

CS 378 – Big Data Programming

Lecture 8

Custom Writable

Review

- Assignment 3 - InvertedIndex
- We'll look at implementation details of:
 - Mapper
 - Combiner (amount of shuffle data reduced slightly)
 - Reducer
 - Supporting classes
- Other questions/issues?

MRUnit

- MRUnit (and Mockito)
 - Unit testing tools for Hadoop map-reduce (with Junit)
 - Locally exercise your map-reduce code
 - Step through **map ()** and **reduce ()** methods in your IDE
- Example
 - Maven build
 - Debugging in an IDE
- Some methods to consider
 - **equals ()**, **toString ()**, **hashCode ()**

Assignment 4

- Recall the word statistics output:
 - Key: word
 - Value: document count, mean, variance
- Suppose that we collect this info every day
- Then aggregate these stats by week, month,...
 - But not reprocess the original emails for each aggregation
- Need to output counts with stats

Assignment 4

- Modified word statistics output:
 - Key: word
 - Value:
 - Longs: document count, total count, sum of squares
 - Doubles: mean, variance
- We have mixed types, so **LongArrayWritable** and **DoubleArrayWritable** aren't appropriate
- Solution: Write a custom class for our stats data

Review Writable

- Hadoop **Writable** interface
 - Inputs to and outputs from **map ()**
 - Inputs to and outputs from **reduce ()**
- Implements serialization for I/O
- Required methods:
 - **readFields (DataInput in)**
 - **write (DataOutput out)**
- Let's call our class: **WordStatisticsWritable**

Custom Writable

- Approach 1 for `WordStatisticsWritable`:
 - Include a `LongArrayWritable` and a `DoubleArrayWritable`
- Required methods:
 - `write(DataOutput out)`
 - Writes a `LongArrayWritable`, then a `DoubleArrayWritable`
 - `readFields(DataInput in)`
 - Reads a `LongArrayWritable`, then a `DoubleArrayWritable`

Custom Writable

- Approach 2 for `WordStatisticsWritable`:
 - Use primitive Java types (`long`, `double`)
- Required methods:
 - `write(DataOutput out)`
 - Write primitive values to `DataOutput` instance
 - `writeLong()`, `writeDouble()`
 - `readFields(DataInput in)`
 - Read primitive values from `DataInput` instance
 - `readLong()`, `readDouble()`

Custom Writable

- What other methods might we need for **WordStatisticsWritable**?
- For output to text file:
 - **toString()**
- For MRUnit tests:
 - **equals()**

Assignment 4 – Job 1

- For the daily run, input is files containing emails
- Output is text file (using **TextOutputFormat**):
 - Key: word
 - Tab
 - Values (comma separated):
 - document count, total count, sum of squares, mean, variance
- To aggregate multiple days of data, we need a job that reads multiple days of data in this format

Aggregator Job

- You'll write a second map-reduce job that:
- Reads the text files output by WordStatistics
 - From multiple runs of WordStatistics
- Aggregates the values:
 - Sum the counts
 - Compute new mean, variance
- Outputs the same format as WordStatistics
 - Might want to aggregate these as well

Aggregator

- Recall that Hadoop provides a file format class to read output generated with `TextFileFormat`:
 - `KeyValueTextInputFormat`
- Aggregator job should use this input file format
- Mapper converts input to `WordStatisticsWritable`
- Combiner - Can we use one?
- What does the reducer do?

Assignment 4

- Bonus: Write a single reduce class that works for:
 - WordStatistics combiner and reducer, and
 - WordStatisticsAggregator combiner and reducer.