To Click or not to Click?
The Role of Contextualized and User-Centric Web Snippets

Nikos Zotos – Patras University
Paraskevi Tzekou – Patras University
George Tsatsaronis – Athens University
Lefteris Kozanidis – Patras University
Sofia Stamou – Patras University
Iraklis Varlamis – Athens University

Lost in Search Results

RESULTS

- Too many for a query
- Convey little information about their relevance to the query

Challenge: How do users choose the URLs to click on?

Clicking Decisions

- URLs might help
- Title represents the page contents
- Text fragments give a glimpse to the page’s content

Snippet: A set of contiguous text extracted from a page using statistical methods

Snippet Selection

- Statistical Natural Language Processing
  This web-based course in statistical natural language processing is meant to provide the basic material for a distance learning course, although part of a
  training will normally be required. The course is free and open to everybody.
  Participants: An introductory course within the web is designed to give students practical experience and insights into the field of statistical NLP.
  Text and resources: An inventory of available tools and resources for statistical NLP, to be used in carrying out the project work.

Acknowledgements
The Role of Snippets

Snippets do not really help the users decide on which URLs to click?
WHY NOT?
- Not obviously related to the query intention
- Marginally informative of the pages’ content
- Lack coherence, incomplete text

Question: Can we improve the contribution of snippets in the decision-making process?

1. Select query-relevant snippets
2. Rely on text semantics
3. Examine coherence
4. Examine expressiveness
5. Ask users

Motivation for our Study

Design a sound model for snippet selection based on semantics

Our Contribution

Hypothesis
- Semantic processing of both the query and the query-relevant pages will give better snippets
- Semantically-selected snippets will help the users make clicking decisions

Our contribution:
Designed a method that selects Expressive and Coherent snippets by accounting for their Usefulness to the query intention

Towards Useful Snippets

Procedure
Given a query and a set of relevant pages
1) disambiguate the query intention
2) select candidate snippets based on their semantic similarity to the query
3) keep query-useful snippets
4) evaluate snippets’ coherence and expressiveness
5) return best-matching snippet
Identifying the Query Intention

Semi-automatic Query Sense Disambiguation:
- Map query keywords to WordNet
- Process the top N (N=20) returned pages and map their content terms to WordNet
- Take query matching-senses that have a semantic relation to the pages’ content terms senses
  - Display them to the user
- Ask the user select the query sense that best describes the query intention

Towards Query-Relevant Snippets

Query and Page semantic processing:
- Expand query terms with their WordNet synonyms
- Find all appearances of query terms in the page’s text
- Define window of query items
- Compute VSM

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Selecting Query-Useful Snippets

Query-snippet semantic correlation values weighted by the score of relation type (r) quantifies the quality of the selected passage

\[ \text{Quality}(S, q) = \frac{1}{n \times m} \sum_{j=1}^{m} \sum_{k=1}^{n} \text{Similarity}(q_j, S_k) \times \text{RelationWeight}(r) \]

Based on the findings of Song et al., 2004 (CICLing)

Synonymy: 1, Hyper/Hyponymy: 0.5, Mero/Holonymy: 0.4

Combining Relevance and Quality between snippet and query terms derives the snippet’s Usefulness to the query intention

\[ \text{Usefulness} (S, q) = \text{Relevance}(q, S) \times \text{Quality} (S, q) \]

Evaluating Selected Snippet

- Task I: Measuring Coherence
- Task II: Measuring Expressiveness

**Coherence**: indicates the degree of in-snippet semantic correlation and is useful in selecting the URLs to click on

**Expressiveness**: indicates the degree of semantic correlation between snippet and remaining text terms and is useful in focusing retrieval to useful text fragments
Evaluating Selected Snippet (2)

**Semantic Coherence**: semantic similarity that snippet terms exhibit to each other, as determined in WordNet

\[
\text{Coherence}(S_1) = \frac{1}{n} \sum_{i,j=1}^{n} \text{arg max}_{w_j} \text{similarity}(w_i, w_j)
\]

Wu and Palmer metric

**Expressiveness**: semantic similarity that snippet and remaining text terms exhibit to each other

\[
\text{Expressiveness}(S_1, (D - S_1)) = \text{Usefulness}(S_1, (D - S_1))
\]

Product of: (i) Terminological Overlap (Relevance) between snippet terms and terms in the remaining document (D-S_1) and (ii) Avg. Semantic Correlation between snippet and remaining document terms, weighted by the Relation(r) type.

Experimental Study: Goals

- Examine performance of our semantically-driven snippet selection model
- Compared the performance of our model to the performance of the Alicante statistical passage retrieval algorithm
- Examine influence of semantically-derived snippets on user decisions

Carried out a blind user study with 15 participants who were asked to make click decisions based on a number of different snippets offered for the same queries and pages

Experimental Setup

- Dataset: NPL collection
  - 30 experimental queries
  - 10,737 query-relevant documents
  - Every NPL document approximates the snippet size (~23 terms)
  - NPL queries vary in size between 2 and 9 words

- Getting Started
  - Semi-automatic annotation of queries with an appropriate WordNet sense
  - Semantic annotation of all document content terms
  - Computation of semantic similarity values between query and document terms

Experimental Setup (2)

- Merge NPL documents into a single text (virtual document)
- Issue queries and select snippets
- Comparison of snippets selected by the TF/IDF statistical model to the snippets selected by our semantically-driven model and the snippets selected by their combination
- Evaluation metric: interpolated 11-point Precision-Recall curves
Experimental results

The combination of statistical and semantic criteria for snippet selection yields a 3.5% improvement.

The improvement is non-negligible considering that NPL is a well-structured, balanced, and small data collection.

Human Survey

Recruited 15 users and used the NPL dataset to select snippets based on:
- Baseline Alicante algorithm
- Usefulness metric
- Semantic Coherence metric
- Expressiveness metric

Which of the displayed snippets do you think will direct you to a document that can successfully answer the query intention?

Users prefer Query-Relevant Snippets

Semantics-driven passage retrieval can assist the users focus on retrieved results

Conclusions

- **New approach** for query-centric snippet selection
- Evaluation models for measuring snippet coherence and expressiveness
- Extensive experimentation will help us define the contribution of every metric in the snippet selection process
- A novel technique towards personalized passage retrieval algorithms
Thank You😊

QUESTIONS?