01	5878.855806492...	4488.391853699...	7269.319759285...
13	6424	2024-06-01	AT	AT	2024-06-01	6086.861022647...	5303.551589813...	6870.170455482...
14	3959	2024-06-01	CZ	CZ	2024-06-01	3930.238843309...	3251.644738828...	4608.832947790...

Fig. 11. Forecast vs Real Data



123 views	country	date	123 forecast_value	123 lower_bound	123 upper_bound
32224	NL	6/1/2024	27731.53842	24433.21799	31029.85885
6112	AE	6/1/2024	5106.20643	4438.679172	5773.733689
4876	CH	6/1/2024	4408.436855	3957.804616	4859.069094
15366	BE	6/1/2024	12881.68191	11353.7357	14409.62813
33317	GR	6/1/2024	31159.58353	25728.61474	36590.55231
5306	HU	6/1/2024	5461.444754	4446.14594	6476.743569
2872	IC	6/1/2024	3369.485523	1972.838945	4766.132101
1094	JO	6/1/2024	778.5094627	432.7965198	1124.222406
2872	LT	6/1/2024	3831.761953	3255.097637	4408.426268
696	MT	6/1/2024	703.6657253	507.7699475	899.5615031
1391	SI	6/1/2024	1419.149963	1129.85448	1708.445446
7026	TN	6/1/2024	5878.855806	4488.391854	7269.319759
50144	DE	6/1/2024	47456.97471	41244.67265	53669.27678
5205	EG	6/1/2024	3799.985574	2727.120644	4872.850504
5664	ID	6/1/2024	5465.084213	4533.051944	6397.116482

Fig. 12. Forecast vs Real Data with Google Sheets