



Shredding the Slopes *with Statistics*

*How Boyne Resorts Built Custom Models to
Forecast Skier Visits*

DOMO

BOYNE RESORTS

EXPERIENCE THE LIFESTYLE

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CONFIDENTIAL

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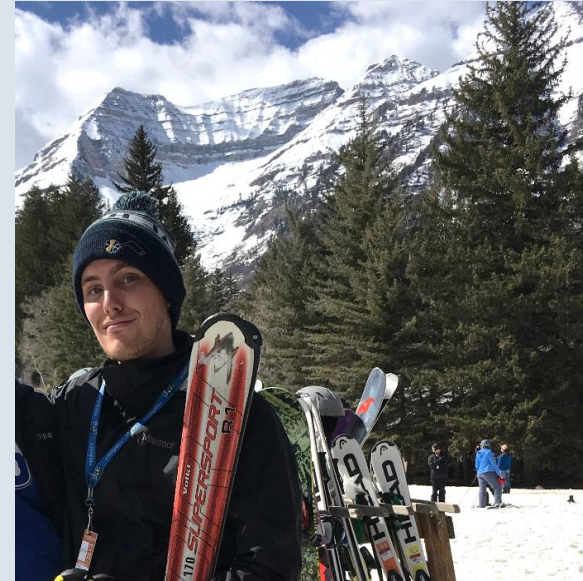
Data Scientist

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Data Science Professional Services

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Associate Data Scientist

Domo

AI Labs

Data Science Professional Services

Key Takeaways

The background of the slide is a photograph of various ski equipment laid out on a dark, weathered wooden plank surface. From left to right, there are two blue skis, a red ski pole, two green skis with 'DOWN' written on them, two black ski poles, and two white skis. The equipment is arranged in a somewhat organized fashion, with the skis standing upright and the poles lying horizontally.

Create an
end-to-end
data science &
machine learning
solution,
all in Domo

Use Jupyter
Workspaces
to build &
deploy custom
forecasting
models

Monitor model
performance &
data pipelines
using automated
dashboards &
alerts

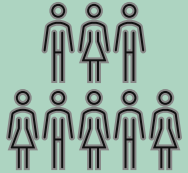


BOYNE RESORTS

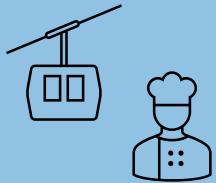
EXPERIENCE THE LIFESTYLE

- Third largest mountain resort company in North America; founded in 1947
- Owns 10 ski resorts & 14 golf course across the US & Canada
 - Brighton (Utah)
 - Big Sky (Montana)
 - Sugarloaf and Sunday River (Maine)
 - Boyne Mountain and The Highlands (Michigan)
 - Cypress Mountain (British Columbia)
- Domo customer since 2020

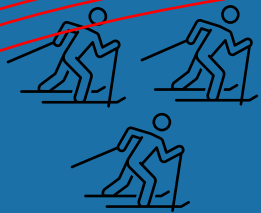
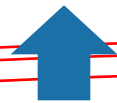
Boyne's Million-Dollar Question



How many staff do we need next week?



What services do we need to provide?



How many skiers are coming?

Forecast using machine learning model

Why use DOMO for machine learning solution?

- Build entire solution within your Domo instance
- Partner with Domo's AI Labs team for assistance



Skier Visit Custom Forecasting Solution

Fully-automated, 10-day forecast of
daily skier visits for each resort

Forecast takes into consideration historical trends in
skier visits, weather, number of tickets bought
in advance, holidays, and more



Before & After

NO MORE LAST-MINUTE GUESSING: Estimating skier visits for the next 10 days using custom forecasting models

NO MORE LOST SPREADSHEETS: Forecasts are easily accessible to all via Domo dashboards

PREPARE

ANALYZE

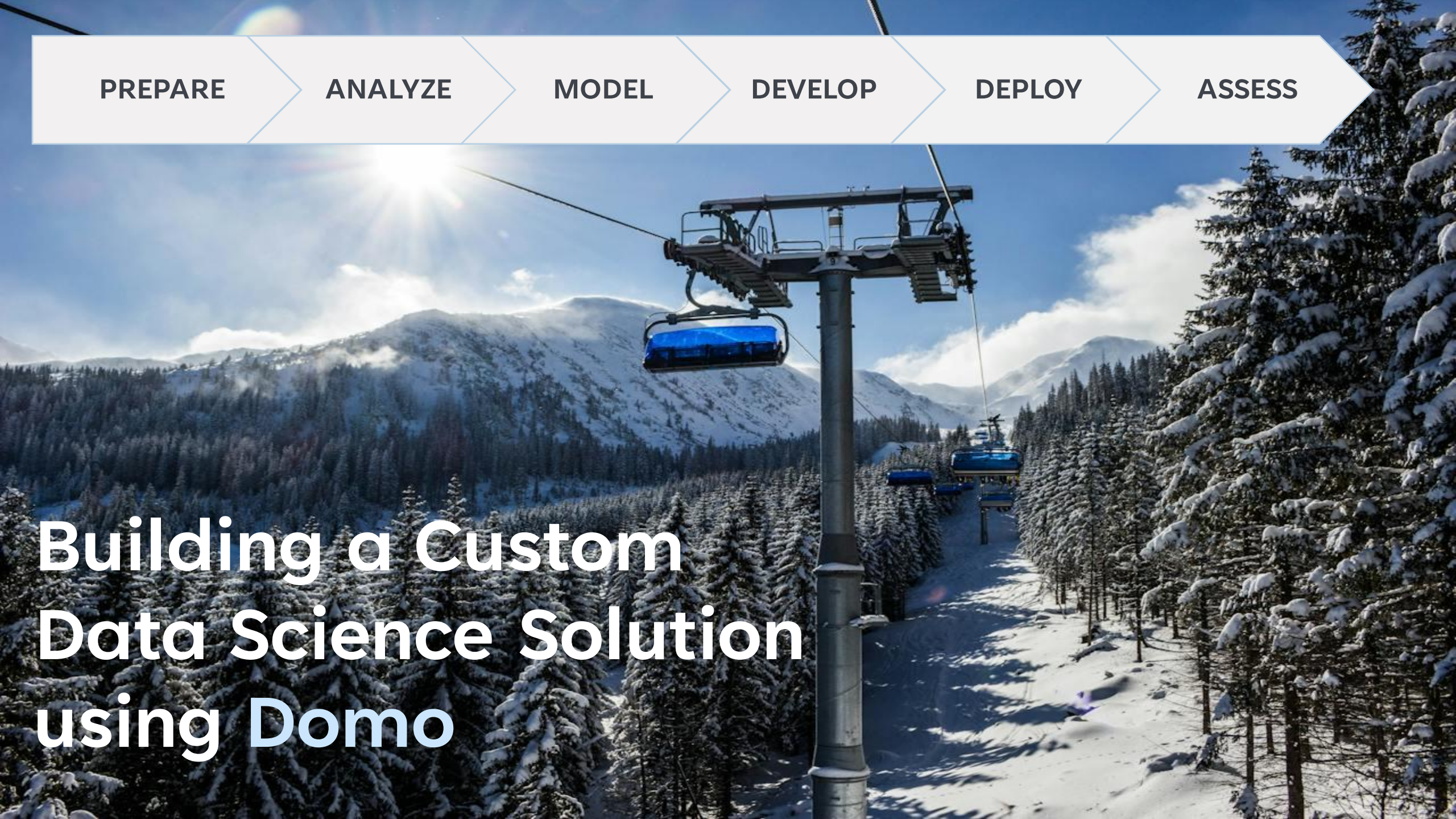
MODEL

DEVELOP

DEPLOY

ASSESS

Building a Custom Data Science Solution using Domo



PREPARE

ANALYZE

MODEL

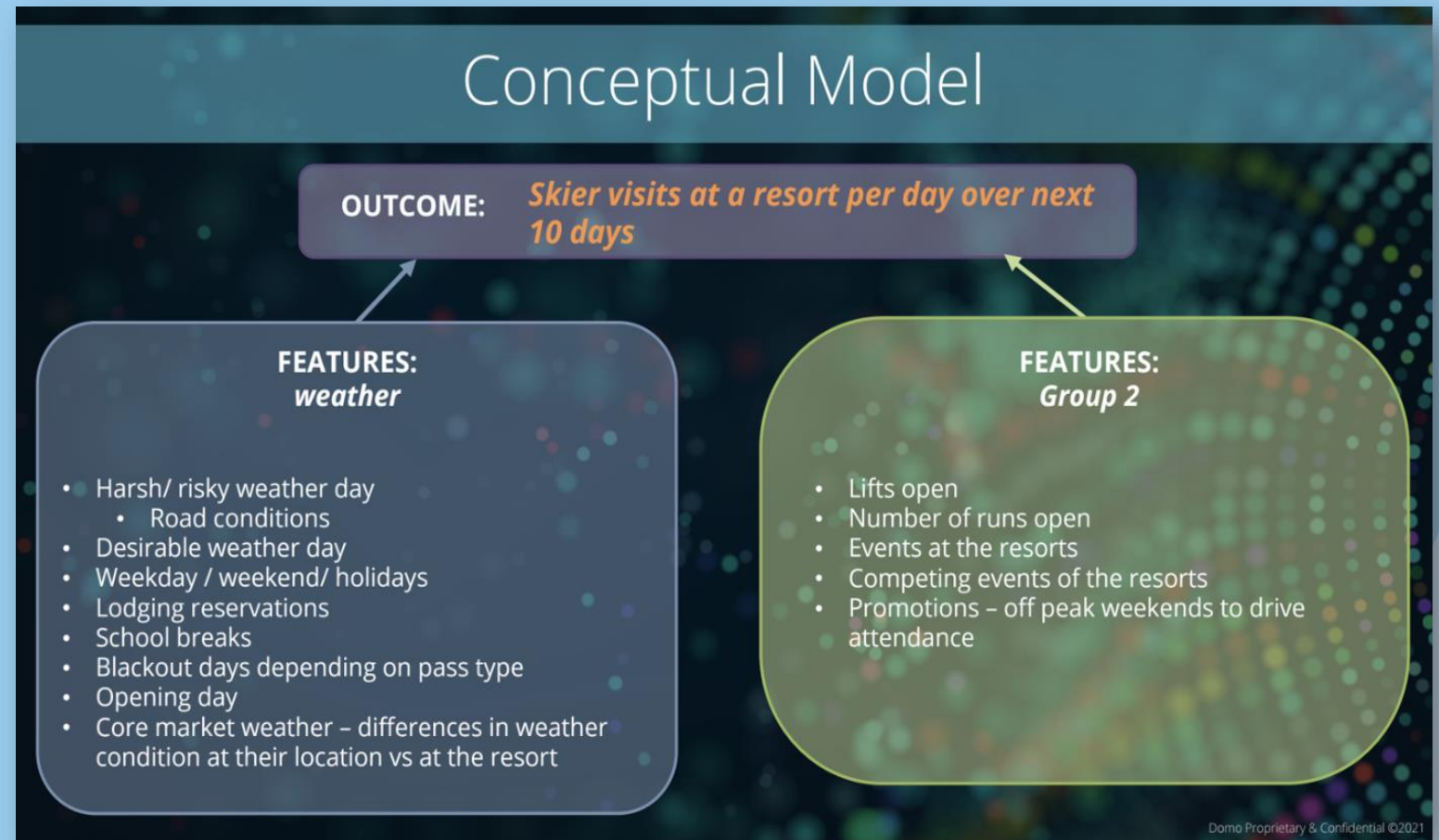
DEVELOP

DEPLOY

ASSESS

Spring 2022

Created a conceptual model, which listed features that influence skier visits



PREPARE

ANALYZE

MODEL

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ASSESS

Spring 2022

Completed a metric map that detailed data availability & quality for each feature in Boyne's conceptual model

Variable Type	Variable	Do you have a measure in your data of this variable?	Variable Name in Dataset	Description of Variable	Unit of Analysis/ Granularity	Variable Type	Range or Categories	Category Labels of Integer Variables	Rank/Ordering of Text Variables (from lowest to highest)	Name of Dataset in Domo where Variable is Saved	Link to Dataset in Domo	Notes
Dependent Variable/Outcome	Total Skier Visits	Yes	tot_months_employ	Number of months employed at company	By day by resort	Integer	0 to 10,000	N/A	N/A	Ski_Ops_Detail_All_Resorts	https://domo-data-science.domo.com	
Feature	Lift Tickets Booked for day of Interest	Yes	lift_tix_booked	Number of tickets booked for date of interest on given date	By date by resort by date of interest.	Integer	0 to 9,500	N/A	N/A	lift_bookings_detail	https://domo-data-science.domo.com	
Feature	Max Temperature Day of Interest	Yes	max_temp_actual	Max Temperature on given date	By date by resort.	Integer	14 to 63	N/A	N/A	daily_weather_detail	https://domo-data-science.domo.com	There is quite a bit of missing data on this feature
Feature	Max Temperature 14-Day Forecast	Yes	max_temp_14day_fc	Forecasted Max Temperature 14 days from today.	By date by resort	Integer	23 to 57	N/A	N/A	daily_weather_fc_detail	https://domo-data-science.domo.com	We only have this data for the past 2 years (we started collecting it in 2022)

PREPARE

ANALYZE

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DEVELOP

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Spring 2022

Created a dataset with
features from the
conceptual model
& metric map

DOMO

BOYNE RESORTS

DASHBOARDS

ALERTS

BUZZ

APPSTORE

DATA

MORE

←

DS_Rolled_Up_v262,470 rows

OVERVIEW

DATA

CARDS

LINEAGE

PDP

ALERTS

AutoML

Search Columns

20 rows filtered by: Date xResortDescription xClear all

	ResortDescription	Date	Total Ticket Visits	Snow Actual FC 1 Day	Snow Actual FC 2 Day	Snow Actual FC 3 Day	Snow Actual FC 4 Day	Snow Actual FC 5 Day
	abc+ filter	+ filter	1.23+ filter	123+ filter	123+ filter	123+ filter	123+ filter	123+ filter
1	Big Sky Resort	Jan 1, 2023	3,693.00	0	0	0	1	0
2	Big Sky Resort	Jan 2, 2023	3,552.00	0	0	0	1	1
3	Big Sky Resort	Jan 3, 2023	3,624.00	0	0	0	0	0
4	Big Sky Resort	Jan 4, 2023	3,975.00	0	0	0	0	0
5	Big Sky Resort	Jan 5, 2023	4,357.00	0	0	0	0	0
6	Brighton Ski Bowl	Jan 1, 2023	2,920.00	1	1	1	1	1
7	Brighton Ski Bowl	Jan 2, 2023	4,836.00	1	1	1	1	1
8	Brighton Ski Bowl	Jan 3, 2023	3,438.00	1	1	0	0	0
9	Brighton Ski Bowl	Jan 4, 2023	3,706.00	0	0	0	0	0
10	Brighton Ski Bowl	Jan 5, 2023	3,698.00	1	1	0	0	0
11	Loon Mountain	Jan 1, 2023	1,189.00	0	0	1	1	0
12	Loon Mountain	Jan 2, 2023	2,675.00	0	0	0	0	0
13	Loon Mountain	Jan 3, 2023	635.00	0	0	0	0	0
14	Loon Mountain	Jan 4, 2023	729.00	0	0	0	0	0
15	Loon Mountain	Jan 5, 2023	890.00	1	1	0	1	0
16	Summit at Snoqual...	Jan 1, 2023	3,138.00	0	0	0	0	0
17	Summit at Snoqual...	Jan 2, 2023	4,816.00	0	0	0	0	0
18	Summit at Snoqual...	Jan 3, 2023	1,534.00	0	1	0	0	0
19	Summit at Snoqual...	Jan 4, 2023	1,617.00	0	0	0	0	

PREPARE

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DEPLOY

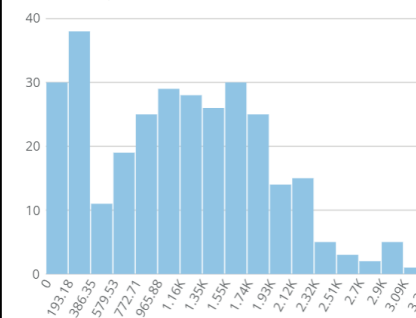
ASSESS

Summer 2022

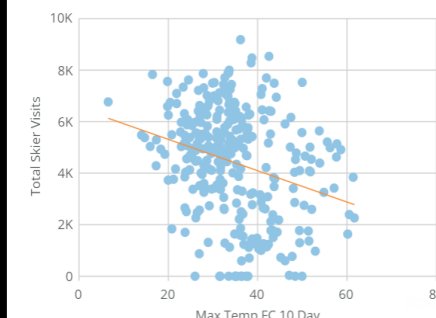
Examined relationships between predictive features & skier visits, which informed modeling strategies

Skier Visit Forecast EDA

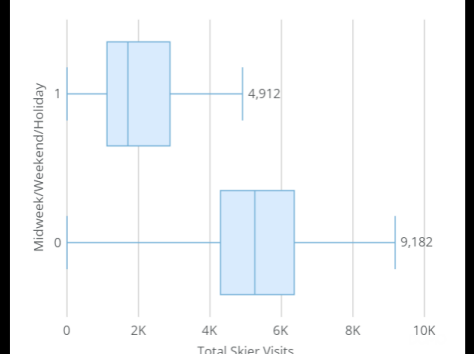
Skier Visits Booked 7 Days Out Histogram
3 Nulls | 1% of all rows Summary Number Skier Vis



Max Temp FC 10 Day vs. Total Skier Visits ...
-0.2734 Correlation



Total Skier Visits vs. Non-Holiday.Weekend...



Total Skier Visits | Correlation Matrix

	Total Skier Visits	Skier Visits Booked 1 Day Out	Season Pass Visits -1	Snow Actual FC 1 Day	Max Temp FC 1 Day	Non.Holiday.Weekend
Total Skier Visits	1	0.88	0.56	0.01	-0.22	0.14
Skier Visits Booked 1 Day Out	0.88	1	0.44	0	-0.18	-0.11
Season Pass Visits -1	0.56	0.44	1	-0.11	-0.11	0.25
Snow Actual FC 1 Day	0.01	0	-0.11	1	0.04	0.01
Max Temp FC 1 Day	-0.22	-0.18	-0.11	0.04	1	0.12
Non.Holiday.Weekend	0.14	-0.11	0.25	0.01	0.12	1

-1 0 1

PREPARE

ANALYZE

MODEL

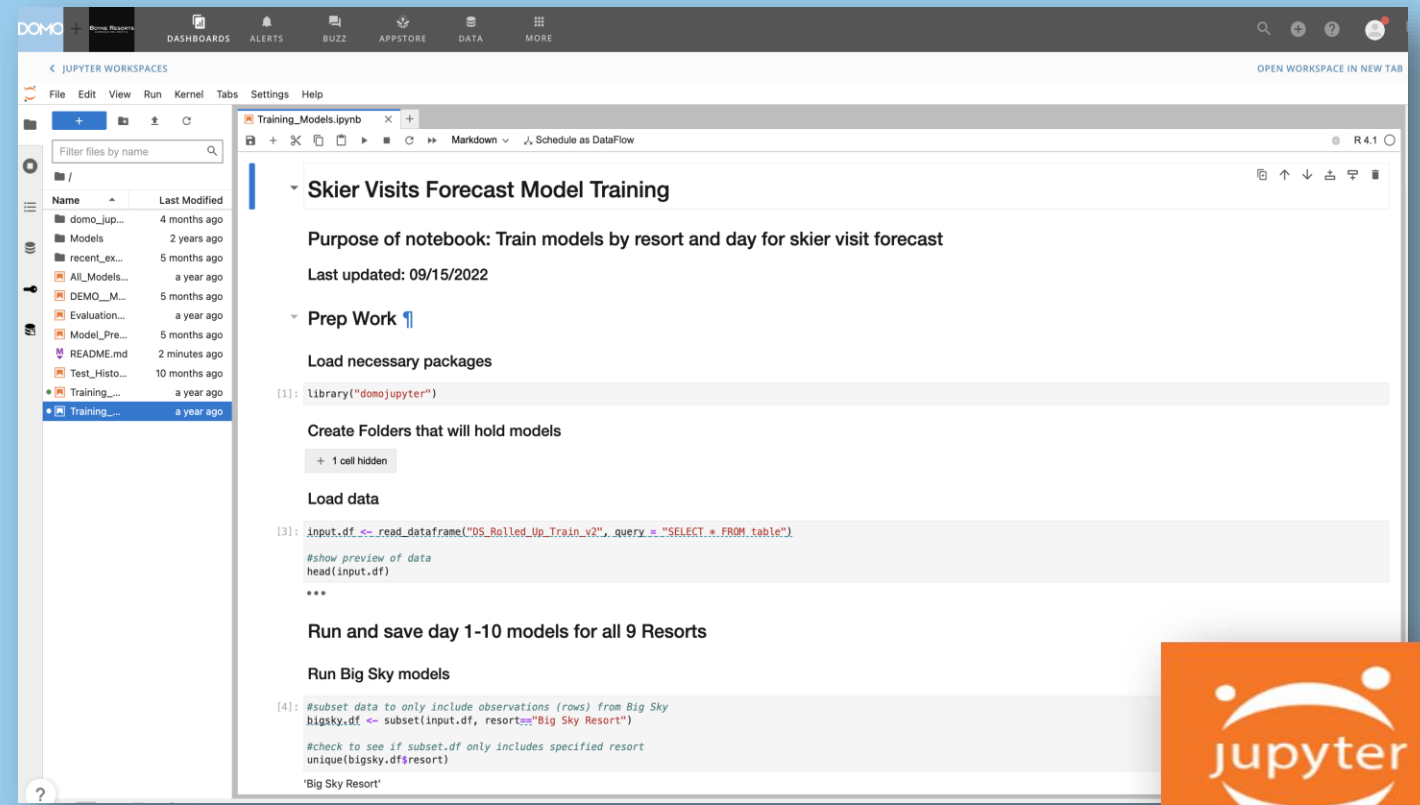
DEVELOP

DEPLOY

ASSESS

Summer 2022

Built & tested multiple custom forecasting models using Jupyter Workspaces





Fall 2022

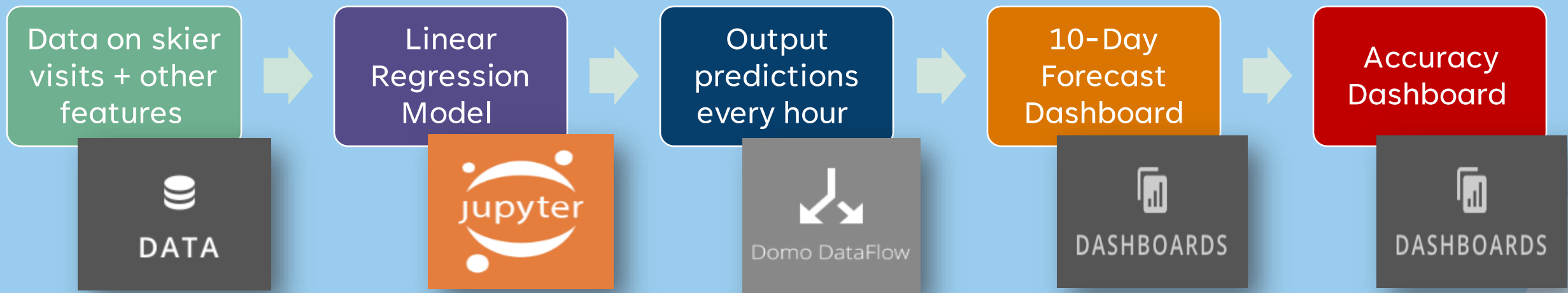
Built a machine learning pipeline that was automated + monitored





Fall 2022

Built a machine learning pipeline that was automated + monitored **all in Domo**
Domo



PREPARE

ANALYZE

MODEL

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ASSESS

Winter 2022–Spring 2023

Beta launched the forecasting solution to Boyne's analytics team



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PREPARE

ANALYZE

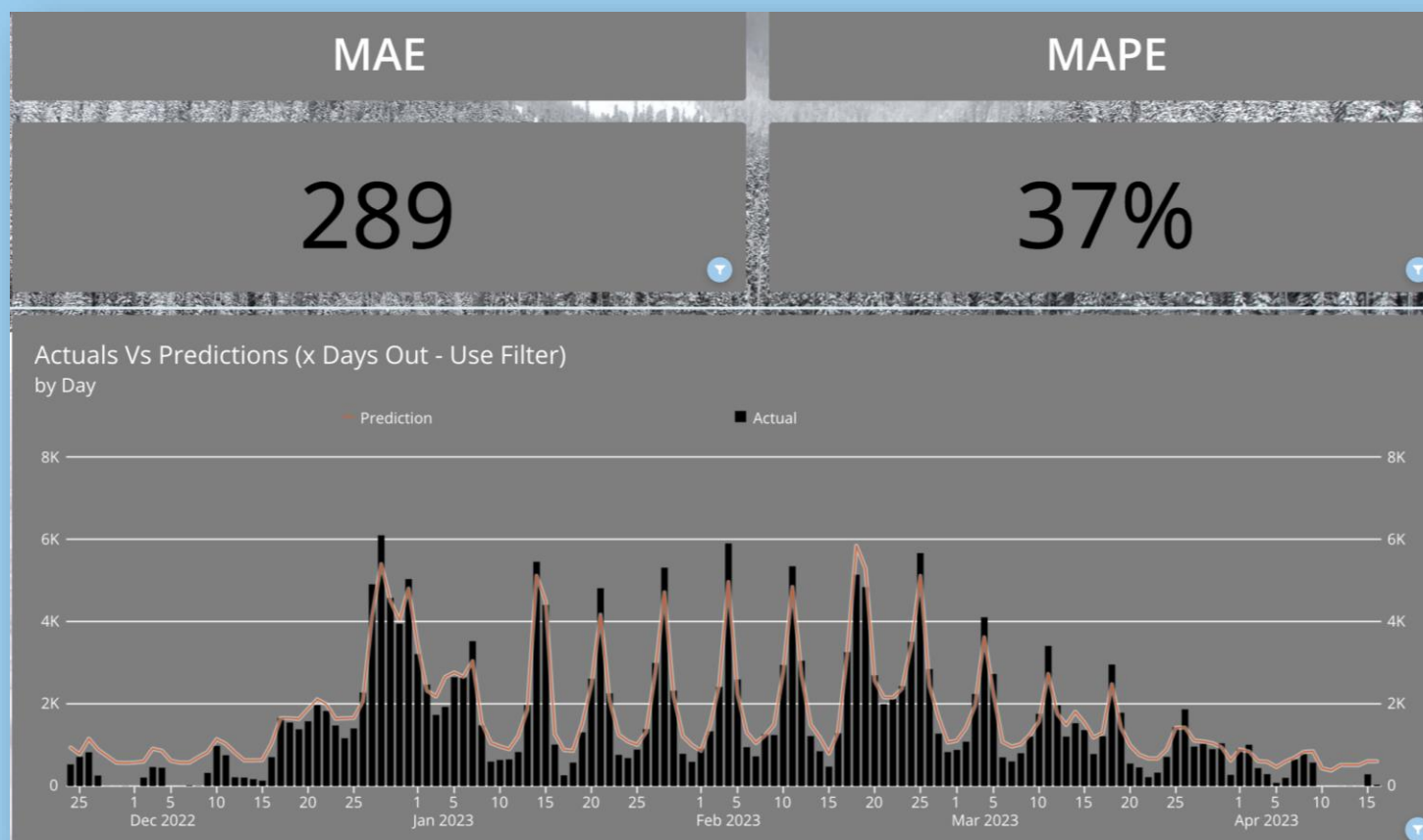
MODEL

DEVELOP

DEPLOY

ASSESS

Summer 2023



Examined model accuracy for the 2022-23 ski season

Evaluated potential data & modeling improvements

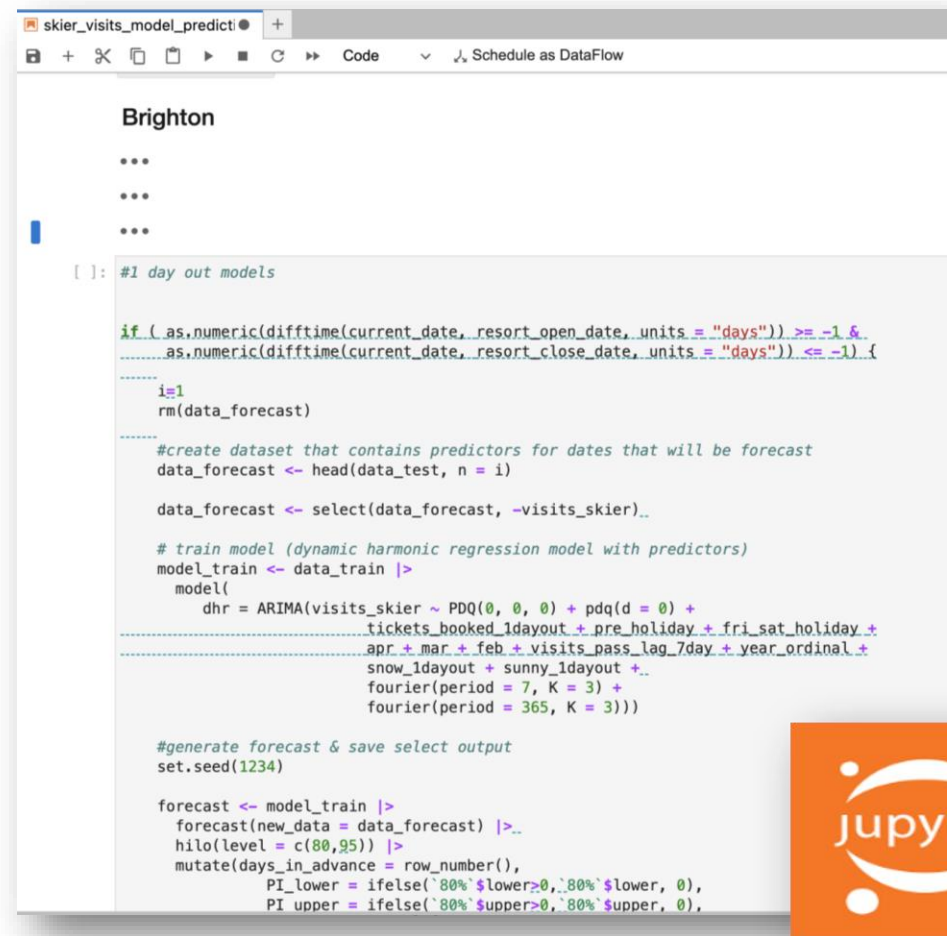
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PREPARE

ANALYZE

MODEL
V2DEVELOP
V2DEPLOY
V2ASSESS
V2

Tested v1 model vs alternate models using Jupyter Workspaces



```
skier_visits_model_predict
+
[ ]: #1 day out models

if ( as.numeric(difftime(current_date, resort_open_date, units = "days")) >= -1 &
      as.numeric(difftime(current_date, resort_close_date, units = "days")) <= -1 ) {
  i=1
  rm(data_forecast)

  #create dataset that contains predictors for dates that will be forecast
  data_forecast <- head(data_test, n = i)

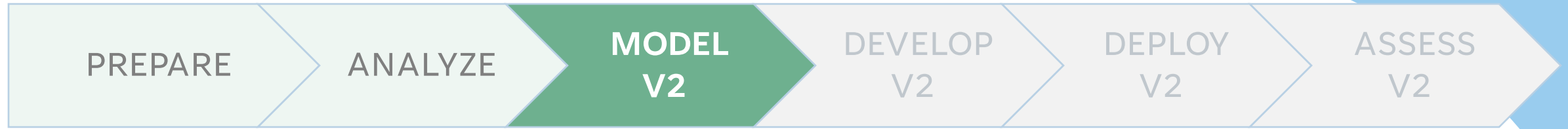
  data_forecast <- select(data_forecast, -visits_skier)..

  # train model (dynamic harmonic regression model with predictors)
  model_train <- data_train |>
  model(
    dhr = ARIMA(visits_skier ~ PDQ(0, 0, 0) + pdq(d = 0) +
      tickets_booked_1dayout + pre_holiday + fri_sat_holiday +
      apr + mar + feb + visits_pass_lag_7day + year_ordinal +
      snow_1dayout + sunny_1dayout +
      fourier(period = 7, K = 3) +
      fourier(period = 365, K = 3))

  #generate forecast & save select output
  set.seed(1234)

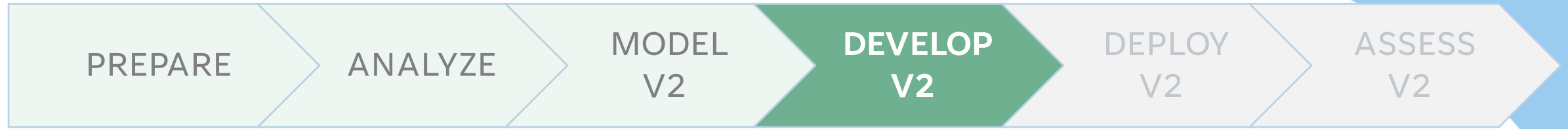
  forecast <- model_train |>
  forecast(new_data = data_forecast) |>
  hilo(level = c(80, 95)) |>
  mutate(days_in_advance = row_number(),
    PI_lower = ifelse(`80%$lower`>0, `80%$lower`, 0),
    PI_upper = ifelse(`80%$upper`>0, `80%$upper`, 0),
```



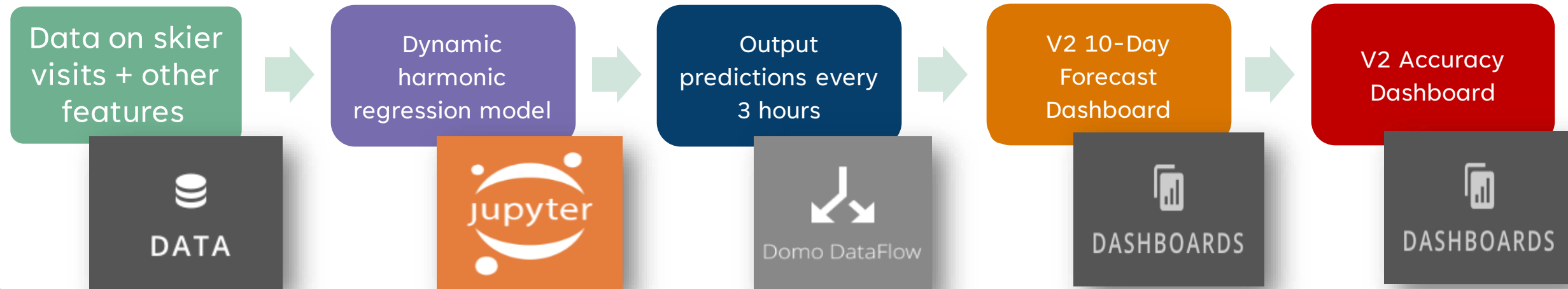


Most accurate was an alternate model
(dynamic harmonic regression model with predictive features)

Days Out	Model V1		Alternate Model A		Alternate Model B	
	MAE	MAPE	MAE	MAPE	MAE	MAPE
1	414	44%	214	23%	476	50%
2	421	45%	351	40%	528	55%
3	438	46%	414	44%	551	59%



Made adjustments to machine learning pipeline & redeployed





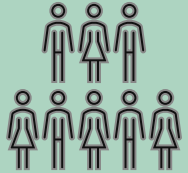
Solution is fully rolled-out to
Boyne C-suite + leadership
teams at each resort

STAY TUNED

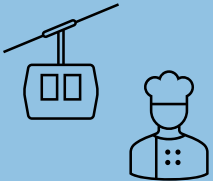
Start work on V3
this summer

Is This Solution Worth the Investment?

Boyne's Million-Dollar Question



How many staff do we need next week?



What services do we need to provide?



How many skiers are coming?

Saving **1%** in labor costs
from staffing more
efficiently
will cover the solution cost

Key Takeaways

The background of the slide is a photograph of various ski equipment laid out on a dark, weathered wooden plank surface. From left to right, there are two blue skis, a red ski pole, two green skis with 'DOWN' branding, two black ski poles, and two white skis. At the bottom, several ski boots are visible, including blue and black ones and some with white snow on them.

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Use Jupyter
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Q & A

