Apache Pig for Data Science

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Introduction

- I'm a Principal Architect at Hortonworks
- I work primarily doing Data Science in the Hadoop Ecosystem
- Prior to this, I've spent my time and had a lot of fun
  - Doing data mining on medical data at Explorys using the Hadoop ecosystem
  - Doing signal processing on seismic data at Ion Geophysical using MapReduce
  - Being a graduate student in the Math department at Texas A&M in algorithmic complexity theory
- I'm going to talk about Apache Pig's role for doing scalable data science.

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- Familiar relational primitives available
- Extensible via User Defined Functions and Loaders for customized data processing and formats

Apache Pig: An Familiar Example

```
SENTENCES= load '...' as (sentence:chararray);
WORDS = foreach SENTENCES
        generate flatten(TOKENIZE(sentence))
        as word;
WORD_GROUPS = group WORDS by word;
WORD_COUNTS = foreach WORD_GROUPS
              generate group as word, COUNT(WORDS);
store WORD_COUNTS into '...';
```

Understanding Data

"80% of the work in any data project is in cleaning the data."

— D.J. Patel in *Data Jujitsu*

Understanding Data

A core pre-requisite to analyzing data is understanding data's shape and distribution. This requires (among other things):

- Computing distribution statistics on data
- Sampling data

Understanding Data: Datafu

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- Unsupervised Learning
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  - Market Basket Analysis
- Supervised Learning
  - Classification
  - Regression
  - Recommendation

Building Machine Learning Models with Pig

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- Build one large model on all (or almost all) of the data
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Pig can assist in intelligently sampling down the large data into a training set. You can then use your favorite ML algorithm (which can be run on the JVM) to generate a machine learning model.

Applying Models with Pig

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- Write a UDF in Java or another JVM language which can apply the model to a data point
- Call the UDF from a pig script to distribute the application of the model across your data in parallel

What is Natural Language Processing?

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- Mature field with many useful libraries on the JVM
  - Apache OpenNLP
  - Stanford CoreNLP
  - MALLET

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- Sometimes high-volume, complex analysis
  - Search Engines
  - Social media content analysis
- Typically many small-data problems in parallel
  - Often requires only the context of a single document
  - Ideal for encapsulating as Pig UDFs

Natural Language Processing: Demo

- Stanford CoreNLP integrated the work of Richard Socher, et al [2] using recursive deep neural networks to predict sentiment of movie reviews.
- There is a large set of IMDB movie reviews used to analyze sentiment analysis [1].
- Let's look at how to encapsulate this into a Pig UDF and run on some movie review data.

Results

- Executing on a sample of size 1022 Positive and Negative documents.
- Overall Accuracy of 77.2%

		Actual		
		Positive	Negative	Total
Predicted	Positive	367	114	481
	Negative	119	422	541
	Total	486	536	1022

Questions

Thanks for your attention! Questions?

- Code & scripts for this talk available on my github presentation page.[2]
- Find me at http://caseystella.com
- Twitter handle: @casey_stella
- Email address: cstella@hortonworks.com

[2] http://github.com/cestella/presentations/

Bibliography

[1] Andrew L. Maas, Raymond E. Daly, Peter T. Pham, Dan Huang, Andrew Y. Ng, and Christopher Potts. Learning word vectors for sentiment analysis. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies*, pages 142–150, Portland, Oregon, USA, June 2011. Association for Computational Linguistics.

[2] Richard Socher, Alex Perelygin, Jean Wu, Jason Chuang, Christopher D. Manning, Andrew Y. Ng, and Christopher Potts. Recursive deep models for semantic compositionality over a sentiment treebank. In *Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing*, pages 1631–1642, Stroudsburg, PA, October 2013. Association for Computational Linguistics.