pySpark Cheatsheet

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# Command Shell Execution Within iPython



## Examine Underlying HDFS Directory Structures in a Jupyter Notebook

%sx hdfs dfs -ls ../../lambda

Output:

['Found 6 items',

'drwxr-xr-x - saviops saviops 0 2017-08-09 16:59 ../../lambda/UNKNOWN',

'drwxr-xr-x - saviops saviops 0 2017-08-23 03:44 ../../lambda/definitions-parquet',

'drwxr-xr-x - saviops saviops 0 2017-07-31 13:06 ../../lambda/smf-json',

'drwxr-xr-x - saviops saviops 0 2017-08-23 03:25 ../../lambda/smf-parquet',

'drwxr-xr-x - hdfs saviops 0 2017-06-28 15:44 ../../lambda/summaries-json',

'drwxr-xr-x - saviops saviops 0 2017-08-23 04:11 ../../lambda/summaries-parquet']

Logout[Control Panel](https://10.200.4.13/hub/home)Untitled Last Checkpoint: a few seconds ago (autosaved)

pySpark Basic (Spark 1.4.1)

* [File](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [Edit](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [View](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [Insert](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [Cell](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [Kernel](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)
* [Help](https://10.200.4.13/user/bbeauchamp/notebooks/Untitled.ipynb)

CodeMarkdownRaw NBConvertHeading

Cell Toolbar:NoneEdit MetadataRaw Cell FormatSlideshow

In [1]:

**print** "test"

test

In [17]:

**%**sx ls

Out[17]:

['derby.log',

'Getting Started with SparkSQL.ipynb',

'metastore\_db',

'output2.csv',

'Untitled.ipynb']

In [8]:

**%**sx hdfs dfs **-**ls

Out[8]:

['Found 2 items',

'-rw-r--r-- 3 bbeauchamp bbeauchamp 185038 2016-03-04 14:03 output\_file.json',

'drwxr-xr-x - bbeauchamp bbeauchamp 0 2016-03-04 14:25 test\_parquet.txt']

In [18]:

test = sqlContext.read.json("output\_file.json")

In [19]:

**print** test.take(1)

[Row(CORRIDOR=u'1701-PB340', DRIVER\_ETA\_MINS\_REM=369.0, HOUR\_OF\_DAY=19.0, KM\_REMAINING=139.03697714753346, LATITUDE=33.543056, LAT\_LON\_CORR=u'33.40\_-82.00\_33.58\_-84.52', LONGITUDE=-83.01861099999999, MINS\_REMAINING=95.0, SHIPMENT\_ID=u'304716814', carrier=u'USXI', currentLocationTime=u'2015-02-07T19:51:00.000Z', dest\_lat=33.576, dest\_lon=-84.5154, hour\_of\_day\_local=14.0, plannedArrivalTime=u'2015-02-08T02:00:00.000Z')]

In [6]:

test.printSchema()

root

|-- CORRIDOR: string (nullable = true)

|-- DRIVER\_ETA\_MINS\_REM: double (nullable = true)

|-- HOUR\_OF\_DAY: double (nullable = true)

|-- KM\_REMAINING: double (nullable = true)

|-- LATITUDE: double (nullable = true)

|-- LAT\_LON\_CORR: string (nullable = true)

|-- LONGITUDE: double (nullable = true)

|-- MINS\_REMAINING: double (nullable = true)

|-- SHIPMENT\_ID: string (nullable = true)

|-- carrier: string (nullable = true)

|-- currentLocationTime: string (nullable = true)

|-- dest\_lat: double (nullable = true)

|-- dest\_lon: double (nullable = true)

|-- hour\_of\_day\_local: double (nullable = true)

|-- plannedArrivalTime: string (nullable = true)

In [7]:

test.write.save("test\_parquet.txt", format="parquet")

In [9]:

df = sqlContext.read.parquet("test\_parquet.txt")

In [10]:

df.count()

​

Out[10]:

408

In [11]:

**print** df

DataFrame[CORRIDOR: string, DRIVER\_ETA\_MINS\_REM: double, HOUR\_OF\_DAY: double, KM\_REMAINING: double, LATITUDE: double, LAT\_LON\_CORR: string, LONGITUDE: double, MINS\_REMAINING: double, SHIPMENT\_ID: string, carrier: string, currentLocationTime: string, dest\_lat: double, dest\_lon: double, hour\_of\_day\_local: double, plannedArrivalTime: string]

In [12]:

pdf = df.toPandas()

In [13]:

type(pdf)

​

Out[13]:

pandas.core.frame.DataFrame

In [14]:

**import** pandas **as** pd

​

In [15]:

pdf.to\_csv("output2.csv", header=0)

In [ ]:

​

## Transfer a CSV file to HDFS

file name after upload via jupyter filename in HDFS home

%sx hdfs dfs -put /home/bbeauchamp/pg\_lanes\_export\_2017-05-18.csv pg\_lanes\_export\_2017-05-18.csv

# DataFrames (pyspark.sql.dataframe.DataFrame)

## Concatenate 2 pySpark DataFrames, row-wise

df1 = spark.range(3)

df1.show()

df2 = spark.range(4)

df2.show()

df = df1.union(df2)

df.show()

Output:

+---+

| id|

+---+

| 0|

| 1|

| 2|

+---+

+---+

| id|

+---+

| 0|

| 1|

| 2|

| 3|

+---+

+---+

| id|

+---+

| 0|

| 1|

| 2|

| 0|

| 1|

| 2|

| 3|

+---+

## Display DataFrame Columns and Types

df = sqlContext.sql("SELECT \* from shipment\_sums limit 5")

display(df)

Output:

DataFrame[carriers: array<string>, computedTimeUtc: string, countDeliveryLocationArrivals: bigint, countDeliveryLocationDepartures: bigint, countGeolocationUpdates: bigint, countPickupLocationArrivals: bigint, countPickupLocationDepartures: bigint, countRestatedPickupLocationArrivals: bigint, countRestatedPickupLocationDepartures: bigint, customers: array<string>, kmsDirectShipment: double, kmsTraversedShipment: double, legCount: bigint, modes: array<string>, poiFromId: bigint, poiFromLatitude: double, poiFromLongitude: double, poiFromName: string, poiToId: bigint, poiToLatitude: double, poiToLongitude: double, poiToName: string, routePoiIds: array<bigint>, routePoiNames: array<string>, secsDurationLifeCycle: double, secsMovingInTransit: double, secsStationaryInTransit: double, secsStationaryMax: double, shipmentDestinationArrivalAnalyticUtc: string, shipmentDestinationArrivalDetectedUtc: string, shipmentDestinationArrivalReportedUtc: string, shipmentDestinationDepartureAnalyticUtc: string, shipmentDestinationDepartureReportedUtc: string, shipmentEndActualUtc: string, shipmentEndLocalDate: string, shipmentEndLocalDow: bigint, shipmentEndLocalHour: bigint, shipmentEndLocalMonth: bigint, shipmentEndLocalTime: string, shipmentEndLocalTimeZone: string, shipmentEndLocalYear: bigint, shipmentId: string, shipmentOriginArrivalAnalyticUtc: string, shipmentOriginArrivalDetectedUtc: string, shipmentOriginArrivalReportedUtc: string, shipmentOriginDepartureAnalyticUtc: string, shipmentOriginDepartureDetectedUtc: string, shipmentOriginDepartureReportedUtc: string, shipmentScheduleStatus: string, shipmentStartActualUtc: string, shipmentStartLocalDate: string, shipmentStartLocalDow: bigint, shipmentStartLocalHour: bigint, shipmentStartLocalMonth: bigint, shipmentStartLocalTime: string, shipmentStartLocalTimeZone: string, shipmentStartLocalYear: bigint, shipmentSummaryId: string, shipper: string]

## DataFrame Schema

smurf\_processed\_df.printSchema()

Output:

root

|-- smfMetaData: struct (nullable = true)

| |-- defaultProcessMode: string (nullable = true)

| |-- deviceId: string (nullable = true)

| |-- endpointReceiptTime: string (nullable = true)

| |-- endpointResponseCode: string (nullable = true)

| |-- ipAddress: string (nullable = true)

## Export a Spark Data Frame to CSV

Three ways:

df.toPandas().to\_csv('mycsv.csv')

df.write.csv('mycsv.csv')

df.coalesce(1).write.csv('mycsv.csv')

## Extract a column from a pyspark DataFrame as a List

grp\_list = final\_df.rdd.map(lambda r: r.grp).collect()

print grp\_list

Returns:

[u'14979844271498287624', u'14979844271498287624', u'14979844271498287624',...]

## Extract a struct (structure) as a DataFrame

Note: In this example, ‘poi\_state’ is the column name of a column which is a struct.

poi\_state\_df\_2 = test\_result\_df.select('poi\_state.\*')

poi\_state\_df\_2.show(n=3, truncate = 25)

## Extract Distinct Values from a DataFrame Column

df.select("columnname").distinct().show()

## Extract Nested JSON Data in Spark

<http://bigdatums.net/2016/02/12/how-to-extract-nested-json-data-in-spark/>

## Register a DataFrame as a Temporary Table

vessel\_poi\_count\_df = sqlContext.sql('''

SELECT mmsi, imo, count(distinct(poi)) as poi\_count

FROM vessel\_poi

GROUP BY mmsi, imo

ORDER BY count(distinct(poi)) DESC

''')

vessel\_poi\_count\_df.registerTempTable('vessel\_poi\_count')

print vessel\_poi\_count\_df.count()

vessel\_poi\_count\_df.show(5)

# Output # of pois traversed by a ship, in a year

# 25883

#+---------+-------+-------------------+

#| mmsi| imo|count(DISTINCT poi)|

#+---------+-------+-------------------+

#|311913000|9118006| 131|

#|311007600|9073892| 129|

#|314220000|9005742| 129|

#|244890901|9760407| 127|

#|245219000|8915756| 127|

#+---------+-------+-------------------+

## Sample a DataFrame (approximate sample)

od\_sample = od.sample(withReplacement=False, fraction=0.04, seed=13) # Sample 4% of data

## Sort a DataFrame

od\_sample = od\_sample.sort("od\_pair", ascending=True)

Output:

+---------+-------+-------+

|source\_id|dest\_id|od\_pair|

+---------+-------+-------+

| 10| 1077|10-1077|

| 10| 1171|10-1171|

| 10| 136| 10-136|

+---------+-------+-------+

# Sort potentially by Multiple Columns

vessel\_df = start\_moored\_df[start\_moored\_df['imo'] == vessel\_imo\_str]

print "vessel\_df=", vessel\_df.show(5)

sorted\_desc\_df = vessel\_df.orderBy(['timestamp'], ascending=[0])

print "sorted descending=", sorted\_desc\_df.show(5)

Output:

vessel\_df=

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

| timestamp| mmsi| imo|moored|nav\_status| lat| lon|sog| pois|

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

|1483246223|235102677|9604146| 1| 5|22.4477|113.8881|0.2|[5715, 5576, 5776...|

|1483581689|235102677|9604146| 1| 5| 1.3571|103.5467|0.2|[12320, 12354, 12...|

|1484010564|235102677|9604146| 1| 5| 6.946| 79.8298|0.0| [12094]|

|1484510320|235102677|9604146| 1| 5| 24.989| 55.0521|0.0|[16417, 16421, 16...|

|1484671995|235102677|9604146| 1| 5|27.0948| 56.0583|0.0|[17044, 11510, 11...|

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

sorted descending=

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

| timestamp| mmsi| imo|moored|nav\_status| lat| lon|sog| pois|

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

|1514413286|235102677|9604146| 1| 5|37.9542| 23.5801|0.0|[10834, 10677, 10...|

|1513895423|235102677|9604146| 1| 5|32.8184| 35.013|0.2| [11380, 11381]|

|1513687285|235102677|9604146| 1| 5| 31.834| 34.6458|0.0| [11377]|

|1512638579|235102677|9604146| 1| 5| 1.365|103.5443|0.0|[12354, 12358, 12...|

|1512546458|235102677|9604146| 1| 5| 1.275|103.7826|0.0|[14299, 14300, 17...|

+----------+---------+-------+------+----------+-------+--------+---+--------------------+

## Statistics on pyspark.sql.dataframe.DataFrame columns

### Calculate Mean and Median of a Column

import numpy as np

vessel\_poi\_count\_df.show(5)

+---------+-------+---------+

| mmsi| imo|poi\_count|

+---------+-------+---------+

|311913000|9118006| 131|

|311007600|9073892| 129|

|314220000|9005742| 129|

|244890901|9760407| 127|

|245219000|8915756| 127|

+---------+-------+---------+

poi\_count\_list = vessel\_poi\_count\_df.rdd.map(lambda r: r.poi\_count).collect()

print "median=", np.median(poi\_count\_list)

print "mean=", np.mean(poi\_count\_list)

Output:

median= 21.0

mean= 24.9121044701

### Statistics Summary for a pySpark DataFrame

vessel\_poi\_count\_df.describe().show()

+-------+-------------------+--------------------+------------------+

|summary| mmsi| imo| poi\_count|

+-------+-------------------+--------------------+------------------+

| count| 25883| 24839| 25883|

| mean|4.114968495927829E8|1.4876571290188815E7| 24.91210447011552|

| stddev| 1.37569361042951E8| 6.857711122390723E7|19.900553546011217|

| min| 112| 103558307| 1|

| max| 886092406| 995467000| 131|

+-------+-------------------+--------------------+------------------+

# pyspark.sql

Select a Field from a Row

print take\_out[0]

take\_out[0].SAPShipmentID

Output:

Row(SAPShipmentID=u'0305463905')

u'0305463905'

# SparkSQL

# Case Statements

shipment\_modes\_df = sqlContext.sql(''' SELECT poiFromId, poiToId,

truckCount / (truckCount + intermodalCount + unknownCount) as truckPct

FROM

(SELECT poiFromId, poiToId,

SUM(CASE WHEN mode = 'truck' THEN 1 ELSE 0 END) AS truckCount,

SUM(CASE WHEN mode = 'intermodal' THEN 1 ELSE 0 END) AS intermodalCount,

SUM(CASE WHEN mode = 'unknown' THEN 1 ELSE 0 END) AS unknownCount

FROM

(SELECT shipmentId, poiFromId, poiToId,

explode(modes) as mode

FROM shipment\_sums\_table

WHERE legCount = 1)

GROUP BY poiFromId, poiToId

ORDER BY poiFromId, poiToId

)

order by truckPct

''')

# DataFrame (pyspark.sql.dataframe.DataFrame)

## Change a DataFrame’s Column Names

from pyspark.sql.functions import explode

df1.show()

+---+---+------------+

| a|col| c|

+---+---+------------+

| 1| 1| [7, 8, 9]|

| 1| 2| [7, 8, 9]|

| 1| 3| [7, 8, 9]|

| 2| 4|[10, 11, 12]|

| 2| 5|[10, 11, 12]|

| 2| 6|[10, 11, 12]|

+---+---+------------+

df2 = df1.selectExpr("a as alph", "col as exploded", "c as age")

df2.show()

Output:

+----+--------+------------+

|alph|exploded| age|

+----+--------+------------+

| 1| 1| [7, 8, 9]|

| 1| 2| [7, 8, 9]|

| 1| 3| [7, 8, 9]|

| 2| 4|[10, 11, 12]|

| 2| 5|[10, 11, 12]|

| 2| 6|[10, 11, 12]|

+----+--------+------------+

## Create a DataFrame from Scratch

df = sqlContext.createDataFrame([Row(a=1, b=[1,2,3],c=[7,8,9]), Row(a=2, b=[4,5,6],c=[10,11,12])])

df.show()

Output:

+---+---------+------------+

| a| b| c|

+---+---------+------------+

| 1|[1, 2, 3]| [7, 8, 9]|

| 2|[4, 5, 6]|[10, 11, 12]|

+---+---------+------------+

Note: This is tyape pyspark.sql.dataframe.DataFrame

## Execute SQL on a DataFrame

sqlContext.registerDataFrameAsTable(data, "myTable")

df2 = sqlContext.sql("SELECT Name AS name, askdaosdka as age from myTable")

df2.show()

# Output

#+-------+---+

#| name|age|

#+-------+---+

#|Alberto| 2|

#| Dakota| 2|

#+-------+---+

## Explode a List inside a DataFrame column

df = sqlContext.createDataFrame([Row(a=1, b=[1,2,3],c=[7,8,9]), Row(a=2, b=[4,5,6],c=[10,11,12])])

df.show()

Output:

+---+---------+------------+

| a| b| c|

+---+---------+------------+

| 1|[1, 2, 3]| [7, 8, 9]|

| 2|[4, 5, 6]|[10, 11, 12]|

+---+---------+------------+

df1 = df.select(df.a, explode(df.b), df.c)

df.show()

Output:

+---+---+------------+

| a|col| c|

+---+---+------------+

| 1| 1| [7, 8, 9]|

| 1| 2| [7, 8, 9]|

| 1| 3| [7, 8, 9]|

| 2| 4|[10, 11, 12]|

| 2| 5|[10, 11, 12]|

| 2| 6|[10, 11, 12]|

+---+---+------------+

## Loading a Schema while Correcting org.apache.parquet.io.ParquetDecodingException

This throws an Exception:

smf\_parquet = sqlContext.read.parquet( '/lambda/smf-parquet/POC/smurf-processed//quarter=2017-q1/\*',

'/lambda/smf-parquet/POC/smurf-processed//quarter=2017-q2/\*',

'/lambda/smf-parquet/POC/smurf-processed//quarter=2017-q3/\*')

smf\_parquet.registerTempTable('smurf\_processed')

test\_df = sqlContext.sql('''

SELECT \*

FROM smurf\_processed

LIMIT 10''')

test\_df.take(5)

but the following works:

merged\_df = spark.read.option("mergeSchema", "true").parquet( '/lambda/smf-parquet/POC/smurf-processed//quarter=2017-q1/\*',  
'/lambda/smf-parquet/POC/smurf-processed//quarter=2017-q2/\*')

## Read a Parquet File into a DataFrame

shipment\_summaries\_path = '/lambda/summaries-parquet/PG/shipment-summaries/\*'

shipment\_sums = sqlContext.read.parquet(shipment\_summaries\_path) # pyspark.sql.dataframe.DataFrame

## Store DataFrame as Temp Table for Later Querying

shipment\_sums.createOrReplaceTempView("shipment\_sums\_table")

Query from the Temp Table:

test\_df = sqlContext.sql('''SELECT shipmentId FROM shipment\_sums\_table limit 1''')

test\_df.head()

Output:

Row(shipmentId=u'0306098015')

# Select an Array Element

df.printSchema()

## root

## |-- stuff: array (nullable = true)

## | |-- element: struct (containsNull = true)

## | | |-- a: long (nullable = true)

## | | |-- b: long (nullable = true)

## | | |-- c: long (nullable = true)

sqlContext.sql("SELECT stuff[0].a FROM df").show()

## +---+

## |\_c0|

## +---+

## | 1|

## +---+

# Parquet

## Explode a list or array data field

shipment\_df = sqlContext.sql('''SELECT shipmentId, modes

FROM shipment\_sums\_table

where legCount = 2

limit 5

''')

shipment\_df.show()

Output:

+----------+--------------+

|shipmentId| modes|

+----------+--------------+

|0306080481|[truck, truck]|

|0306120361|[truck, truck]|

|0306120411|[truck, truck]|

|0306103320|[truck, truck]|

|0306078031|[truck, truck]|

+----------+--------------+

# What modes are available?

modes\_df = sqlContext.sql('''SELECT shipmentId,

explode(distinct modes)as mode

FROM shipment\_sums\_table

WHERE legCount = 2

limit 6

''')

modes\_df.show()

Output:

+----------+-----+

|shipmentId| mode|

+----------+-----+

|0306080481|truck|

|0306080481|truck|

|0306120361|truck|

|0306120361|truck|

|0306120411|truck|

|0306120411|truck|

+----------+-----+

**Exploding an Array stored in a Column**

Unexploded:

start\_moored = sqlContext.sql('''

SELECT timestamp, mmsi, pois

FROM (

SELECT \*

FROM pos\_data

WHERE moored = 1 and prev\_moored = 0 and prev2\_moored = 0 and prev3\_moored = 0 and prev4\_moored = 0 and prev5\_moored = 0 and prev6\_moored = 0 and prev7\_moored = 0

) a

'''

)

Output:

+----------+---------+--------------+

| timestamp| mmsi| pois|

+----------+---------+--------------+

|1493653149|212370000| [12223]|

|1493847898|212370000|[14952, 15249]|

|1493949978|212370000| [12223]|

|1494075847|212370000| [12275]|

|1494258522|212370000| [12223]|

Exploded:

start\_moored = sqlContext.sql('''

SELECT timestamp, mmsi, poi

FROM (

SELECT \*

FROM pos\_data

WHERE moored = 1 and prev\_moored = 0 and prev2\_moored = 0 and prev3\_moored = 0 and prev4\_moored = 0 and prev5\_moored = 0 and prev6\_moored = 0 and prev7\_moored = 0

) a

LATERAL VIEW OUTER EXPLODE(pois) zzz AS poi

'''

Output:

+----------+---------+-----+

| timestamp| mmsi| poi|

+----------+---------+-----+

|1493653149|212370000|12223|

|1493847898|212370000|14952| # These were

|1493847898|212370000|15249| # exploded

|1493949978|212370000|12223|

|1494075847|212370000|12275|

|1494258522|212370000|12223|

|1494419315|212370000|14952|

|1494419315|212370000|15249|

|1494621881|212370000|12275|

|1494913457|212370000|12223|

+----------+---------+-----+

# Strings

## Concatenate strings

CONCAT(SUBSTR(smfPayloadData.timestamp.asOf,1,10), ' ',

SUBSTR(smfPayloadData.timestamp.asOf, 12, 8)) as test

## Convert a numeric field to a string

test = sqlContext.sql('''

SELECT DISTINCT format\_string("%s", poiFromId) as originId,

format\_string("%s", poiToId) as destId,

format\_string("%s-%s", poiFromId, poiToId) as od\_pair

FROM shipment\_sums

LIMIT 5

''')

print type(test)

test.show(5)

Output:

+--------+------+-------+

|originId|destId|od\_pair|

+--------+------+-------+

| 39| 981| 39-981|

| 31| 1056|31-1056|

| 38| 547| 38-547|

| 33| 174| 33-174|

| 37| 40| 37-40|

+--------+------+-------+

## Substring

SUBSTR(smfPayloadData.timestamp.asOf,1,10)

output: “2016-03-01”

# Timestamps

## Convert string to timestamp

shipment\_carr = sqlContext.sql('''

SELECT smfPayloadData.paired.shipmentId,

smfPayloadData.paired.shipper,

smfPayloadData.paired.carrier,

smfPayloadData.timestamp.asOf as dest\_arr\_utc,

to\_utc\_timestamp('2016-03-01 00:00:00','UTC') as example\_timestamp

FROM mapped

where smfPayloadData.events.DeliveryLocationArrival is not null

and smfPayloadData.timestamp.asOf >= to\_utc\_timestamp('2016-03-01 00:00:00','UTC')

and smfPayloadData.timestamp.asOf < to\_utc\_timestamp('2016-03-02 00:00:00','UTC')

limit 1

''')

printResultsAsJson(shipment\_carr)

output:

{

**"example\_timestamp": "2016-03-01 00:00:00.0"**,

"carrier": "SCNN",

"shipper": "PG",

"dest\_arr\_utc": "2016-03-01T23:51:00.000Z",

"shipmentId": "Jackie will add"

}

## Convert Unix Timestamp to Formatted Date

mooring\_exp\_df = sqlContext.sql('''

SELECT \*,

from\_unixtime(timestamp, 'YYYY-MM-dd') as timestamp\_dt

FROM start\_moored

ORDER BY mmsi, timestamp

LIMIT 10

'''

)

+----------+---------+-----+------------+

| timestamp| mmsi| poi|timestamp\_dt|

+----------+---------+-----+------------+

|1493942222|173313120|12052| 2017-05-04|

|1494196603|173313120|12043| 2017-05-07|

|1494472207|173313120|12052| 2017-05-11|

...

## Convert Unix Timestamp to ISO Standard Date and Time

port\_pairs = sqlContext.sql('''

select mmsi,

orig\_timestamp, from\_unixtime(orig\_timestamp, "YYYY-MM-dd'T'HH-mm-SS'Z'") as orig\_dt, orig\_poi,

dest\_timestamp, from\_unixtime(dest\_timestamp, "YYYY-MM-dd'T'HH-mm-SS'Z'") as orig\_dt, dest\_poi”””)