Apache Spark

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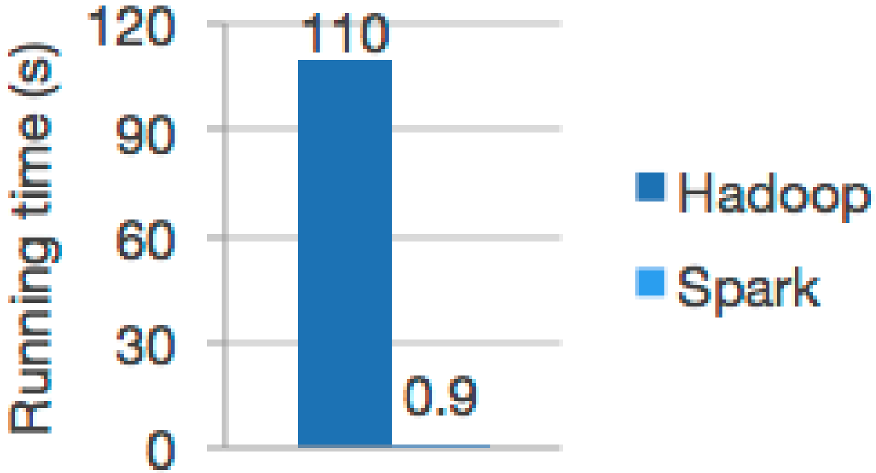
Apache Spark

- *Lightning-fast unified analytics engine* for large-scale data processing.
- Speed:

  Run workloads 100x faster.



Spark.apache.org

Apache Spark

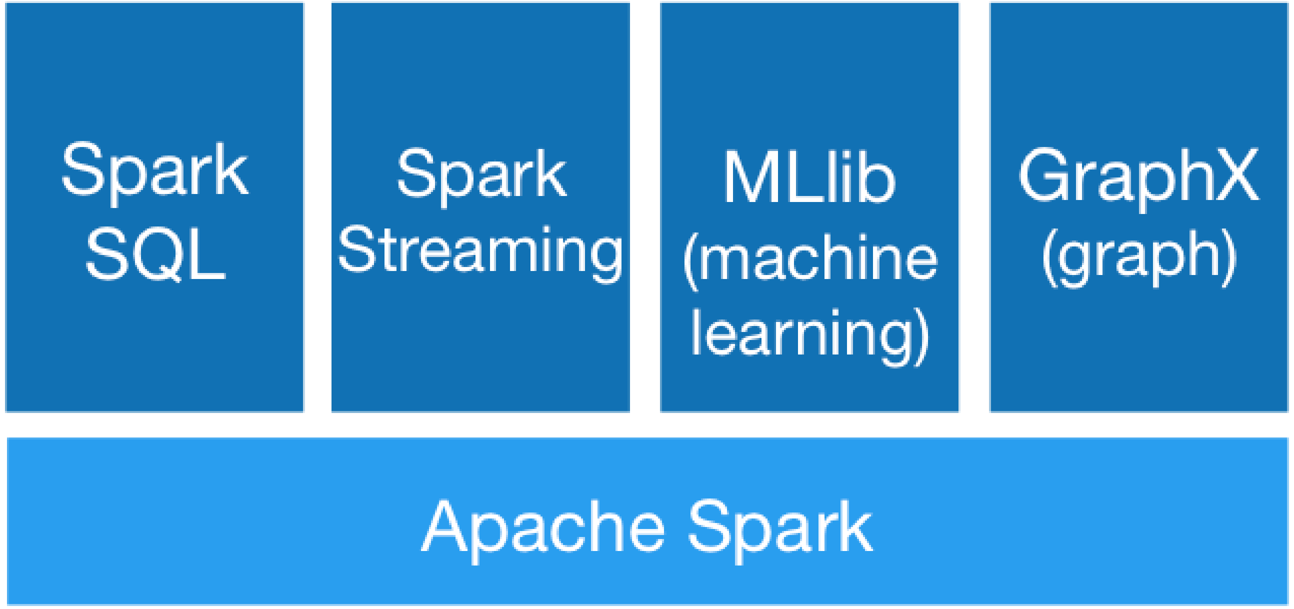
- *Lightning-fast unified analytics engine* for large-scale data processing.
- Speed:

  Run workloads 100x faster.
- Ease of Use

  Write applications quickly in Java, Scala, Python, R, and SQL.
- Generality

  Combine SQL, streaming, and complex analytics.

Spark Components



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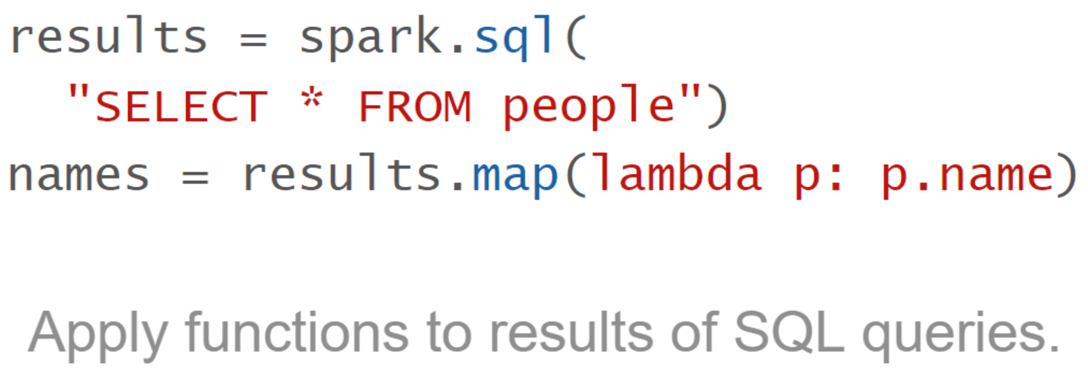
Spark SQL

Apache Spark's module for working with structured data.

- Integrated

Seamlessly mix SQL queries with Spark programs.



```
results = spark.sql(
  "SELECT * FROM people")
names = results.map(lambda p: p.name)
```

Apply functions to results of SQL queries.

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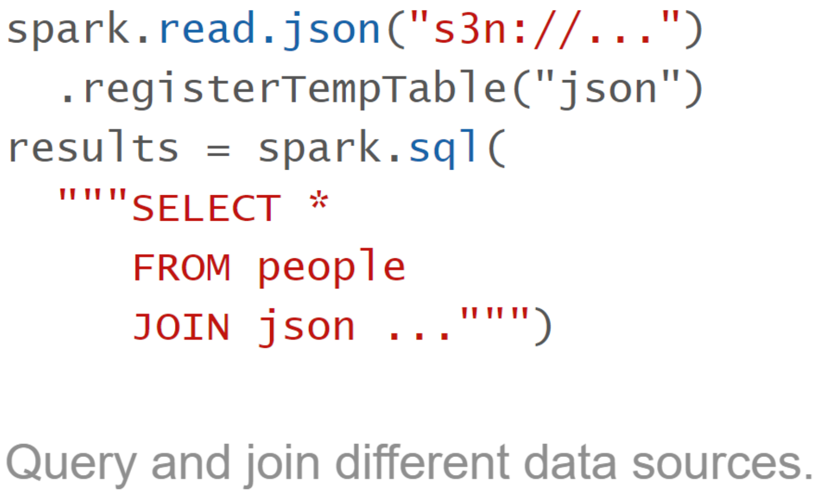
Spark SQL

Apache Spark's module for working with structured data.

- Uniform Data Access

Connect to any data source the same way.



```
spark.read.json("s3n://...")
  .registerTempTable("json")
results = spark.sql(
  """SELECT *
     FROM people
     JOIN json ..."""）
```

Query and join different data sources.

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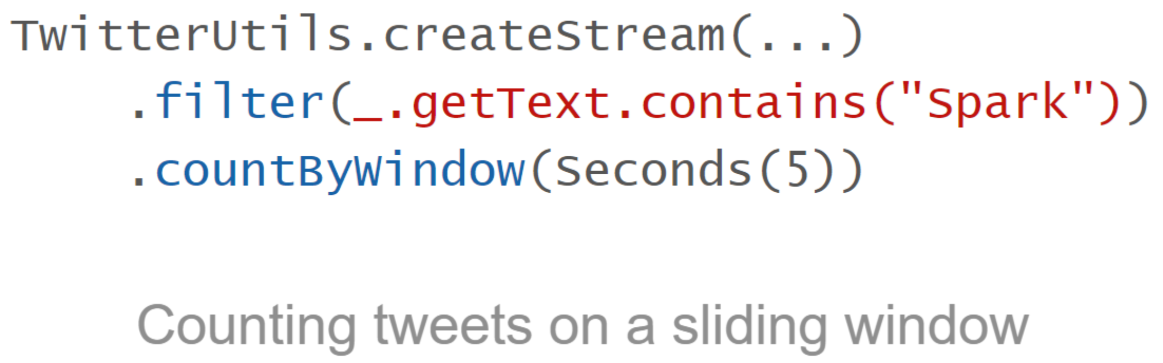
Spark Streaming

Spark Streaming makes it easy to build scalable fault-tolerant streaming applications.

- Ease of Use

  Build applications through high-level operators.



```
TwitterUtils.createStream(...)
    .filter(_.getText.contains("Spark"))
    .countByWindow(Seconds(5))
```

Counting tweets on a sliding window

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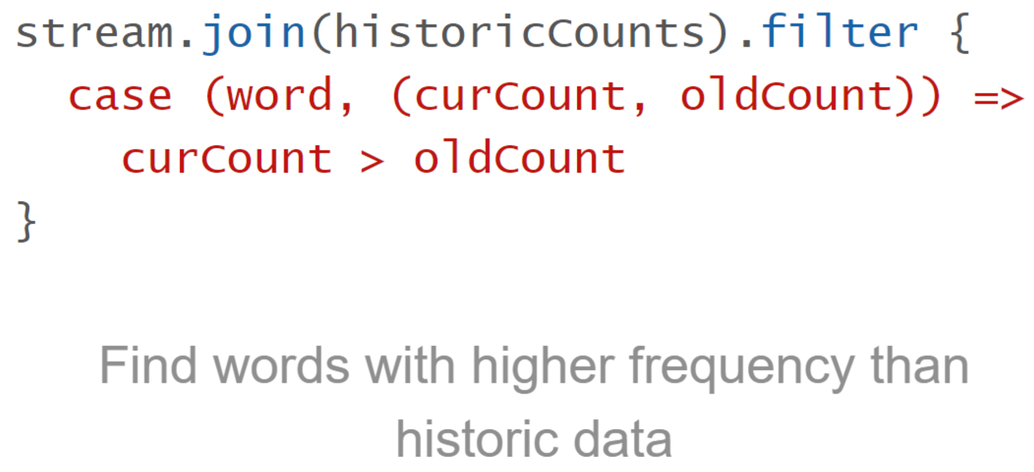
Spark Streaming

Spark Streaming makes it easy to build scalable fault-tolerant streaming applications.

- Spark Integration

  Combine streaming with batch and interactive queries.



```
stream.join(historicCounts).filter {
  case (word, (curCount, oldCount)) =>
    curCount > oldCount
}
```

Find words with higher frequency than historic data

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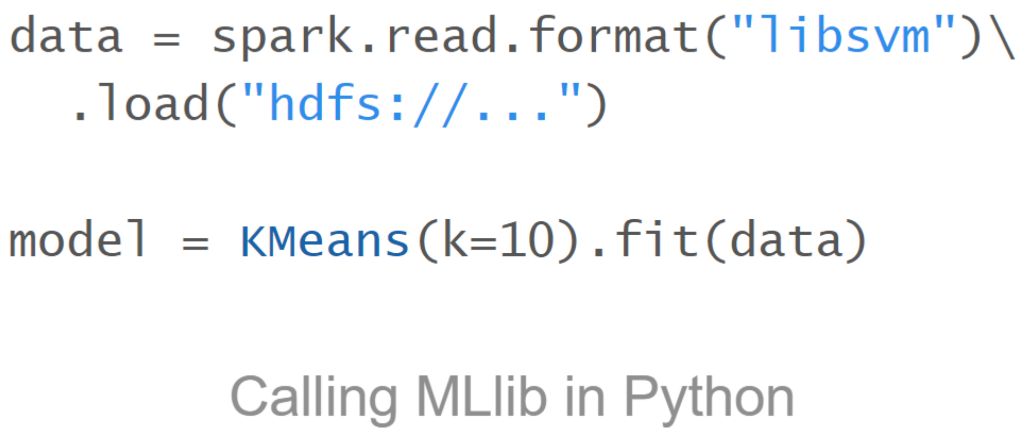
Spark MLlib

- **MLlib** is Apache Spark's scalable machine learning library.
- Ease of Use

  Usable in Java, Scala, Python, and R.



```
data = spark.read.format("libsvm")\
  .load("hdfs://...")

model = KMeans(k=10).fit(data)
```

Calling MLlib in Python

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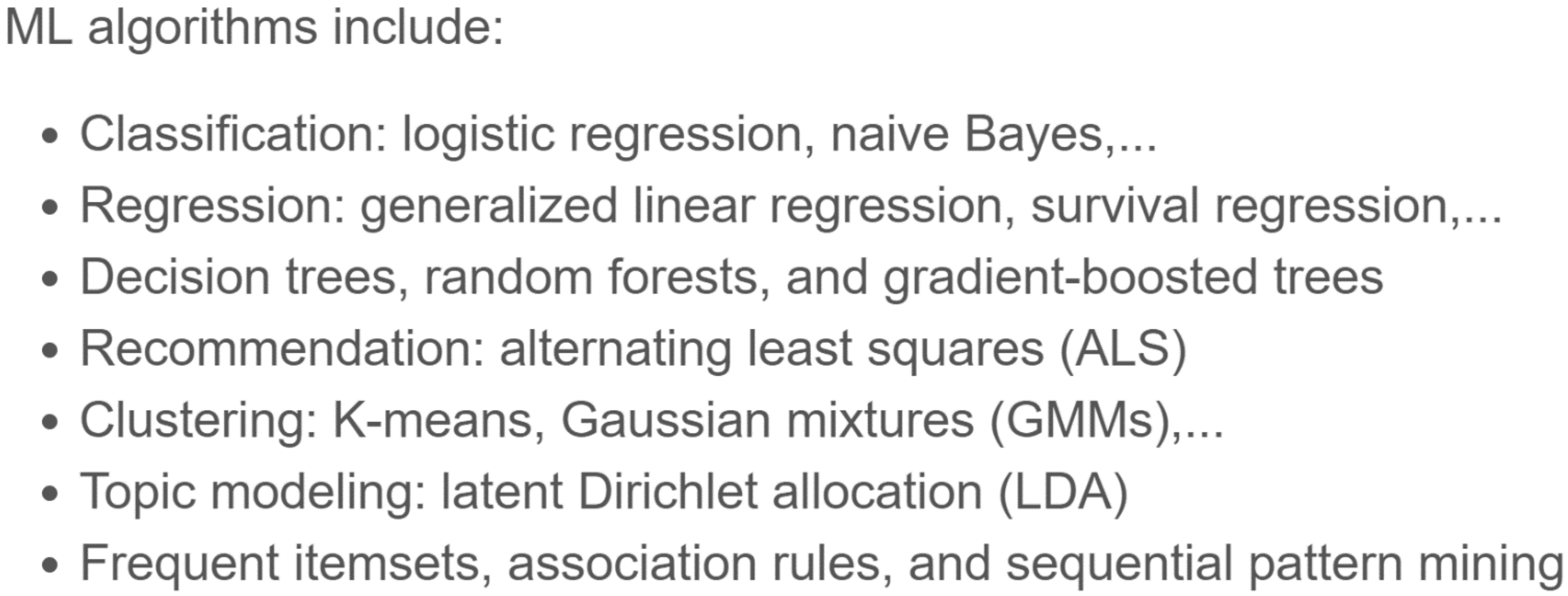
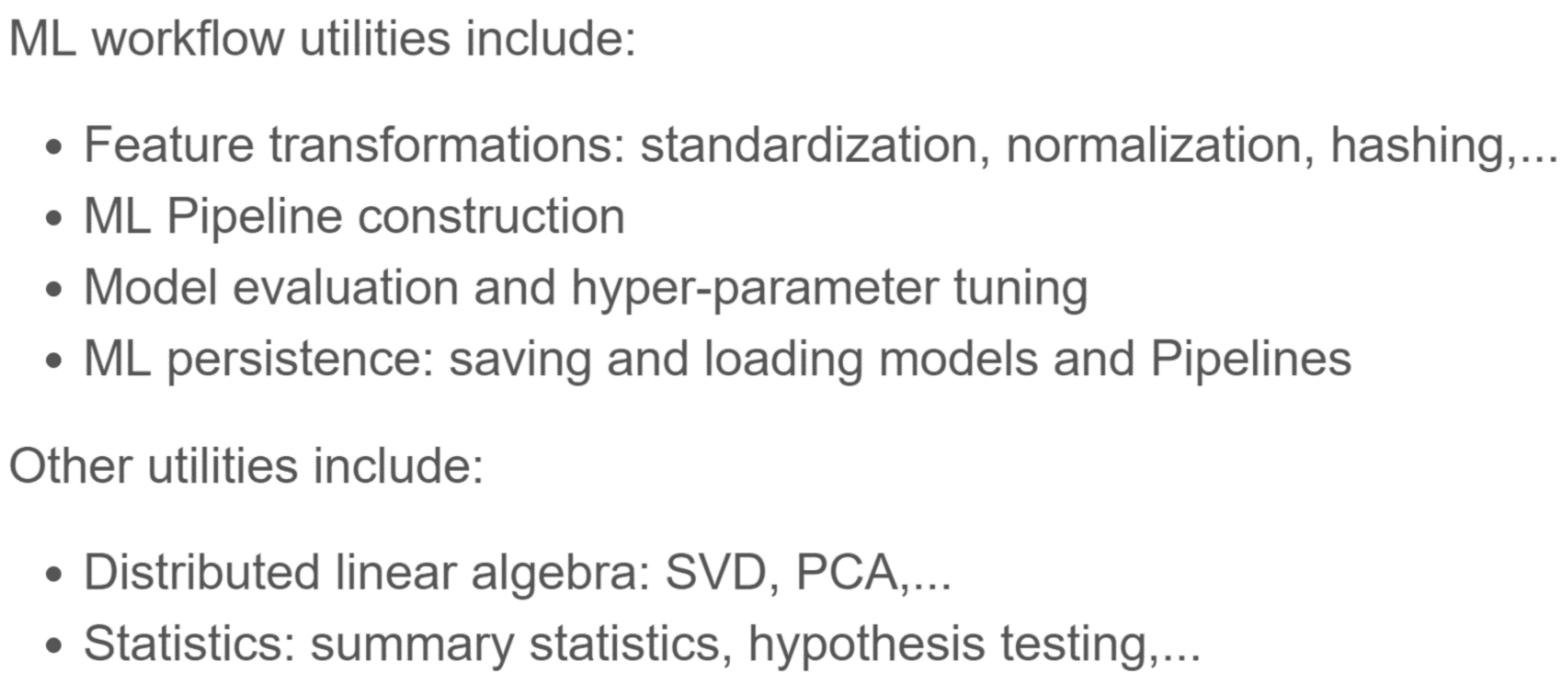
Spark MLlib



ML algorithms include:

- Classification: logistic regression, naive Bayes,...
- Regression: generalized linear regression, survival regression,...
- Decision trees, random forests, and gradient-boosted trees
- Recommendation: alternating least squares (ALS)
- Clustering: K-means, Gaussian mixtures (GMMs),...
- Topic modeling: latent Dirichlet allocation (LDA)
- Frequent itemsets, association rules, and sequential pattern mining

Spark MLlib



ML workflow utilities include:

- Feature transformations: standardization, normalization, hashing,...
- ML Pipeline construction
- Model evaluation and hyper-parameter tuning
- ML persistence: saving and loading models and Pipelines

Other utilities include:

- Distributed linear algebra: SVD, PCA,...
- Statistics: summary statistics, hypothesis testing,...

Spark GraphX

GraphX is Apache Spark's API for graphs and graph-parallel computation.

- Flexibility

  Seamlessly work with both graphs and collections.

- Algorithms

  Choose from a growing library of graph algorithms.

- Speed

  Comparable performance to the fastest specialized graph processing systems.