GTE-Cluster: A Temporal Search Interface for Implicit Temporal Queries

http://wia.info.unicaen.fr/GTEAspNetFlatTempCluster_Server

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GTE-Cluster
Search
Interface

Ricardo Campos
LIAAD – INESC Porto, LA
Polytechnic Institute of Tomar, Portugal
ricardo.campos@ipt.pt
http://www.ccc.ipt.pt/~ricardo

Gaël Dias
HULTECH/GREYC,
University of Caen Basse-Normandie,
France
gael.dias@unicaen.fr
http://dias.users.greyc.fr

Alípio Mário Jorge
LIAAD – INESC Porto, LA
DCC - FCUP
University of Porto, Portugal
amjorge@fc.up.pt
http://www.liaad.up.pt/~amjorge/

Célia Nunes
Department of Mathematics and Center of
Mathematics, University of Beira Interior,
Covilhã, Portugal
celian@ubi.pt
http://www.mat.ubi.pt/~celia/

ABSTRACT

Given that most of the temporal queries issued by users are implicit by nature [2], detecting its underlying temporal intent turns out to be a very interesting problem and a real need to improve the performance of search systems.

In this context, most state-of-the-art methodologies consider any occurrence of temporal expressions in Web snippets and other Web data, as equally relevant to an implicit temporal query. This is obviously not true for most part of the query results.

2011 Haiti Earthquake Anniversary

www.pbs.org/...2011/haiti-earthquake-anniversary...

As of **2010** (see **1500** photos), the following major **earthquakes** have been recorded in **Haiti**. The 1st one occurred in **1564**. **2010** has been a tragic date, however in **2012** Haiti will organize the Carnival...

In this work, we aim to define the temporal intents of implicit temporal queries in order to further improve the Web search process.

For that purpose, we propose a language-independent strategy to associate top relevant years to any text query by analyzing its corresponding Web snippets. Selecting the relevant temporal expressions, however, may prove to be a particularly difficult task, since only a few of them are actually relevant to the query. Hence our goal is twofold:

1. Select the most relevant dates for a given query
2. Discard all non-relevant or incorrect ones;

The ability to identify relevant dates automatically is potentially useful for several tasks , including temporal clustering [3].

In this demo, we present GTE-Cluster an online temporal search interface which consistently allows searching for topics in a temporal perspective by clustering relevant temporal Web search results.

• 1564
• 2010

• 2010

• 1991
• 2003

Our Approach

ARCHITECTURE

ALGORITHM

Algorithm: Determine the list of clusters for the query q

Input: query q

- 1: $S \leftarrow \text{GetSnippetsFromSearchEngine}(q)$
- 2: For each $S_i \in S$, $i = 1, \dots, n$
- 3: Apply Text Processing
- 4: $W_{S_i} \leftarrow$ Select best relevant words/multiwords in S_i
- 5: $D_{S_i} \leftarrow$ Select all temporal patterns in S_i
- 6: $W_S \leftarrow \bigcup_{i=1}^n W_{S_i}$
- 7: $D_S \leftarrow \bigcup_{i=1}^n D_{S_i}$
- 8: Compute M_{ct}
- 9: For each $d_j \in D_S$
- 10: Compute $GTE(q, d_j)$
- 11: $D_S^{rel} \leftarrow$ Determine the final list of m relevant dates by applying GTE-Class
- 12: $C_j \leftarrow \emptyset$
- 13: For each $d_j \in D_S^{rel}$, $j = 1, \dots, m$
- 14: For each $S_i \in S$, $i = 1, \dots, n$
- 15: if S_i has d_j then
- 16: $C_j += S_i$

Output: C clusters

TEMPORAL SIMILARITY MODULE (GTE)

$$GTE(q, d_j) = sim(q, d_j) \in [0, 1]$$

Our proposal is that the relevance between a pair is better defined if, instead of just focusing on the self-similarity (between the query and the date), we calculate all the similarities existing between the date and each of the most important topics that appear together with the candidate date.

$$GTE(q, d_j) = F(sim(w_p, d_j)), w_j \in W^*$$

F is an aggregator function of the several $(sim(w_p, d_j)), w_j \in W^*$:

• Max/Min;

• Arithmetic Mean;

• **Median.**

sim can be any similarity measure

• PMI;

• DICE;

• Jaccard;

• EI;

• Normalized Google Distance;

• Web Jaccard;

• Web Overlap;

• Web DICE;

• Web PMI.

• Cosine;

• Latent Semantic Analysis;

• Semantic Vector Space Model;

• **InfoSimba [6].**

$$IS(w_j, d_j) = \frac{\sum_{i \in X} \sum_{j \in Y} S(i, j)}{\left(\sum_{i \in X} \sum_{j \in Y} S(i, j) + \sum_{i \in Y} \sum_{j \in X} S(i, j) - \sum_{i \in X} \sum_{j \in Y} S(i, j) \right)}$$

InfoSimba:

IS calculates the correlation between all pairs of two context vectors X and Y , where X is the context vector representation of w_j and Y is the context vector representation of d_j

For this purpose 5 possible representations have been defined:

• $(W; W)$;

• $(D; D)$;

• $(W; D)$;

• $(D; W)$;

• **$(WD; WD)$.**

S is any similarity measure, such as PMI, DICE, Jaccard, etc.

T is the minimum similarity value above which, words and candidate dates should be selected as elements of the two context vectors

For that end, a conceptual temporal correlation matrix M_{ct} , which stores the similarity between the most important words and the candidate dates is built;

		a	b	c	2011	2012
a						
b						
c						
2011						
2012						

DATE FILTERING MODULE (GTE-Class):

Classical threshold-based strategy [4];

1. relevant, if $(GTE(q, d_j) \geq \lambda)$
2. non-relevant, if $(GTE(q, d_j) < \lambda)$

TEMPORAL CLUSTERING (GTE-Cluster):

GTE-Cluster focuses on adding top relevant temporal features to post-retrieval clustering based on the following principle:

P1: Two snippets are temporally similar if they are highly related to the same set of dates.

Each web snippet S_i contains a set of $D_{S_i}^{rel}$ dates, which directly reflect the web snippet temporal purpose.

Since its text can contain several different relevant temporal features, we permit overlapping: each snippet S_i may belong to a number of m clusters $C = \{C_1, C_2, \dots, C_m\}$.

The final set of clusters consists of m entities, where m is the number of relevant dates in D_S^{rel}

Intuitively, each C_j is labeled directly by D_S^{rel}

The set of clusters are then sorted in ascending order by date.

One such presentation of the results enables users to have a quick overview of a topic, without the need to go through an extensive list of results.

One of the advantages of our clustering model is that instead of considering all the temporal expressions as equally relevant as in [1], we determine which ones are more relevant to the user text query.

One consequence of this is a direct impact on the quality of the retrieved clusters, as non-relevant or wrong dates are discarded.

DEMO

The results of our research can be graphically explored by a demo search interface http://wia.info.unicaen.fr/GTEAspNetFlatTempCluster_Server, which allows the execution of different kinds of queries, such as business (e.g. “iPad”), cultural (e.g. “avatar movie”), musical (e.g. “Radiohead”) or natural disaster ones (e.g. “Haiti earthquake”).

We rely on Bing Search API with the *en-US* language parameter to retrieve 50 results per query.

In response to a query submitted in a search box, GTE-Cluster displays a set of clusters generated on the fly.

We offer two types of retrieval: one that returns only the relevant clusters (marked in blue) and one that combines relevant clusters with non-relevant ones (marked in red).

Each cluster is assigned a temporal similarity value reflecting its GTE similarity with the user query. Note that clusters with a similarity value < 0.35 are considered non-relevant

CONCLUSIONS

• In this paper, we presented GTE-Cluster a temporal search interface that focuses on disambiguating a text query with respect to its temporal purpose(s);

• We proposed a strategy for temporal clustering of Web search results, where snippets are clustered by year;

• We believe that the introduction of the temporal dimension will help to mitigate the limitations that users experience when their information needs include topics of a temporal nature;

• This is our first version approach to flat temporal clustering of search results. While we already achieved an initial stage of flat clustering by time, our proposal still lacks an approach focused on topics;

• As future research, we aim to provide an effective clustering algorithm that clusters and ranks snippets, both based on their temporal and conceptual proximities;

• A future approach should also consider a more elaborated mechanism in terms of ranking by applying an inter-cluster and an intra-cluster solution;

• Finally, we may use the similarity value associated to each cluster to offer an ordered set of temporal query suggestions.

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