Data Curation

- Ingest
- Validate
- Transform
- Correct
- Consolidate (dedup)
- And visualize information to be integrated
Data Warehouse Roots

- Retail sector started integrating sales data into a data warehouse in the early 1990’s
- Average system was 2X budget and 2X late
- Because of data integration headaches
- However, warehouse paid for itself within 6 months with smarter buying decisions!

Issues

- sold $100K of widgets to IBM, Inc.
- sold 800K Euros of m-widgets to IBM, SA
- Translate currencies
- Is IBM, SA the same as IBM, Inc?
- Are m-widgets the same as widgets?

The Pile-On

- Essentially all enterprises followed suit and built warehouses of customer facing data
- Serviced by so-called Extract-Transform-and Load (ETL) tools
Architecture


Traditional Wisdom - ETL

- Human defines a global schema
- Assign a programmer to each data source to:
  - Understand it
  - Write local to global mapping (in a scripting language)
  - Write cleaning routine
  - Run the ETL
- Scales to (maybe) 25 data sources

Traditional ETL Methodology – Schema Mapping

Traditional ETL Methodology – Data Transformation


Current Situation

• Enterprises want to integrate more and more data sources
  - Miller beer example
  - Novartis example
  - Goby example (we will see this again)
• Traditional ETL won’t scale!!!!
• Point-projects in departments -- Staffed by a data scientist
  - Brand manager deciding marketing spend
  - Augmenting demographic customer data for department use
• Traditional ETL way too heavy-weight

The Rest of This Module

• Curation example
• Low end (individual data scientist) support
• Enterprise support
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Introduction

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Issues

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The Problem

Demo of Goby.com

In Summary

• Data is dirty!!!!!
• Sometimes not clear how to clean it
  – 2 restaurants at the same address: food court or one went out of business??
• Transformations may be a big problem

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New Ideas - 1

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Startups in This Space (probably a bunch more)

- Paxata
- Trifacta (commercial Data Wrangler)
- Cambridge Semantics
- Data Tamer
- ClearStory
- Attivio
**At Least Two Foci**

- Support for the individual data scientist
- Enterprise data integration

**Support for the Data Scientist**

- Wrangler video
  - [http://vis.stanford.edu/wrangler/](http://vis.stanford.edu/wrangler/)

**Summary**

- Expect more systems in this space
- At low prices
- Market will be gated by the availability of data scientists
  - Insurance example
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Data Tamer Goals

- Do the "long tail"
  - Better/cheaper/faster than the ad-hoc techniques being used currently
- By inverting the normal ETL architecture
  - Machine learning and statistics
  - Ask for human help only when automatic algorithms are unsure

Data Tamer Architecture

Data Tamer -- Ingest

- Assumes (for now) a data source is a collection of records, each a collection of (attribute-name, value) pairs.
- Loaded into Postgres
Data Tamer – Schema Integration

• Must be told whether there is a predefined partial or complete global schema or nothing

• Starts integrating data sources
  – Using synonyms, templates, and authoritative tables for help
  – 1st couple of sources require asking the crowd for answers
  – System gets better and better over time

Data Tamer – Schema Integration

• Inner loop is a collection of experts
  – T-test on the data
  – Cosine similarity on attribute names
  – Cosine similarity on the data

• Scores combined heuristically

• After modest training, get 90% of the matching attributes on Goby and Novartis automatically
  – Cuts human cost dramatically

Data Tamer – Crowd Sourcing

• Hierarchy of experts
• With specializations
• With algorithms to adjust the “expertness” of experts
• And a marketplace to perform load balancing
• Currently doing a large scale evaluation at Novartis
  – Late flash: it works!!!!
Schema Mapping Suggestions

Local

Global

Threshold

Schema Mapping Suggestions

Local

Global

Threshold

Schema Mapping Suggestions

Local

Global

Threshold

Schema Mapping Suggestions

Local

Global

Threshold
Schema Mapping Suggestions

Data Tamer – Entity Consolidation

- On tables defined by schema integration module
- Entity matching on all attributes, weighted by value presence and distribution
- Basically a data clustering problem
- With a first pass to try to identify "blocks" of records
  - Otherwise N ** 2 in the number of records
- Wildly better than Goby; a bit better than domain-specific Verisk module

Entity Clusters
Select a specific record

Entity identified:
Craft Farm (3519)

Record details

Green line: above threshold
Red line: below threshold

Data Tamer Future

- Text
- Relationships
- Hierarchical data (maybe)
- Adaptors
- Better algorithms
- User-defined operations
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New Ideas - 2
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The Way Forward

• Enterprises will want to integrate more and more data sources
  – This is the number one headache of most of them
  – Too expensive to do manually with a programmer

• Remains to be seen what fraction of the market can be aided by Data Tamer-style tools
  – Initial results are encouraging

Cleaning will be a big issue forever
  – How clean does your data need to be?

I imagine a big database of transformations
  – Pick the one that you need

Data scientists will have to familiar with this stuff
  – Not just stat and data management

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