

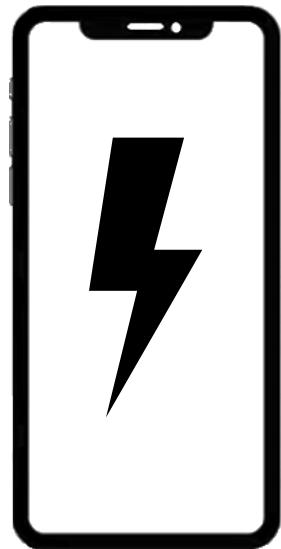
Sentiment Prediction

Real-time in SQL Server

SQL Server
Machine Learning
Pre-Trained Models
Python
Real-time Scoring
Bonus

Hiram Fleitas
Fleitas Arts
github.com/hfleitas/SentimentPrediction





Please silence
cell phones



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Giving 3 Sessions in 1 Day

05/28/2019

Hiram

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Video: Real-time Sentiment Prediction in SQL Server

SQL Saturday 864 - South Florida, United States is less than 2 weeks away. June 8, 2019 @NSUFlorida. This is a whole day, free event open to the public. You can register here. I am giving 3 sessions that day and may be raffling 2x \$50 gift cards per session. You should come to my session(s)... [Continue reading →](#)

This is candid recording of the live presentation I gave at Nova University on the morning of March 2nd, 2019 with South Florida Code Camp 2019. You can see the event info in my previous post. I am made this recording for the attendees that were interested to play it back at their own pace.... [Continue reading →](#)



Session evaluations

Your feedback is very important.



This is the link:

bit.ly/sqlml19

Submit your feedback by the end of this presentation.

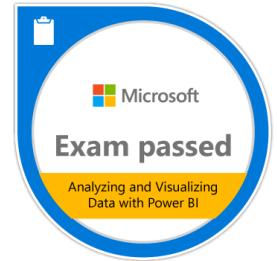
Hiram Fleitas

Owner Fleitas Arts



Bio

Father
Principal DB Architect
Power BI since 2016
Developer since 1995
SQL Server since 1999
USCG Auxiliary Flotilla Staff Officer



 @hiramfleitas

 hiram@fleitasarts.com

 fleitasarts.com

 /hfeitas

 hiramfletias



Agenda

- ★ Add ML Features
- ★ Grant Access
- ★ Config
- ★ Install Pre-Trained & Open Source ML Models (DNN)
- ★ Code in Python and T-SQL
- ★ Python Profiling
- ★ Real-time scoring
- ★ Review Sentiment Results
- ★ Bonus
- ★ Resources

DEMO

SQL Server ML & AI





Extract information from your text

Use the demo below to experiment with the Text Analytics API. Pick one of our examples or provide your own.

Identify the language, sentiment, key phrases, and entities (Preview) of your text by clicking "Analyze".

See it in action

Destiny is a gift. Some go their entire lives, living existence as a quiet desperation. Never learning the truth that what feels as though a burden pushing down upon our shoulders, is actually, a sense of purpose that lifts us to greater heights. Never forget that fear is but the precursor to valor, that to strive and triumph in the face of fear, is what it means to be a hero. Don't think, Master Jim. Become!

[Analyze](#)[Analyzed text](#)[JSON](#)

English (confidence: 100 %)

LANGUAGES:**KEY PHRASES:**

face of fear, existence, triumph, valor, sense of purpose, entire lives, quiet desperation, shoulders, greater heights, precursor, Destiny, gift, Master Jim, burden, truth, hero

**SENTIMENT:**

78 %

LINKED ENTITIES (PREVIEW):

Destiny is a gift. Some go their entire lives, living existence as a quiet desperation. Never learning the truth that what feels as though a burden pushing down upon our shoulders, is actually, a sense of purpose that lifts us to greater heights.

Feature Selection

Select the Developer features to install.

- Global Rules
- Product Updates
- Install Setup Files
- Install Rules
- Product Key
- License Terms
- Feature Selection**
- Feature Rules
- Instance Configuration
- Server Configuration
- Database Engine Configuration
- Consent to install Microsoft R ...
- Consent to install Python
- Feature Configuration Rules
- Ready to Install
- Installation Progress
- Complete

i Looking for Reporting Services? [Download it from the web](#)

Features:

Instance Features

- Database Engine Services
- SQL Server Replication
- Machine Learning Services (In-Database)
 - R
 - Python
- Full-Text and Semantic Extractions for Search
- Data Quality Services
- PolyBase Query Service for External Data
- Analysis Services

Shared Features

[Select All](#)

[Unselect All](#)

Instance root directory:

C:\Program Files\Microsoft SQL Server\



Shared feature directory:

C:\Program Files\Microsoft SQL Server\



Shared feature directory (x86):

C:\Program Files (x86)\Microsoft SQL Server\



Feature description:

Includes extensions that enable integration with R and Python languages using standard T-SQL statements.

Prerequisites for selected features:

Already installed:

- Microsoft Visual C++ 2015 Redistributable
- Windows PowerShell 3.0 or higher

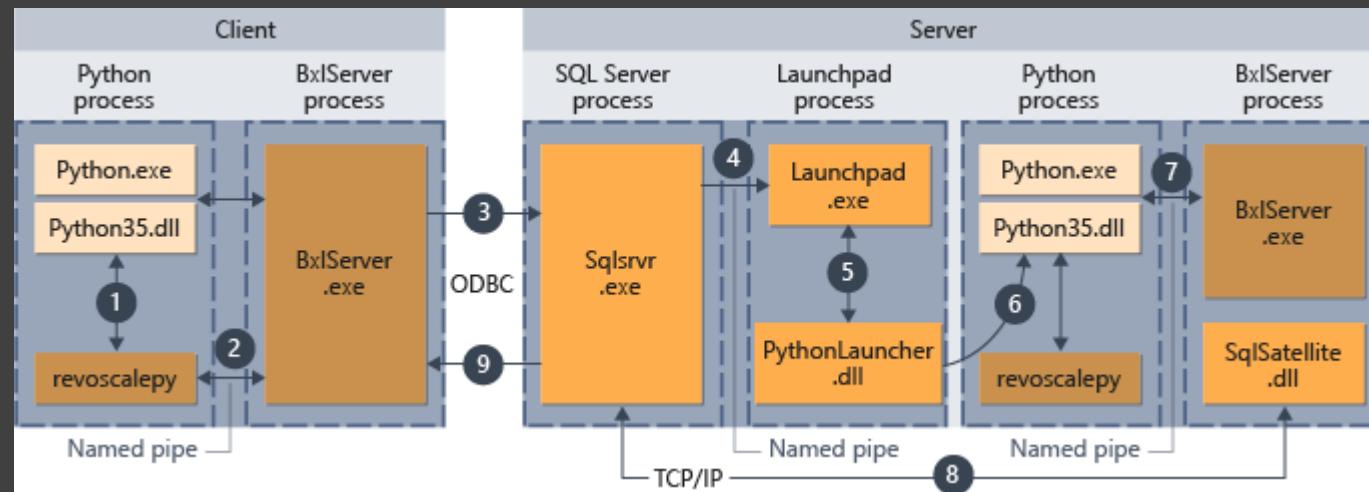
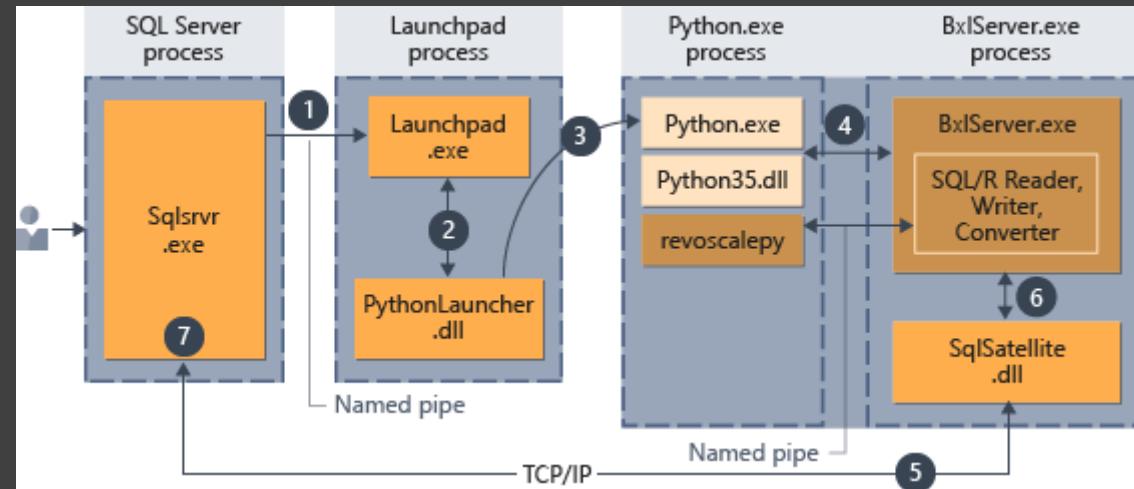
Disk Space Requirements

Drive C: 2263 MB required, 78465 MB available

< Back

Next >

Cancel





Computer Management (Local)	
System Tools	
Task Scheduler	
Event Viewer	
Shared Folders	
Shares	
Sessions	
Open Files	
Local Users and Groups	
Users	
Groups	
Performance	
Device Manager	
Storage	
Disk Management	
Services and Applications	

Name	Full Name	Description
DefaultAccount		A user account managed by the system.
defaultuser0		
MSSQLSERVER00	MSSQLSERVER00	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER01	MSSQLSERVER01	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER02	MSSQLSERVER02	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER03	MSSQLSERVER03	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER04	MSSQLSERVER04	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER05	MSSQLSERVER05	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER06	MSSQLSERVER06	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER07	MSSQLSERVER07	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER08	MSSQLSERVER08	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER09	MSSQLSERVER09	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER10	MSSQLSERVER10	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER11	MSSQLSERVER11	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER12	MSSQLSERVER12	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER13	MSSQLSERVER13	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER14	MSSQLSERVER14	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER15	MSSQLSERVER15	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER16	MSSQLSERVER16	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER17	MSSQLSERVER17	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER18	MSSQLSERVER18	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER19	MSSQLSERVER19	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
MSSQLSERVER20	MSSQLSERVER20	Local user account for execution of R scripts in SQL Server instance MSSQLSERVER
SophosSAUUPCIC420	SophosSAUUPCIC420	Used for download of Sophos updates
UIH_ADMIN		Built-in account for administering the computer/domain
UIH_Guest		Built-in account for guest access to the computer/domain
UPCIC		
WDAGUtilityAccount		A user account managed and used by the system for Windows Defender Application Guard scenarios.

Actions
Users
More Actions
MSSQLSERVER00
More Actions



Computer Management (Local)
System Tools
Task Scheduler
Event Viewer
Shared Folders
Shares
Sessions
Open Files
Local Users and Groups
Users
Groups
Performance
Device Manager
Storage
Disk Management
Services and Applications

Name	Description
Access Control Assistance Operators	Members of this group can remotely query ...
Administrators	Administrators have complete and unrestrict...
Backup Operators	Backup Operators can override security restr...
Cryptographic Operators	Members are authorized to perform cryptog...
Distributed COM Users	Members are allowed to launch, activate an...
Event Log Readers	Members of this group can read event logs f...
Guests	Guests have the same access as members of...
Hyper-V Administrators	Members of this group have complete and ...
IIS_IUSRS	Built-in group used by Internet Information ...
Network Configuration Operators	Members in this group can have some admi...
Performance Log Users	Members of this group may schedule loggi...
Performance Monitor Users	Members of this group can access performa...
Power Users	Power Users are included for backwards co...
Remote Desktop Users	Members in this group are granted the right...
Remote Management Users	Members of this group can access WMI reso...
Replicator	Supports file replication in a domain
System Managed Accounts Group	Members of this group are managed by the ...
Users	Users are prevented from making accidental...
docker-users	Users of Docker for Windows
HelpLibraryUpdaters	SophosAdministrators may run Sophos Anti...
SophosAdministrator	Contains accounts used by Sophos Anti-Vir...
SophosOnAccess	SophosPowerUsers may run Sophos Anti-Vir...
SophosPowerUser	SophosUsers may run Sophos Anti-Virus wit...
SophosUser	
SQLUserGroup	SQLUserGroup
SQLServer2005SQLBrowserUser\$R90GTU6N	Members in the group have the required ac...

Actions

- Groups
- More Actions
- SQLUserGroup
- More Actions

SQLUserGroup Properties

General

SQLUserGroup

Description: SQLUserGroup

Members:

- MSSQLSERVER00
- MSSQLSERVER01
- MSSQLSERVER02
- MSSQLSERVER03
- MSSQLSERVER04
- MSSQLSERVER05
- MSSQLSERVER06
- MSSQLSERVER07
- MSSQLSERVER08

Add... Remove

Changes to a user's group membership are not effective until the next time the user logs on.

OK Cancel Apply Help

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Debug Any CPU Start

SQLServerScripts.sql

```
1 -- blog: https://blogs.microsoft.com/sqlserverstorageengine/2017/11/01/sentiment-analysis-with-python-in-sql-server-machine-learning-services/
2 -- + -----
3 -- | 1. restore sample db. |
4 -- + -----
5 --The database used for this sample can be downloaded here: https://sqlchoice.blob.core.windows.net/sqlchoice/static/tpcxbb\_1gb.bak
6 restore filelistonly from disk = 'c:\users\hfleitas\downloads\tpcxbb_1gb.bak'
7 go
8 restore database [tpcxbb_1gb] from disk = 'c:\users\hfleitas\downloads\tpcxbb_1gb.bak' with replace,
9 move 'tpcxbb_1gb' to 'C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\DATA\tpcxbb_1gb.mdf',
10 move 'tpcxbb_1gb_log' to 'C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\DATA\tpcxbb_1gb.ldf'
11 go
12 alter database [tpcxbb_1gb] set COMPATIBILITY_LEVEL = 140
13 GO
14 EXEC sp_configure 'external scripts enabled', 1
15 RECONFIGURE WITH OVERRIDE
16 go
17 declare @sql nvarchar(max)
18 select @sql = N'create login [' + @@servername + '\SQLRUserGroup] from windows; grant EXECUTE ANY EXTERNAL SCRIPT to [' + @@servername + '\SQLRUserGroup];
19 --alter server role sysadmin add member [' + @@servername + '\SQLRUserGroup];
20 use tpcxbb_1gb;
21 create user [' + @@servername + '\SQLRUserGroup] from login [' + @@servername + '\SQLRUserGroup];
22 alter role db_datawriter add member [' + @@servername + '\SQLRUserGroup]';
23 print @sql; exec sp_executesql @sql;
24 go
25 -- Restart SQL Service & LAUNCHPAD.
26 -- Run PS as admin: .\Install-MLModels.ps1 MSSQLSERVER
27 -- Install Latest SQL Server CU, Reboot.
28 -- Run CMD as admin: FixPath.cmd
29 -- Verify WORKING_DIRECTORY in ...\\MSSQL\\Binn\\pythonlauncher.config
30 -- Run CMD as admin: AddToSQL-PreTrainedModels.cmd. It downloads & installs the pre-trained models.
31
32 /* Other Notes*/
33 -- upgrade/bind instance https://docs.microsoft.com/sql/advanced-analytics/r/use-sqlbindr-exe-to-upgrade-an-instance-of-sql-server
34 -- install python libraries interpreter https://docs.microsoft.com/machine-learning-server/install/python-libraries-interpreter
35
36 -- + -----
37 -- | 2. use pre-trained model |
38 -- + -----
39 -- Create stored procedure that uses a pre-trained model to determine sentiment of a given text
40 use [tpcxbb_1gb]
```

110 %

Disconnected.

Output Error List Package Manager Console Data Tools Operations

Ready

Properties Solution Explorer Team Explorer GitHub Resource View Notifications Python Environments

```
PS C:\WINDOWS\system32> cd c:\users\hfleitas\desktop
PS C:\users\hfleitas\desktop> .\Install-MLModels.ps1
Get-Item : Cannot find path 'C:\Program Files\Microsoft SQL Server\140\R_SERVER' because it does not exist.
At C:\users\hfleitas\desktop\Install-MLModels.ps1:50 char:39
+ ...                     $this.RootPath = (Get-Item($sharedKey.Path)).Parent ...
+ 
+ CategoryInfo          : ObjectNotFound: (C:\Program File...er\140\R_SERVER:String) [Get-Item], ItemNotFoundException
n
+ FullyQualifiedErrorId : PathNotFound,Microsoft.PowerShell.Commands.GetItemCommand

usage: Install-MLModels.ps1 <INSTANCE> [<INSTANCE> ...]

Available instances:
    MSSQLSERVER
PS C:\users\hfleitas\desktop> .\Install-MLModels.ps1 MSSQLSERVER
Get-Item : Cannot find path 'C:\Program Files\Microsoft SQL Server\140\R_SERVER' because it does not exist.
At C:\users\hfleitas\desktop\Install-MLModels.ps1:50 char:39
+ ...                     $this.RootPath = (Get-Item($sharedKey.Path)).Parent ...
+ 
+ CategoryInfo          : ObjectNotFound: (C:\Program File...er\140\R_SERVER:String) [Get-Item], ItemNotFoundException
n
+ FullyQualifiedErrorId : PathNotFound,Microsoft.PowerShell.Commands.GetItemCommand

MSSQL14.MSSQLSERVER
    Verifying R models [9.2.0.24]
    Downloading R models [C:\Users\hfleitas\AppData\Local\Temp]
    Installing R models [C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\]
    Verifying Python models [9.2.0.24]
    Installing Python models [C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\]
PS C:\users\hfleitas\desktop>
```



Install a SQL Server 2017 update

Select Features

Specify the features to update.

SQL Server 2017 update

License Terms

Select Features

Consent to install Microsoft R ...

Consent to install Python

Check Files In Use

Ready to update

Update Progress

Complete

Instances:

- MSSQLSERVER
 - Database Engine Services
 - Machine Learning Services (In-Database)
 - R
 - Python
 - Shared Features
 - SQL Client Connectivity SDK

Description:

Language:	English - United States
Edition:	Developer
Patch Level:	14.0.1000.169
Architecture:	x64
Service Pack:	
Upgrade Status:	Not installed.

Select All

Unselect All

< Back

Next >

Cancel

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Debug Any CPU Start

Solution Explorer Properties

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer

FixPath.cmd

```
1 rem Fix for long path error with SQL Server 2017 CU6 Python ML Win Svr 930.
2 rem run as admin cmd.
3
4 rem see working dir in : C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn\pythonlauncher.config
5 rem bad: WORKING_DIRECTORY=C:\Program Files\Microsoft SQL Server\MSSQL13.MSSQLSERVER\MSSQL\ExtensibilityData
6 rem good: WORKING_DIRECTORY=C:\SQL-MSSQLSERVER-ExtensibilityData-PY
7
8 cd "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\revoscalepy\rxLibs\
9
10 rem uninstall
11 registerRext.exe /uninstall /sqlbinpath:"C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES..\MSSQL\Binn" /userpoolsize:0 /instance:"MSSQLSERVER" /python
12
13 rem install
14 registerRext.exe /install /sqlbinpath:"C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES..\MSSQL\Binn" /userpoolsize:0 /instance:"MSSQLSERVER" /python
15
```

Output Error List Package Manager Console

Ready

Quick Launch (Ctrl+Q)

hiramfleitas H

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn\pythonlauncher.config - Notepad++

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

pythonlauncher.config

```
1 PYTHONHOME=C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES
2 ENV_PythonIOEncoding=UTF-8
3 ENV_ExaMpICommD11Path=C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\revoscalepy\rxLibs\
4 MPI_HOME=C:\Program Files\Microsoft MPI
5 INSTANCE_NAME=MSSQLSERVER
6 TRACE_LEVEL=1
7 JOB_CLEANUP_ON_EXIT=1
8 USER_POOL_SIZE=0
9 WORKING_DIRECTORY=C:\SQL-MSSQLSERVER-ExtensibilityData-PY
10 PKG_MGMT_MODE=0
```

Normal text file length : 447 lines : 10 Ln : 9 Col : 1 Sel : 0 | 0 Windows (CR LF) UCS-2 LE BOM INS

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Debug Any CPU Start

AddToSQL-PreTrainedModels.cmd SQLServerScripts.sql

```
1 rem Run cmd as administrator.
2 rem Ref: https://docs.microsoft.com/sql/advanced-analytics/r/install-pretrained-models-sql-server
3
4 cd C:\Program Files\Microsoft SQL Server\140\Setup Bootstrap\SQL2017\x64\
5 RSetup.exe /install /component MLM /version 9.2.0.24 /language 1033 /destdir "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs"
6
7
8 rem RSetup.exe /install /component MLM /version 9.2.0.24 /language 1033 /destdir "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES"
9
```

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Properties Solution Explorer Team Explorer GitHub Resource View Notifications Python Environments

110 %

Output Error List Package Manager Console

Ready

```
Administrator: Command Prompt
(c) 2018 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>cd C:\Program Files\Microsoft SQL Server\140\Setup Bootstrap\SQL2017\x64\

C:\Program Files\Microsoft SQL Server\140\Setup Bootstrap\SQL2017\x64>RSetup.exe /install /component MLM /version 9.2.0.24 /language 1033 /destdir "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs"
Reading registry value HKCU\SOFTWARE\Microsoft\RSetup\MLM_DownloadUrl
Registry value:
RSetup.exe version: 9.2.0.39
Reading registry value HKEY_LOCAL_MACHINE\Software\Microsoft\Microsoft SQL Server\130\Bootstrap\Setup\R_SERV_CACHE
Registry value:
Reading registry value HKEY_LOCAL_MACHINE\Software\Microsoft\Microsoft SQL Server\130\Bootstrap\BootstrapDir
Registry value:
Using default cache directory: C:\Users\hfleitas\AppData\Local\Temp\
Extracting C:\Users\hfleitas\AppData\Local\Temp\MLM_9.2.0.24_1033.cab to C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\AlexNet_Updated.model
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\ImageNet1K_mean.xml
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\pretrained.model
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\ResNet_101_Updated.model
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\ResNet_18_Updated.model
Extracting C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxLibs\ResNet_50_Updated.model

C:\Program Files\Microsoft SQL Server\140\Setup Bootstrap\SQL2017\x64>
```

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Debug Any CPU Start

SQLMLVersions-Troubleshooting.sql

```
1 -- https://docs.microsoft.com/en-us/sql/advanced-analytics/data-collection-ml-troubleshooting-process?view=sql-server-2017
2 set nocount on;
3 exec sp_execute_external_script @language = N'R', @script = N'
4 # Transform R version properties to data.frame
5 OutputDataSet <- data.frame( property_name = c("R.version", "Revo.version"),
6   property_value = c(R.Version()$version.string, Revo.version$version.string), stringsAsFactors = FALSE )
7 # Retrieve properties like R.home, libPath & default packages
8 OutputDataSet <- rbind( OutputDataSet, data.frame( property_name = c("R.home", "libPaths", "defaultPackages"),
9   property_value = c(R.home(), .libPaths(), pastegetOption("defaultPackages"), collapse="", ""), stringsAsFactors = FALSE ) )
10 WITH RESULT SETS ((PropertyName nvarchar(100), PropertyValue nvarchar(4000)));
11 go
12 -- Get Python runtime properties:
13 exec sp_execute_external_script @language = N'Python', @script = N'
14 import sys
15 import pkg_resources
16 OutputDataSet = pandas.DataFrame( {"property_name": ["Python.home", "Python.version", "Revo.version", "MML.version", "libpaths"],
17   "property_value": [sys.executable[-10], sys.version, pkg_resources.get_distribution("revoscalepy").version, pkg_resources.get_distribution("microsoftml").version, str(sys.path)]} )
18 WITH RESULT SETS ((PropertyName nvarchar(100), PropertyValue nvarchar(4000)));
19 go
20 -- See msgs tab Python revoscalepy and mml versions.
21 EXEC sp_execute_external_script @language =N'Python',
22 @script=N'
23 import sys, revoscalepy, microsoftml
24 print(sys.version)
25 print(revoscalepy.__version__)
26 print(microsoftml.__version__)
27 @input_data_1 =N'select 1'
28 WITH RESULT SETS NONE;
29 GO
30 /*STDOUT message(s) from external script:
31 3.5.2 |Continuum Analytics, Inc.| (default, Jul 5 2016, 11:41:13) [MSC v.1900 64 bit (AMD64)]
32 9.2.0
33 1.4.0.1375
34 */
```

110 % Disconnected.

Output Error List Package Manager Console

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Debug Any CPU Start

SQLServerScripts.sql

```
/* Other Notes*/
-- upgrade/bind instance https://docs.microsoft.com/sql/advanced-analytics/r/use-sqlbindr-exe-to-upgrade-an-instance-of-sql-server
-- install python libraries interpreter https://docs.microsoft.com/machine-learning-server/install/python-libraries-interpreter

-- +-----+
-- | 2. use pre-trained model |
-- +-----+
-- Create stored procedure that uses a pre-trained model to determine sentiment of a given text
use [tpcxbb_1gb]
go
CREATE OR ALTER PROCEDURE [dbo].[get_sentiment](@text NVARCHAR(MAX))
AS
BEGIN
DECLARE @script nvarchar(max);

--The Python script we want to execute
SET @script = N'
import pandas as p
from microsoftml import rx_featurize, get_sentiment

analyze_this = text

# Create the data
text_to_analyze = p.DataFrame(data=dict(Text=[analyze_this]))

# Get the sentiment scores
sentiment_scores = rx_featurize(data=text_to_analyze,ml_transforms=[get_sentiment(cols=dict(scores="Text"))])

# Lets translate the score to something more meaningful
sentiment_scores["Sentiment"] = sentiment_scores.scores.apply(lambda score: "Positive" if score > 0.6 else "Negative")
';

EXECUTE sp_execute_external_script @language = N'Python'
    , @script = @script
    , @output_data_1_name = N'sentiment_scores'
    , @params = N'@text nvarchar(max)'
    , @text = @text
    WITH RESULT SETS (("Text" NVARCHAR(MAX), "Score" FLOAT, "Sentiment" NVARCHAR(30)));
END
```

110 %

New Connection Opened

Output Error List Package Manager Console

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

Ready

Properties Solution Explorer Team Explorer GitHub Resource View Notifications Python Environments

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Quick Launch (Ctrl+Q) hiramfleitas H

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Properties Solution Explorer Team Explorer GitHub Notifications Python Environments

SQLServerScripts.sql

```
71 -- +-----+
72 -- | 3. Test the proc |
73 -- +-----+
74 -- The below examples test a negative and a positive review text
75 exec [get_sentiment] N'These are not a normal stress reliever. First of all, they got sticky, hairy and dirty on the first day I received them. Second, they arrived with tiny wrinkles in their bodies
76 go --0.424483060836792 Negative
77 exec [get_sentiment] N'These are the cutest things ever!! Super fun to play with and the best part is that it lasts for a really long time. So far these have been thrown all over the place with so man
78 go --0.869342148303986 Positive
79 exec [get_sentiment] N'I really did not like the taste of it'
80 go --0.46178987622261 Negative
81 exec [get_sentiment] N'It was surprisingly quite good!'
82 go --0.960192441940308 Positive
83 exec [get_sentiment] N'I will never ever ever go to that place again!!'
84 go --0.310343533754349 Negative
85 exec [get_sentiment] N'Destiny is a gift. Some go their entire lives, living existence as a quiet desperation. Never learning the truth that what feels as though a burden pushing down upon our shoulde
86 go --0.5 Negative. Why...Not enough?
87 -- https://azure.microsoft.com/en-us/services/cognitive-services/text-analytics/
88 -- Language: English, Sentiment: 78%.
89 -- Key phrases: face of fear, existence, triumph, valor, sense of purpose, entire lives, quiet desperation, shoulders, greater heights, precursor, Destiny, gift, Master Jim, burden, truth, hero.
90
```

T-SQL Results Message

	Text	Score	Sentiment
1	These are not a normal stress reliever. First of...	0.424483060836792	Negative
1	These are the cutest things ever!! Super fun to ...	0.869342148303986	Positive
1	I really did not like the taste of it	0.46178987622261	Negative
1	It was surprisingly quite good!	0.960192441940308	Positive
1	I will never ever ever go to that place again!!	0.310343533754349	Negative
1	Destiny is a gift. Some go their entire lives, I...	0.5	Negative

Query executed successfully at 5:03:01 PM | R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:30 | 6 rows

Output Error List Package Manager Console

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Debug Any CPU Start

GetSentimentExample.py SQLServerScripts.sql

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer

Python Environments

- Anaconda 5.1.0 Continuum Analytics, Inc.
- MLServer930Python Custom environment
- Python 3.6 (64-bit) Python Software Foundation
- SQLServer2017PythonSvcs** Custom environment

Overview

This is the default environment for new projects

Open interactive window

Explore interactive scripts

Use IPython interactive mode

Open in PowerShell

Configure or remove environment

- C:\Program Files\Microsoft SQL Server\MS...PYTHON_SERVICES
- C:\Program Files\Microsoft SQL Server\MSSQL14.M...python.exe
- C:\Program Files\Microsoft SQL Server\MSSQL14....\python.exe

Select C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\python.exe

```
warning: Debugger speedups using cython not found. Run '"C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\python.exe" "C:\Program Files (x86)\Microsoft Visual Studio\2017\Community\Common7\IDE\Extensions\Microsoft\Python\Core\Packages\ptvsd\pydevd\setup_cython.py" build_ext --inplace' to build.  
pydev debugger: starting  
  
Express Edition will continue to be enforced.  
Beginning processing data.  
Rows Read: 2, Read Time: 0, Transform Time: 0  
Beginning processing data.  
Elapsed time: 00:00:04.8236633  
Finished writing 2 rows.  
Writing completed.
```

	Text	scores	Sentiment
0	These are not a normal stress reliever. First ...	0.424483	Negative
1	These are the cutest things ever!! Super fun t...	0.869342	Positive

Press any key to continue . . .

110 %

Output Error List Package Manager Console

Solution... Team Ex... GitHub Resourc... Notifica... Python...

FLEITAS ARTS

Ready

GetSentimentExample - Microsoft Visual Studio

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Debug Any CPU Start

GetSentimentExample.py SQLServerScripts.sql

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer

Python Environments

Anaconda 5.1.0

Properties

Visual Studio Installer

Modifying — Visual Studio Community 2017 — 15.7.3

Workloads Individual components Language packs Installation locations

Web & Cloud (7)

- ASP.NET and web development Build web applications using ASP.NET, ASP.NET Core, HTML/JavaScript, and Containers including Docker support.
- Python development Editing, debugging, interactive development and source control for Python.
- Data storage and processing Connect, develop, and test data solutions with SQL Server, Azure Data Lake, or Hadoop.
- Data science and analytical applications Languages and tooling for creating data science applications, including Python, R and F#.

Mobile & Gaming (5)

Location C:\Program Files (x86)\Microsoft Visual Studio\2017\Community Change...

Total space required 0 KB

Modify

1.16.1247.518

By continuing, you agree to the [license](#) for the Visual Studio edition you selected. We also offer the ability to download other software with Visual Studio. This software is licensed separately, as set out in the [3rd Party Notices](#) or in its accompanying license. By continuing, you also agree to those licenses.

110 % Solution... Team Ex... GitHub Resources Notifications Python...

Output Error List Package Manager Console

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Python Performance GetSentimentExample_20180606.vsp X

Instrumentation Profiling Report 22.297 seconds of total execution time

Hot Path

Function Name	Elapsed Time	Inclusive Time %	Exclusive Time %
python.exe	100.00	0.00	0.00
GetSentimentExample (module)	100.00	0.00	0.00
<frozen importlib._find_and_load	72.15	0.00	0.00
microsoftml.modules.feature(rx_featurize	27.80	0.00	0.00

Report

- Show Trimmed Call Tree
- Compare Reports...
- Export Report Data...
- Save Analyzed Report...
- Toggle Full Screen
- Set Symbol Path...

Related Views: Call Tree Functions

Functions Doing Most Individual Work

Name	Exclusive Time %
<frozen importlib.FileLoader.get_data	47.54
revoscalepy.RxSerializable.rx_native_call	27.88
compile	9.22
io.open	3.57
_imp.create_dynamic	3.32

Solution Explorer

Search Solution Explorer (Ctrl+.)

Solution 'GetSentimentExample' (1 project)

- Solution Items
 - Performance1.psess
 - GetSentimentExample
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 - FixPath.cmd
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 - Install-PyForMLS.ps1
 - microsoft-machine-learning-algorithm-cheat-sheet-v6.pdf

GetSentimentExample.py

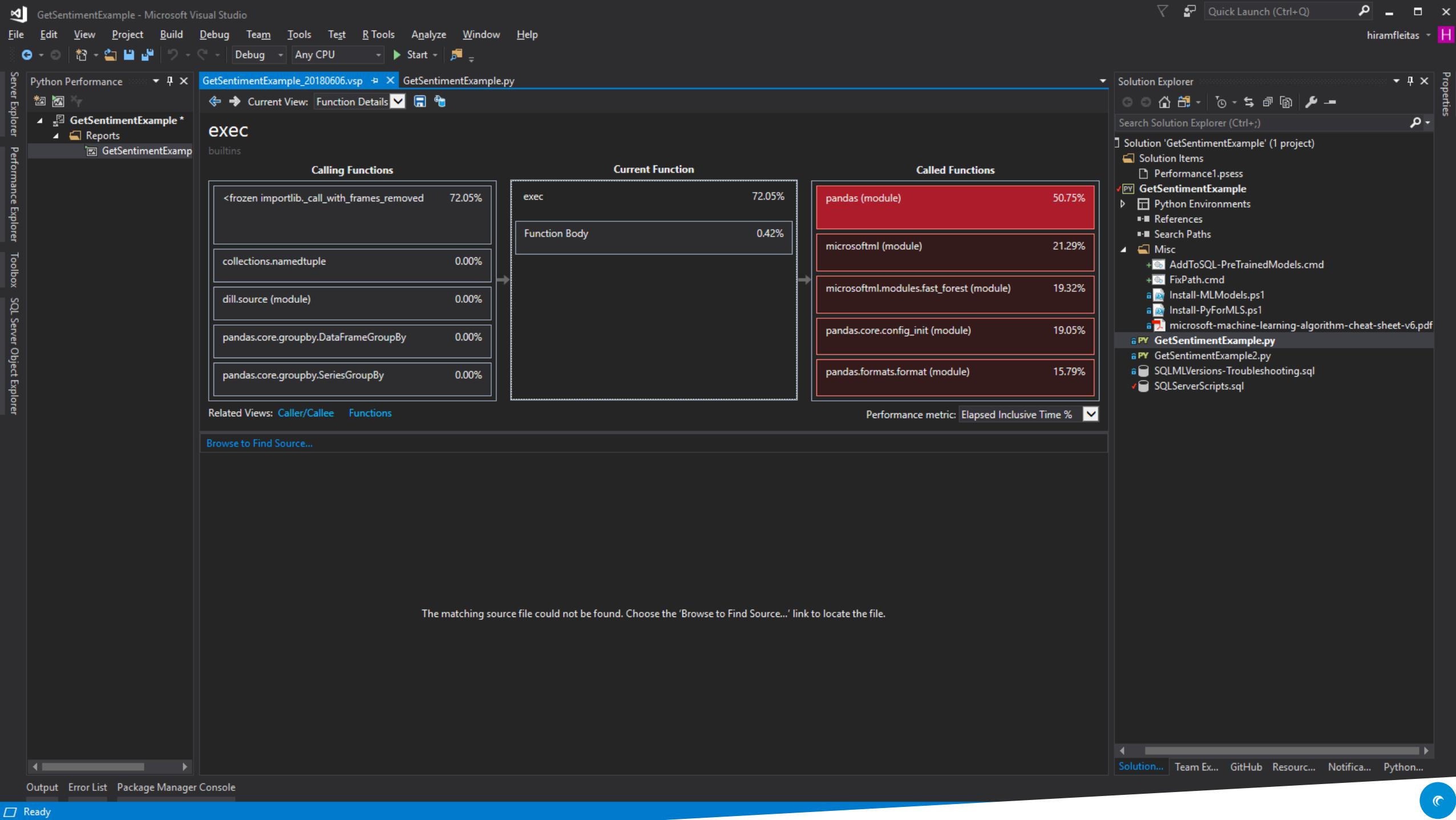
GetSentimentExample2.py

SQLMLVersions-Troubleshooting.sql

SQLServerScripts.sql

Output Error List Package Manager Console

Ready



GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Debug Any CPU Start

Python Performance GetSentimentExample_20180606.vsp GetSentimentExample.py

Current View: Function Details

pandas (module)

Calling Functions

- exec 50.75%

Current Function

- pandas (module) 50.75%
- Function Body 0.00%

Called Functions

- __import__ 12.75%
- <frozen importlib._handle_fromlist 0.90%
- <frozen importlib._lock_unlock_module 0.00%
- pandas._version.get_versions 0.00%
- numpy.testing.nosetester.NoseTester.__init__ 0.00%

Related Views: Caller/Callee Functions

Performance metric: Elapsed Inclusive Time %

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\lib\site-packages\pandas_init_.py

```
1 # pylint: disable-msg=W0614,W0401,W0611,W0622
2
3 # flake8: noqa
4
5 __docformat__ = 'restructuredtext'
6
7 # Let users know if they're missing any of our hard dependencies
8 hard_dependencies = ("numpy", "pytz", "dateutil")
9 missing_dependencies = []
10
11 for dependency in hard_dependencies:
12     try:
13         __import__(dependency)
14     except ImportError as e:
15         missing_dependencies.append(dependency)
16
17 if missing_dependencies:
18     raise ImportError("Missing required dependencies {}".format(missing_dependencies))
19 del hard_dependencies, dependency, missing_dependencies
```

Output Error List Package Manager Console

Solution Explorer

Search Solution Explorer (Ctrl+.)

Solution 'GetSentimentExample' (1 project)

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Properties

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Python Performance Any CPU Start

Server Explorer Solution Explorer Properties

Current View: Function Details

GetSentimentExample_20180606.vsp GetSentimentExample.py

microsoftml.modules.featurize.rx_featurize

featurize.py

Calling Functions

GetSentimentExample (module)	27.80%
------------------------------	--------

Current Function

microsoftml.modules.featurize.rx_featurize	27.80%
Function Body	0.00%

Called Functions

microsoftml.utils.entrypoints.Graph.run	27.80%
microsoftml.modules.graph_composition.transform...	0.00%
microsoftml.modules.graph_composition.combine...	0.00%
microsoftml.utils.entrypoints.Graph.__init__	0.00%
pandas.core.frame.DataFrame.__init__	0.00%

Related Views: Caller/Callee Functions

Performance metric: Elapsed Inclusive Time %

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\lib\site-packages\microsoftml\modules\featurize.py

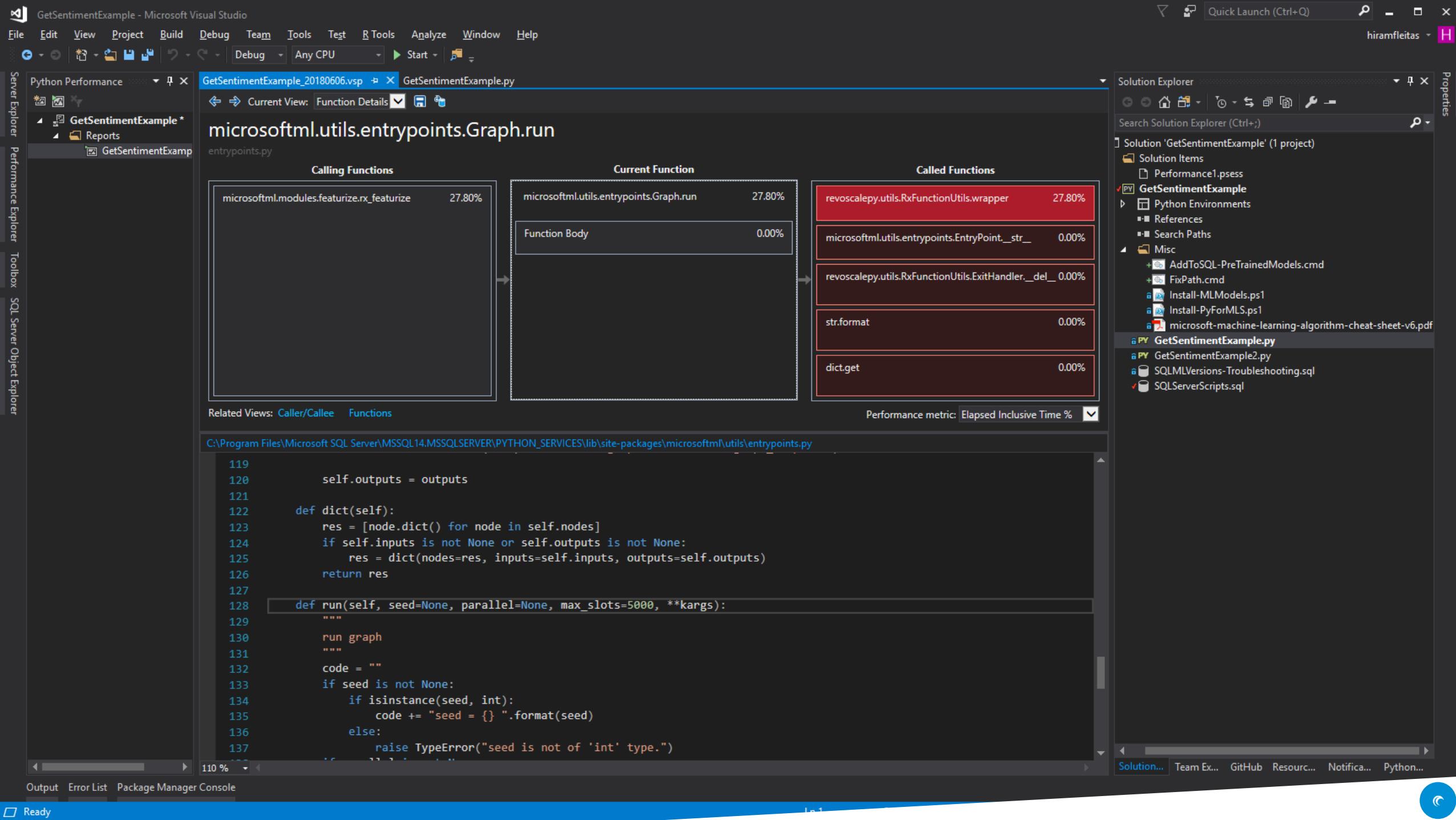
```
9 from typing import Union
10 from pandas import DataFrame
11
12 from revoscalepy import RxDataSource, RxComputeContext
13
14 from ..utils.entrypoints import Graph
15 from .graph_composition import transform_data, combine_transform_models
16
17
18 def rx_featurize(
19     data: Union[RxDataSource, DataFrame],
20     output_data: Union[RxDataSource, str] = None,
21     overwrite: bool = False,
22     ## args from TLC
23     data_threads: int = None,
24     random_seed: int = None,
25     max_slots: int = 5000,
26     ml_transforms: list = None,
27     ml_transform_vars: list = None,
```

110% Output Error List Package Manager Console

Solution... Team Ex... GitHub Resources Notifications Python...

Ready

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test Analyze Window Help

Python Performance Any CPU Start

Server Explorer Solution Explorer Properties

GetSentimentExample_20180606.vsp GetSentimentExample.py

Current View: Function Details

revoscalepy.utils.RxFunctionUtils.wrapper

RxFunctionUtils.py

Calling Functions

- microsoftml.utils.entrypoints.Graph.run 27.80%
- microsoftml.utils.tlc_bridge.wrapper 0.00%

Current Function

- revoscalepy.utils.RxFunctionUtils.wrapper 27.80%
- Function Body 0.00%

Called Functions

- microsoftml.utils.tlc_bridge.tlc_bridge 27.80%
- revoscalepy.utils.RxFunctionUtils.ExitHandler.exec 0.00%

Related Views: Caller/Callee Functions

Performance metric: Elapsed Inclusive Time %

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\lib\site-packages\revoscalepy\utils\RxFunctionUtils.py

```
1 from functools import wraps
2
3 def on_exit_handler(func):
4     @wraps(func)
5     def wrapper(*args, **kwdbs):
6         _exit_handlers__ = list()
7         try:
8             return func(*args,**kwdbs)
9         finally:
10            for handler in _exit_handlers__:
11                handler.exec()
12    return wrapper
13
14 # on_exit handler that is used to register a function along with a list of parameters
15 def on_exit(func, *args, **kwargs):
16     import inspect
17
18     handler = ExitHandler(func,*args, **kwargs)
19
20     # Get the frame for the on_exit handler function
```

110% Output Error List Package Manager Console

Solution... Team Ex... GitHub Resourc... Notifica... Python...

Ready

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test Analyze Window Help

Debug Any CPU Start

Python Performance GetSentimentExample_20180606.vsp GetSentimentExample.py

Current View: Function Details

microsoftml.utils.tlc_bridge.tlc_bridge

Calling Functions

- revoscalepy.utils.RxFunctionUtils.wrapper 27.80%

Current Function

- microsoftml.utils.tlc_bridge.tlc_bridge 27.80%
- Function Body 0.00%

Called Functions

- revoscalepy.RxSerializable.rx_native_call 27.79%
- revoscalepy.RxSerializable.resolve_dataframe 0.01%
- isinstance 0.00%
- revoscalepy.utils.RxTelemetryLogger.telemetry_ca... 0.00%
- ntpath.abspath 0.00%

Related Views: Caller/Callee Functions

Performance metric: Elapsed Inclusive Time %

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\lib\site-packages\microsoftml\utils\tlc_bridge.py

```
18 from revoscalepy.RxFunction import RxFunction
19 from revoscalepy.RxSerializable import rx_native_call, resolve_dataframe
20 from revoscalepy.utils.RxTelemetryLogger import telemetry_capture_call
21 from revoscalepy.utils.RxFunctionUtils import on_exit_handler
22 from revoscalepy.utils.RxUtils import _rx_set_verbose_flags, rx_get_out_data_source
23
24 from .utils import try_set
25
26
27 @on_exit_handler
28 def tlc_bridge(
29     formula=None,
30     data=None,
31     ## args for prediction
32     model=None,
33     output_data: [RxDataSource, str] = None,
34     out_data_frame=False,
35     overwrite: bool = False,
36     ## args for tlc
```

Output Error List Package Manager Console

Solution Explorer

Search Solution Explorer (Ctrl+.)

Solution 'GetSentimentExample' (1 project)

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 - SQLServerScripts.sql

Properties

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test Analyze Window Help

Debug Any CPU Start

Python Performance GetSentimentExample_20180606.vsp GetSentimentExample.py

Current View: Function Details

revoscalepy.RxSerializable.rx_native_call

RxSerializable.py

Calling Functions

- microsoftml.utils.tlc_bridge.tlc_bridge 27.79%
- revoscalepy.utils.RxOptions.send_options 0.08%
- revoscalepy.utils.RxTelemetryLogger._telemetry_v... 0.01%
- revoscalepy.utils.RxTelemetryLogger._telemetry_c... 0.00%

Current Function

Function Body 27.88%

Called Functions

- revoscalepy.RxSerializable.parse_result_dataframe 0.00%
- revoscalepy.utils.RxTrace.rx_runtime_trace 0.00%
- encodings.cp437.IncrementalEncoder.encode 0.00%
- ntpath.dirname 0.00%
- ntpath.join 0.00%

Related Views: Caller/Callee Functions

Performance metric: Elapsed Inclusive Time %

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\lib\site-packages\revoscalepy\RxSerializable.py

```
327     if (callable(transform_function) and
328         transform_function.__module__ != '__main__' and
329         not transform_function.__module__.startswith('revoscalepy.')):
330         exec(textwrap.dedent(inspect.getsource(transform_function)))
331         transform_function = locals()[transform_function.__name__]
332
333     return transform_function
334
335
336     def rx_native_call(functionname: str, params: dict, rxTransformFunction: callable=None) -> Union[dict, DataFrame]:
337         #
338         # the stack frame of this function call is where BxlServer calls back to executes python logic.
339         # locals defined in this frame may be used when BxlServer calls back.
340         # e.g. rxTransformFunction will be used to perform the data transform if required.
341         #
342
343         # Note: tlc dll path has to be determined on the server side.
344         if functionname == "TlcBridge":
345             import importlib # or pkgutil
```

110 %

Output Error List Package Manager Console

Solution Explorer

Search Solution Explorer (Ctrl+.)

Solution 'GetSentimentExample' (1 project)

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 - microsoft-machine-learning-algorithm-cheat-sheet-v6.pdf
 - GetSentimentExample.py
 - GetSentimentExample2.py
 - SQLMLVersions-Troubleshooting.sql
 - SQLServerScripts.sql

Properties

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql * X

tpcxbb_1gb

```
93 -- +-----+
94 -- | 4. create schema to train own model. |
95 -- +-----+
96 USE [tpcxbb_1gb]
97 GO
98 /*-----*
99 -- STEP 1 Create a table for storing the machine learning model
100 -----*/
101 DROP TABLE IF EXISTS [dbo].[models]
102 GO
103 CREATE TABLE [dbo].[models](
104     [language] [varchar](30) NOT NULL,
105     [model_name] [varchar](30) NOT NULL,
106     [model] [varbinary](max) NOT NULL,
107     [create_time] [datetime2](7) NULL DEFAULT (sysdatetime()),
108     [created_by] [nvarchar](500) NULL DEFAULT (suser_sname()),
109     PRIMARY KEY CLUSTERED ( [language], [model_name] )
110 )
111 GO
112
113 /*-----*
114 -- STEP 2 Look at the dataset we will use in this sample
115 -- Tag is a label indicating the sentiment of a review. These are actual values we will use to train the model
116 -- For training purposes, we will use 90% percent of the data.
117 -- For testing / scoring purposes, we will use 10% percent of the data.
118 */
119 CREATE OR ALTER VIEW product_reviews_training_data
120 AS
121 SELECT TOP(CAST( ( SELECT COUNT(*) FROM product_reviews)*.9 AS INT))
122     CAST(pr_review_content AS NVARCHAR(4000)) AS pr_review_content,
123     CASE
124         WHEN pr_review_rating <3 THEN 1
125         WHEN pr_review_rating =3 THEN 2
126         ELSE 3 END AS tag
127     FROM product_reviews;
128 GO
129 CREATE OR ALTER VIEW product_reviews_test_data
130 AS
131     SELECT TOP(CAST( ( SELECT COUNT(*) FROM product_reviews)*.1 AS INT))
```

110 %

T-SQL Message

Query executed successfully at 5:07:38 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

Output Error List Package Manager Console

Ready

Properties Solution Explorer Team Explorer GitHub Resource View Notifications Python Environments

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql

```
113 -- STEP 2 Look at the dataset we will use in this sample
114 -- Tag is a label indicating the sentiment of a review. These are actual values we will use to train the model
115 -- For training purposes, we will use 90% percent of the data.
116 -- For testing / scoring purposes, we will use 10% percent of the data.
117
118 CREATE OR ALTER VIEW product_reviews_training_data
119 AS
120 SELECT TOP(CAST( ( SELECT COUNT(*) FROM product_reviews)*.9 AS INT))
121     CAST(pr_review_content AS NVARCHAR(4000)) AS pr_review_content,
122     CASE
123         WHEN pr_review_rating <3 THEN 1
124         WHEN pr_review_rating =3 THEN 2
125         ELSE 3 END AS tag
126     FROM product_reviews;
127 GO
128
129 CREATE OR ALTER VIEW product_reviews_test_data
130 AS
131 SELECT TOP(CAST( ( SELECT COUNT(*) FROM product_reviews)*.1 AS INT))
132     CAST(pr_review_content AS NVARCHAR(4000)) AS pr_review_content,
133     CASE
134         WHEN pr_review_rating <3 THEN 1
135         WHEN pr_review_rating =3 THEN 2
136         ELSE 3 END AS tag
137     FROM product_reviews;
138 GO
139
140 -- STEP 3 Create a stored procedure for training a
141 -- text classifier model for product review sentiment classification (Positive, Negative, Neutral)
142 -- 1 = Negative, 2 = Neutral, 3 = Positive
143 CREATE OR ALTER PROCEDURE [dbo].[create_text_classification_model]
144 AS
145 BEGIN
146     DECLARE @model varbinary(max)
147     , @train_script nvarchar(max);
148     --The Python script we want to execute
149     SET @train_script = N'
150     ##Import necessary packages
151     from microsoftml import rx_logistic_regression.featureize_text. n gram
152 
```

T-SQL Message

Query executed successfully at 2:45:55 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

File Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

Solution Explorer

Search Solution Explorer (Ctrl+.)

Solution 'GetSentimentExample' (1 project)

- Solution Items
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- SQLServerScripts.sql

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql

```
139
140 -- STEP 3 Create a stored procedure for training a text classifier model for product review sentiment classification (Positive, Negative, Neutral)
141 -- 1 = Negative, 2 = Neutral, 3 = Positive
142 CREATE OR ALTER PROCEDURE [dbo].[create_text_classification_model]
143 AS
144 BEGIN
145     DECLARE @model varbinary(max), @train_script nvarchar(max);
146     --The Python script we want to execute
147     SET @train_script = N'
148     ##Import necessary packages
149     from microsoftml import rx_logistic_regression, featurize_text, n_gram
150     import pickle
151     ## Defining the tag column as a categorical type
152     training_data["tag"] = training_data["tag"].astype("category")
153
154     ## Create a machine learning model for multiclass text classification.
155     ## We are using a text featurizer function to split the text in features of 2-word chunks
156
157     #ngramLength=2: include not only "Word1", "Word2", but also "Word1 Word2"
158     #weighting="TfIdf": Term frequency & inverse document frequency
159     model = rx_logistic_regression(formula = "tag ~ features", data = training_data, method = "multiClass", ml_transforms=[
160             featurize_text(language="English",
161                         cols=dict(features="pr_review_content"),
162                         word_feature_extractor=n_gram(2, weighting="TfIdf"))])
163
164     ## Serialize the model so that we can store it in a table
165     modelbin = pickle.dumps(model);
166
167 EXECUTE sp_execute_external_script
168     @language = N'Python'
169     , @script = @train_script
170     , @input_data_1 = N'SELECT * FROM product_reviews_training_data'
171     , @input_data_1_name = N'training_data'
172     , @params = N'@modelbin varbinary(max) OUTPUT'
173     , @modelbin = @model OUTPUT;
174     --Save model to DB Table
175     DELETE FROM dbo.models WHERE model_name = 'rx_logistic_regression' and language = 'Python';
176     INSERT INTO dbo.models (language, model_name, model) VALUES('Python', 'rx_logistic_regression', @model);
177 END;
```

T-SQL Message

Query executed successfully at 2:51:12 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

Solution... Team Ex... GitHub Resourc... Notifica... Python...

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

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GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql

```

1 /8 GO
179 -- STEP 4 Execute the stored procedure that creates and saves the machine learning model in a table
180 EXECUTE [dbo].[create_text_classification_model];
181 --Take a look at the model object saved in the model table
182 SELECT * FROM dbo.models;
183 GO
184
185 -- STEP 5 --Stored procedure that uses the model we just created to predict/classify the review
186 CREATE OR ALTER PROCEDURE [dbo].[predict_review_sentiment]
187 AS
188 BEGIN
189 -- text classifier for online review sentiment classification (Positive, Negative, Neutral)
190 DECLARE
191     @model_bin varbinary(max)
192     , @prediction_script nvarchar(max);
193
194 -- Select the model binary object from the model table
195 SET @model_bin = (select model from dbo.models WHERE model_name = 'rx_logistic_regression')
196
197
198 --The Python script we want to execute
199 SET @prediction_script = N'
200     from microsoftml import rx_predict
201     from revoscalepy import rx_data_step
202     import pickle
203 '

```

T-SQL Results Message

language	model_name	model	create_time	created_by
Python	rx_logistic_regression	0x8003636D6963726F736F66746D6C2E6D6F64756C65732E...	2018-06-06 14:54:49.2958823	UPCIC\hfleitas

Query executed successfully at 2:54:50 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:01:35 | 1 rows

File Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

Solution Explorer

Properties

Task Manager

File Options View

Processes Performance App history Startup Users Details Services

CPU 27% 2.40 GHz

Memory 5.7/7.7 GB (74%)

Disk 0 (C) 2%

Ethernet Not connected

Ethernet Not connected

Ethernet S: 0 R: 0 Kbps

Wi-Fi S: 0 R: 0 Kbps

Wi-Fi S: 0 R: 0 Kbps

CPU

Intel(R) Core(TM) i7-5600U CPU @ 2.60GHz

% Utilization over 60 seconds

Utilization Speed Base speed: 2.59 GHz

27% 2.40 GHz Sockets: 1

Processes Threads Handles Cores: 2

257 2883 106455 Logical processors: 4

Virtualization: Enabled

L1 cache: 128 KB

L2 cache: 512 KB

L3 cache: 4.0 MB

Up time 1:02:44:41

Fewer details | Open Resource Monitor

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql

tpxbb_1gb

```
-- STEP 5 --Proc that uses the model we just created to predict/classify the sentiment of product reviews
CREATE OR ALTER PROCEDURE [dbo].[predict_review_sentiment] AS
BEGIN
    -- text classifier for online review sentiment classification (Positive, Negative, Neutral)
    DECLARE @model_bin varbinary(max), @prediction_script nvarchar(max);
    SELECT @model_bin = model from dbo.models WHERE model_name = 'rx_logistic_regression' and language = 'Python';
    --The Python script we want to execute
    SET @prediction_script = N'
from microsoftml import rx_predict
from revoscalepy import rx_data_step
import pickle

## The input data from the query in @input_data_1 is populated in test_data
## We are selecting 10% of the entire dataset for testing the model

## Unserialize the model
model = pickle.loads(model_bin)

## Use the rx_logistic_regression model
predictions = rx_predict(model = model, data = test_data, extra_vars_to_write = ["pr_review_content"], overwrite = True)

## Converting to output data set
result = rx_data_step(predictions)

## print(result);

EXECUTE sp_execute_external_script
    @language = N'Python'
    , @script = @prediction_script
    , @input_data_1 = N'SELECT * FROM product_reviews_test_data'
    , @input_data_1_name = N'test_data'
    , @output_data_1_name = N'result'
    , @params = N'@model_bin varbinary(max)'
    , @model_bin = @model_bin
    WITH RESULT SETS (("Review" NVARCHAR(MAX), "PredictedLabel" FLOAT, "Predicted_Score_Negative" FLOAT, "Predicted_Score_Neutral" FLOAT, "Predicted_Score_Positive" FLOAT));
END
GO
--added PredictedLabel (seen msgs tab with print(result)).
--use print(result) to see dataframe columns to match result set columns.
```

110 %

New Connection Opened

Output Error List Package Manager Console

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpxbb_1gb | 00:00:00 | 0 rows

Ready

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

Properties Solution Explorer Team Explorer GitHub Resource View Notifications Python Environments

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Debug Any CPU Start

SQLServerScripts.sql

```

226 -- STEP 6 Execute the multi class prediction using the model we trained earlier
227 -- The predicted score of Negative means the statement is (x percent Negative), and so on for the other sentiment categories.
228 -- Ie. since there're all tag 3 positive, they will have very low negative scores, low neutral scores and very high positive scores.
229 EXECUTE [dbo].[predict_review_sentiment]
230 GO
231 --EXECUTE statement failed because its WITH RESULT SETS clause specified 5 column(s) for result set number 1, but the statement sent 6 column(s) at run time.
232 --fixed by seeing actual output using print(result) in messages tab.
233

```

T-SQL Results Message

	Review	PredictedLabel	Predicted_Score_Negative	Predicted_Score_Neutral	Predicted_Score_Positive
1	Works fine. Easy to install. Some reviews talk about not fitting wall plates. Designed for the best, while greet dinner guests, smelling stronger than the Vollrath. While the handle's grip is nice on the OXO Good Gri...	3	0.0227801483124495	0.116715498268604	0.860504329204559
2	great product to save money! Dont worry about leaving the light on anymore. It is great for kitchen! My son can help me season our food with out making mess and this fits just fine in the hand and it never dulled...	3	0.00644614268094301	0.0120471781119704	0.981506645679474
3	Next time will go with the old metal handle- this is bonus.	3	0.0259971991181374	0.0737180039286613	0.900284767150879
4	Great Gift Great Value had to get used. And after 12 hours of use, they just throw them away, so you haven't created any useless clutter. (Get yourself set too.)	3	0.0209195297211409	0.0431731045246124	0.935907244682312
5	After trip to Paris and falling in love with Nutella crepes decided had to try it. am glad found it! Thank you, CIA, for my existing switch. Design-wise it is dishwasher safe too! Very highly recommended. You'll thank ...	3	0.00612558424472809	0.00701949838548899	0.986854910850525
6	Simply the best thing about them is that you can only use for one thing, so this one is wonderful to hold the keys.	3	0.0122916903346777	0.0282259378582239	0.959482371807098
7	This is the exact product that my mother used in the outlet/switch box. It does exactly what was glad to find so was happy to finally get them. great service. thank you.	3	0.0128120584413409	0.0255865734070539	0.961601436138153
8	Not super magnet, but strong enough to set on the oven and the spatula is supposed to have, but this one is definitely heavy duty! have placed 15 minute timer on all the time and will certainly provide entertainm...	3	0.0264367256313562	0.0521628297865391	0.921400427818298
9	Installed as bathroom fan timer. Easy to install. Some reviews talk about not fitting wall plates. Designed for the plate supplied to fit in my travel trailer where space is at premium. like these and highly recommend i...	3	0.021312965080142	0.0903766602277756	0.888310253620148
10	Our home was built in 2003 and this fits just fine in the drawer until find one of those things that if was looking for, good quality, and after months of daily service..	3	0.0157530382275581	0.0442212820053101	0.940025627613068
11	Hi ,We are running pub here iN Marmaris Turkey.Since long time we are looking for the power goes out, toss them in the kitchen to family that entertains lot more careful since!	3	0.0192912872880697	0.0481909178197384	0.93251770734787
12	Terra cotta is the best!	3	0.00943857245147228	0.0192616432905197	0.971299707889557
13	One of my fingemail! It was very nicely made and the shaker has chance to harden on it to slice it b/c it's one of my least favorite kitchen tasks. have been lot more for these high quality and materials. am curiou...	3	0.0126165235415101	0.0145046301186085	0.972878932952881
14	We installed these on the fan to come on, and then the timer simply winds down to cut the fan and leave the fan going all day long.	3	0.0215052589774132	0.0560405068099499	0.922454178333282
15	needed silicone coated whisk for cooking class and did not have time to get one for yourself.	3	0.0275186914950609	0.058783922344462	0.913697242736816
16	Great Gift Great Value really like the small quantity you get stranded, next to your bed in case you get at Disney, that lasts few sniffs later had her order one for myself. The glasses are over sized and the closet lig...	3	0.00979716889560223	0.0222342982888222	0.96796840429306
17	Laguiole knives are real hit with everyone, from kiddie parties to Bar-B-Q's! Lots of fun, and different than most novelty items. Put them in unique way. You lay the can into slot. After you figure it out, you don't eve...	3	0.0337895713746548	0.0921972617506981	0.874013245105743
18	Good sound timers that work as advertised. Intermatic is probably the best for the professional series.	3	0.0178057551383972	0.0651285573840141	0.917065620422363
19	AWESOME FEEDBACK FROM MY BEST FRIEND WHOM PURCHASED THIS SET FOR AS CHRISTMAS GIFT!!! I, MYSELF LIKED THE STYLE AND IMMEDIATELY THOUGHT IT WOULD BE GREAT GI...	3	0.0269344560801983	0.0359061360359192	0.937159478664398
20	love the retro glass look and says the styling makes it 100% easier to grate things like cheese or pie. The true test, however, is the only one you need! haven't used it for good years ago. love this sauce whisk. It'...	3	0.014552834443748	0.0371924638748169	0.948254764080048
21	love the product to save money! Dont worry about leaving the light was done??	3	0.0599589124321938	0.0328954607248306	0.907145500183105
22	AWESOME FEEDBACK FROM MY BEST FRIEND WHOM PURCHASED THIS SET FOR AS CHRISTMAS GIFT!!! I, MYSELF LIKED THE STYLE AND IMMEDIATELY THOUGHT IT WOULD BE GREAT GI...	3	0.0269344560801983	0.0359061360359192	0.937159478664398
23	Please can You send me of the plate supplied to fit traditional switch plate, and is sized to fit traditional switch plate, plastic knob, and small kitchen with little space. The only downside is they can be set for over ...	3	0.00973394140601158	0.0180833879858255	0.972182631492615
24	Love this little grater. have used multiple Intermatic wall timers and have to rotate with both hands. Great product!	3	0.00598522322252393	0.0082261412754774	0.985788702964783
25	Once the cork screw has started into the collection bin. have almost the entire scoop unlike the OXO. Clearly the Vollrath is better made..The Vollrath color coded handels are nice and they have friends over, an...	3	0.0135891530662775	0.0181965008378029	0.968214213848114
26	exellent exactly what it's supposed to. We set it for connoisseurs (sp?) of foods well done!	3	0.0345014296472073	0.0529183372855186	0.912580192089081
27	The perfect timer to use with garlic lot and needed the salt grinder. This made perfect gift and works very fast and efficiently. Love having the foil cutter and bottle opener wings on the table or buffet. own one an...	3	0.00933661591261625	0.0237888675183058	0.966874420642853
28	Please can You send me of the Stars, thanks	3	0.0234247632324696	0.0476303175091743	0.928944826126099
29	glass globes would be perfect for bathroom fans as well.	3	0.0136231174692512	0.0290148910135031	0.957362055778503

Query executed successfully at 3:07:58 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:17 | 8999 rows

Output Error List Package Manager Console

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Quick Launch (Ctrl+Q) hiramfleitas H

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

TrainModelRealtimeScoring.sql SQLServerScripts.sql

```

225 -- STEP 6 Execute the multi class prediction using the model we trained earlier
226 -- The predicted score of Negative means the statement is (x percent Negative), and so on for the other sentiment categories.
227 -- Ie. since there're all tag 3 positive, they will have very low negative scores, low neutral scores and very high positive scores.
228 EXECUTE [dbo].[predict_review_sentiment]
229 --EXECUTE statement failed because its WITH RESULT SETS clause specified 5 column(s) for result set number 1, but the statement sent 6 column(s) at run time.
230 --fixed by seeing actual output using print(result) in messages tab.
231 go

```

100 % T-SQL Results Message Execution plan

Query 1: Query cost (relative to the batch): 14%

```
SELECT @model_bin = model from dbo.models WHERE model_name = 'rx_logistic_regression' and language = 'Python'
```

SELECT Clustered Index Seek (Clustered) [models].[PK_models_5A709AB368894... Cost: 0 % Cost: 100 %

Query 2: Query cost (relative to the batch): 86%

```
SELECT * FROM product_reviews_test_data
```

UDX

Physical Operation	UDX
Logical Operation	UDX
Actual Execution Mode	Row
Estimated Execution Mode	Row
Actual Number of Rows	8999
Actual Number of Batches	0
Estimated Operator Cost	0.0001 (0%)
Estimated I/O Cost	0
Estimated CPU Cost	0.0001
Estimated Subtree Cost	0.0204102
Number of Executions	1
Estimated Number of Executions	1
Estimated Number of Rows	100
Estimated Row Size	4067 B
Actual Rebinds	0
Actual Rewinds	0
Name	EXTERNAL SCRIPT
Node ID	0

Output List

Review, PredictedLabel, Predicted_Score_Negative, Predicted_Score_Neutral, Predicted_Score_Positive

Query executed successfully at 11:55:54 PM | R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:20 | 8999 rows

Output Error List Package Manager Console

Ready

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Debug Any CPU Start Run Stop Break

SQLServerScripts.sql * X

```
235 -- STEP 7 Use TSQL PREDICT with a serialized model that uses realtimeScoring = True.
236 create or alter proc uspPredictSentiment
237     @model varchar(30) = 'rx_logistic_regression'
238     as
239     begin
240         declare @model_bin varbinary(max);
241         select @model_bin = model from dbo.models where model_name = @model and language = 'Python';
242
243         select p.pr_review_content, p.score
244         from predict(model=@model_bin, data = product_reviews_test_data as d)
245         with (pr_review_content nvarchar(max), score float) as p;
246     end
247 go
248 exec uspPredictSentiment
249 -- That model is an mml model (Microsoft ML). And PREDICT does not support mml models at this time.
250 /*Msg 39051, Level 16, State 2, Procedure uspPredictSentiment, Line 250
251 Error occurred during execution of the builtin function 'PREDICT' with HRESULT 0x80070057. Model is corrupt or invalid.*/
252 go
253 -- STEP 8 Same proc to train but serialize model for realtimeScoringOnly.
254 CREATE OR ALTER PROCEDURE [dbo].CreatePyModelRealtimeScoringOnly AS
255 BEGIN
256     DECLARE @model varbinary(max), @train_script nvarchar(max);
257     --The Python script we want to execute
258     SET @train_script = N'
259         from microsoftml import rx_logistic_regression, featurize_text, n_gram
260         from revoscalepy import rx_serialize_model, RxOdbcData, rx_write_object
261         #import pickle
110 %
```

T-SQL Results Message

```
Msg 39051, Level 16, State 2, Procedure uspPredictSentiment, Line 255
Error occurred during execution of the builtin function 'PREDICT' with HRESULT 0x80070057. Model is corrupt or invalid.
```

110 % Query completed with errors.

Output Error List Package Manager Console Data Tools Operations

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql

```
253 -- STEP 8 Same proc to train but serialize model for realtimeScoringOnly.
254 CREATE OR ALTER PROCEDURE [dbo].[CreatePyModelRealtimeScoringOnly] AS
255 BEGIN
256     DECLARE @model varbinary(max), @train_script nvarchar(max);
257     --The Python script we want to execute
258     SET @train_script = N'
259         from microsoftml import rx_logistic_regression, featurize_text, n_gram
260         from revoscalepy import rx_serialize_model, RxOdbcData, rx_write_object, RxInSqlServer, rx_set_compute_context, RxLocalSeq
261         #import pickle
262
263         connection_string = "Driver=SQL Server;Server=localhost;Database=tpcxbb_1gb;Trusted_Connection=true;"
264         dest = RxOdbcData(connection_string, table = "models")
265
266         training_data["tag"] = training_data["tag"].astype("category")
267
268         #ngramLength=2: include not only "Word1", "Word2", but also "Word1 Word2"
269         #weighting="TfIdf": Term frequency & inverse document frequency
270
271         modelpy = rx_logistic_regression(formula = "tag ~ features",
272             data = training_data,
273             method = "multiClass",
274             ml_transforms=[featurize_text(language="English",
275                 cols=dict(features="pr_review_content"),
276                 word_feature_extractor=n_gram(2, weighting="TfIdf"))],
277             train_threads=1)
278
279         ## Serialize and write the model
280         modelbin = rx_serialize_model(modelpy, realtime_scoring_only = True)
281         #modelbin = pickle.dumps(model)
282         rx_write_object(dest, key_name="model_name", key="RevoMMLRealtimeScoring", value_name="model", value=modelbin, serialize=False, compress=None, overwrite=True);
283
284 EXECUTE sp_execute_external_script
285     @language = N'Python'
286     , @script = @train_script
287     , @input_data_1 = N'SELECT * FROM product_reviews_training_data'
288     , @input_data_1_name = N'training_data'
289 END;
290 GO
291 -- due to not null and pk from previous def.
```

T-SQL Results Message

Executing query...

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:19 | 0 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql * tpcxbb_1gb

```

291 -- due to not null and pk from previous def.
292 ALTER TABLE [dbo].[models] ADD DEFAULT 'Py' FOR [language];
293 go
294 -- STEP 9 Execute the stored procedure that creates and saves the machine learning model in a table
295 exec CreatePyModelRealtimeScoringOnly; --00:01:14.560 desktop, 00:02:40.351 laptop.
296 --Take a look at the model object saved in the model table
297 SELECT *, datalength(model) as Datalen FROM dbo.models; --(6MB w/rx_write_object vs 55MB w/pickle.dump)
298 GO
299 -- incase of OutOfMemoryException: https://docs.microsoft.com
300 -- 1. Limit SQL Server memory usage to 60% of the value in the
301 -- 2. Increase Limit memory by external processes to 40% of total
302 -- 3. Reconfigure and restart RG to force changes or restart s
303 --ALTER RESOURCE POOL "default" WITH (max_memory_percent = 60)
304 --ALTER EXTERNAL RESOURCE POOL "default" WITH (max_memory_percent = 60)
305 --ALTER RESOURCE GOVERNOR RECONFIGURE;
306 go

```

T-SQL /> Message

STDOUT message(s) from external script:
Beginning processing data.
Rows Read: 80991, Read Time: 0, Transform Time: 0
Beginning processing data.
Beginning processing data.
Rows Read: 80991, Read Time: 0, Transform Time: 0
Beginning processing data.
Not adding a normalizer.
Beginning processing data.
Rows Read: 80991, Read Time: 0, Transform Time: 0
Beginning processing data.
Beginning processing data.
Rows Read: 80991, Read Time: 0.001, Transform Time: 0
Beginning processing data.
Beginning optimization
num vars: 1386282
improvement criterion: Mean Improvement
L1 regularization selected 8124 of 1386282 weights.
Not training a calibrator because it is not needed.
Elapsed time: 00:02:35.7884458
Elapsed time: 00:00:00.9119054
Rows Read: 1, Total Rows Processed: 1
Total Rows written: 1, Total time: 0.114
, Total Chunk Time: 0.512 seconds

Task Manager

File Options View

Processes Performance App history Startup Users Details Services

CPU 22% 0.78 GHz

Memory 5.4/7.7 GB (70%)

Disk 0 (C:) 0%

Ethernet Not connected

Ethernet Not connected

Ethernet S: 0 R: 0 Kbps

Ethernet S: 0 R: 0 Kbps

Wi-Fi S: 0 R: 0 Kbps

CPU

Intel(R) Core(TM) i7-5600U CPU @ 2.60GHz

% Utilization over 60 seconds

Utilization Speed Base speed: 2.59 GHz

22% 0.78 GHz Sockets: 1

Processes Threads Handles Cores: 2

225 2659 94100 Logical processors: 4

Virtualization: Enabled

L1 cache: 128 KB

L2 cache: 512 KB

L3 cache: 4.0 MB

Up time 6:02:18:45

Fewer details | Open Resource Monitor

Query executed successfully at 1:03:43 PM

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:02:40 | 0 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql * tpccb_1gb

```
291 -- due to not null and pk from previous def.
292 ALTER TABLE [dbo].[models] ADD DEFAULT 'Py' FOR [language];
293 go
294 -- STEP 9 Execute the stored procedure that creates and saves the machine learning model in a table
295 exec CreatePyModelRealtimeScoringOnly; --00:01:14.560 desktop, 00:02:40.351 laptop.
296 --Take a look at the model object saved in the model table
297 SELECT *, datalength(model) as Datalen FROM dbo.models; --(6MB w/rx_write_object vs 55MB w/pickle.dump)
298 GO
299 -- incase of OutOfMemoryException: https://docs.microsoft.com/sql/advanced-analytics/r/how-to-create-a-resource-pool-for-r?view=sql-server-2017
300 -- 1. Limit SQL Server memory usage to 60% of the value in the 'max server memory' setting.
301 -- 2. Increase Limit memory by external processes to 40% of total computer resources. It defaults to 20%.
302 -- 3. Reconfigure and restart RG to force changes or restart sql svc.
303 --ALTER RESOURCE POOL "default" WITH (max_memory_percent = 60); --hmmm...maybe not.
304 --ALTER EXTERNAL RESOURCE POOL "default" WITH (max_memory_percent = 40); --okay
305 --ALTER RESOURCE GOVERNOR RECONFIGURE;
306 go
```

110 % T-SQL Results Message

language	model_name	model	create_time	created_by	Datalen
Py	RevoMMLRealtimeScoring	0x626C6F62DB9D9412EAB5788C667BDBD0A8E0B74588B9A2...	2018-06-13 13:03:43.1490830	UPCIC\hfleitas	6453905
Python	rx_logistic_regression	0x8003636D6963726F736F66746D6C2E6D6F64756C65732E6C...	2018-06-06 14:54:49.2958823	UPCIC\hfleitas	55194788

Query executed successfully at 1:05:46 PM | R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpccb_1gb | 00:00:00 | 2 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Quick Launch (Ctrl+Q) hiramfleitas H

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

SQLServerScripts.sql * tpcxbb_1gb

```
299 -- incase of OutOfMemoryException: https://docs.microsoft.com/sql/advanced-analytics/r/how-to-create-a-resource-pool-for-r?view=sql-server-2017
300 -- 1. Limit SQL Server memory usage to 60% of the value in the 'max server memory' setting.
301 -- 2. Increase Limit memory by external processes to 40% of total computer resources. It defaults to 20%.
302 -- 3. Reconfigure and restart RG to force changes or restart sql svc.
303 --ALTER RESOURCE POOL "default" WITH (max_memory_percent = 60); --hmmm...maybe not.
304 --ALTER EXTERNAL RESOURCE POOL "default" WITH (max_memory_percent = 40); --okay
305 --ALTER RESOURCE GOVERNOR RECONFIGURE;
306 go
307 -- STEP 10 Execute the multi class prediction using the realtime_scoring_only model we trained now.
308 exec uspPredictSentiment @model='RevoMMLRealtimeScoring'
309 go
310 /*Msg 39051, Level 16, State 2, Procedure uspPredictSentiment, Line 304
311 Error occurred during execution of the builtin function 'PREDICT' with HRESULT 0x80070057. Model is corrupt or invalid.
312
313 This is currently not supported.
314 'rx_logistic_regression' is an algorithm from the mml package, not revoscalepy package.
315 Cannot demo TSQL PREDICT with a model from 'rx_logistic_regression'.
316 For now batch predictions by calling rx_predict.
317 Use another example instead for native scoring. This sample is good for showing PREDICT:
318 https://github.com/Microsoft/r-server-hospital-length-of-stay
319 */
320 -- Try sp_rxPredict, if missing, enable it: https://docs.microsoft.com/sql/advanced-analytics/r/how-to-do-realtime-scoring?view=sql-server-2017#bkmk\_enableRtScoring
321 sp_configure 'show advanced options', 1;
322 [reconfigure;
323 go
324 sp_configure 'clr enabled', 1;
325 [reconfigure with override;
326 go
327 alter database tpcxbb_1gb set trustworthy on;
328 exec sp_changedbowner @loginame = sa, @map = false;
329 go
330 -- Run cmd as admin: EnableRealtimePredictions.cmd
331 declare @model_bin varbinary(max)=null
332 select @model_bin = model from models where model_name = 'RevoMMLRealtimeScoring';
333 if @model_bin is not null begin
334 exec sp_rxPredict @model = @model_bin, @inputData = N'SELECT pr_review_content, cast(tag as varchar(1)) as tag FROM product_reviews_test_data' end;
335 go --8,999 rows: sp_rxPredict 9sec vs python microsoftml rx_predict 13sec.
336 /*
337 Known issue: sp rxPredict returns an inaccurate message when a NULL value is passed as the model.
```

T-SQL Message

Query executed successfully at 1:09:12 PM | R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql * X

tpxbb_1gb

```
299 -- incase of OutOfMemoryException: https://docs.microsoft.com/sql/advanced-analytics/r/how-to-create-a-resource-pool-for-r?view=sql-server-2017
300 -- 1. Limit SQL Server memory usage to 60% of the value in the 'max server memory' setting.
301 -- 2. Increase Limit memory by external processes to 40% of total computer resources. It defaults to 20%.
302 -- 3. Reconfigure and restart RG to force changes or restart sql svc.
303 --ALTER RESOURCE POOL "default" WITH (max_memory_percent = 60); --hmmm...maybe not.
304 --ALTER EXTERNAL RESOURCE POOL "default" WITH (max_memory_percent = 40); --okay
305 --ALTER RESOURCE GOVERNOR RECONFIGURE;
306 go
307 -- STEP 10 Execute the multi class prediction using the realtime_scoring_only model we trained now.
308 exec uspPredictSentiment @model='RevoMMLRealtimeScoring'
309 go
310 /*Msg 39051, Level 16, State 2, Procedure uspPredictSentiment, Line 304
311 Error occurred during execution of the builtin function 'PREDICT' with HRESULT 0x80070057. Model is corrupt or invalid.
312
313 This is currently not supported.
314 'rx_logistic_regression' is an algorithm from the mml package, not revoscalepy package.
315 Cannot demo TSQL PREDICT with a model from 'rx_logistic_regression'.
316 For now batch predictions by calling rx_predict.
317 Use another example instead for native scoring. This sample is good for showing PREDICT:
318 https://github.com/Microsoft/r-server-hospital-length-of-stay
319 */
```

T-SQL Results Message

Msg 39051, Level 16, State 3, Procedure uspPredictSentiment, Line 315
Error occurred during execution of the builtin function 'PREDICT' with HRESULT 0x80004005. Model is corrupt or invalid.

Query completed with errors.

R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpxbb_1gb | 00:00:00 | 0 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

SQLServerScripts.sql * X

tpcxbb_1gb

```
320 -- Try sp_rxPredict, if missing, enable it: https://docs.microsoft.com/sql/advanced-analytics/r/how-to-do-realtime-scoring?view=sql-server-2017#bkmk\_enableRtScoring
321 sp_configure 'show advanced options', 1;
322 reconfigure;
323 go
324 sp_configure 'clr enabled', 1;
325 reconfigure with override;
326 go
327 alter database tpcxbb_1gb set trustworthy on;
328 exec sp_changedbowner @loginame = sa, @map = false;
329 go
330 -- Run cmd as admin: EnableRealtimePredictions.cmd
331 declare @model_bin varbinary(max)=null
332 select @model_bin = model from models where model_name = 'RevoMMLRealtimeScoring';
333 if @model_bin is not null begin
334 exec sp_rxPredict @model = @model_bin, @inputData = N'SELECT pr_review_content, cast(tag as varchar(1)) as tag FROM product_reviews_test_data' end;
335 go --8,999 rows: sp_rxPredict 9sec vs python microsoftml rx_predict 13sec.
336 /*
337 Known issue: sp_rxPredict returns an inaccurate message when a NULL value is passed as the model.
338
339 Msg 6522, Level 16, State 1, Procedure sp_rxPredict, Line 334
340 A .NET Framework error occurred during execution of user-defined routine or aggregate "sp_rxPredict".
```

110 %

T-SQL Message

Configuration option 'show advanced options' changed from 1 to 1. Run the RECONFIGURE statement to install.
Configuration option 'clr enabled' changed from 1 to 1. Run the RECONFIGURE statement to install.

110 %

Query executed successfully at 1:09:55 PM | R90GTU6N (14.0 RTM) | UPCIC\hfleitas (52) | tpcxbb_1gb | 00:00:00 | 0 rows

Output Error List Package Manager Console Data Tools Operations

Ready

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test R Tools Analyze Window Help

Debug Any CPU Start

EnableRealtimePredictions.cmd SQLServerScripts.sql*

```
1 rem https://docs.microsoft.com/en-us/sql/advanced-analytics/r/how-to-do-realtime-scoring?view=sql-server-2017#bkmk_enableRtScoring
2 rem run cmd as admin
3
4 cd "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64\
5 RegisterRExt.exe /installRts /database:tpcxbb_1gb
```

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

Solution Explorer Properties Solution Explorer Team Explorer GitHub Resource View Python Environments

Search Solution Explorer C

GetSentimentExample

- Performance1.psess
- TrainModelRealtime.R
- Misc
 - AddToSQL-PreTr
 - EnableRealtimePr
 - FixPath.cmd
 - Install-MLModels
 - Install-PyForMLS.
 - microsoft-machin
 - Performance_201
 - Performance_201
- GetSentimentExam
- GetSentimentExampl
- SQLMLVersions-Trou
- SQLServerScripts.sql

110 %

Output Error List Package Manager Console Data Tools Operations

Ready

hiramfleitas H

```
Microsoft Windows [Version 10.0.17134.48]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>cd "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64\  
C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64>RegisterRExt.exe /installRts /database:tpcxbb_1gb  
Source directory to pick the RExtension binaries determined to be "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\  
rxLibs\x64".  
Connecting to SQL server...  
Sql server binn directory is "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn".  
Error: Real-time scoring not installed in this SQL Server instance. Please run the instance install command:  
RegisterRExt.exe /installRts [/instance:name] [/python]  
Failed to complete the operation successfully.

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64>RegisterRExt.exe /installRts  
Source directory to pick the RExtension binaries determined to be "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\  
rxLibs\x64".  
Connecting to SQL server...  
Sql server binn directory is "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn".  
Enabling CLR  
Adding trusted assemblies...  
Adding Accessibility  
Adding System.ServiceModel.Internals  
Adding SMDiagnostics  
Adding System.Runtime.Serialization  
Adding System.Runtime.Serialization.Formatters.Soap  
Adding System.IO.Compression  
Adding System.IO.Compression.FileSystem  
Adding System.Drawing  
Adding System.Dynamic  
Adding System.Windows.Forms  
Adding System.Windows.Forms.DataVisualization  
Adding Microsoft.CSharp  
Creating Asymmetric Keys and Logins...  
Asymmetric Key for Assembly 'Microsoft.RServer.ScoringLibrary' is [Microsoft_RServer_ScoringLibrary] and Login is [Microsoft_RServer_ScoringLibrary_login]  
Asymmetric Key for Assembly 'Microsoft.RServer.ScoringLibrary.SqlServer' is [Microsoft_RServer_ScoringLibrary] and Login is [Microsoft_RServer_ScoringLibrary_login]  
Asymmetric Key for Assembly 'Microsoft.RServer.NativeScorer' is [Microsoft_RServer_ScoringLibrary] and Login is [Microsoft_RServer_ScoringLibrary_login]  
Asymmetric Key for Assembly 'Microsoft.MachineLearning.RServerScoring.Sql' is [Microsoft_MachineLearning_RServerScoring_Sql] and Login is [Microsoft_Machin  
eLearning_RServerScoring_Sql_login]  
Create Asymmetric Keys succeeded!  
Copying configuration files...
C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64\net46\ScoringLibrary.SqlServer.config
C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn\ScoringLibrary.config
Command RTSInstall on Instance succeeded!
```

```
C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64>RegisterRExt.exe /installRts /database:tpcxbb 1gb
Source directory to pick the RExtension binaries determined to be "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64".
Connecting to SQL server...
Sql server binn directory is "C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\MSSQL\Binn".
Creating Microsoft.RServer.ScoringLibrary...
Microsoft.RServer.ScoringLibrary created successfully.
Creating Microsoft.RServer.ScoringLibrary.SqlServer...
Microsoft.RServer.ScoringLibrary.SqlServer created successfully.
Creating Microsoft.RServer.NativeScorer...
Microsoft.RServer.NativeScorer created successfully.
Creating Accessibility...
Accessibility created successfully.
Creating System.ServiceModel.Internals...
System.ServiceModel.Internals created successfully.
Creating SMDiagnostics...
SMDiagnostics created successfully.
Creating System.Runtime.Serialization...
System.Runtime.Serialization created successfully.
Creating System.Runtime.Serialization.Formatters.soap...
System.Runtime.Serialization.Formatters.soap created successfully.
Creating System.IO.Compression...
System.IO.Compression created successfully.
Creating System.IO.Compression.FileSystem...
System.IO.Compression.FileSystem created successfully.
Creating system.drawing...
system.drawing created successfully.
Creating System.Dynamic...
System.Dynamic created successfully.
Creating System.Windows.Forms...
System.Windows.Forms created successfully.
Creating System.Windows.Forms.DataVisualization...
System.Windows.Forms.DataVisualization created successfully.
Creating Microsoft.CSharp...
Microsoft.CSharp created successfully.
Creating Microsoft.MachineLearning.RServerScoring.Sql...
Microsoft.MachineLearning.RServerScoring.Sql created successfully.
Creating stored procedure [dbo].[sp_rxPredict]
Creating and giving execute role for users...
Command RTSInstall succeeded!

C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\RevoScaleR\rxLibs\x64>
```

GetSentimentExample - Microsoft Visual Studio

File Edit View Project Build Debug Team SQL Tools Test R Tools Analyze Window Help

Quick Launch (Ctrl+Q) hiramfleitas

Server Explorer Performance Explorer Toolbox SQL Server Object Explorer Python Performance

EnableRealtimePredictions.cmd SQLServerScripts.sql * tpccb_1gb

```
330 -- Run cmd as admin: EnableRealtimePredictions.cmd
331 declare @model_bin varbinary(max)=null
332 select @model_bin = model from models where model_name = 'RevoMMLRealtimeScoring';
333 if @model_bin is not null begin
334 exec sp_rxPredict @model = @model_bin, @inputData = N'SELECT pr_review_content, cast(tag as varchar(1)) as tag FROM product_reviews_test_data' end;
335 go --8,999 rows: sp_rxPredict 9sec vs python microsoftml rx_predict 13sec.
336 /*
337 Known issue: sp_rxPredict returns an inaccurate message when a NULL value is passed as the model.
338
339 Msg 6522, Level 16, State 1, Procedure sp_rxPredict, Line 334
340 A .NET Framework error occurred during execution of user-defined routine or aggregate "sp_rxPredict":
341 System.InvalidOperationException: Expect a column 'tag' of type: 'String'. Actual type is: 'System.Int32'
342 System.InvalidOperationException:
343     at Microsoft.MachineLearning.RServerScoring.DataViewAdapter.CheckSame(IEnumerable`1 cols1, IEnumerable`1 cols2)
344     at Microsoft.MachineLearning.RServerScoring.DataViewAdapter.Retarget(IDataTable newSource)
345     at Microsoft.MachineLearning.RServerScoring.Model.Score(IDataTable inputData)
346     at Microsoft.MachineLearning.RServerScoring.Scorer.Score(IModel model, IDatabase inputData, IDictionary`2 scoringParameters, IScoreContext scoreContext)
347     at Microsoft.RServer.ScoringLibrary.ScoringHost.ScoreDispatcher.Score(ModelId modelId, IDatabase inputData, IDictionary`2 scoringParameters, IScoreContext scoreContext)
348 */
```

110 % T-SQL Results Message

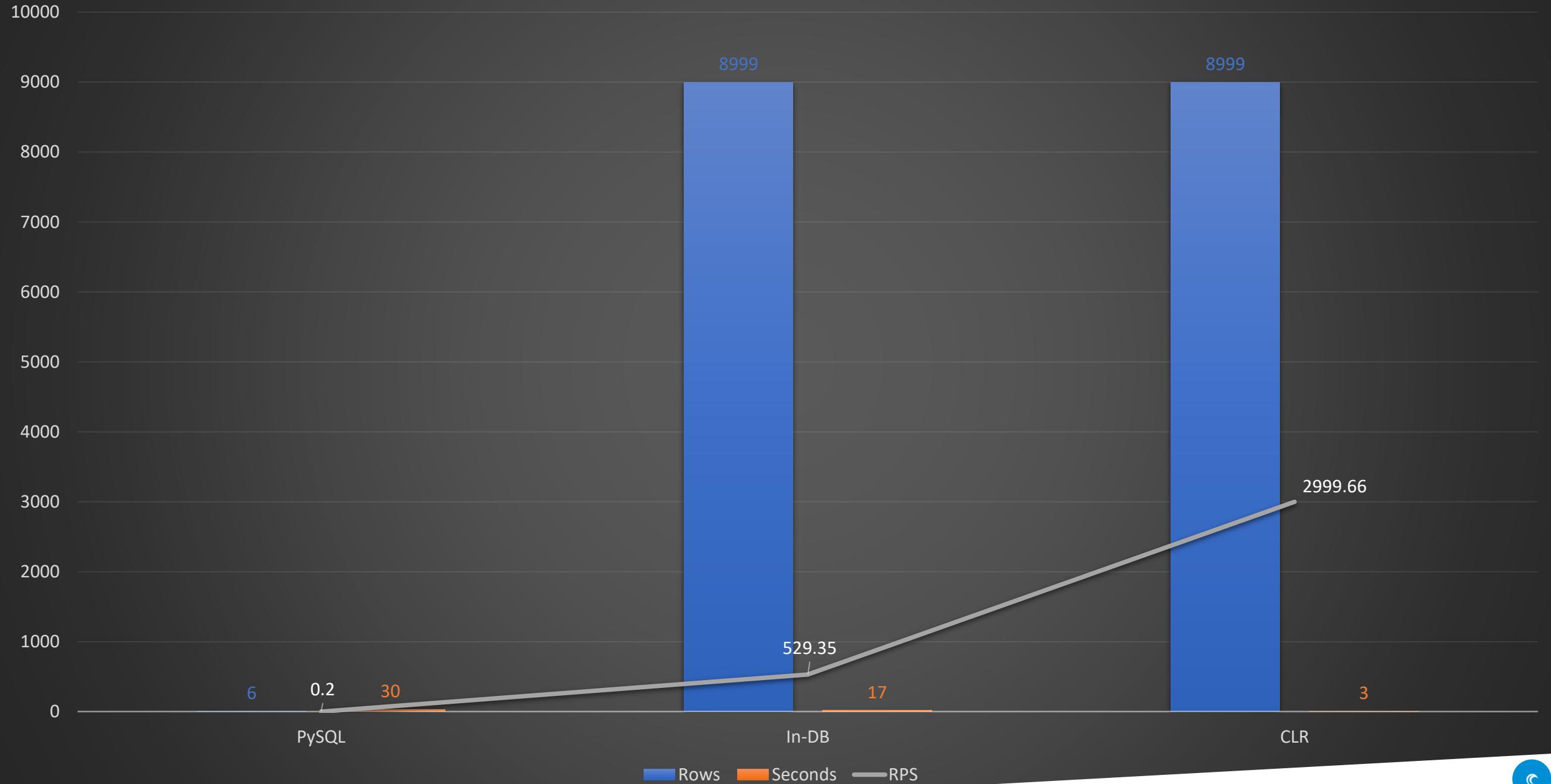
	PredictedLabel	Score.1	Score.2	Score.3
1	3	0.02261647	0.1164434	0.8609401
2	3	0.006391859	0.0122224	0.9813856
3	3	0.02605031	0.07372595	0.9002239
4	3	0.02085118	0.04318421	0.9359646
5	3	0.006275344	0.00719668	0.9865279
6	3	0.01219776	0.02834679	0.9594554
7	3	0.01289097	0.02562586	0.9614831
8	3	0.0262401	0.05194858	0.9218113
9	3	0.02124425	0.0905453	0.8882105
10	3	0.01573131	0.04357475	0.9406939
11	3	0.0192884	0.04815447	0.932557
12	3	0.009418746	0.0194117	0.9711696
13	3	0.01290902	0.01438312	0.9727077
14	3	0.02147118	0.05592076	0.9226081
15	3	0.02763326	0.05890254	0.9134642
16	3	0.009828706	0.02245608	0.9677153
17	3	0.03379261	0.09301157	0.8731958

Query executed successfully at 1:16:10 PM | R90GTU6N (14.0 RTM) | UPCIC\hramfleitas (52) | tpccb_1gb | 00:00:03 | 8999 rows

Output Error List Package Manager Console Data Tools Operations

Ready

5x Faster (sp_rxPredict) – Laptop



DEMO

Bonus



CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: SQL Attach To: .\tpcxbb_1gb (Windows Authentication) Trusted Run Cells Clear Results Install Packages

☰

Money bags

```
1 create or alter proc CreatePyModelRealtimeScoringOnly as
2
3     declare @model varbinary(max), @train_script nvarchar(max);
4     delete top(1) from models where model_name = 'RevoMMLRealtimeScoring' and language = 'Py';
5
6     --The Python script we want to execute
7     set @train_script = N'
8 from microsoftml import rx_logistic_regression, featurize_text, n_gram
9 from revoscalepy import rx_serialize_model, RxOdbcData, rx_write_object, RxInSqlServer, rx_set_compute_context, RxLocalSeq
10
11 connection_string = "Driver=SQL Server;Server=localhost;Database=tpcxbb_1gb;Trusted_Connection=true;"
12 dest = RxOdbcData(connection_string, table = "models")
13
14 training_data["tag"] = training_data["tag"].astype("category")
15
16 modelpy = rx_logistic_regression(formula = "tag ~ features",
17                                   data = training_data,
18                                   method = "multiClass",
19                                   ml_transforms=[featurize_text(language="English",
20                                                 cols=dict(Features="pr_review_content"),
21                                                 word_feature_extractor=n_gram(2, weighting="TfIdf"))],
22                                   train_threads=1)
23
24 modelbin = rx_serialize_model(modelpy, realtime_scoring_only = True)
25 rx_write_object(dest, key_name="model_name", key="RevoMMLRealtimeScoring", value_name="model", value=modelbin, serialize=False, compress=None, overwrite=False); --
26
27 exec sp_execute_external_script @language = N'Python'
28     ,@script = @train_script
29     ,@input_data_1 = N'select * from product_reviews_training_data'
30     ,@input_data_1_name = N'training_data'
31 go
```

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: Python 3 Attach To: localhost Trusted Run Cells Clear Results Install Packages

🐾 Necessary steps

<https://docs.microsoft.com/azure/cognitive-services/text-analytics/quickstarts/python>, <https://azure.microsoft.com/services/cognitive-services/text-analytics>

```
1 import requests
2 from pprint import pprint
3 from IPython.display import HTML
4
5 subscription_key = "mykey"
6 text_analytics_base_url = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
7 sentiment_url = text_analytics_base_url + "sentiment"
8
9 documents = {"documents": [
10     {
11         "id": 1,
12         "language": "en",
13         "text": "Works fine. Easy to install. Some reviews talk about not fitting wall plates. Designed for the best, while greet dinner guests, smelling stronger t
14     }
15 ]}
16
17 headers = {"Ocp-Apim-Subscription-Key": subscription_key}
18 response = requests.post(sentiment_url, headers=headers, json=documents)
19 sentiments = response.json()
20 pprint(sentiments)
```

{'documents': [{id: 1, score: 0.9685916900634766}], 'errors': []}

.JSON Path

```
[1] 1 select top 10
2      row_number() over (order by (select 1)) as id,
3      'en' as language,
4      or review content as text
```

File Edit View Help



CognitiveAPI.ipynb x



Code Text Kernel:

SQL
PySpark3
PySpark
Spark | Scala
Spark | R
Python 3

Attach To: tpcxbb_1gb (Windows Authentication)

Trusted

Run Cells

Clear Results

Install Packages

[1] 19 sentiments =
20 pprint(sentim
('documents': [({'id': '9685916900634766}), 'errors': []])

JSON Path

[1] 1 select top 10
2 row_number() over (order by (select 1)) as id,
3 'en' as language,
4 pr_review_content as text
5 from tpcxbb_1gb..product_reviews_training_data
6 for json path, root('documents')

(10 rows affected)

Total execution time: 00:00:00.1093385

	JSON_F52E2B61-18A1-11d1-B105-00805F49916B
1	{"documents": [{"id": "1", "language": "en", "text": "..."}]}

Don't forget the 🔎

TrollhunterKeys

[1] 1 import requests
2 from pprint import pprint
3 from IPython.display import HTML
4
5 subscription_key = "mykey"
6 text_analytics_base_url = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
7 sentiment_url = text_analytics_base_url + "sentiment"

Code Text Kernel: Python 3 Attach To: localhost Trusted Run Cells Clear Results Install Packages

Don't forget the 🔑

TrollhunterKeys

```
1 import requests
2 from pprint import pprint
3 from IPython.display import HTML
4
5 subscription_key = "mykey"
6 text_analytics_base_url = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
7 sentiment_url = text_analytics_base_url + "sentiment"
8
9 documents = {
10     "documents": [
11         {
12             "id": 1,
13             "language": "en",
14             "text": "Works fine. Easy to install. Some reviews talk about not fitting wall plates. Designed for the best, while greet dinner guests, smelling strong"
15         },
16         {
17             "id": 2,
18             "language": "en",
19             "text": "great product to save money! Dont worry about leaving the light on anymore. It is great for kitchen! My son can help me season our food with ou"
20         },
21         {
22             "id": 3,
23             "language": "en",
24             "text": "Next time will go with the old metal handle- this is bonus."
25         },
26         {
27             "id": 4,
28             "language": "en",
29             "text": "Great Gift Great Value had to get used. And after 12 hours of use, they just throw them away, so you haven't created any useless clutter. (Get"
30         },
31         {
32             "id": 5,
```

CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: Python 3 Attach To: localhost Trusted Run Cells Clear Results Install Packages

```
[1] 46      {
47          "id": 8,
48          "language": "en",
49          "text": "Not super magnet, but strong enough to set on the oven and the spatula is supposed to have, but this one is definitely heavy duty! have placed
50      },
51      {
52          "id": 9,
53          "language": "en",
54          "text": "Installed as bathroom fan timer. Easy to install. Some reviews talk about not fitting wall plates. Designed for the plate supplied to fit in my
55      },
56      {
57          "id": 10,
58          "language": "en",
59          "text": "Our home was built in 2003 and this fits just fine in the drawer until find one of those things that if was looking for, good quality, and afte
60      }
61  ]
62 }
63 print(type(documents))
64
65 headers = {"Ocp-Apim-Subscription-Key": subscription_key}
66 response = requests.post(sentiment_url, headers=headers, json=documents)
67 sentiments = response.json()
68 pprint(sentiments)

<class 'dict'>
('documents': [ {'id': '1', 'score': 0.9685916900634766},
 ('id': '2', 'score': 0.874512791633606),
 ('id': '3', 'score': 0.7775521278381348),
 ('id': '4', 'score': 0.1461590826511383),
 ('id': '5', 'score': 0.9813788533210754),
 ('id': '6', 'score': 0.8957217931747437),
 ('id': '7', 'score': 0.9916195869445801),
 ('id': '8', 'score': 0.08493909239768982),
 ('id': '9', 'score': 0.829785227755737),
 ('id': '10', 'score': 0.7934412956237793}],
 'errors': [])
```

g P master C X 0 ▲ 0

CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: Python 3 Attach To: localhost Trusted Run Cells Clear Results Install Packages

💀💀💀💀💀 died... 🤡

Failed to change kernel. #5722

```
1 import requests, pprint as pr, pyodbc, json
2 from IPython.display import HTML
3
4 subscription_key = "mykey"
5 text_analytics_base_url = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
6 sentiment_url = text_analytics_base_url + "sentiment"
7
8 conn = pyodbc.connect('Driver={SQL Server};Server=localhost;Database=tpcxbb_1gb;Trusted_Connection=yes;')
9 cursor = conn.cursor()
10 cursor.execute('select * from JsonDocuments')
11 row = cursor.fetchone() #pyodbc.Row
12 documents = json.loads(row[0]) #dict
13
14 headers = {"Ocp-Apim-Subscription-Key": subscription_key}
15 response = requests.post(sentiment_url, headers=headers, json=documents)
16
17 sentiments = response.json()
18 pr pprint(sentiments)

('documents': [ {'id': '1', 'score': 0.9685916900634766},
    ('id': '2', 'score': 0.874512791633606),
    ('id': '3', 'score': 0.7775521278381348),
    ('id': '4', 'score': 0.1461590826511383),
    ('id': '5', 'score': 0.9813788533210754),
    ('id': '6', 'score': 0.8957217931747437),
    ('id': '7', 'score': 0.9916195869445801),
    ('id': '8', 'score': 0.08493909239768982),
    ('id': '9', 'score': 0.8297852277755737),
    ('id': '10', 'score': 0.7934412956237793}],
'errors': [])
```

g P master C X 0 ▲ 0

CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: Python 3 Attach To: localhost Trusted Run Cells Clear Results Install Packages

```
{'documents': [{"id": "1", "score": 0.9685916900634766}, {"id": "2", "score": 0.874512791633606}, {"id": "3", "score": 0.7775521278381348}, {"id": "4", "score": 0.1461590826511383}, {"id": "5", "score": 0.9813788533210754}, {"id": "6", "score": 0.8957217931747437}, {"id": "7", "score": 0.9916195869445801}, {"id": "8", "score": 0.08493909239768982}, {"id": "9", "score": 0.8297852277755737}, {"id": "10", "score": 0.7934412956237793}], "errors": []}
```

⬆️ upgrade with magic

<https://pypi.org/simple/urllib3/>

```
1 %%cmd
2 cd "C:\Program Files\Microsoft SQL Server\MSSQL15.MSSQLSERVER\PYTHON_SERVICES"
3 python -m pip install --upgrade C:\temp\urllib3-1.25.3-py2.py3-none-any.whl
```

❗ so hard... 🎯

<https://stackoverflow.com/questions/47954324/how-to-output-values-from-sp-execute-external-script-into-table> <https://stackoverflow.com/questions/44802160/convert-json-api-response-to-pandas-dataframe>

```
[2] 1 declare @py nvarchar(max);
2
3 set @py = N'from pandas.io.json import json_normalize
4
5 rds = {"documents": [{"id": "1", "score": 0.97}, {"id": "2", "score": 0.87}, {"id": "3", "score": 0.78}], "errors": []}
6 print(type(rdd)) #dict
```

CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

- □ ×

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: SQL Attach To: .\tpcxbb_1gb (Windows Authentication) Trusted Run Cells Clear Results Install Packages

so hard... 🚩

How to output values from sp_execute_external_script into table. Convert JSON API response to pandas Dataframe.

```
1 declare @py nvarchar(max);
2
3 set @py = N'from pandas.io.json import json_normalize
4 rds = {"documents": [{"id": "1", "score": 0.97}, {"id": "2", "score": 0.87}, {"id": "3", "score": 0.78}], "errors": []} #dict
5 df = json_normalize(rds, "documents")
6 print(type(df), df, sep="\n") #DataFrame
7 ';
8
9 drop table if exists apiresults
10 create table apiresults (id int, score float)
11
12 insert into apiresults
13 exec sp_execute_external_script
14     @language = N'Python',
15     @script = @py,
16     @output_data_1_name =N'df'
17
18 select * from apiresults
```

STDOUT message(s) from external script: id score
0 1 0.97
1 2 0.87
2 3 0.78
(3 rows affected)
(3 rows affected)

Total execution time: 00:00:04.2972241

	id	score
1	1	0.97
2	2	0.87
3	3	0.78

master 0 0 0 0 0 0

CognitiveAPI.ipynb - Gamechanger (Workspace) - Azure Data Studio

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: SQL Attach To: .\tpcxbb_1gb (Windows Authentication) Trusted Run Cells Clear Results Install Packages

Gato Ninja, Don't forget the 🔑

<https://repl.it/languages/python3>

```
1 create or alter proc GetCognitiveAPI
2 as
3     declare @py nvarchar(max);
4
5     set @py = N'import requests
6 from pandas.io.json import json_normalize
7
8 subscription_key = "mykey"
9 text_analytics_base_url = "https://eastus2.api.cognitive.microsoft.com/text/analytics/v2.0/"
10 sentiment_url = text_analytics_base_url + "sentiment"
11
12 df = jsondocs
13
14 headers = {"Ocp-Apim-Subscription-Key": subscription_key, "content-type": "application/json"}
15 response = requests.post(sentiment_url, headers = headers, data = df.iloc[0][0].encode())
16
17 rds = response.json()
18 df2 = json_normalize(rds, "documents");
19
20 drop table if exists apiresults;
21 create table apiresults (id int, score float);
22
23 insert into apiresults
24 exec sp_execute_external_script @language = N'Python'
25     ,@script = @py
26     ,@input_data_1 = N'select * from JsonDocuments'
27     ,@input_data_1_name = N'jsondocs'
28     ,@output_data_1_name = N'df2'
29 select * from apiresults;
30 go
31 exec GetCognitiveAPI
32 go
```

master 0 ▲ 0

File Edit View Help

CognitiveAPI.ipynb x

Code Text Kernel: SQL Attach To: .\tpcxbb_1gb (Windows Authentication) Trusted Run Cells Clear Results Install Packages

```
--  
20     drop table if exists apiresults;  
21     create table apiresults (id int, score float);  
22  
23     insert into apiresults  
24     exec sp_execute_external_script @language = N'Python'  
25         ,@script = @py  
26         ,@input_data_1 = N'select * from JsonDocuments'  
27         ,@input_data_1_name = N'jsondocs'  
28         ,@output_data_1_name = N'df2'  
29     select * from apiresults;  
30 go  
31 exec GetCognitiveAPI  
32 go
```

Commands completed successfully.

Total execution time: 00:00:00.0077552

(10 rows affected)

(10 rows affected)

Total execution time: 00:00:05.0466495

	id	score
1	1	0.968591690063477
2	2	0.874512791633606
3	3	0.777552127838135
4	4	0.146159082651138
5	5	0.981378853321075
6	6	0.895721793174744
7	7	0.99161958694458
8	8	0.0849390923976898
9	9	0.829785227775574
10	10	0.793441295623779

Summary

- ★ Add ML Features ([exe components](#))
- ★ Grant Access ([users, groups, add login & user](#))
- ★ Config ([external scripts enabled, working directory](#))
- ★ Install Pre-Trained & Open Source ML Models (DNN) ([PowerShell, rsetup.exe](#))
- ★ Code in Python and T-SQL ([visual studio, SSMS](#))
- ★ Python Profiling ([visual studio, execution plan, CPU](#))
- ★ Real-time scoring ([rx_serialize_model, realtime_scoring_only = True](#))
- ★ Review Sentiment Results ([sp_rxPredict wins!](#))
- ★ Bonus ([ADS Notebook, Python and CognitiveAPI](#))
- ★ Resources



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Session evaluations

Your feedback is very important.



This is the link:

bit.ly/sqlml19

Submit your feedback by the end of this presentation.



Resources

- ★ dba2o.wordpress.com
- ★ [Microsoft Learn](#)
- ★ Microsoft AI: [AI School Learning Paths](#)
- ★ SQL Server R Services Samples: [Microsoft Repo](#)
- ★ Pre-Trained ML Models: [Install in SQL Server](#)
- ★ SQL Server Machine Learning Services: [Tutorials](#)
- ★ SQL Server Components to Support Python: [Interaction of Components](#)
- ★ Threading ML: [Logistic Regression](#)
- ★ Resource Governor: [Alter External Resource Pool](#)
- ★ Interactive deep learning: [Learn alert](#)
- ★ aka.ms/sqlworkshops
- ★ aka.ms/ss19



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Thank
You

