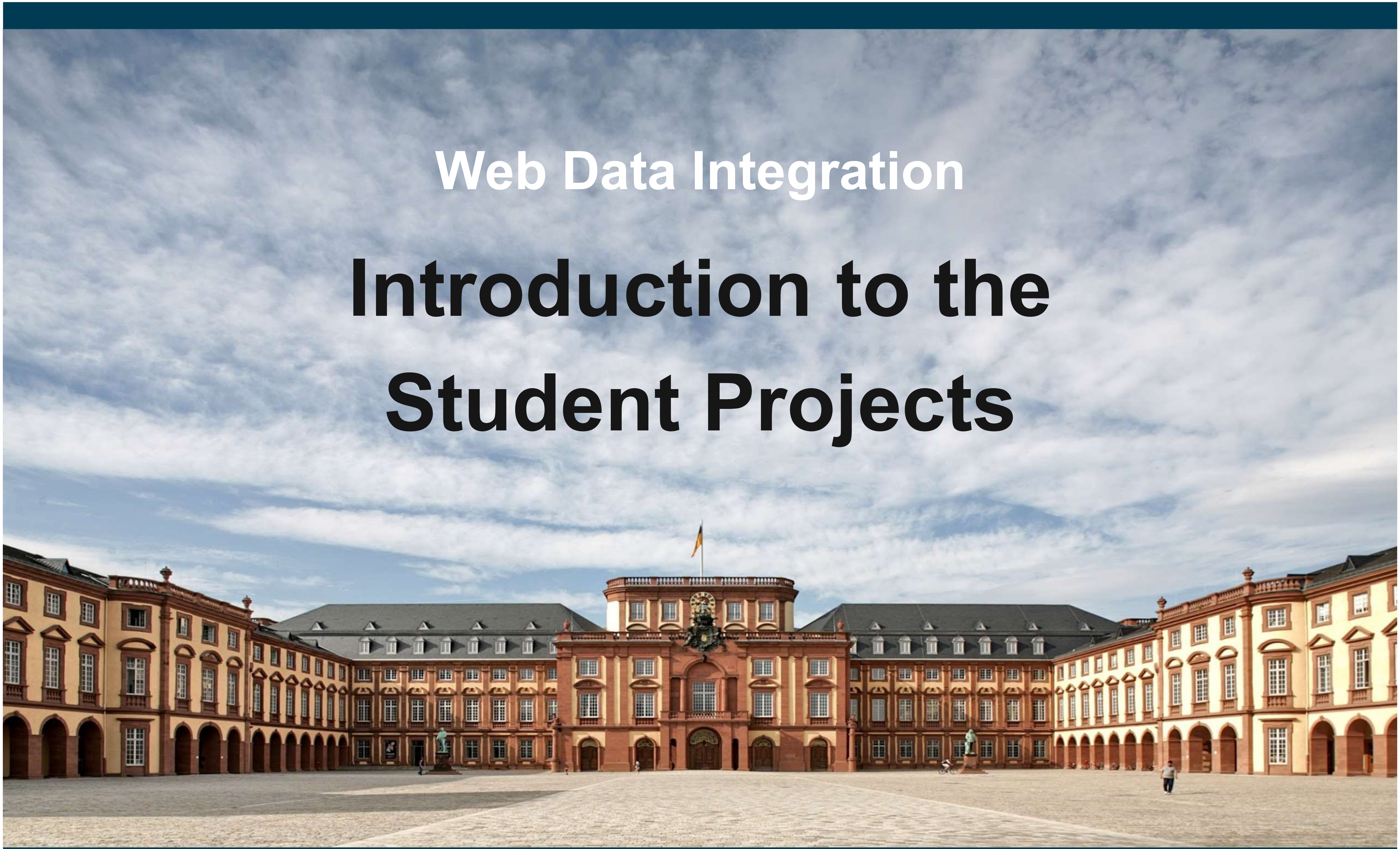


Web Data Integration

Introduction to the Student Projects

Agenda

1. Overview
   - Phase I: Data Collection and Data Translation
   - Phase II: Identity Resolution
   - Phase III: Data Fusion
2. Details about Phase I: Data Collection and Data Translation
   - Requirements
   - Examples
   - Data Sources
3. Group Formation
4. Start of Group Work

Overview Student Projects

- Phase I: Data Collection and Data Translation

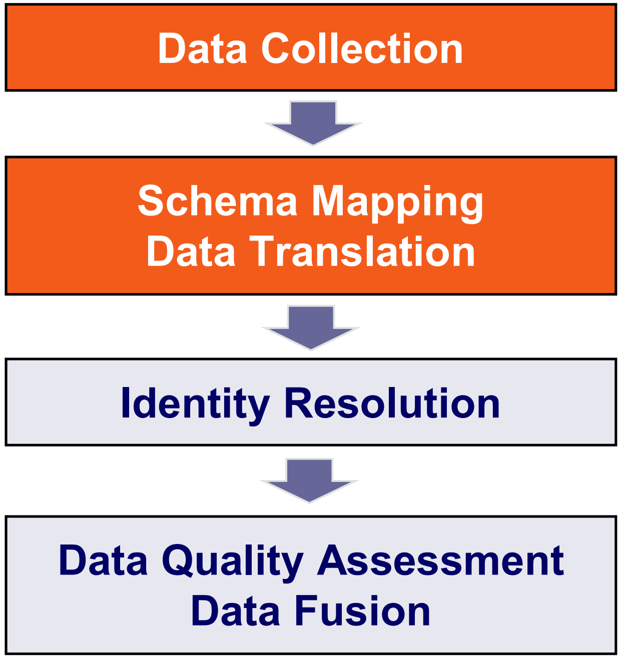
Duration: now till October 16th

Tasks:

1. Find a partner (groups of five)
2. Decide on a use case
3. Collect data from the Web
4. Profile your data and write outline about profile
5. Generate integrated schema (target schema)
6. Convert all your data into the integrated schema using MapForce

Result: All data is represented using a single unified schema

- one XML file per data source



Data Collection

Schema Mapping
Data Translation

Identity Resolution

Data Quality Assessment
Data Fusion

Overview Student Projects

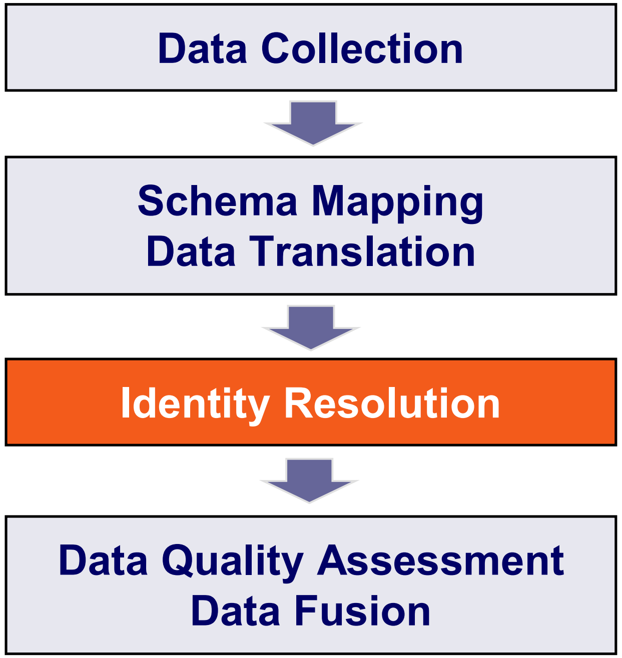
- Phase II: Identity Resolution

  Duration: October 16th – November 13th

  Tasks: Extend Java project template to

  1. Identify records in different data sets that describe the same entity
  2. Experiment with different combinations of similarity measures
  3. Use blocking to speed up the comparisons
  4. Evaluate quality of your approach

  Result: Correspondences between records in different data sets that describe the same entity



Overview Student Projects

- Phase III: Data Fusion

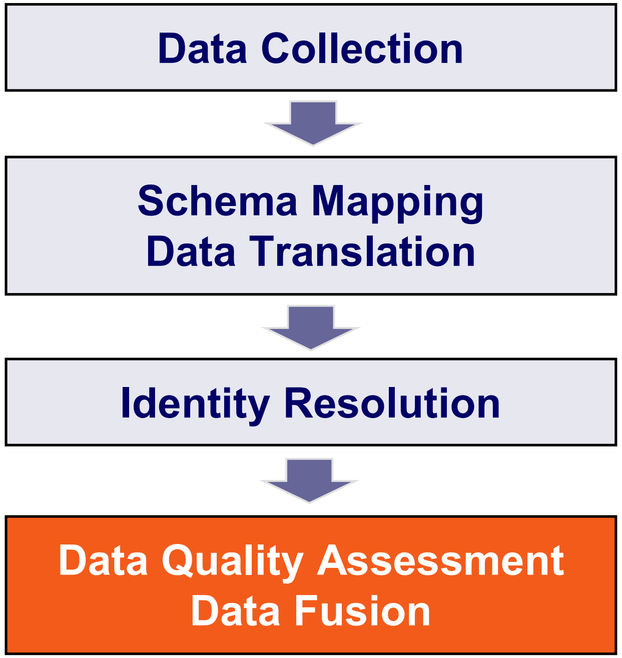
Duration: November 14th – November 28th

Tasks: Extend Java project template to

1. Merge data and resolve data conflicts
2. Experiment with different conflict resolution strategies
3. Measure the quality and completeness of the final fused data set

Results:

1. Fused data set in which each real-world entity is described by only a single record and these records contain no data conflicts
2. Project report (12 pages) summarizing the results of the phases 1-3



Overview Student Projects

- Final Presentations
  - Dates: December 4th and December 5th
  - Overview of your use case
  - Explain your data
  - Explain the strategies that you used in each step
  - Discuss the quality of your solution of each step

Grading of the Projects (IE683, 3 ECTS)

Individual contribution to:

70%: Project work

- quality of your solution
- systematic experimentation with different alternatives
- systematic evaluation of experiments
- quality of written report

30%: Final presentation

- structure
- slides
- discussion

Please submit table on who did what together with the report.

Coaching Sessions

- Ralph and Alex will give you tips and answer questions concerning your project.
- Registration via email to Ralph and Alex is mandatory!
  - until Monday night (min. 2 days before the coaching session)!
  - including the questions that you like to discuss
- Ralph and Alex will assign you a time slot for the Wednesdays/Thursdays coaching session and inform you about the slot via email.

Schedule

Week	Wednesday	Thursday
04.09.2024	**Lecture:** Introduction to Web Data Integration	- no lecture -
11.09.2024	**Lecture:** Structured Data on the Web	**Lecture:** Data Exchange Formats
18.09.2024	**Lecture:** Data Exchange Formats	**Lecture:** Schema Mapping
25.09.2024	**Lecture:** Schema Mapping	**Project:** Introduction to Student Projects
02.10.2024	**Exercise:** Introduction to MapForce	**Coaching:** Schema Mapping
09.10.2024	**Project:** Feedback about Project Outlines	**Lecture:** Identity Resolution
16.10.2024	**Lecture:** Identity Resolution	**Exercise:** Identity Resolution
23.10.2024	**Project Work:** Identity Resolution	**Coaching:** Identity Resolution
30.10.2024	**Project Work:** Identity Resolution	**Coaching:** Identity Resolution
06.11.2024	**Lecture**: Data Quality and Data Fusion	**Lecture:** Data Quality and Data Fusion
13.11.2024	**Exercise:** Data Quality and Data Fusion	**Project Work:** Data Quality and Data Fusion
20.11.2024	**Project Work:** Data Quality and Fusion	**Coaching:** Data Quality and Fusion
27.11.2024	**Project Work:** Data Quality and Fusion	**Coaching:** Data Quality and Fusion
04.12.2024	**Presentation of Project Results**	**Presentation of Project Results**
12.12.2024	Final Exam	

Administrative Requirement – Exam Registration

- To receive a grade for your project, you must register for the IE683 “exam” through Portal2 (different exam as IE670).
- The registration period is from the 23rd of October to the 6th of November.

Details about Phase I: Data Collection and Data Translation

- Duration: now – October 18th
- Today
  1. Form teams of five people
  2. Decide on a domain/use case
  3. Start data collection and profiling

- Until Sunday, October 6th, 23:59
  - Send a 4 page abstract on your project (details next slide)
- Wednesday, October 9th,15:30-17:00
  - You get feedback on your abstract (if necessary)
- Wednesday, October 2nd, 15:30-17:00
  1. Introduction to **MapForce**
  2. Start using MapForce to translate data to target schema

Project Requirements

You should integrate:

1. 3 different data sets
2. at least 2,500 entities described in total (in joint dataset)
   - but more are better, good: >10,000 but <100,000
3. at least 1,000 entities should be contained in at least two datasets
   - please estimate based on small sample
4. at least 8 attributes in joint dataset
   - entities should be identifiable by attribute combinations of at least two attributes, e.g. name+birthdate, ID attributes do not count, but are good supervision
5. at least 5 attributes should be contained in at least two datasets
   - some attributes (other than name) should be contained in three datasets (for fusion by voting)
6. ideally, at least one of your attributes is a list attribute
   - actors of a movie, directors of a company, songs on a CD

Project Abstracts

- Purpose of project abstract
  - check whether your ideas are feasible
  - proof that you fulfill the requirements (last slide)
- Content
  1. Brief description of use case
  2. Explanation how the datasets fulfill the requirements
     1. Schema and basic profile of each dataset
        - number of records per class
        - attributes with high percentage of missing values
     2. Integrated schema and overlap with input schemata
     3. Explanation why enough entities are likely contained in multiple datasets
- Submit via email to
  Ralph Peeters, Alexander Brinkmann and Christian Bizer
- Deadline: Sunday, October 6th, 23:59

Tables that MUST be used in Project Abstracts

1. Schema and Basic Profile of each Data Set

Table 1. Datasets

Dataset	Source(*)	Format	# of entities	# of attributes	List of attributes (**)
IMDB	Download URL	csv	17,000	10	title, director (MV), year,…
DBpedia	Dbpedia.org/sparql	xml	23,500	8	name, birthDate, activeYears,..
Freebase	Download URL	csv	11,000	14	first name, surname, spouse,...

(*) Should explain where from and how you got the data
(**) Mark attributes with >30% missing values (MV)

2. Integrated Schema and Overlap with Input Schemata

Table 2. Attribute Intersection with Integrated Schema

Attribute name	Attribute type	Datasets in which the attribute is found
name	string	dataset1, dataset2, dataset3,.dataset4 (use proper dataset names)
director	string/list	dataset1, dataset3
year	date	dataset2, dataset3, dataset4
…		…

Requirements for the Final Project Report

- 12 pages (sharp!) – counted without title page, table of content, literature list
  - Every extra page (including appendix pages) will reduce your mark by 0.33
- Due to Sunday, 1st December 2024, 23:59
  - Send by email to **Chris, Ralph and Alex**
- You must use latex template of Springer CS Proceedings
  - http://www.springer.com/de/it-informatik/lncs/conference-proceedings-guidelines
- Also submit
  - your code and
  - (a subset) of your data
  - the who did what table
- Please cite sources properly if you use any
  - Preferred citation style [Author, year]

Possible Use Cases for Student Projects

- Movies
  - budget, actors, directors, oscar nominations...
- Companies
  - performance, sector, key persons, Panama papers data
- Musicians
  - first name, last name, birth date, birth place, bands, albums …
- Songs
  - title, album, artist, releases, producer, composer…
- Books (most boring!)
  - title, author(s), number of pages, language, publisher, translator, …

Example Use Case 1: Movies

- Individual Data Sets contain
  - Movies
  - Actors
  - Directors
  - Oscar Nominations & Wins
  - Golden Globe Nominations & Wins

- Integrated dataset will contain
  1. Movies with release date, budget,... and awards nominated/won
  2. lists of actors and directors per movie

Example Use Case 1: Movies

- Lists of Oscar/Golden Globe nominees and winners
  - http://aggdata.com/awards/oscar
  - http://aggdata.com/awards/golden_globes
  - http://www.amstat.org/publications/jse/datasets/oscars.dat.txt
- List of The Guardian greatest films (by Genre)
  - http://www.guardian.co.uk/news/datablog/2010/oct/16/greatest-films-of-all-time
- A large movie list
  - https://github.com/vlandham/vlandham.github.com/blob/master/vis/movie/data/movies_all.csv

Example Use Case 1: Movies

- Movie data from DBpedia
- Issue a SPARQL query against http://dbpedia.org/sparql
- Result can be stored as CSV, JSON, XML, …

```
SELECT ?title ?budget ?gross ?director
WHERE {     ?x a dbo:Film .
                 ?x dbo:budget ?budget .
                 ?x dbo:gross ?gross .
           ?x dbo:director ?d .
                 ?d foaf:name ?director .
                 ?x rdfs:label ?title .
           FILTER(LANG(?title)="en")
       }
```

Example Use Case 2: Companies

- Goal: Combine multiple datasets into a single dataset having the following attributes:
  - company name
  - website
  - founding date
  - headquarters country (regional branch vs. company)
  - headquarters city
  - industry (single taxonomy)
  - Assets (normalized)
  - revenue (normalized)
  - founders (list)

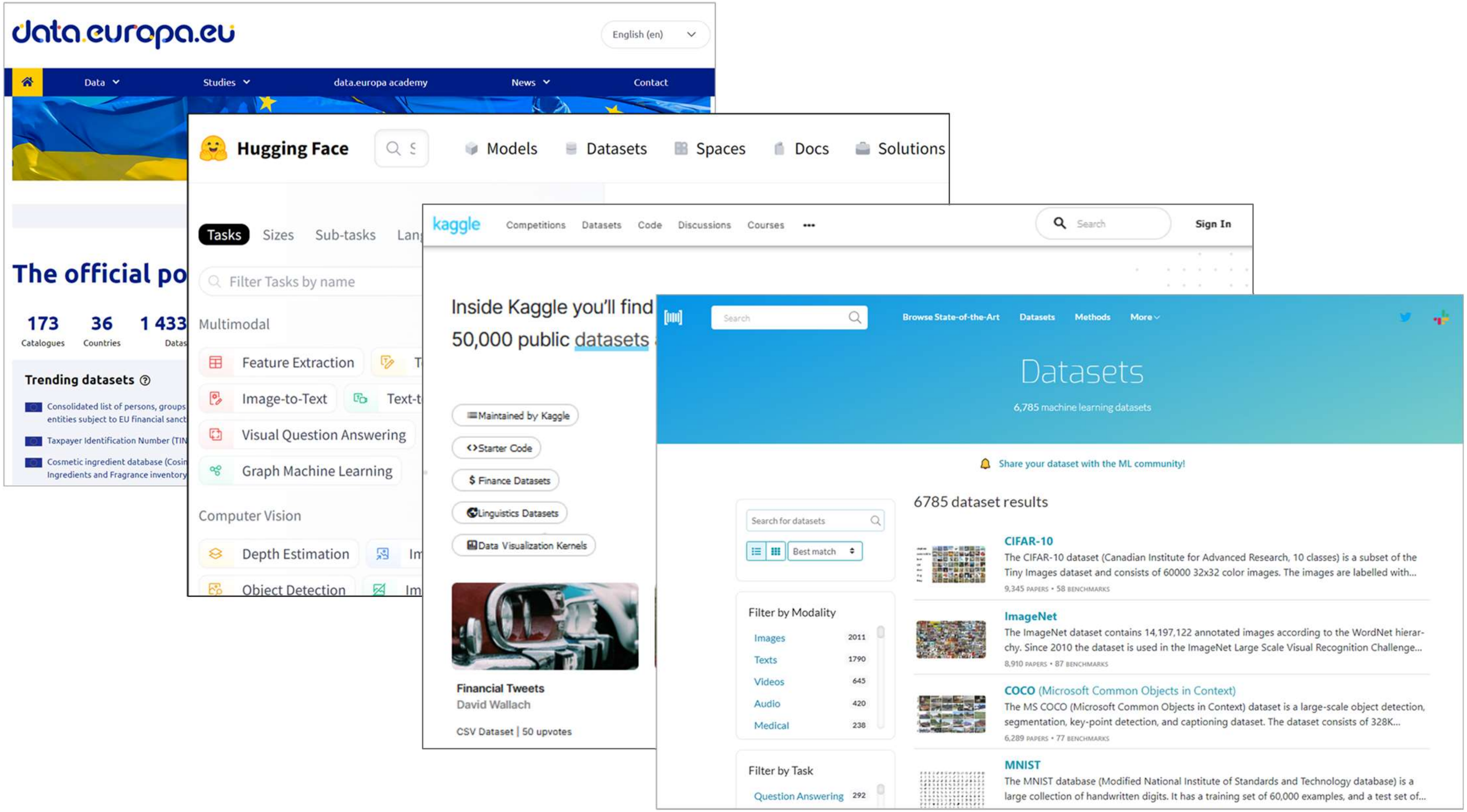
Sources of Data about Companies

- Forbes data set with top 2000 companies worldwide
  - https://www.kaggle.com/ash316/forbes-top-2000-companies
- Open Data 500 Companies data set with 500 US located companies
  - https://www.kaggle.com/govlab/open-data-500-companies
- Kaggle data set with 7.1M companies
  - https://www.kaggle.com/kaleab1/companies
- Companies data from DBpedia

```
SELECT ?name ?ind_label ?equity ?income
WHERE {  ?x a dbo:Company .
                          ?x rdfs:label ?name .
                          ?x dbo:industry ?industry .
                          ?industry rdfs:label ?ind_label .
                          ?x dbo:equity ?equity .
                 ?x dbo:netIncome ?income .
                                          FILTER(LANG(?name)="en“
                                          && LANG(? ind_label)="en")
          }
```

Where do I find Data for my Project?

- Data Portals



data.europa.eu

English (en)

Data | Studies | data.europa academy | News | Contact

The official po

173 Catalogues | 36 Countries | 1 433 Datas

Trending datasets

- Consolidated list of persons, groups entities subject to EU financial sanct
- Taxpayer Identification Number (TIN
- Cosmetic ingredient database (Cosin Ingredients and Fragrance inventory

Hugging Face

Models | Datasets | Spaces | Docs | Solutions

Tasks | Sizes | Sub-tasks | Lan

Filter Tasks by name

Multimodal

Feature Extraction | T

Image-to-Text | Text-t

Visual Question Answering

Graph Machine Learning

Computer Vision

Depth Estimation | Im

Object Detection | Im

kaggle

Competitions | Datasets | Code | Discussions | Courses | •••

Search | Sign In

Inside Kaggle you'll find

50,000 public datasets

Maintained by Kaggle

Starter Code

$ Finance Datasets

Linguistics Datasets

Data Visualization Kernels

Financial Tweets

David Wallach

CSV Dataset | 50 upvotes

Search | Browse State-of-the-Art | Datasets | Methods | More

Datasets

6,785 machine learning datasets

Share your dataset with the ML community!

Search for datasets

Best match

6785 dataset results

Filter by Modality

Images	2011
Texts	1790
Videos	645
Audio	420
Medical	238

Filter by Task

Question Answering	292

CIFAR-10

The CIFAR-10 dataset (Canadian Institute for Advanced Research, 10 classes) is a subset of the Tiny Images dataset and consists of 60000 32x32 color images. The images are labelled with...

9,345 PAPERS • 58 BENCHMARKS

ImageNet

The ImageNet dataset contains 14,197,122 annotated images according to the WordNet hierarchy. Since 2010 the dataset is used in the ImageNet Large Scale Visual Recognition Challenge...

8,910 PAPERS • 87 BENCHMARKS

COCO (Microsoft Common Objects in Context)

The MS COCO (Microsoft Common Objects in Context) dataset is a large-scale object detection, segmentation, key-point detection, and captioning dataset. The dataset consists of 328K...

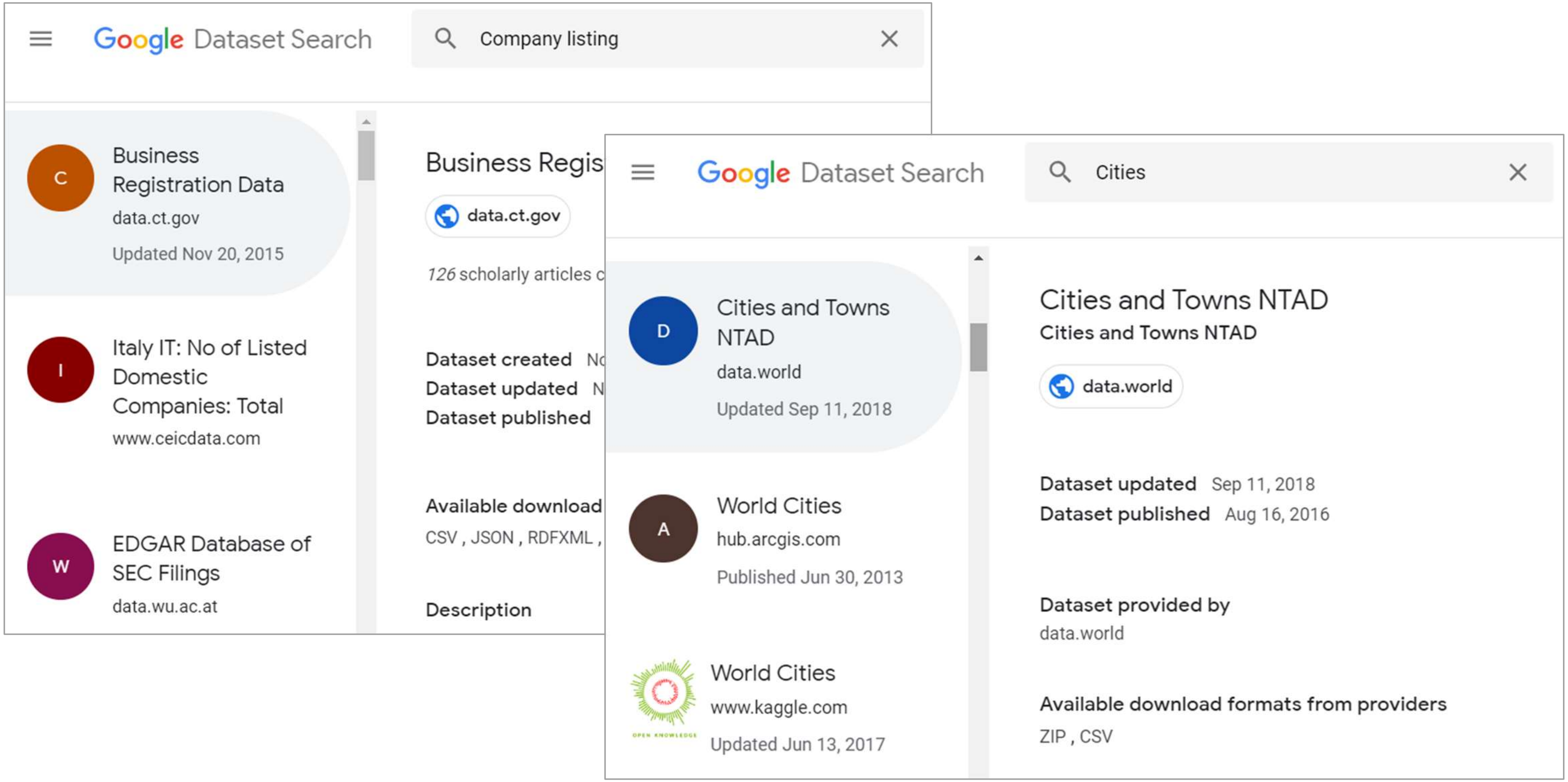
6,289 PAPERS • 77 BENCHMARKS

MNIST

The MNIST database (Modified National Institute of Standards and Technology database) is a large collection of handwritten digits. It has a training set of 60,000 examples, and a test set of...

Where do I find Data for my Project?

- Google Dataset Search
  - https://toolbox.google.com/datasetsearch



Google Dataset Search

Company listing

C Business Registration Data
data.ct.gov
Updated Nov 20, 2015

I Italy IT: No of Listed Domestic Companies: Total
www.ceicdata.com

W EDGAR Database of SEC Filings
data.wu.ac.at

Business Regis

data.ct.gov

126 scholarly articles c

Dataset created No
Dataset updated N
Dataset published

Available download
CSV , JSON , RDFXML ,

Description

Google Dataset Search

Cities

D Cities and Towns NTAD
data.world
Updated Sep 11, 2018

A World Cities
hub.arcgis.com
Published Jun 30, 2013

World Cities
www.kaggle.com
Updated Jun 13, 2017

Cities and Towns NTAD

Cities and Towns NTAD

data.world

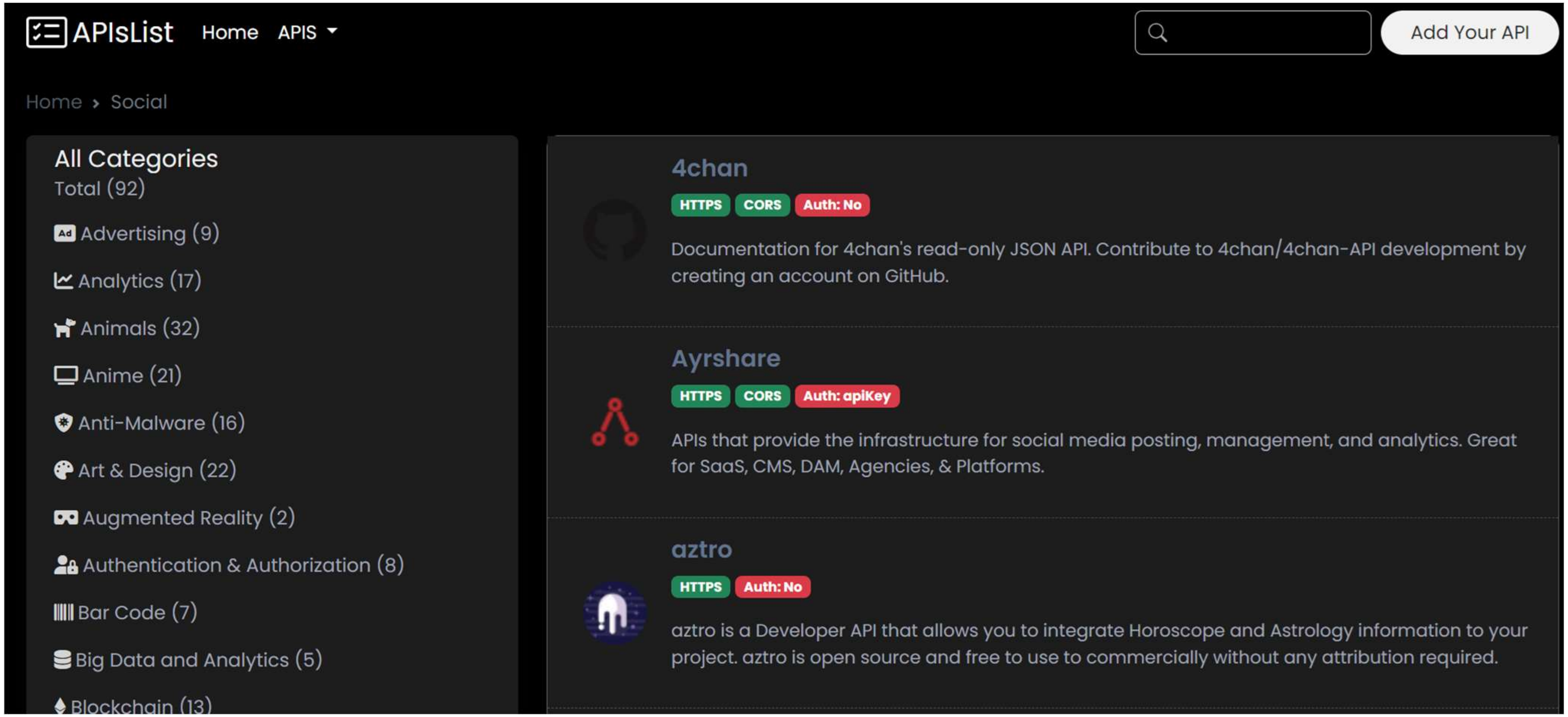
Dataset updated Sep 11, 2018
Dataset published Aug 16, 2016

Dataset provided by
data.world

Available download formats from providers
ZIP , CSV

Where do I find Data for my Project?

- Web APIs
  - e.g., apislist.com – lists many public APIs
  - requires some additional effort (using the API and getting the data)
  - hotels, restaurants, real-estate



All Categories
Total (92)

- Advertising (9)
- Analytics (17)
- Animals (32)
- Anime (21)
- Anti-Malware (16)
- Art & Design (22)
- Augmented Reality (2)
- Authentication & Authorization (8)
- Bar Code (7)
- Big Data and Analytics (5)
- Blockchain (13)

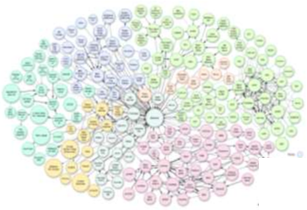
4chan
HTTPS CORS Auth: No
Documentation for 4chan's read-only JSON API. Contribute to 4chan/4chan-API development by creating an account on GitHub.

Ayrshare
HTTPS CORS Auth: apiKey
APIs that provide the infrastructure for social media posting, management, and analytics. Great for SaaS, CMS, DAM, Agencies, & Platforms.

aztro
HTTPS Auth: No
aztro is a Developer API that allows you to integrate Horoscope and Astrology information to your project. aztro is open source and free to use to commercially without any attribution required.

Where do I find Data for my Project?

- DBpedia, Wikidata and other Linked Data sources
- Look at a single resource
  - http://dbpedia.org/resource/2001:_A_Space_Odyssey_%28film%29



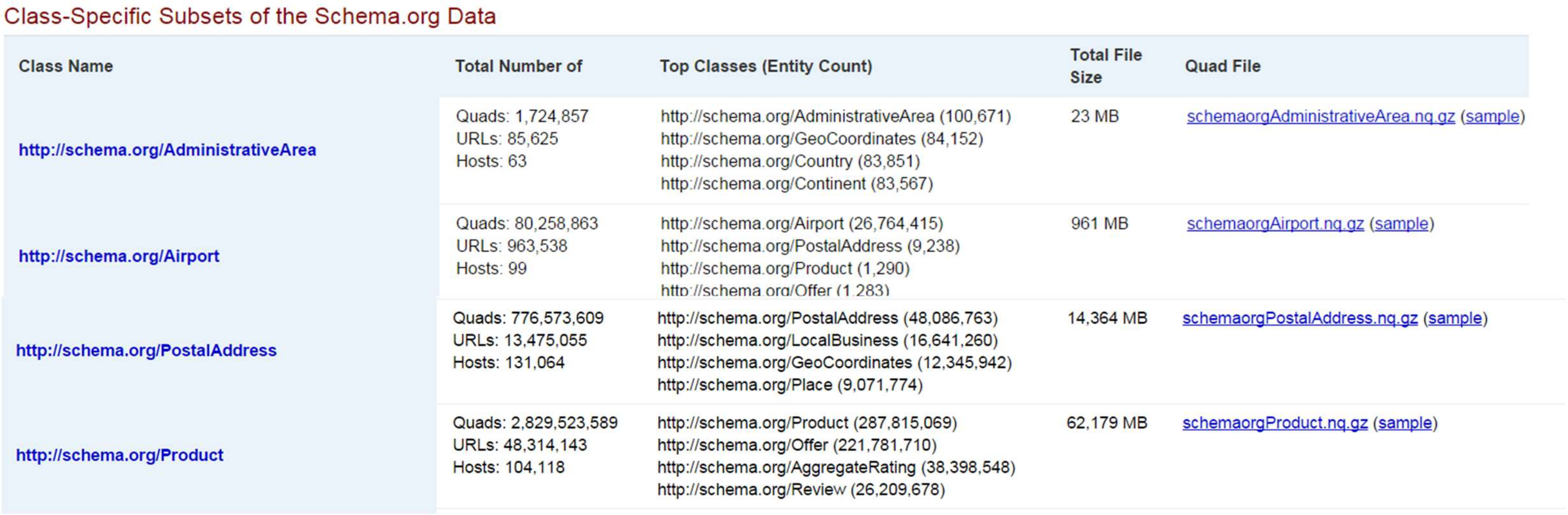
- Look which properties are there (preferable dbpedia-owl)
- Construct a SPARQL query
- Go to http://dbpedia.org/sparql and get the data
- Hint: use OPTIONAL for properties that are not present for all entities:

```
SELECT ?title ?budget ?gross ?director
WHERE {     ?x a dbo:Film .
            OPTIONAL {?x dbo:gross ?gross . }
            ...
```

There are 87,000 Films in DBpedia, but only 9,000 with gross

Where do I find Data for my Project?

- Schema.org data that has been crawled from multiple web sites.
  - Product, local business, hotel, job posting, ….
  - http://www.webdatacommons.org/structureddata/
- Data per Website as JSON-Tables
  - http://webdatacommons.org/structureddata/schemaorgtables/



Class-Specific Subsets of the Schema.org Data

Class Name	Total Number of	Top Classes (Entity Count)	Total File Size	Quad File
http://schema.org/AdministrativeArea	Quads: 1,724,857 URLs: 85,625 Hosts: 63	http://schema.org/AdministrativeArea (100,671) http://schema.org/GeoCoordinates (84,152) http://schema.org/Country (83,851) http://schema.org/Continent (83,567)	23 MB	schemaorgAdministrativeArea.nq.gz (sample)
http://schema.org/Airport	Quads: 80,258,863 URLs: 963,538 Hosts: 99	http://schema.org/Airport (26,764,415) http://schema.org/PostalAddress (9,238) http://schema.org/Product (1,290) http://schema.org/Offer (1,283)	961 MB	schemaorgAirport.nq.gz (sample)
http://schema.org/PostalAddress	Quads: 776,573,609 URLs: 13,475,055 Hosts: 131,064	http://schema.org/PostalAddress (48,086,763) http://schema.org/LocalBusiness (16,641,260) http://schema.org/GeoCoordinates (12,345,942) http://schema.org/Place (9,071,774)	14,364 MB	schemaorgPostalAddress.nq.gz (sample)
http://schema.org/Product	Quads: 2,829,523,589 URLs: 48,314,143 Hosts: 104,118	http://schema.org/Product (287,815,069) http://schema.org/Offer (221,781,710) http://schema.org/AggregateRating (38,398,548) http://schema.org/Review (26,209,678)	62,179 MB	schemaorgProduct.nq.gz (sample)

Creating an Integrated Schema

1. Have a look at your input data
   - Which entities exist? What attributes do they have?
2. Check input data against project requirements (see Slide 12)
   - Create the tables for the project abstract (see Slide 14)
3. Apply schema integration method from lecture
   - Rules of Thumb or Spaccapietra, et al.

Creating an Integrated Schema

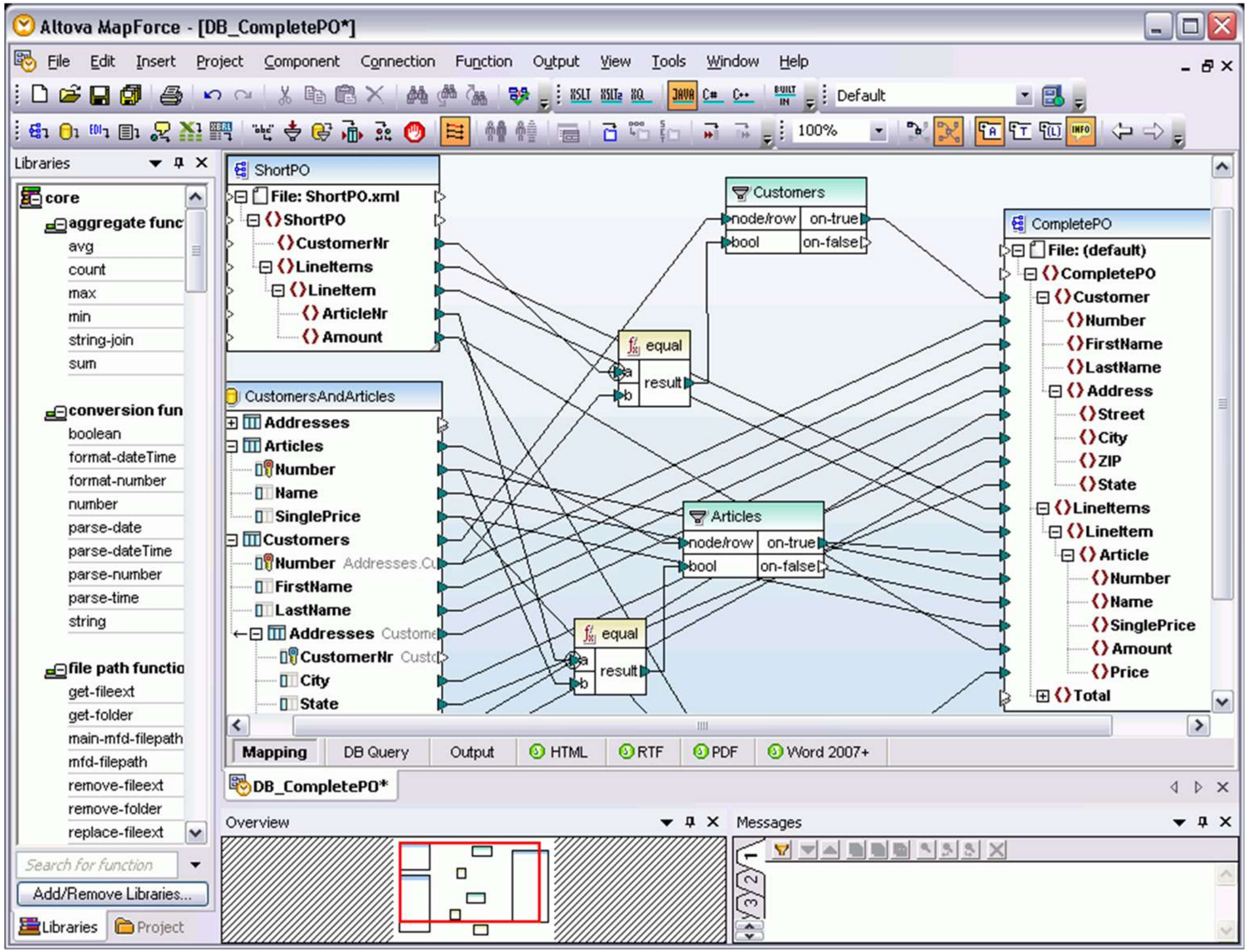
Hint: Create an example XML file

- using the integrated schema
- for some data from each input source
- in order to check if integrated schema can represent input data.

```
<movies>
     <movie>
       <title>2001</title>
       <director>
       <firstname>Stanley</firstname>
       <lastname>Kubrick</lastname>
       ...
   </director>
 </movie>
 ...
</movies>
```

Outlook: Exercise Next Wednesday

1. Introduction to MapForce by Alex and Ralph
2. Start translating your data into the unifying schema using MapForce



...and now

1. Team formation
   a. Students with team:
      ➔ Put your name in the list
   b. Students without team
      ➔ Let us know and we will assign you

   Are there any open issues?

   Are there any questions?

2. Agree on use case
3. Start collecting data