Microsoft

Real-time ML Journey

MicrosoftML + Revoscale

Hiram Fleitas

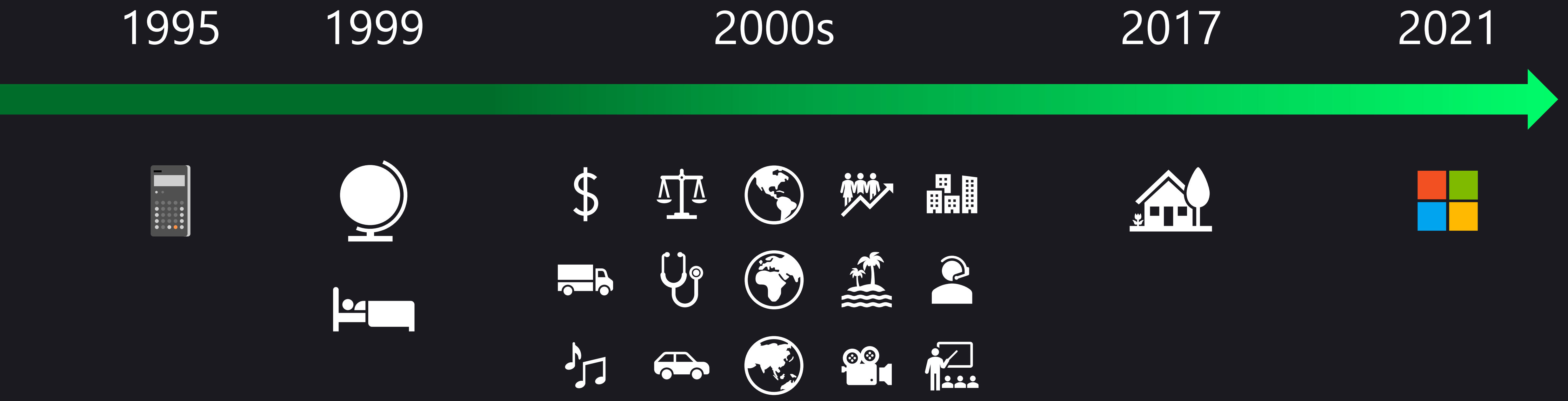
Senior Customer Engineer
Microsoft Data & AI

badges

About Me

aka.ms/hiram

1. Machine Learning
2. Synapse Analytics
3. Power Platform
4. DevOps



1995

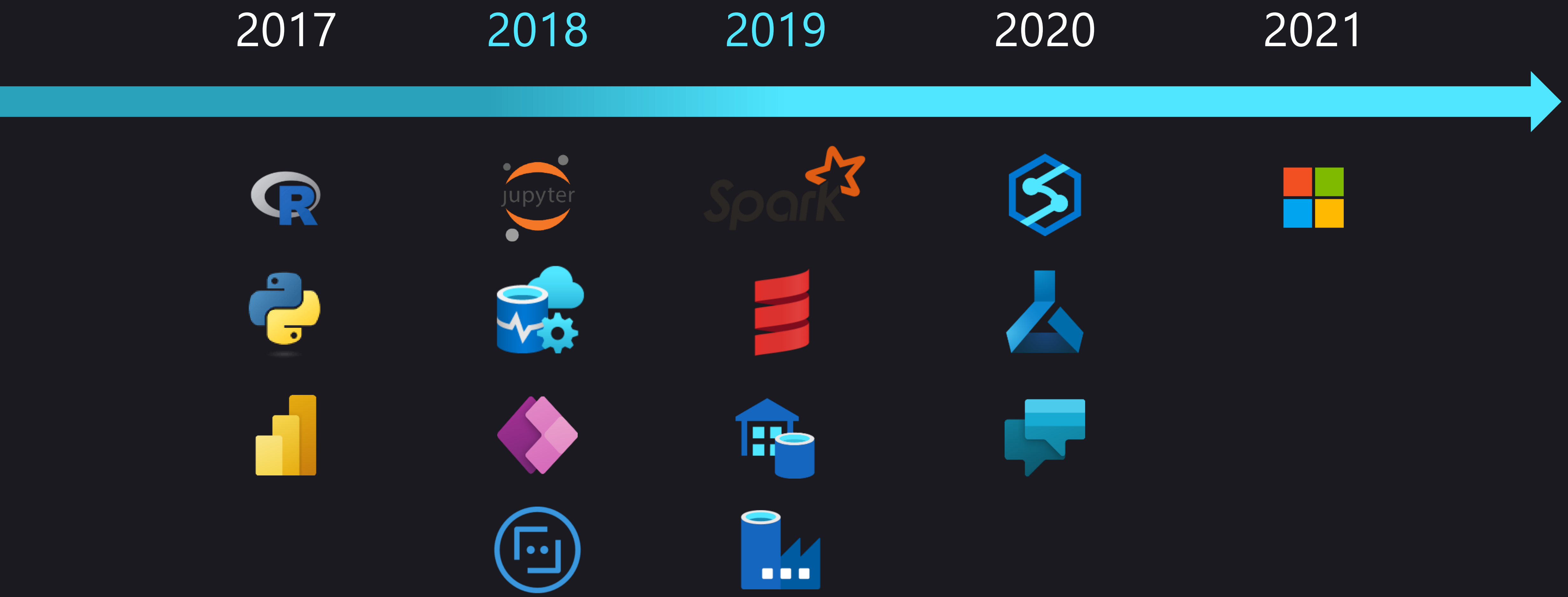
1999

2000s

2017

2021

Legal, Medical, Retail, Travel Insurance, ISV, HR, Cruise Line, PnC Insurance, plus more…



2017

2018

2019

2020

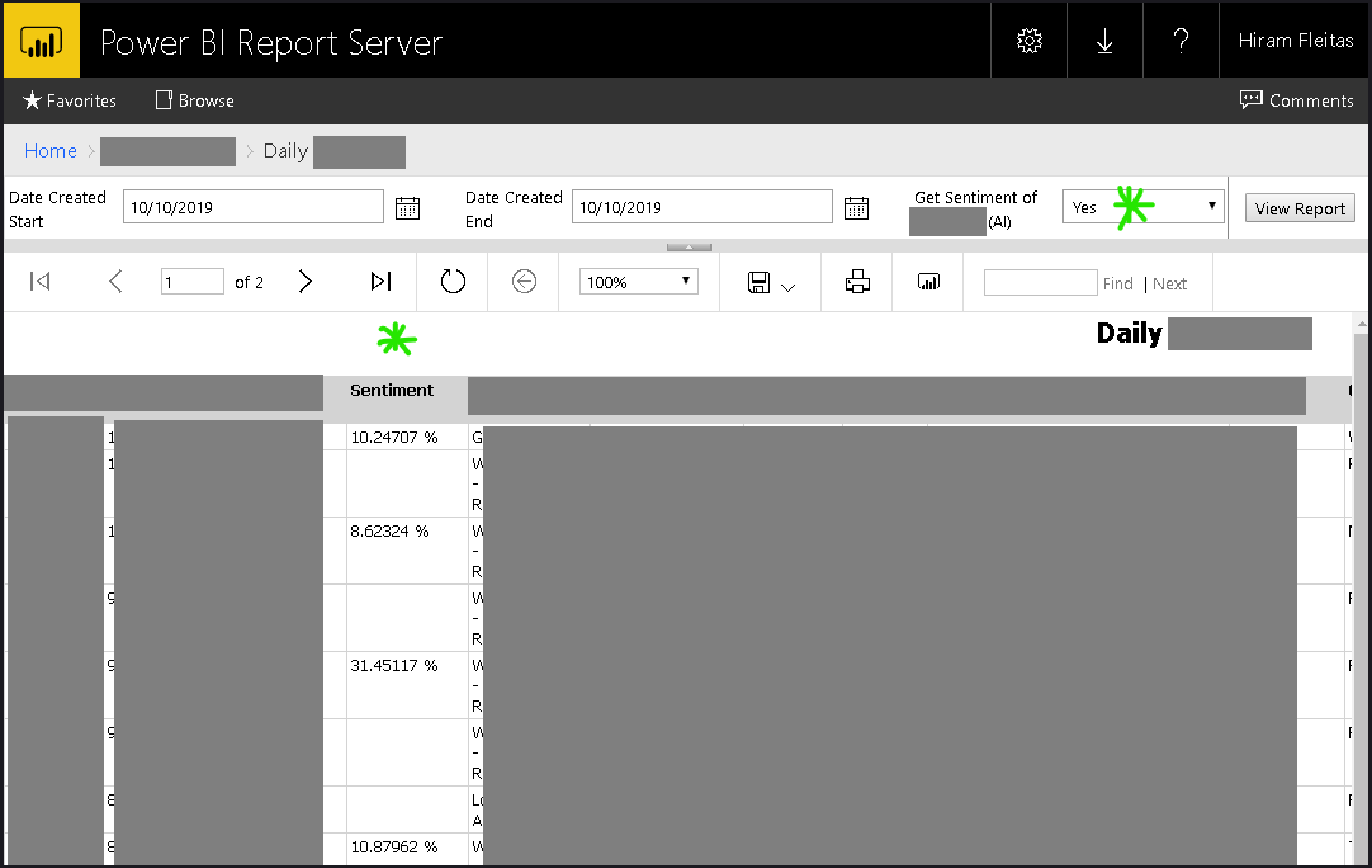
2021

Agenda

with impact

1. Sentiment $30M
2. QnA Chat Bots $200K
3. Forms $2M
4. Capital Modeling $500M
5. Length of Stay $40M
6. Search by Photo $200K

Sentiment $30M



Power BI Report Server

Hiram Fleitas

Home > [redacted] > Daily [redacted]

Date Created Start: 10/10/2019

Date Created End: 10/10/2019

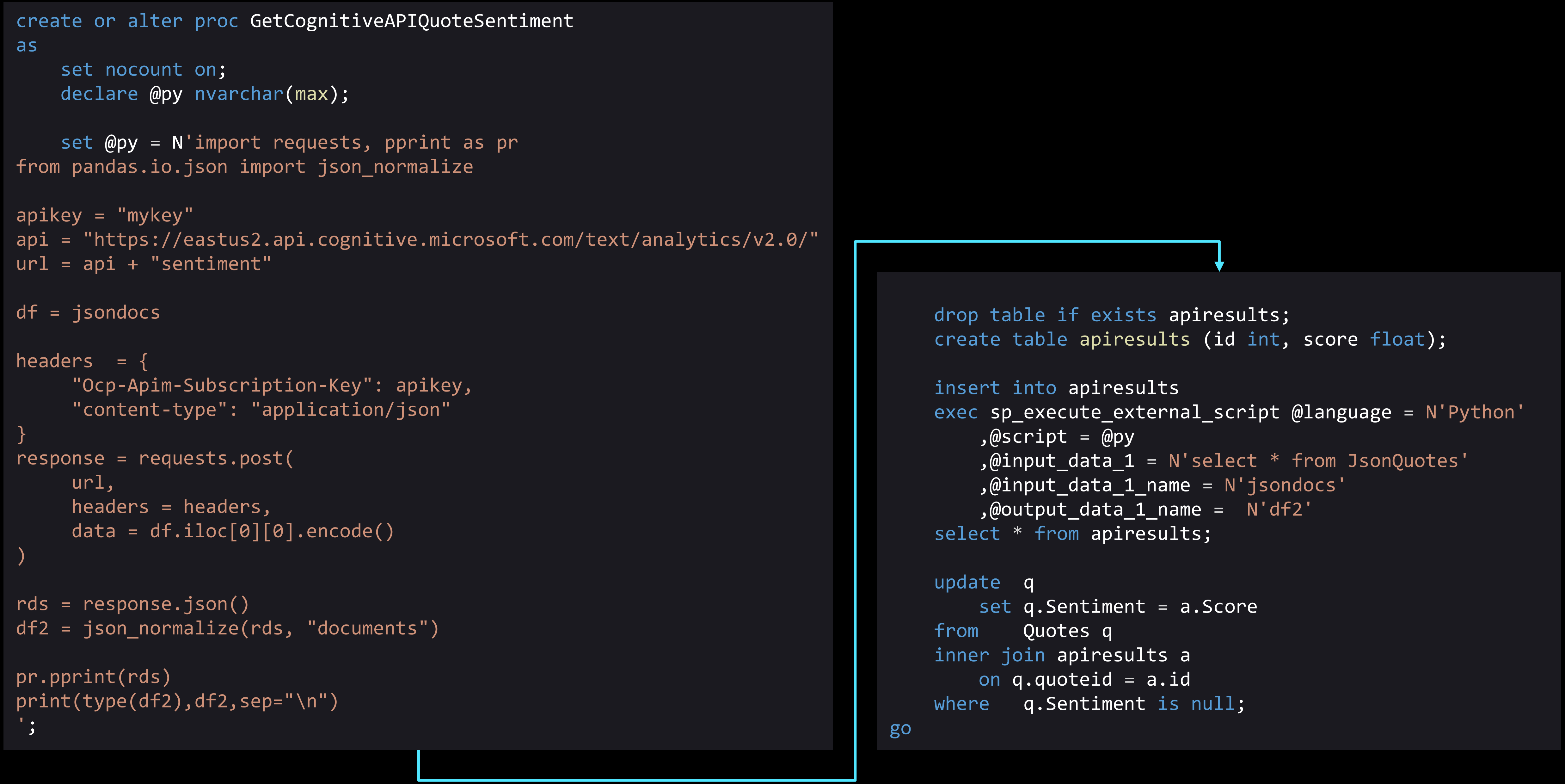
Get Sentiment of [redacted] (AI): Yes

Daily [redacted]

[redacted]	Sentiment	[redacted]
[redacted]	10.24707 %	[redacted]
[redacted]		[redacted]
[redacted]	8.62324 %	[redacted]
[redacted]		[redacted]
[redacted]	31.45117 %	[redacted]
[redacted]		[redacted]
[redacted]		[redacted]
[redacted]	10.87962 %	[redacted]

Learn more:

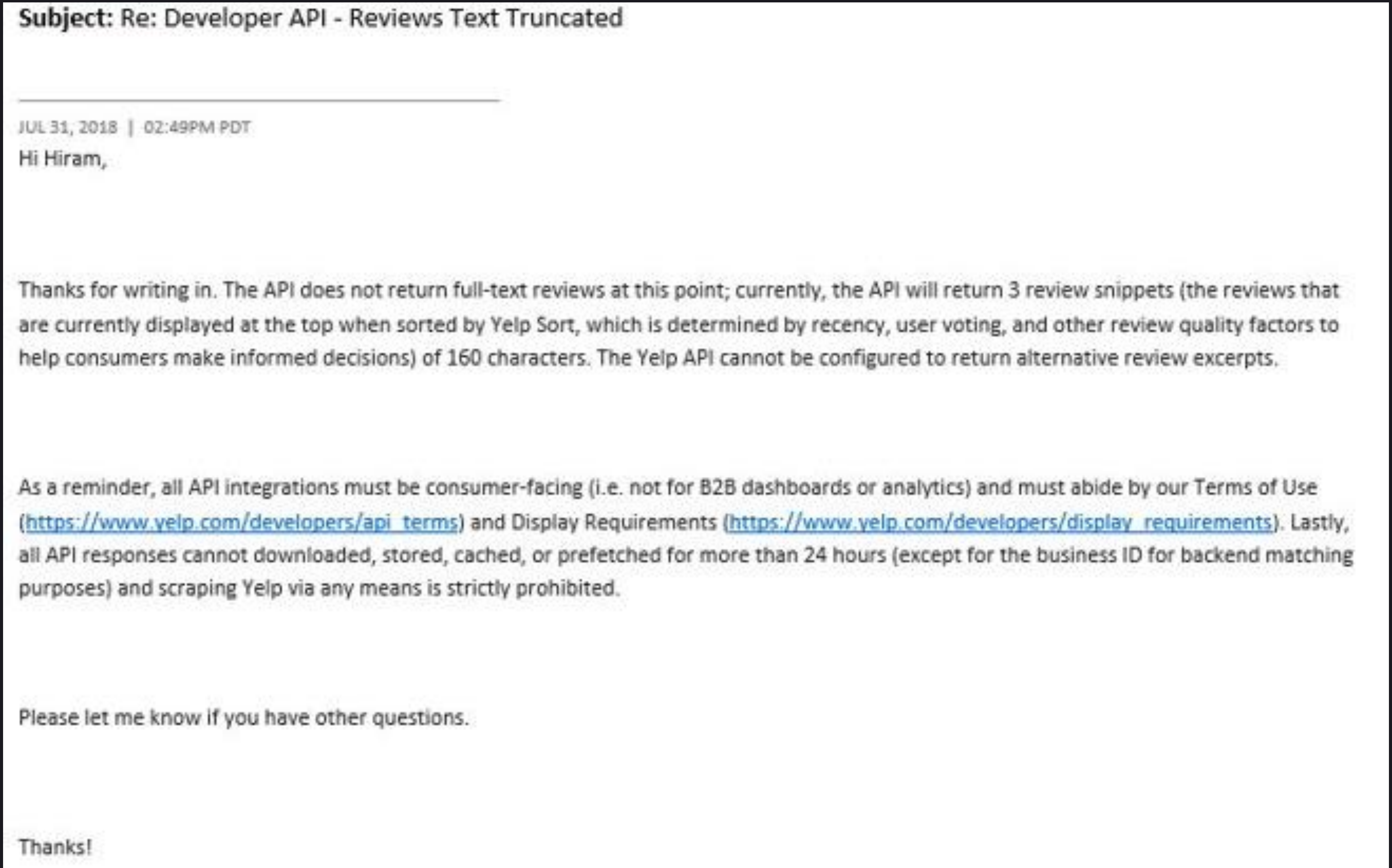
Hide Column based up Parameter Selected SSRS



```
create or alter proc GetCognitiveAPIQuoteSentiment
as
    set nocount on;
    declare @py nvarchar(max);

    set @py = N'import requests, pprint as pr
from pandas.io.json import json_normalize

apikey = "mykey"
api = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
url = api + "sentiment"

df = jsondocs

headers  = {
     "Ocp-Apim-Subscription-Key": apikey,
     "content-type": "application/json"
}
response = requests.post(
     url,
     headers = headers,
     data = df.iloc[0][0].encode()
)

rds = response.json()
df2 = json_normalize(rds, "documents")

pr.pprint(rds)
print(type(df2),df2,sep="\n")
';
```

```
    drop table if exists apiresults;
    create table apiresults (id int, score float);

    insert into apiresults
    exec sp_execute_external_script @language = N'Python'
        ,@script = @py
        ,@input_data_1 = N'select * from JsonQuotes'
        ,@input_data_1_name = N'jsondocs'
        ,@output_data_1_name =  N'df2'
    select * from apiresults;

    update  q
        set q.Sentiment = a.Score
    from    Quotes q
    inner join apiresults a
        on q.quoteid = a.id
    where   q.Sentiment is null;
go
```

Learn more:
github.com/hfleitas/seattle2019/blob/master/2SentimentPrediction/Trollhunters.ipynb



Subject: Re: Developer API - Reviews Text Truncated

JUL 31, 2018 | 02:49PM PDT

Hi Hiram,

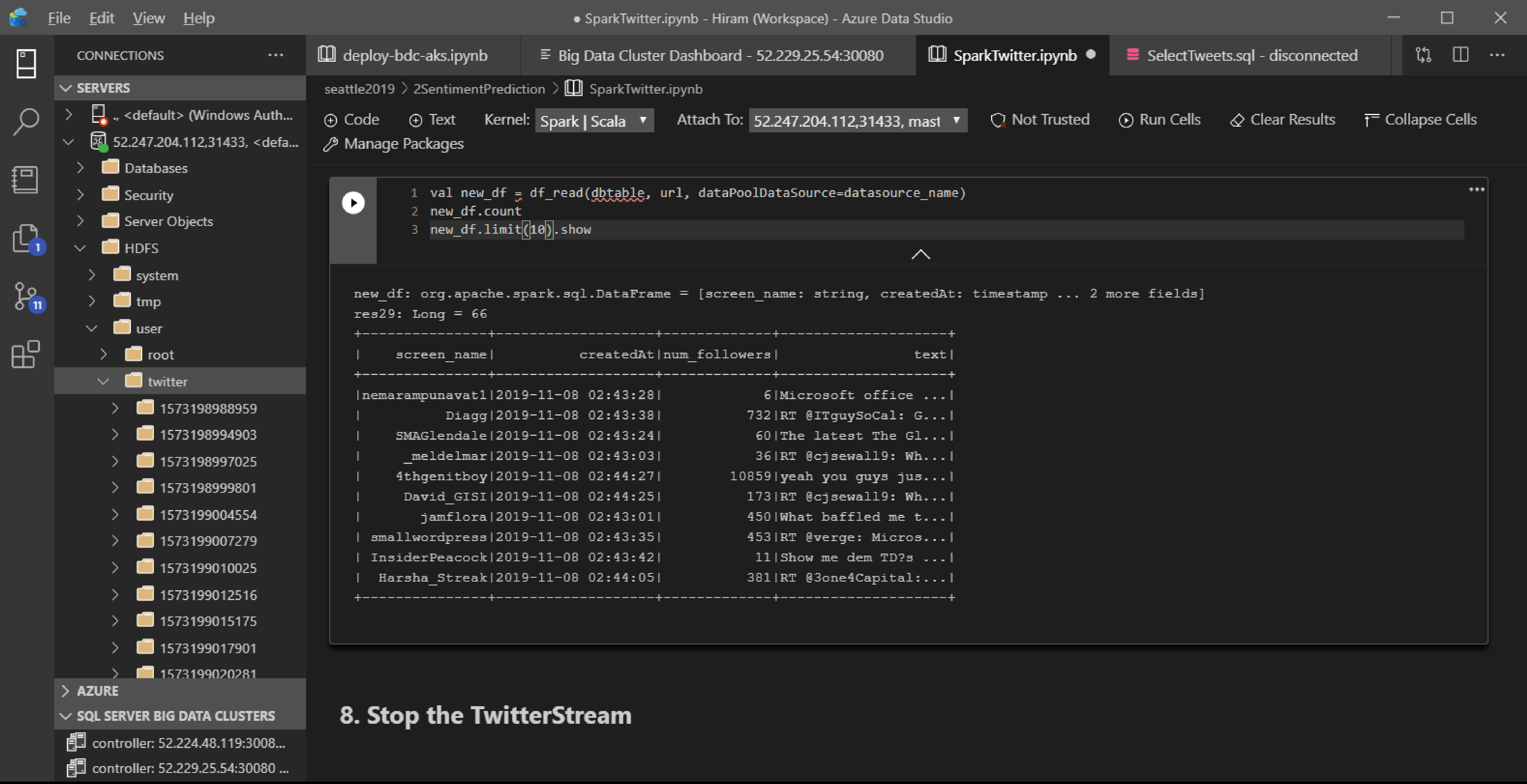
Thanks for writing in. The API does not return full-text reviews at this point; currently, the API will return 3 review snippets (the reviews that are currently displayed at the top when sorted by Yelp Sort, which is determined by recency, user voting, and other review quality factors to help consumers make informed decisions) of 160 characters. The Yelp API cannot be configured to return alternative review excerpts.

As a reminder, all API integrations must be consumer-facing (i.e. not for B2B dashboards or analytics) and must abide by our Terms of Use (https://www.yelp.com/developers/api_terms) and Display Requirements (https://www.yelp.com/developers/display_requirements). Lastly, all API responses cannot downloaded, stored, cached, or prefetched for more than 24 hours (except for the business ID for backend matching purposes) and scraping Yelp via any means is strictly prohibited.

Please let me know if you have other questions.

Thanks!

Learn more:
https://www.yelp.com/developers/api_terms
https://www.yelp.com/developers/display_requirements

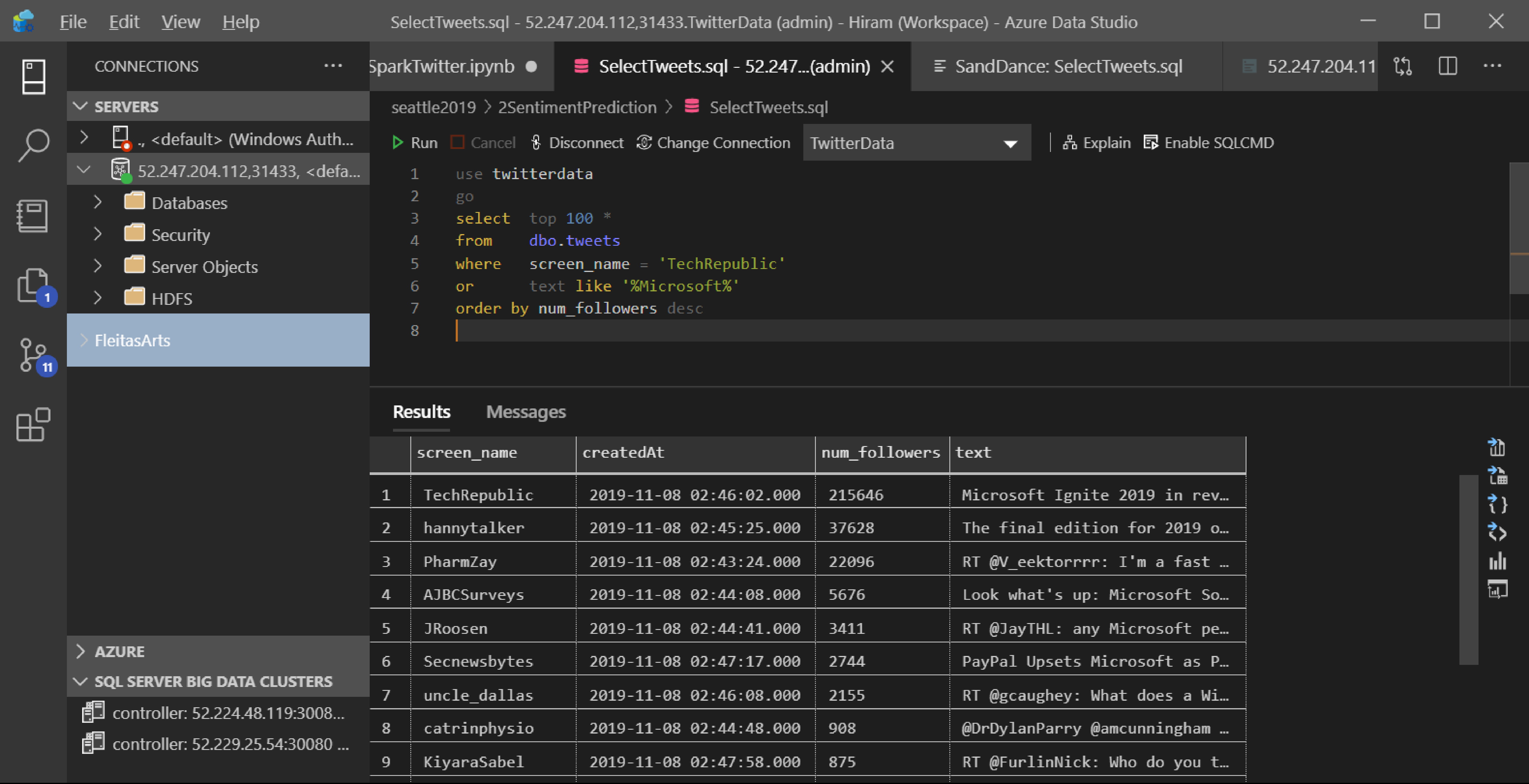

File
Edit
View
Help
● SparkTwitter.ipynb - Hiram (Workspace) - Azure Data Studio
CONNECTIONS
SERVERS
<default> (Windows Auth...
52.247.204.112,31433, <defa...
Databases
Security
Server Objects
HDFS
system
tmp
user
root
twitter
1573198988959
1573198994903
1573198997025
1573198999801
1573199004554
1573199007279
1573199010025
1573199012516
1573199015175
1573199017901
1573199020281
AZURE
SQL SERVER BIG DATA CLUSTERS
controller: 52.224.48.119:3008...
controller: 52.229.25.54:30080 ...
deploy-bdc-aks.ipynb
Big Data Cluster Dashboard - 52.229.25.54:30080
SparkTwitter.ipynb
SelectTweets.sql - disconnected
seattle2019 > 2SentimentPrediction > SparkTwitter.ipynb
Code
Text
Kernel: Spark | Scala
Attach To: 52.247.204.112,31433, mast
Not Trusted
Run Cells
Clear Results
Collapse Cells
Manage Packages

```
val new_df = df_read(dbtable, url, dataPoolDataSource=datasource_name)
new_df.count
new_df.limit(10).show
```

```
new_df: org.apache.spark.sql.DataFrame = [screen_name: string, createdAt: timestamp ... 2 more fields]
res29: Long = 66
+---------------+-------------------+-------------+--------------------+
|    screen_name|          createdAt|num_followers|                text|
+---------------+-------------------+-------------+--------------------+
|nemarampunavat1|2019-11-08 02:43:28|            6|Microsoft office ...|
|          Diagg|2019-11-08 02:43:38|          732|RT @ITguySoCal: G...|
|    SMAGlendale|2019-11-08 02:43:24|           60|The latest The Gl...|
|     _meldelmar|2019-11-08 02:43:03|           36|RT @cjsewall9: Wh...|
|    4thgenitboy|2019-11-08 02:44:27|        10859|yeah you guys jus...|
|     David_GISI|2019-11-08 02:44:25|          173|RT @cjsewall9: Wh...|
|       jamflora|2019-11-08 02:43:01|          450|What baffled me t...|
| smallwordpress|2019-11-08 02:43:35|          453|RT @verge: Micros...|
| InsiderPeacock|2019-11-08 02:43:42|           11|Show me dem TD?s ...|
|  Harsha_Streak|2019-11-08 02:44:05|          381|RT @3one4Capital:...|
+---------------+-------------------+-------------+--------------------+
```

8. Stop the TwitterStream

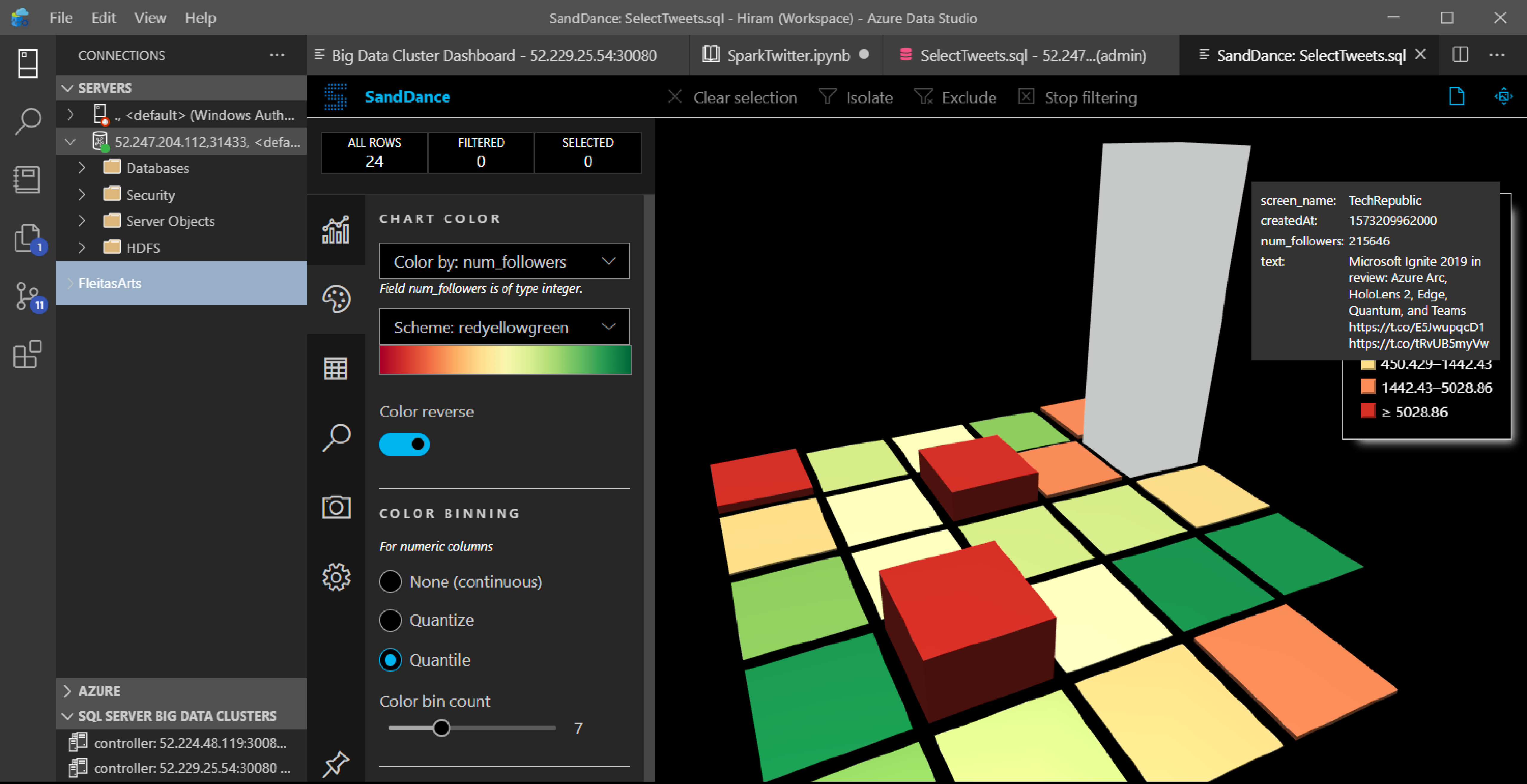
Learn more:
SQL Server Samples - Big Data Clusters - Spark


File
Edit
View
Help
SelectTweets.sql - 52.247.204.112,31433.TwitterData (admin) - Hiram (Workspace) - Azure Data Studio
CONNECTIONS
SERVERS
., <default> (Windows Auth...
52.247.204.112,31433, <defa...
Databases
Security
Server Objects
HDFS
FleitasArts
AZURE
SQL SERVER BIG DATA CLUSTERS
controller: 52.224.48.119:3008...
controller: 52.229.25.54:30080 ...
SparkTwitter.ipynb
SelectTweets.sql - 52.247...(admin)
SandDance: SelectTweets.sql
52.247.204.11
seattle2019
2SentimentPrediction
SelectTweets.sql
Run
Cancel
Disconnect
Change Connection
TwitterData
Explain
Enable SQLCMD
Results
Messages
1
11

```
use twitterdata
go
select  top 100 *
from    dbo.tweets
where   screen_name = 'TechRepublic'
or      text like '%Microsoft%'
order by num_followers desc
```

	screen_name	createdAt	num_followers	text
1	TechRepublic	2019-11-08 02:46:02.000	215646	Microsoft Ignite 2019 in rev...
2	hannytalker	2019-11-08 02:45:25.000	37628	The final edition for 2019 o...
3	PharmZay	2019-11-08 02:43:24.000	22096	RT @V_eektorrrr: I'm a fast ...
4	AJBCSurveys	2019-11-08 02:44:08.000	5676	Look what's up: Microsoft So...
5	JRoosen	2019-11-08 02:44:41.000	3411	RT @JayTHL: any Microsoft pe...
6	Secnewsbytes	2019-11-08 02:47:17.000	2744	PayPal Upsets Microsoft as P...
7	uncle_dallas	2019-11-08 02:46:08.000	2155	RT @gcaughey: What does a Wi...
8	catrinphysio	2019-11-08 02:44:48.000	908	@DrDylanParry @amcunningham ...
9	KiyaraSabel	2019-11-08 02:47:58.000	875	RT @FurlinNick: Who do you t...

Learn more:
SQL Server Samples - Big Data Clusters - Spark


File
Edit
View
Help
SandDance: SelectTweets.sql - Hiram (Workspace) - Azure Data Studio
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controller: 52.224.48.119:3008...
controller: 52.229.25.54:30080 ...
Big Data Cluster Dashboard - 52.229.25.54:30080
SparkTwitter.ipynb
SelectTweets.sql - 52.247...(admin)
SandDance: SelectTweets.sql
SandDance
Clear selection
Isolate
Exclude
Stop filtering
1
11
450.429–1442.43
1442.43–5028.86
≥ 5028.86

ALL ROWS	FILTERED	SELECTED
24	0	0

CHART COLOR

Color by: num_followers

Field num_followers is of type integer.

Scheme: redyellowgreen

Color reverse ●

COLOR BINNING

For numeric columns

○ None (continuous)

○ Quantize

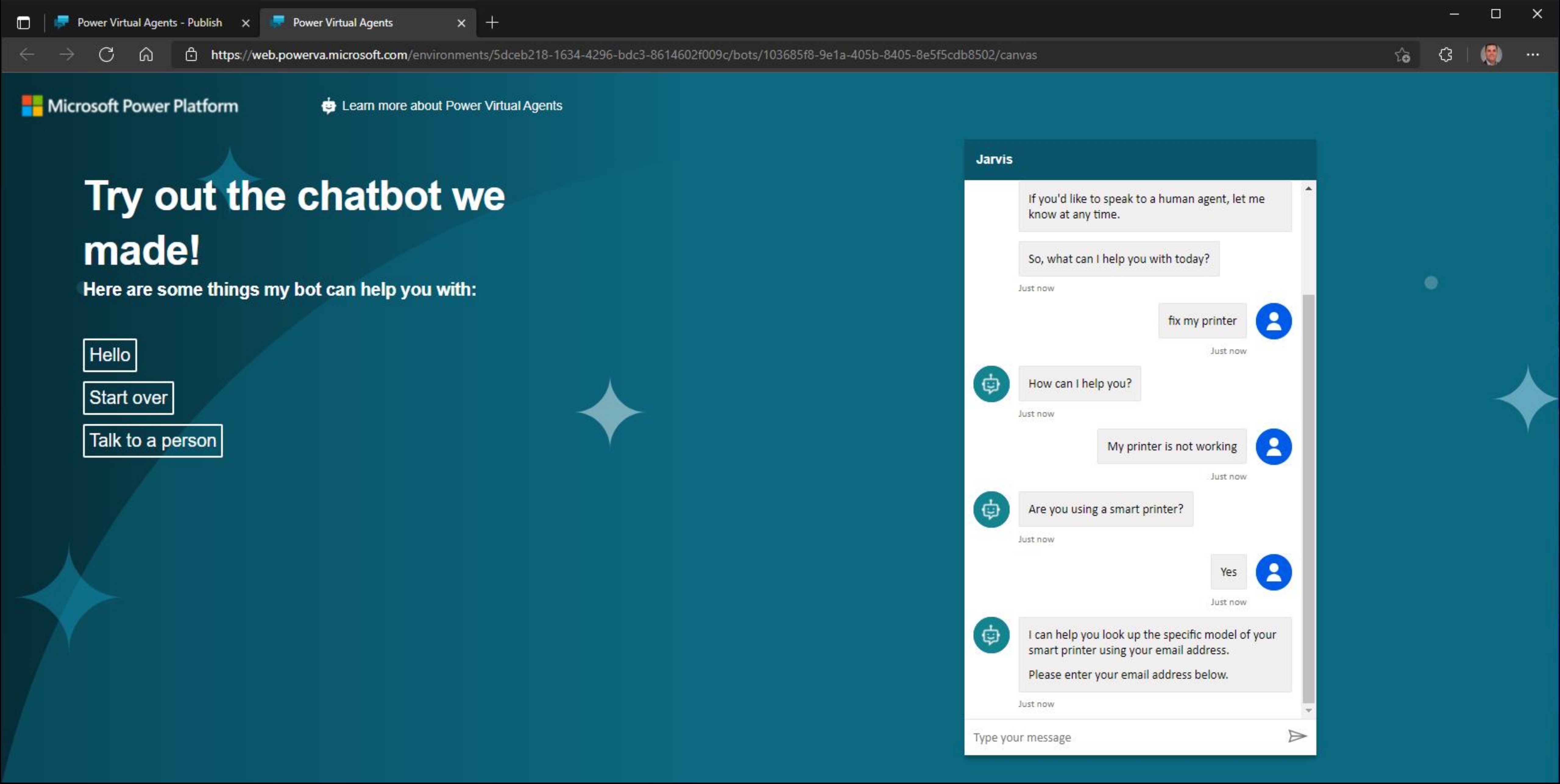
● Quantile

Color bin count 7

screen_name:	TechRepublic
createdAt:	1573209962000
num_followers:	215646
text:	Microsoft Ignite 2019 in review: Azure Arc, HoloLens 2, Edge, Quantum, and Teams https://t.co/E5JwupqcD1 https://t.co/tRvUB5myVw

Learn more:
SQL Server Samples - Big Data Clusters - Spark

QnA Chat Bots $200K


Power Virtual Agents - Publish
Power Virtual Agents
https://web.powerva.microsoft.com/environments/5dceb218-1634-4296-bdc3-8614602f009c/bots/103685f8-9e1a-405b-8405-8e5f5cdb8502/canvas
Microsoft Power Platform
Learn more about Power Virtual Agents
Hello
Start over
Talk to a person
Jarvis
Type your message

Try out the chatbot we made!

Here are some things my bot can help you with:

If you'd like to speak to a human agent, let me know at any time.

So, what can I help you with today?

Just now

fix my printer

Just now

How can I help you?

Just now

My printer is not working

Just now

Are you using a smart printer?

Just now

Yes

Just now

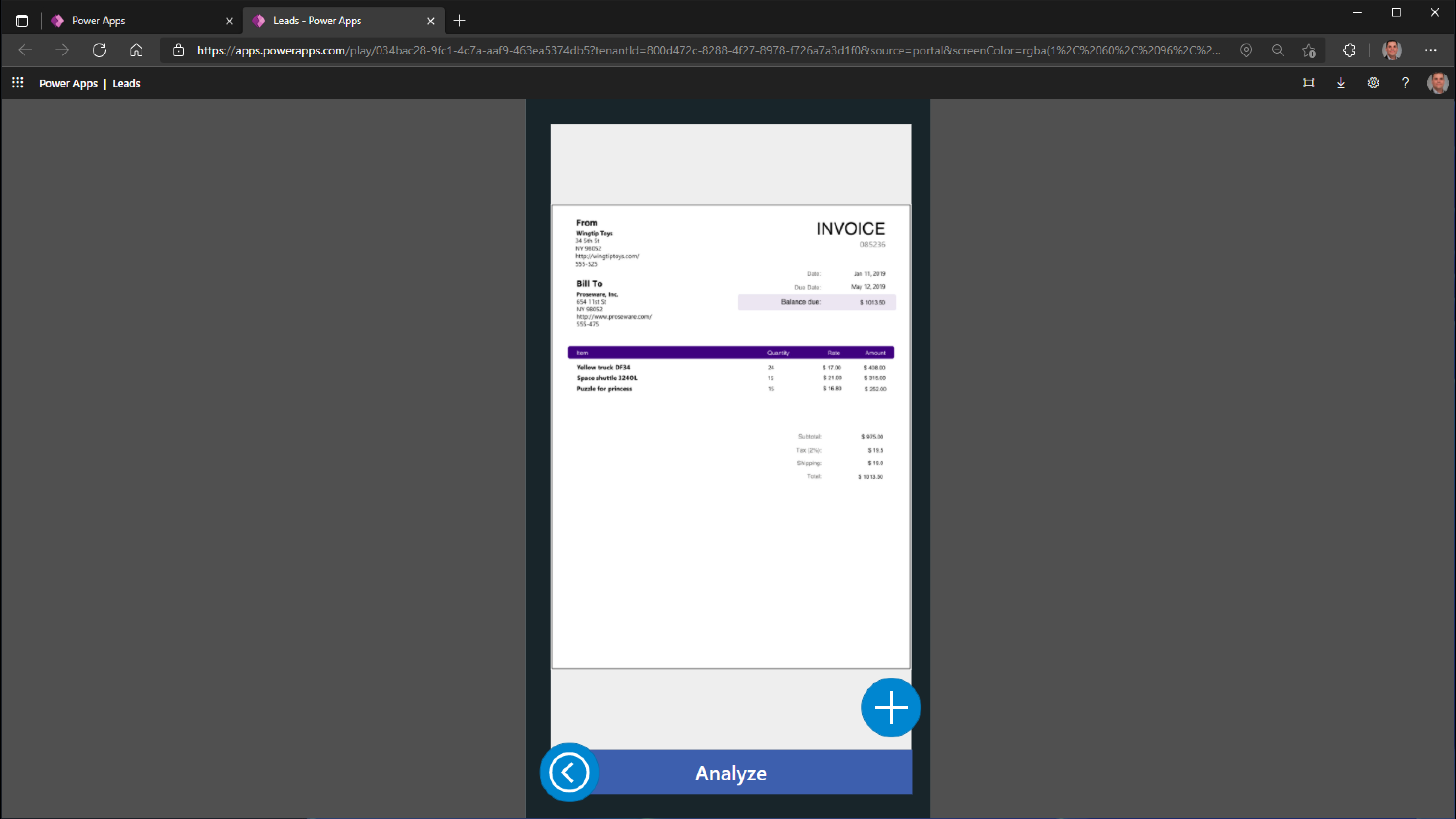
I can help you look up the specific model of your smart printer using your email address.

Please enter your email address below.

Just now

Learn more:
PVA - Build Printer Troubleshooting Bot

Forms $2M


Power Apps
Leads - Power Apps
https://apps.powerapps.com/play/034bac28-9fc1-4c7a-aaf9-463ea5374db5?tenantId=800d472c-8288-4f27-8978-f726a7a3d1f0&source=portal&screenColor=rgba(1%2C%2060%2C%2096%2C%2...
Power Apps | Leads
Analyze

From
Wingtip Toys
34 5th St
NY 98052
http://wingtiptoys.com/
555-525

INVOICE

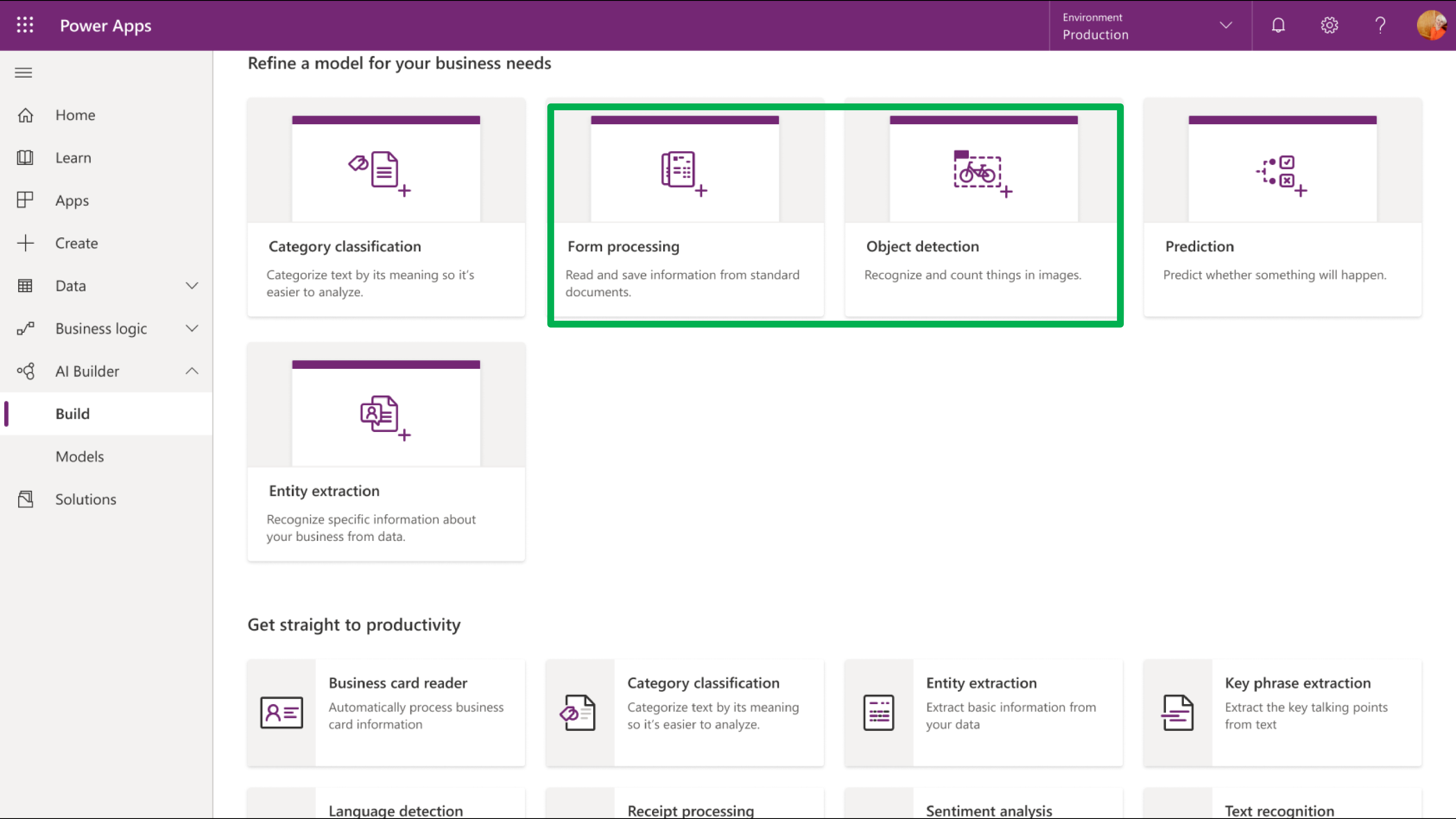
085236

Bill To
Proseware, Inc.
654 11st St
NY 98052
http://www.proseware.com/
555-475

Date:	Jan 11, 2019
Due Date:	May 12, 2019
Balance due:	$ 1013.50

Item	Quantity	Rate	Amount
Yellow truck DF34	24	$ 17.00	$ 408.00
Space shuttle 324OL	15	$ 21.00	$ 315.00
Puzzle for princess	15	$ 16.80	$ 252.00

Subtotal:	$ 975.00
Tax (2%):	$ 19.5
Shipping:	$ 19.0
Total:	$ 1013.50



Refine a model for your business needs

Category classification
Categorize text by its meaning so it's easier to analyze.

Form processing
Read and save information from standard documents.

Object detection
Recognize and count things in images.

Prediction
Predict whether something will happen.

Entity extraction
Recognize specific information about your business from data.

Get straight to productivity

Business card reader
Automatically process business card information

Category classification
Categorize text by its meaning so it's easier to analyze.

Entity extraction
Extract basic information from your data

Key phrase extraction
Extract the key talking points from text

Language detection

Receipt processing

Sentiment analysis

Text recognition

Capital Modeling $500M

Digital Transformation

We are people, not interfaces

Before

- 7 User touchpoints
- 4 Unique manual processes
- Many different files and folders
- Significant user downtime

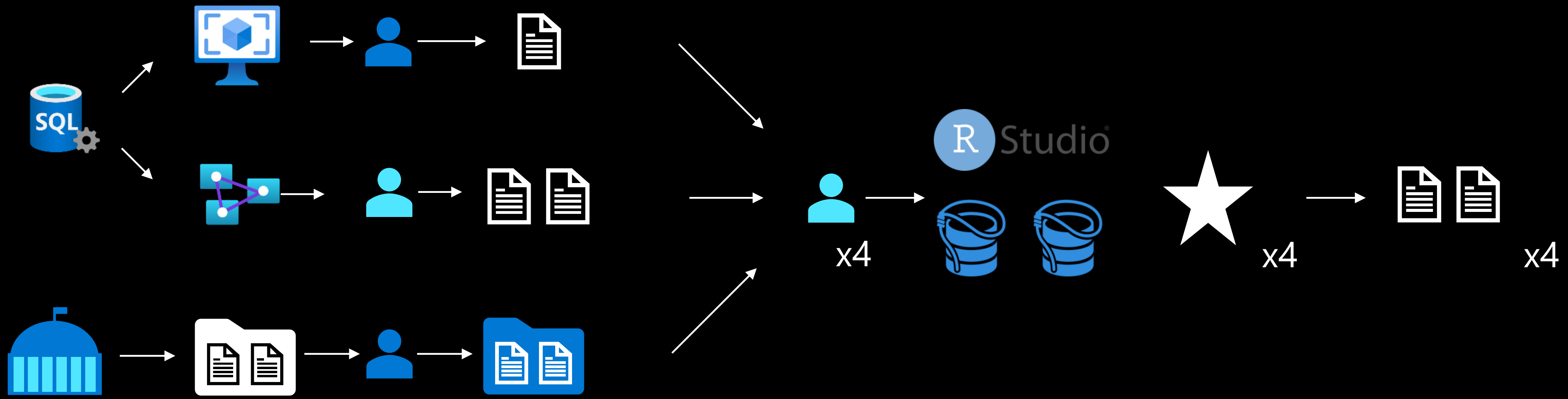
After

- 1 Single pipeline
- 3 Primary stored procedures
- 1 SQL Server
- Minimal user downtime

Digital Transformation

We are people, not interfaces

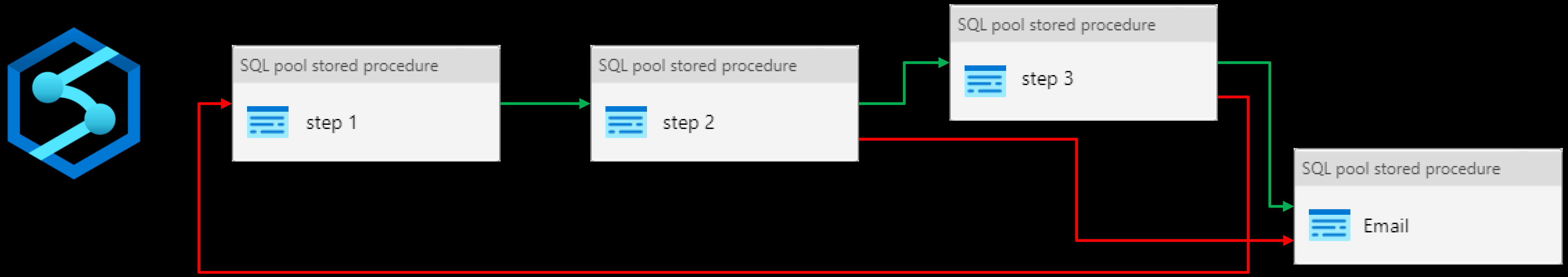
Before



Digital Transformation

We are people, not interfaces

After

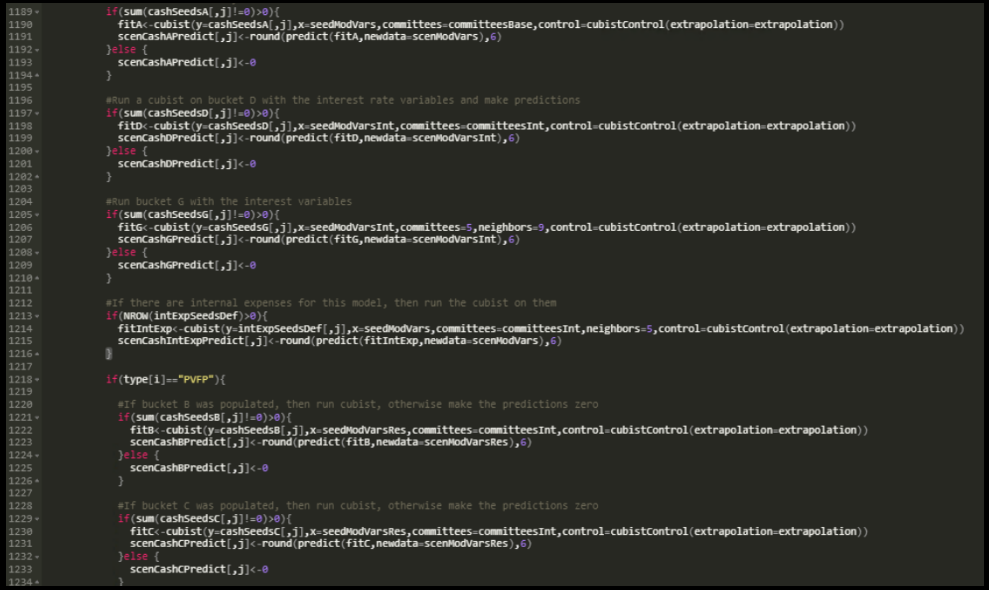

SQL pool stored procedure
step 1
SQL pool stored procedure
step 2
SQL pool stored procedure
step 3
SQL pool stored procedure
Email

Digital Transformation

We are people, not interfaces

Before

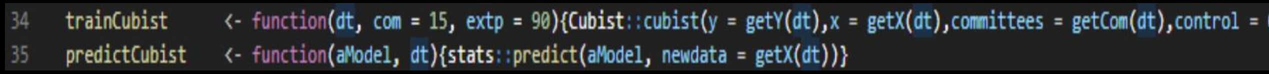
- Loop based logic
- WET (Write Everything Twice)
- Inefficient
- Frequent R troubleshooting



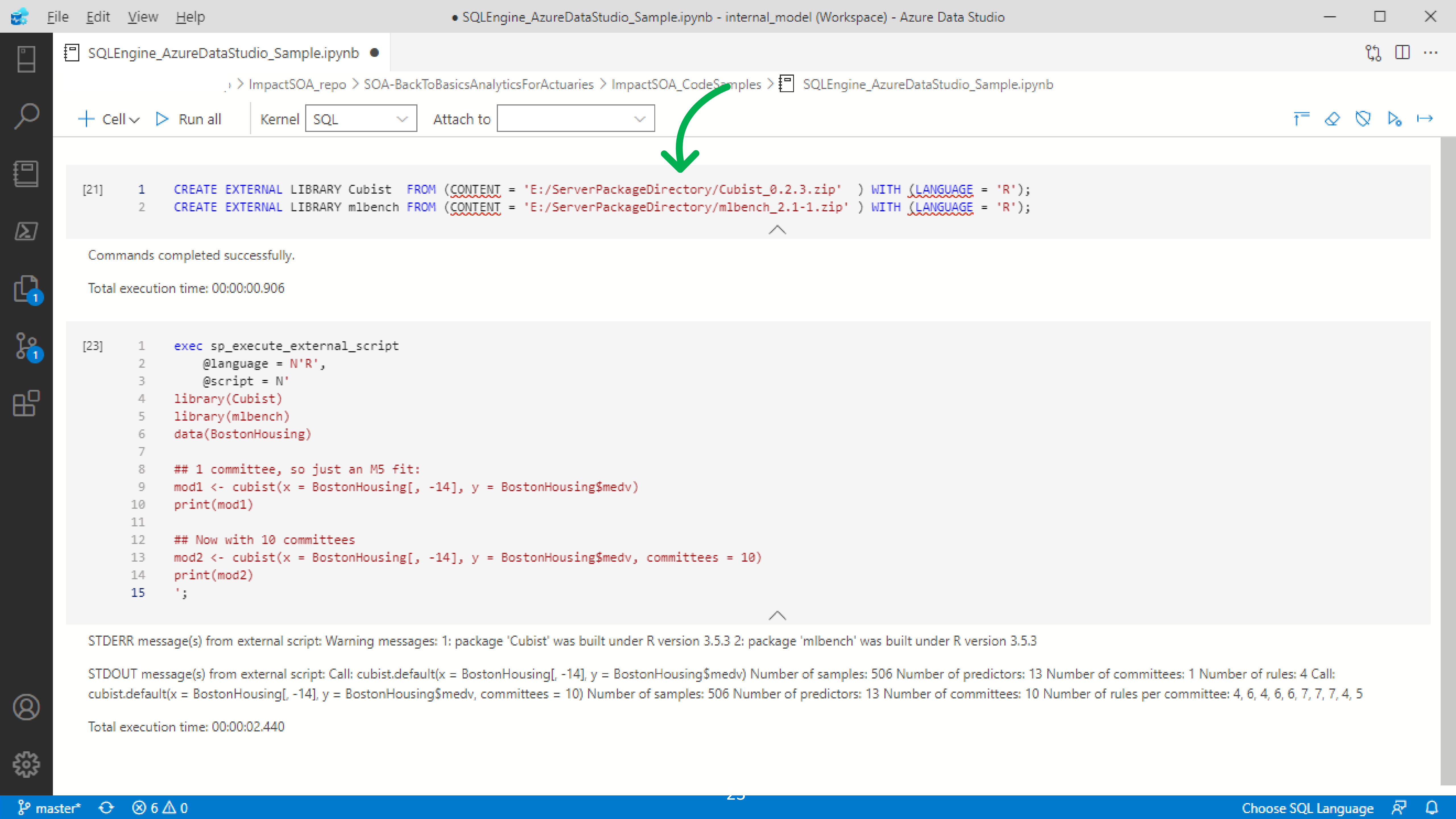
```
if(sum(cashSeedsA[,j]!=0)>0){
  fitA<-cubist(y=cashSeedsA[,j],x=seedModVars,committees=committeesBase,control=cubistControl(extrapolation=extrapolation))
  scenCashAPredict[,j]<-round(predict(fitA,newdata=scenModVars),6)
}else {
  scenCashAPredict[,j]<-0
}

#Run a cubist on bucket D with the interest rate variables and make predictions
if(sum(cashSeedsD[,j]!=0)>0){
  fitD<-cubist(y=cashSeedsD[,j],x=seedModVarsInt,committees=committeesInt,control=cubistControl(extrapolation=extrapolation))
  scenCashDPredict[,j]<-round(predict(fitD,newdata=scenModVarsInt),6)
}else {
  scenCashDPredict[,j]<-0
}

#Run bucket G with the interest variables
if(sum(cashSeedsG[,j]!=0)>0){
  fitG<-cubist(y=cashSeedsG[,j],x=seedModVarsInt,committees=5,neighbors=9,control=cubistControl(extrapolation=extrapolation))
  scenCashGPredict[,j]<-round(predict(fitG,newdata=scenModVarsInt),6)
}else {
  scenCashGPredict[,j]<-0
}

#If there are internal expenses for this model, then run the cubist on them
if(NROW(intExpSeedsDef)>0){
  fitIntExp<-cubist(y=intExpSeedsDef[,j],x=seedModVars,committees=committeesInt,neighbors=5,control=cubistControl(extrapolation=extrapolation))
  scenCashIntExpPredict[,j]<-round(predict(fitIntExp,newdata=scenModVars),6)
}

if(type[i]=="PVFP"){

  #If bucket B was populated, then run cubist, otherwise make the predictions zero
  if(sum(cashSeedsB[,j]!=0)>0){
    fitB<-cubist(y=cashSeedsB[,j],x=seedModVarsRes,committees=committeesInt,control=cubistControl(extrapolation=extrapolation))
    scenCashBPredict[,j]<-round(predict(fitB,newdata=scenModVarsRes),6)
  }else {
    scenCashBPredict[,j]<-0
  }

  #If bucket C was populated, then run cubist, otherwise make the predictions zero
  if(sum(cashSeedsC[,j]!=0)>0){
    fitC<-cubist(y=cashSeedsC[,j],x=seedModVarsRes,committees=committeesInt,control=cubistControl(extrapolation=extrapolation))
    scenCashCPredict[,j]<-round(predict(fitC,newdata=scenModVarsRes),6)
  }else {
    scenCashCPredict[,j]<-0
  }
```

After

- Functional programming
- DRY (Don’t Repeat Yourself)
- Little need for R troubleshooting



```
trainCubist     <- function(dt, com = 15, extp = 90){Cubist::cubist(y = getY(dt),x = getX(dt),committees = getCom(dt),control =
predictCubist   <- function(aModel, dt){stats::predict(aModel, newdata = getX(dt))}
```


File Edit View Help
• SQLEngine_AzureDataStudio_Sample.ipynb - internal_model (Workspace) - Azure Data Studio
SQLEngine_AzureDataStudio_Sample.ipynb ●
› ImpactSOA_repo › SOA-BackToBasicsAnalyticsForActuaries › ImpactSOA_CodeSamples › SQLEngine_AzureDataStudio_Sample.ipynb
+ Cell ▷ Run all
Kernel SQL
Attach to
[21]
[23]
master* ⊗ 6 ⚠ 0
Choose SQL Language

```
CREATE EXTERNAL LIBRARY Cubist  FROM (CONTENT = 'E:/ServerPackageDirectory/Cubist_0.2.3.zip'  ) WITH (LANGUAGE = 'R');
CREATE EXTERNAL LIBRARY mlbench FROM (CONTENT = 'E:/ServerPackageDirectory/mlbench_2.1-1.zip' ) WITH (LANGUAGE = 'R');
```

Commands completed successfully.

Total execution time: 00:00:00.906

```
exec sp_execute_external_script
    @language = N'R',
    @script = N'
library(Cubist)
library(mlbench)
data(BostonHousing)

## 1 committee, so just an M5 fit:
mod1 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv)
print(mod1)

## Now with 10 committees
mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10)
print(mod2)
';
```

STDERR message(s) from external script: Warning messages: 1: package 'Cubist' was built under R version 3.5.3 2: package 'mlbench' was built under R version 3.5.3

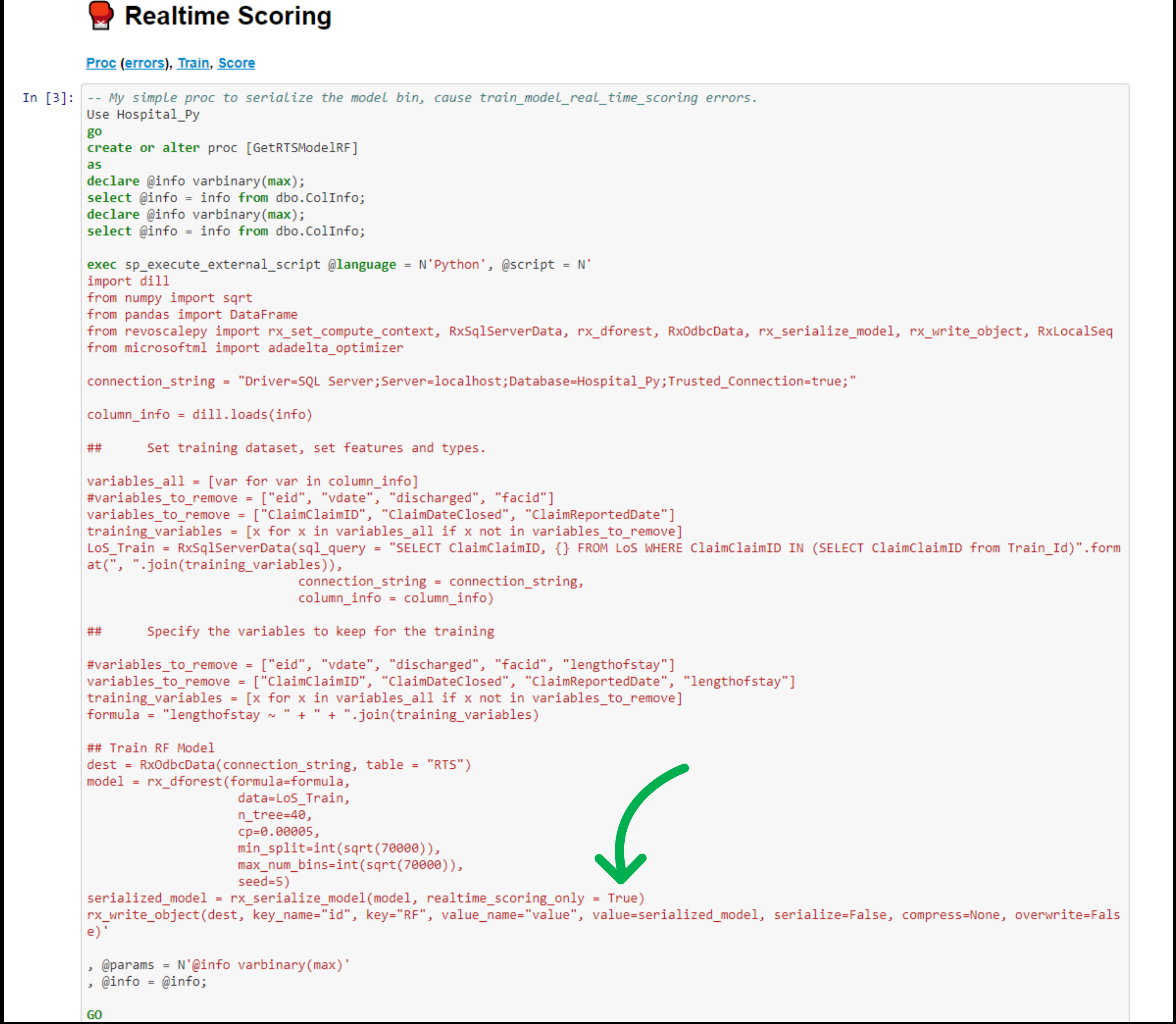
STDOUT message(s) from external script: Call: cubist.default(x = BostonHousing[, -14], y = BostonHousing$medv) Number of samples: 506 Number of predictors: 13 Number of committees: 1 Number of rules: 4 Call: cubist.default(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10) Number of samples: 506 Number of predictors: 13 Number of committees: 10 Number of rules per committee: 4, 6, 4, 6, 6, 7, 7, 7, 4, 5

Total execution time: 00:00:02.440

How to get started? How to reproduce?

1. Identify manual data processes & transformations of high value (ROI).
2. Simplify by consolidating workloads (leverage cloud).
3. Democratize understanding by sharing knowledge.
4. Accelerate business value for down-stream consumers/users.
5. aka.ms/mlsqldev
6. aka.ms/adf/azurelearn
7. RStudio Cheatsheets - RStudio

Length of Stay $40M



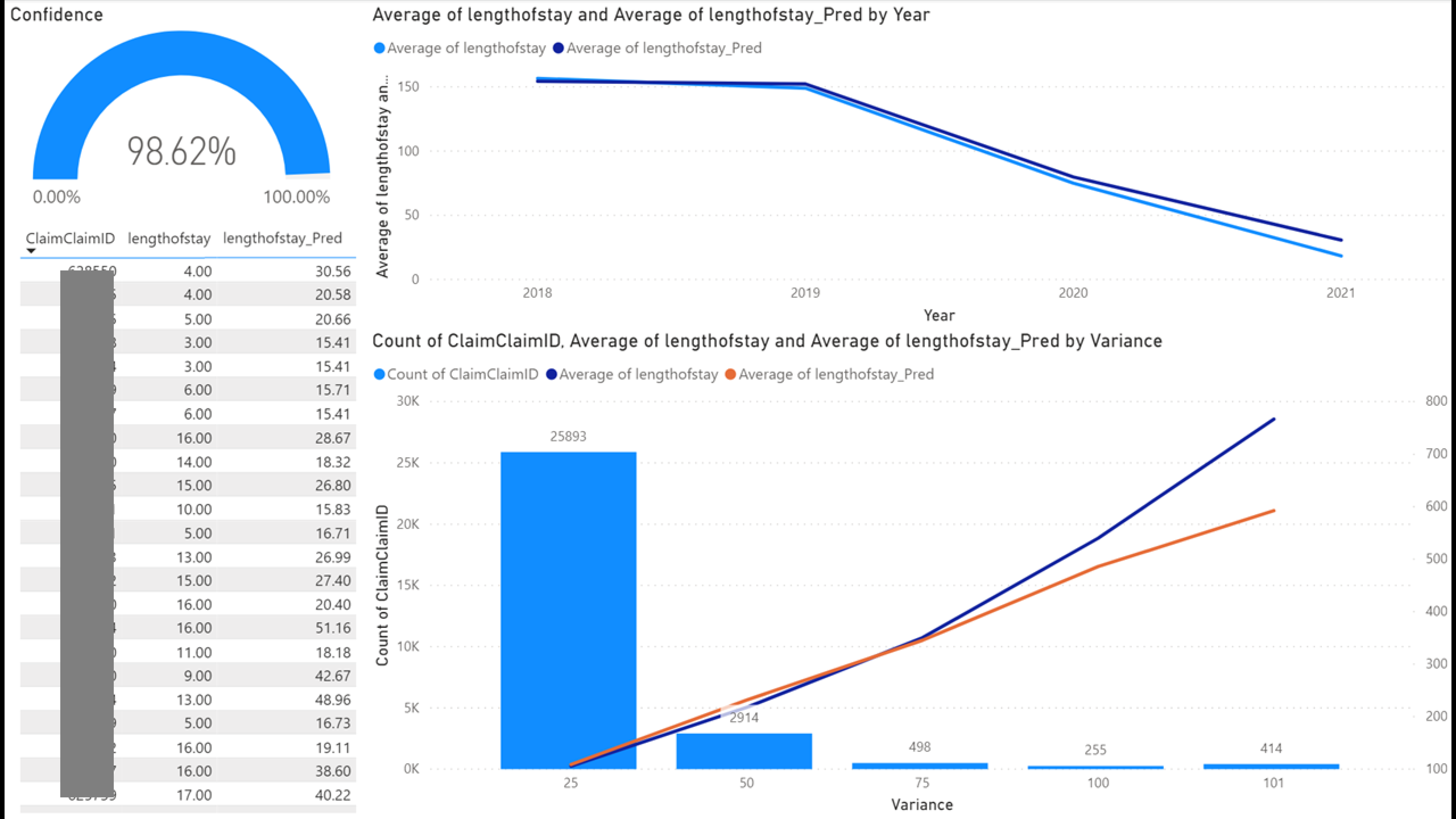
Realtime Scoring

Proc (errors), Train, Score

In [3]:

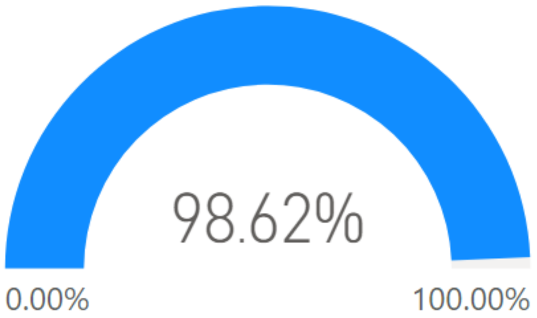
```
-- My simple proc to serialize the model bin, cause train_model_real_time_scoring errors.
Use Hospital_Py
go
create or alter proc [GetRTSModelRF]
as
declare @info varbinary(max);
select @info = info from dbo.ColInfo;
declare @info varbinary(max);
select @info = info from dbo.ColInfo;

exec sp_execute_external_script @language = N'Python', @script = N'
import dill
from numpy import sqrt
from pandas import DataFrame
from revoscalepy import rx_set_compute_context, RxSqlServerData, rx_dforest, RxOdbcData, rx_serialize_model, rx_write_object, RxLocalSeq
from microsoftml import adadelta_optimizer

connection_string = "Driver=SQL Server;Server=localhost;Database=Hospital_Py;Trusted_Connection=true;"

column_info = dill.loads(info)

##      Set training dataset, set features and types.

variables_all = [var for var in column_info]
#variables_to_remove = ["eid", "vdate", "discharged", "facid"]
variables_to_remove = ["ClaimClaimID", "ClaimDateClosed", "ClaimReportedDate"]
training_variables = [x for x in variables_all if x not in variables_to_remove]
LoS_Train = RxSqlServerData(sql_query = "SELECT ClaimClaimID, {} FROM LoS WHERE ClaimClaimID IN (SELECT ClaimClaimID from Train_Id)".form
at(", ".join(training_variables)),
                            connection_string = connection_string,
                            column_info = column_info)

##      Specify the variables to keep for the training

#variables_to_remove = ["eid", "vdate", "discharged", "facid", "lengthofstay"]
variables_to_remove = ["ClaimClaimID", "ClaimDateClosed", "ClaimReportedDate", "lengthofstay"]
training_variables = [x for x in variables_all if x not in variables_to_remove]
formula = "lengthofstay ~ " + " + ".join(training_variables)

## Train RF Model
dest = RxOdbcData(connection_string, table = "RTS")
model = rx_dforest(formula=formula,
                    data=LoS_Train,
                    n_tree=40,
                    cp=0.00005,
                    min_split=int(sqrt(70000)),
                    max_num_bins=int(sqrt(70000)),
                    seed=5)
serialized_model = rx_serialize_model(model, realtime_scoring_only = True)
rx_write_object(dest, key_name="id", key="RF", value_name="value", value=serialized_model, serialize=False, compress=None, overwrite=Fals
e)'

, @params = N'@info varbinary(max)'
, @info = @info;

GO
```

Learn more:
LoS - Realtime Scoring

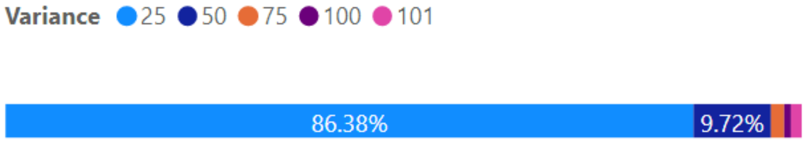

Confidence
98.62%
0.00%
100.00%
Average of lengthofstay and Average of lengthofstay_Pred by Year
● Average of lengthofstay ● Average of lengthofstay_Pred
Average of lengthofstay an...
150
100
50
0
2018
2019
2020
2021
Year
Count of ClaimClaimID, Average of lengthofstay and Average of lengthofstay_Pred by Variance
● Count of ClaimClaimID ● Average of lengthofstay ● Average of lengthofstay_Pred
Count of ClaimClaimID
30K
25K
20K
15K
10K
5K
0K
800
700
600
500
400
300
200
100
25893
2914
498
255
414
25
50
75
100
101
Variance

ClaimClaimID	lengthofstay	lengthofstay_Pred
[redacted]	4.00	30.56
[redacted]	4.00	20.58
[redacted]	5.00	20.66
[redacted]	3.00	15.41
[redacted]	3.00	15.41
[redacted]	6.00	15.71
[redacted]	6.00	15.41
[redacted]	16.00	28.67
[redacted]	14.00	18.32
[redacted]	15.00	26.80
[redacted]	10.00	15.83
[redacted]	5.00	16.71
[redacted]	13.00	26.99
[redacted]	15.00	27.40
[redacted]	16.00	20.40
[redacted]	16.00	51.16
[redacted]	11.00	18.18
[redacted]	9.00	42.67
[redacted]	13.00	48.96
[redacted]	5.00	16.73
[redacted]	16.00	19.11
[redacted]	16.00	38.60
[redacted]	17.00	40.22

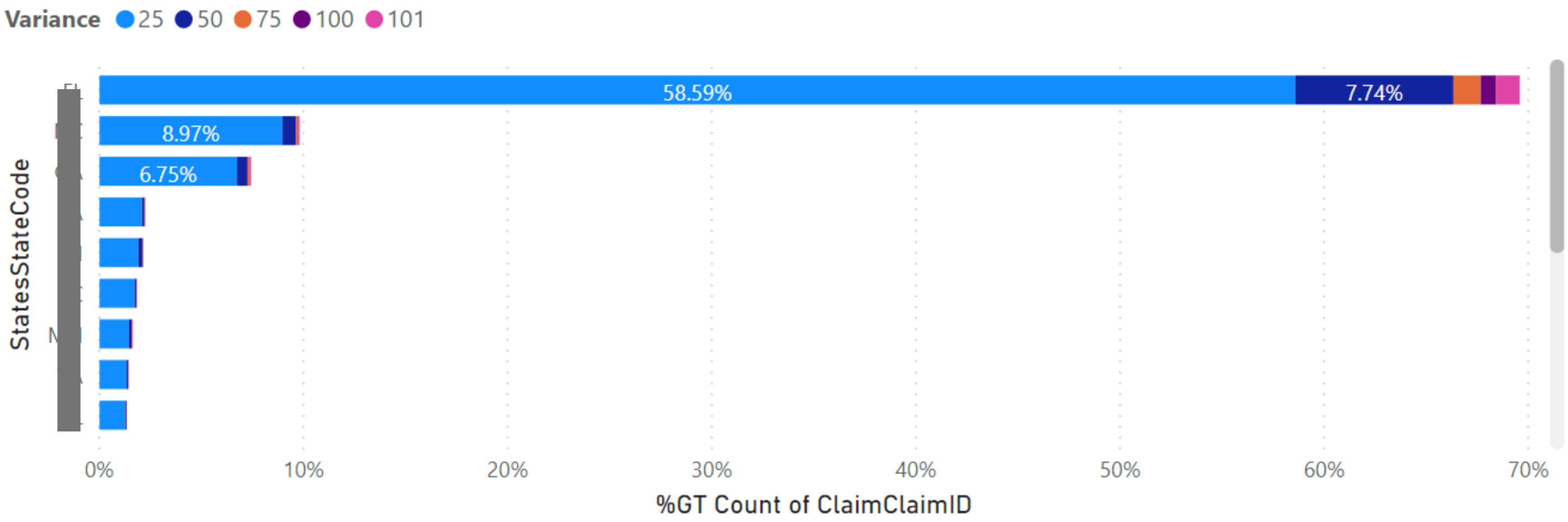
Confidence



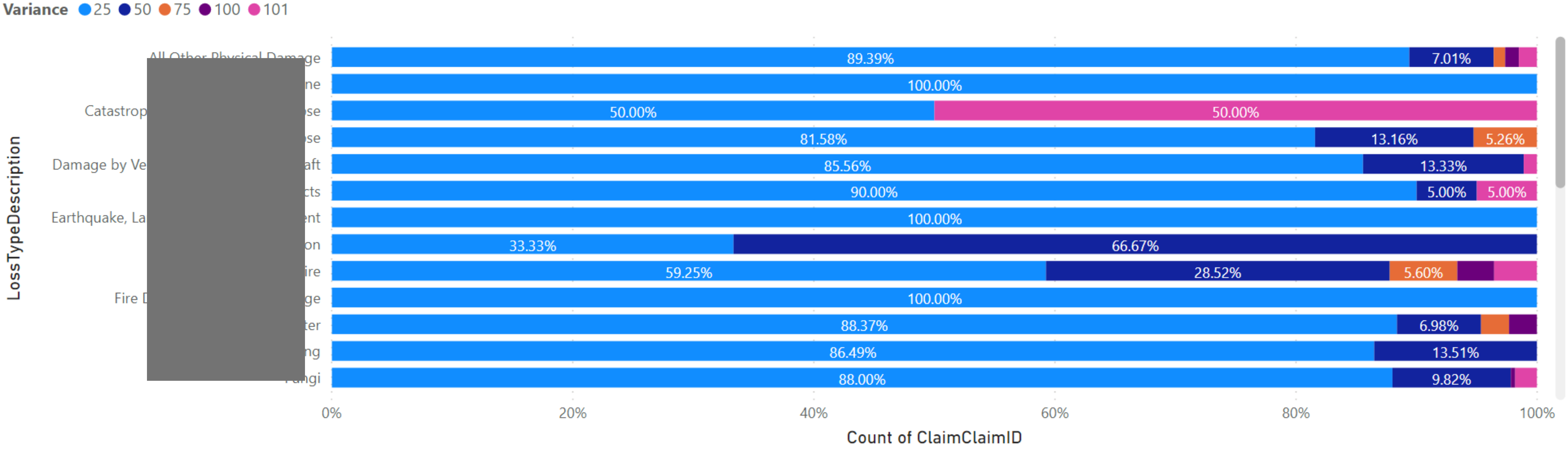
%GT Count of ClaimClaimID by Variance



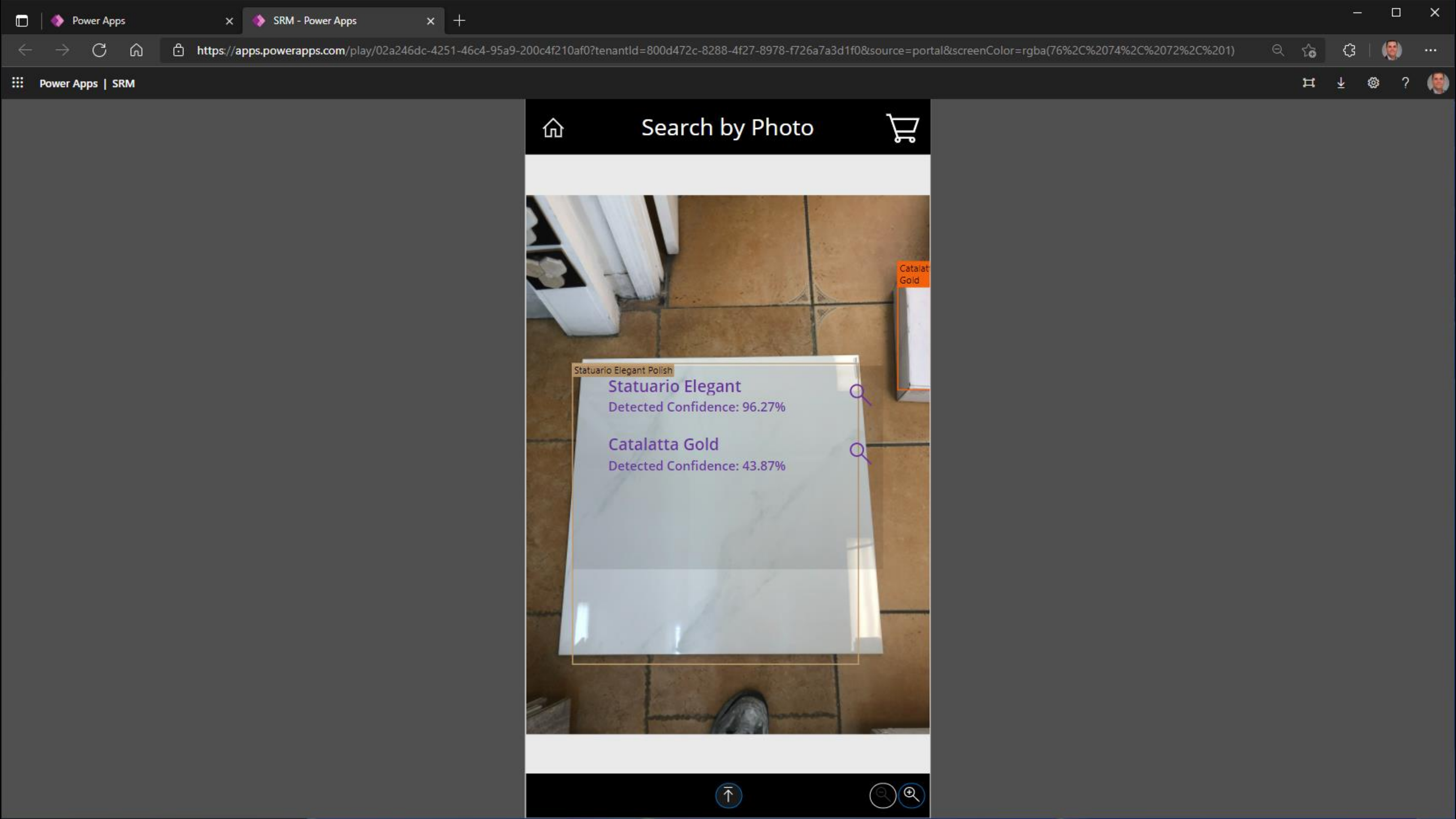
%GT Count of ClaimClaimID by StatesStateCode and Variance



Count of ClaimClaimID by LossTypeDescription and Variance



Search by Photo $200K


Power Apps
SRM - Power Apps
https://apps.powerapps.com/play/02a246dc-4251-46c4-95a9-200c4f210af0?tenantId=800d472c-8288-4f27-8978-f726a7a3d1f0&source=portal&screenColor=rgba(76%2C%2074%2C%2072%2C%201)
Power Apps | SRM
Catalat
Gold
Statuario Elegant Polish

Search by Photo

Statuario Elegant

Detected Confidence: 96.27%

Catalatta Gold

Detected Confidence: 43.87%

Summary

1. Sentiment
2. QnA Chat Bots
3. Forms
4. Capital Modeling
5. Length of Stay
6. Search by Photo

Additional Resources

1. Repo1 (SQL, Python, JS on Node, Power BI)
2. Repo2 (SQL BDC, Spark/Scala, Python, Azure Cog API, Paginated Reports)
3. Repo3 (Synapse, DevOps, In-DB ML, R, Purview)
4. Video (3 minutes)
5. Video (1 hour)

Microsoft

Thank you

Hiram Fleitas

aka.ms/hiram