Spark Structured Streaming

Justin Post

Recap

Streaming Data

- Data that is generated over time (usually continuously)
- Often small amounts of data with high velocity

Common Tasks

- Preprocessing/Sending alerts
- Combining data streams and dealing with time intervals
- Detecting trends, counting, and averages (over certain windows or buckets of time)
- Updating or using predictive models

Big issues

- Need to handle it as it comes in record by record
- Generally, don't want to store all the data from the stream

Spark for Streaming Data

Spark has two systems for streaming data:

- Spark Streaming
    - Uses discretized streams or DStreams
    - Internally is a sequence of RDDs
- Spark Structured Streaming
    - Can use Spark DataFrames with SQL type functions

Spark SQL Recap

Use `pyspark.sql.SparkSession` to create a spark instance

- Spark SQL DataFrames are created and implemented on top of RDDs
  - `df.printSchema()`
- DataFrames are stored across the cluster
  - When transformations are done, lazy evaluation is used
  - When actions are done, computation starts and results returned

Spark SQL Recap

Often do transformations

- `.select()` method can be used to subset columns
- `.withColumn()` method is useful to create a new column from another
- `.filter()` method allows you to subset via a condition

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Summarizations (often with grouping via `.groupBy()`)

- `.avg()`, `.sum()`, `.count()`, etc

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- `.avg()`, `.sum()`, `.count()`, etc

DataFrame isn't printed out when we do the default call of the object due to lazy eval

- `show(n)`, `take(n)`, `collect()`
- **Won't be able to use these with streaming data**

Spark SQL Recap

And don't forget!

- Can use more 'standard' SQL style code:
  - `df.createOrReplaceTempView("df")`
  - `spark.sql("SELECT sex, age FROM df LIMIT 4")`

Spark Structured Streaming

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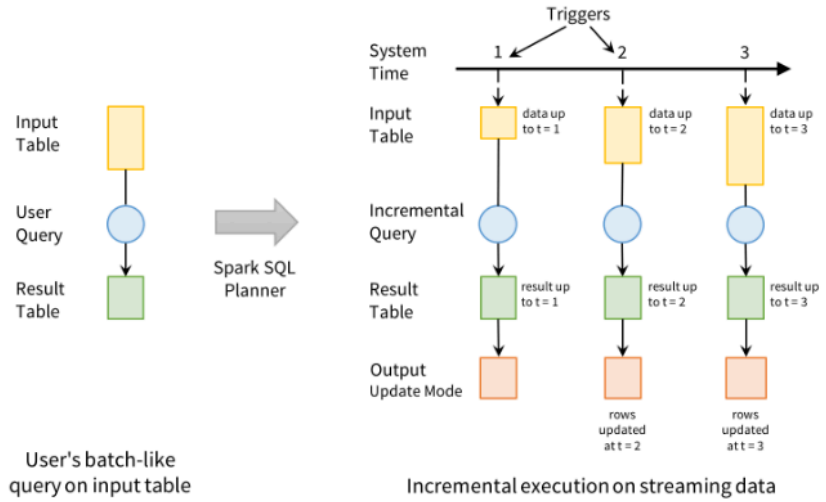
- Still set up sequence of transformations
- Lazy execution until you execute the query that will return data



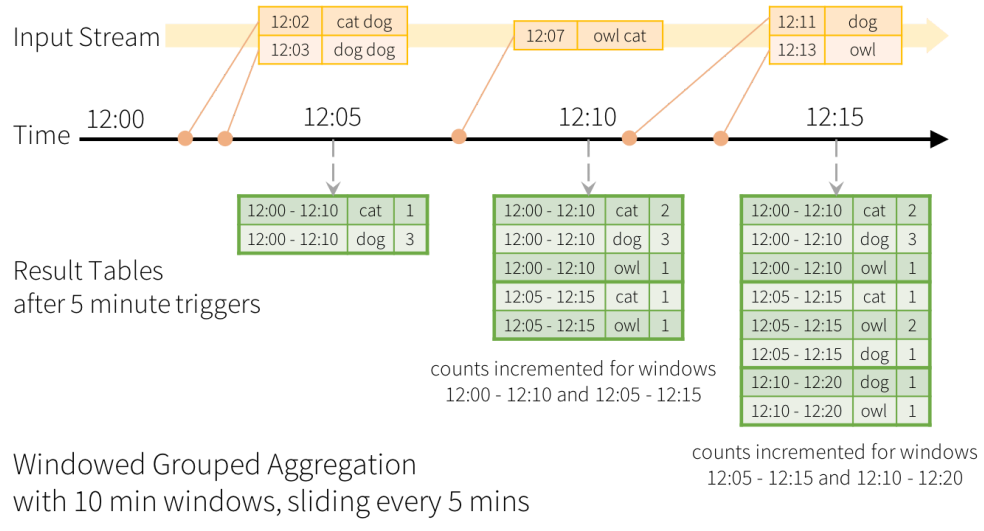
Structured Streaming Processing Model

Users express queries using a batch API; Spark incrementalizes them to run on streams

https://databricks.com/glossary/what-is-structured-streaming

Spark Structured Streaming

- Spark Uses micro-batching at time intervals you set (100 milliseconds minimum)
- Continuous version (1 millisecond) exists but is still experimental
- Easy to do windowing operations!



https://spark.apache.org/docs/latest/structured-streaming-programming-guide.html

Spark Structured Streaming Process

General process:

- Create a spark session

1. Read in a stream
    - Stream from a file, terminal, or use something like kafka
2. Set up transformations/aggregations to do (mostly using SQL type functions)
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3. Set up writing of the query to an output source
   - Console (for debugging)
   - File (say .csv)
   - Database
4. `query.start()` the query!
   - Continues listening until terminated (`query.stop()`)

First: To JupyterLab to do Spark without Streaming!

Basic word count operation

Using Spark SQL we can use functions listed here. Process:

- Read data into a spark SQL dataframe
- Use `split(str, regex)`
- Use `explode(expr)` (separates the elements of the array `expr` into multiple rows, or the elements of map `expr` into multiple rows and columns)

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- Use `.groupBy()` with `.count()`

Syntax similar to what we've done already

```
df.select(["Duration", "Age", "Treatment"]).groupBy("Treatment").avg().show()
```

Second: To pyspark to do Word Counts on Streaming Data!

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Recap

We'll use Spark Structured Streaming to handle our streaming data!

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3. Set up writing of the query to an output source
4. `query.start()` the query!

- We'll look at things like windowing and joining streams as well!