Semi-Automatically Modeling Web APIs to Create Linked APIs

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**About: Downtown Los Angeles**

**Type:** yago:NeighborhoodsInLosAngeles,California

**About:**

Downtown Los Angeles is the central business district of Los Angeles, California, United States, located close to the geographic center of the metropolitan area. The area features many of the city's major arts institutions and sports facilities, sightseeing opportunities, a variety of skyscrapers and associated large multinational corporations and an array of public art and unique shopping opportunities. Downtown is the hub of the city’s freeway network and growing Metro rapid transit system.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>leader title</td>
<td>City Council, U.S. House, State Senate, State Assembly</td>
</tr>
<tr>
<td>population total</td>
<td>39537(xsd:integer)</td>
</tr>
<tr>
<td>area total (km²)</td>
<td>8.538, 13.73988692533248</td>
</tr>
<tr>
<td>foaf:homepage</td>
<td><a href="http://www.downtownla.com">http://www.downtownla.com</a></td>
</tr>
</tbody>
</table>

*Slide by Shubham Gupta*
Downtown Los Angeles is the central business district of Los Angeles, the county seat and the cultural and economic center of the metropolitan area. The area features many of the county's premier job-making opportunities, a variety of skyscrapers and associated large multi-use shopping opportunities. Downtown is the hub of the city's freeway system.

Current temperature: 73°F
Wind: 10 mph SW
Humidity: 51%
Dew Point: 54°

Live weather
<table>
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**Events**

- Transparent Cities: 5/1/2012 REDCAT Theater
- Saving Our Sons: A Community Conversation...
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**Live Twitter Feed**:
- Los Angeles becomes the largest U.S. city to ban plastic bags bit.ly/JAOPdX #LosAngeles #plasticbagban
- Plastic grocery bags will now be banned in #LosAngeles. What do you think of that concept for #Florida?
- “@HuffingtonPost: The nation's second largest city has just banned plastic bags in grocery stores” huff.to/Jygs5N” #LosAngeles #green
- #LosAngeles is now the largest U.S. city to ban plastic bags dlvr.it/1cX0bW

TwiUer Feed
Los Angeles becomes the largest U.S. city to ban plastic bags. Plastic grocery bags will now be banned in...
Downtown Los Angeles is the central business district of Los Angeles, California, United States, located close to the geographic center of the metropolitan area. The area features many of the city’s major arts institutions, opportunities, a variety of skyscrapers and associated large multinational corporate headquarters, and shopping opportunities. Downtown is the hub of the city’s freeway network and serves as the starting point for the major freeways leading to the San Gabriel Valley, Inland Empire, Central Valley, and the Imperial Valley.

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The Problem

- Web-service Invocation request
- JSON/XML
- RDF
- RDF/SPARQL Query

World Weather Online API

World Weather Online provides weather forecast and weather maps for worldwide city and towns. The Developer Weather API allows developers and programmers to access free 5-day weather forecasts in JSON and XML formats.

Web-service Invocation request: http://free.worldweatheronline.com/feed/... format=csv

RDF/SPARQL Query

JSON/XML

RDF

Slide by Shubham Gupta
Modeling APIs

• **Input**
  – Examples of the request URLs
  – Ontology

• **Output**
  – A semantic model of the API built interactively
Approach

- API Invocation
- Annotating Inputs and Outputs
- Extracting Relationships

Slide by Mohsen Taheriyan
Service Invocation

KARMA

Sample Request URLs

Invoking API

Inputs

Outputs

Slide by Mohsen Taheriyan
Annotating Inputs and Outputs

• Using Conditional Random Fields (CRF) to assign a **semantic type** to each column

• Semantic Types
  – Class
  – Data property and domain

• Example
  – OWL Class: **State**
    • [http://dbpedia.org/page/California](http://dbpedia.org/page/California)
  – OWL Data Property, Domain class: **State.name**
    • California
Weather Ontology
Extracting the Relationships

• Construct a graph from
  – Assigned Semantic Types
  – Ontology Graph

• Select minimal tree that connects all semantic types
  – A customized Steiner tree algorithm

• Steiner minimal tree (SMT)
  – $G = (V,E), S \subseteq V, c: E \rightarrow \mathbb{R}$ (S: Steiner Nodes)
  – Shortest network connecting vertices of $T$
  – Approximation Alg. [Kou & Markowsky, 1981]
    • $O(|V|^2|S|)$, Approximation Ratio: less than 2

Slide by Mohsen Taheriyan
Constructing Graph

- **Graph Initialization**
  - Add one node for each semantic type
  - For data property types, also add the domain (if not added before)
Constructing Graph

- Compute Nodes Closure
  - Object Property or hasSubClass relations
Constructing Graph

- Adding the Links
  - Put a link with $w=1$ from the domains to data property nodes
  - For every pair of class nodes like A and B:
    - Put a link with $w=1$ from A to B if there is a direct or inferred object property in the ontology
    - If B is a direct or inferred subclass of A, put a link with $w=1/\epsilon$ from A to B
Visualizing Model in Karma

Slide by Mohsen Taheriyan
Refinement – Change Semantic Types

Semantic types:
- temperature of TemperatureEvent
- humidity of WeatherObservation
- windSpeed of WindEvent
- dewPoint of TemperatureEvent

Mark as key for the class.
Refinement – Adjust the links

Click on State

Choose parent relationship:
- City in
- Organization hasLocation
- Person bornIn
- Point in
- SpatialThing hasSubClass
- SpatialThing in
- Station hasLocation
Final Model in Karma
Status

Web-service Invocation request → JSON/XML → Karma → RDF/SPARQL Query

Web-service Invocation request

JSON/XML

Karma

RDF

RDF/SPARQL Query

Recursos de aprendizaje de la ciencia de datos: un escenario de la web de datos

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Karma

Slide by Pedro Szekely
Generate Other Models?

Karma Model

MSM Model

LOS Model

LIDS Model
Challenge 1: Live Weather in DBPedia (For Every City)
Challenge 2: Scale-Up