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Peetz, M.H.; Meij, E.J.; de Rijke, M.

Published in:
SIGIR 2012 Workshop on Time-aware Information Access: #TAIA2012. Accepted papers

Citation for published version (APA):

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OpenGeist: Insight in the Stream of Page Views on Wikipedia

Maria-Hendrike Peetz
ISLA, University of Amsterdam
M.H.Peetz@uva.nl

Edgar Meij
ISLA, University of Amsterdam
edgar.meij@uva.nl

Maarten de Rijke
ISLA, University of Amsterdam
derijke@uva.nl

ABSTRACT
We present a RESTful interface that captures insights into the zeitgeist of Wikipedia users. The system is an interface for clustering and comparing concepts based on the time series of the number of views of their Wikipedia page. The functionality is motivated by three use cases, ranging from technical novices to expert users and we also provide two real-life example applications.

Categories and Subject Descriptors
H.3 [Information Storage and Retrieval]: H.3.4 Systems and Software; H.3.5 Online Information Services

General Terms
API, Time Series Analysis, Wikipedia

1. INTRODUCTION
In recent years many so-called zeitgeist applications have been launched. Such applications are used to gain insights into the current gist of society and actual affairs. Several news sources run zeitgeist applications for popular and trending news. In addition, there are zeitgeist applications that report on trending publications such as LibraryThing and trending topics, such as Google Zeitgeist. In web dynamics, users’ visitation and search patterns were modeled [1, 6].

Most zeitgeist tools are based on proprietary data and it is therefore often impossible to see beyond the limited amount of information shown by the tools. For many scenarios, though, it would be useful to be able to gain insights in people’s interests. Three examples of time-aware information access scenarios in which such a need arises naturally are described below.

Data mining expert. A data mining expert wants to do experiments based on the popularity of Wikipedia concepts over time.

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He is a financial analyst and would like to know if there are correlations between stock market rates and the general interest for a company. As a financial analyst, he has his own time series analysis tools for financial data, but misses temporal data that captures “general interest” and needs access to the raw data of a few (<20) Wikipedia concepts, including the company and its products.

Brand analyst. A brand expert would like to analyze the current interest, i.e., zeitgeist, regarding her brand. She is interested in her own brand, but also other brands, related to hers. But what does related mean? For her, this means brands that share trends, bursts, and recurring events. She would like to have the results presented visually, in a graph, but also be able to create her own statistics based on machine readable results.

Wikipedia moderator. Wikipedia has moderators, responsible for the evaluation and monitoring of a certain set of articles. They are interested in how many times an article is viewed, in order to distribute valuable and sparse volunteer work to articles of interest. The moderator asks if a certain article receives more interest than it used to. He is interested if one article in a collection of articles (a category) experiences sudden interest, or cluster articles with similar trends of interests into groups. He is not interested in the full set of page view counts per concept, but a subset of similar concepts. He is not interested in raw data, but a bird’s eye view that reveals trends.

There is an interesting open data source from which a stream of people’s changing interests can be observed across a very broad spectrum of areas: the Wikimedia access logs. The logs contain the number of requests made to any Wikimedia domain, sorted by subdomain and aggregated on an hourly basis. Since they are a log of the actual requests, they are noisy and can also contain non-existing web pages. They are also quite large, yielding 60 GB worth of compressed textual data per month. Currently, we update the data on a daily basis and filter the raw source data by matching the URLs of all English Wikipedia articles and their redirects.

In the remainder of this paper we describe an API that facilitates easy access to the access logs. The API works as an interface for three types of user, the data mining expert, a brand analyst, and a Wikipedia moderator, as described above. From these use cases we have identified the following requirements our system should have:

- The user must have access to the raw time series data for a concept.
- The user must be able to find the N most temporally similar concepts.
- The user must be able to group concepts and their data, based

1. For example, the The Japan Times runs a feature titled “The Zeit Gist” every Tuesday, which covers community issues particularly relevant to the foreign community within Japan.
To avoid cycles, we say that a concept is only a member of its
category, whereas a concept can be a member of a (different) category
where a concept can be a member of a category. A category itself
is a uniform resource identifier, but is different from the URI
id of the API. The API is safe, as we provide only GET methods. The
aggregations of the data.

In the remainder of this paper, we describe a REST interface that
describes a client that can retrieve the Wikipedia access logs data
for a specified time period. In Section 1, we give the motivation and
describe the basic retrieval of time series, and in Section 2.2 how
to get general collection statistics. Section 2.3 describes how data
can be grouped.

2. API

In this section we describe an API for a RESTful webservice which
provides a client that can retrieve the Wikipedia access logs data
for a specified time period. In Section 2.2, we describe the
example applications and we end with a concluding section.

2.1 Raw series

For people with expert knowledge the raw data is desirable. The
user needs to be able to directly access the interface and retrieve
page views per day directly without filtering. For example, the
customer would like to get the time series for the company BMW, but
the call of the API would be:

http://opengeist.org/20110101/20111231/concept/BMW

The result is the raw data in json format:

{ 'id':'BMW',
  'timeseries': {'2011-01-01':12,...,'2011-12-31': 20}}...

This object contains the id and a time series object. This interaction
is similar to the interface provided by http://stats.grok.se/.

Following the earlier mentioned design principles, the request
http://opengeist.org/20110101/20111231/concept/BMW/raw.png
returns the time series as a png, and the request
http://opengeist.org/20110101/20111231/category
/German_brands/raw
returns all concept objects with time series of the concepts in the
category of German brands:

{'category':"German_brands",
 'concepts':
  {'id':"BMW",
   'timeseries': ['2011-01-01':12,...,'2011-12-31': 20]...}
}

The visual representation is a comparative plot of the page views
per day.

2.2 Statistics

The brand analyst is preparing a report for the public relations
team of BMW. In order to report the knowledge and interest of
users concerning the brand, she requests

http://opengeist.org/20110101/20111231/concept/BMW/statistics

which will return a json file with the mean, standard deviation,
maximum, and minimum of the page views.

Similarly, the Wikipedia moderator, trying to assess the impor-
tance of his work, requests the statistics for a category with

http://opengeist.org/20110101/20111231/category
/German_Brands/statistics

This returns the aggregated statistics of all concepts in the category
as well as a statistics object for each concept.

The global collection statistics can be accessed with

http://opengeist.org/20110101/20111231/statistics

This shows numbers of pages, categories and overall views per day.
2.3 Grouping

The brand analyst needs to compare time series of concepts. For that, we provide an interface that allows the user to select the most similar concepts, but also cluster similar concepts and return typical concepts (prototypes) of the cluster.

An example request that returns similar concepts is


Here, trends is the filter (see below) and the request returns the three concepts with the most similar time series:

```json
{
  "id":"BMW",
  "timeseries": {'2011-01':80, ... , '2011-12': 20},
  "timeseries_filtered": {'2011-01':60, ... , '2011-12': 15},
  "similar_concepts": [
  { 'id':'Racing_Bart_Mampaey',
    "timeseries": {'2011-01':40, ... , '2011-12': 30},
    "timeseries_filtered": {'2011-01':60, ... , '2011-12': 36},
    "distance" = 34.49 },
  { 'id':'History_of_BMW_motorcycles', ... }... ]
}
```

using the canberra distance metric [4].

The filter indicates in which respect the time series are similar: it preprocesses the time series and extracts information relevant for the specific task. It can request a moving average filter using either trends or moving_average, it can request significantly different viewing patterns using burst, or it can request regular patterns with either recurring or fourier. Using the filter trends or moving_average applies a moving average linear filter, with a window size of 10. It eliminates regular patterns (e.g. more views on weekends) and keeps track of a general trend of the distribution. The filter burst sets all days with page view counts bigger than two standard deviations of the mean with two, proceeds similarly for one standard deviation, and sets the rest to zero. This identifies months with a high number of accesses, and disrespects trends and regular patterns. The filter recurring and fourier is the superposition of the dominant fourier curves of the time series. This filter emphasizes regular events and patterns in the views of Wikipedia pages. The visual representation will be a graph overlaying the topN (here three) similar curves. Figure 2 is the result of the call:


where the similarity is calculated based on the burst filter and the visual representation are the burst-filtered time series.

2.3.1 Clustering of concepts

For the brand analyst, the most similar brands are interesting to be compared with either direct competitors or related brands. Clustering concepts similar to a concept into groups allows the analyst to identify sources of temporal similarity.

A request for concept clusters with similar time series for the brand BMW is


The system returns the four prototypes of the cluster, the cluster assignments and statistics:

```json
{
  "id":"BMW",
  "timeseries":
  [ '2011-01-01':12, ... , '2011-12-31': 20],
  "timeseries_filtered":
  [ '2011-01-01':1, ... , '2011-06-30': 2],
  "clusters":
  [ { "id": 1, 
    "prototype":
    [ '2011-01-01':0, ... , '2011-06-30': 2],
    "distance": 30
```
The number of page views for an entity are an indicator of its fame and general public interest. But what drives a sudden interest for an entity? With our technology, one can easily build a reputation management system that monitors different aspects of an entity and links them to a textually richer reflection of public interest: Twitter. The reputation management system is a dashboard with a monitoring, an alerting, and an informing component. The monitoring component shows page views of pages related to the entity in question: as can be seen for the example BMW, there is more than one Wikipedia page related to BMW, all of them subtopics. If there is a sudden change of page views for one of the subtopics, the alerting component warns the user. If desired, the informing component shows tweets that are about this subtopic.

The API helps with each of the aspects in the monitoring system. It helps selecting temporally related concepts for an entity; for the example entity BMW it can select Wikipedia pages similar to the concepts in Figure 3. For the visualization and monitoring of the entity, it returns a plot for the page views for every single entity. If there are more page views than usual, the filter option bursts filters such recent (and general) increases. Finally, the linking of tweets to an article can be done using methods from Section 3.

4. CONCLUSION

We presented a RESTful web interface to request and retrieve time series for Wikipedia concepts. The time series are based on the logs of the access counts of the Wikipedia page of a concept. This interface does not only return the raw time series, but also filters time series and clusters temporally similar concepts, returning visual or textual objects. The requirements were created based on three use cases, based on technical novices as well as an expert and we showed how the API can suit their needs. For future work, we intend to use this API for experiments and create dashboard interfaces for different user bases. This will certainly result in an expansion of the interface.

Acknowledgments. This research was partially supported by the European Union’s ICT Policy Support Programme as part of the Competitiveness and Innovation Framework Programme, CIP ICT-PSP under grant agreement nr 250430, the European Community’s Seventh Framework Programme (FP7/2007-2013) under grant agreements nr 258191 (PROMISE Network of Excellence) and 288024 (LiMoSINe project), the Netherlands Organisation for Scientific Research (NWO) under project nrs 612.061.815, 612.061.815, 640-004.802, 380-70-011, 727.011.005, 612.001.116, the Center for Creation, Content and Technology (CCCT), the Hyperlocal Service Platform project funded by the Service Innovation & ICT program, the WAHSP and BILAND projects funded by the CLARIN-nl program, the Dutch national program COMMIT, and by the ESF Research Network Program ELIAS.

5. REFERENCES