Why is this restaurant different from all other restaurants? (Captioning for contextual suggestion)

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ABSTRACT

In this position paper, we view queries such as "entertain me" as representing an entirely new class of problems, requiring the creation of new information retrieval applications that fall somewhere between traditional recommender systems and traditional search engines. We call these new applications *contextual suggestion* systems. The effectiveness of these systems depends on their ability to exploit context when selecting suggestions, their ability to provide novel suggestions, and their ability to contrast one suggestion against another. In this paper, we outline requirements for contextual suggestion and provide an example directly related to the primary goal of the workshop.

1. CONTEXTUAL SUGGESTION

To answer complex and incomplete queries such as "entertain me", an information retrieval system must take into account the underlying context, including the location, weather, time of day, date, friends, personal taste and many other factors. When considered in a vacuum, the query "entertain me" is nearly meaningless. When considered in the light of person, place, and time, the system might reasonably respond with a rich selection of suggestions, ranging from videos, books, and other solitary pursuits, to restaurants, concerts, and other social activities. Ideally, the system might even offer to invite available and appropriate friends and family.

When presenting its suggestions, the system must avoid both overwhelming and underwhelming the user. Often, users will seek suggestions on mobile devices, where the interface is constrained by both network bandwidth and screen real estate. The system must clearly and concisely communicate its suggestions, allowing the user to retain or reject them through simple interaction mechanisms. As suggestions are reviewed, the system must accommodate this implicit feedback when making further suggestions, providing a continuous stream of novel and interesting ideas.

To answer a query like "entertain me", we imagine a new class of information retrieval applications, which we call *contextual suggestion* systems. The services provided by contextual suggestion systems fall somewhere between those of traditional recommender systems and those of traditional search systems. Unlike traditional recommender systems, the domain is open and the system can suggestion almost

anything. Unlike traditional search systems, the information need is poorly specified, with the system depending heavily on context to clarify this need. By writing this position paper, we hope to encourage a research agenda explicitly directed towards contextual suggestion.

A contextual suggestion system must describe a suggestion with a caption[1] that contrasts it against similar suggestions and also reflects its particular appeal to the user. To communicate salient aspects, the system must first determine what makes a suggestion unique (or at least unusual) and if this uniqueness might be of particular interest to its user. For example, when suggesting a restaurant, the system might emphasize elements of the menu or ambience that might be particularly appealing. Later in this paper, we provide an example of how contrastive summarization methods might provide one route to this goal, although unfortunately without considering personalization, which we leave to future work.

2. RELATED IDEAS

Many review sites, such as Yelp and Google Places, incorporate extractive summarization of reviews in their captioning for businesses and other entities, but it is not clear to what extent these sites attempt to identify unique aspects of these entities or to personalize their results. A small but growing body of work explores the generation of contrastive summaries, work which is directly applicable to the problem of creating captions that highlight the unique aspects of entities [3, 6]. Researchers such as Teevan et al. [4] explore methods for personalization, which might be applied to contextual suggestion. Clarke et al. [1] examine the impact of captioning on Web search, demonstrating the importance of clear and useful captions.

3. AN EXAMPLE

As an example, we attempt to answer the question posed in our title by applying a simple contrastive summarization method to a collection of Beijing restaurant reviews taken from the site `localnoodles.com`. Our method is a variant of a simple approach that dates back to the earliest days of information retrieval, but which consistently provides reasonable performance and trivially extends to multi-document summarization by taking steps to minimize redundancy [2, 5]. We stick with a simple approach to meet our

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[1]We use the term *captions*, rather than *summaries*, to suggest their lightweight, dynamic, and flexible nature, as well as to reflect the requirement that they include structured information (e.g., addresses and prices).

The Saddle Cantina	The menu has American, tex-mex and true Mexican food... * 15 rmb off tacos on Tuesdays * Daily Happy Hour from 6 pm - 8 pm * Cinco de Drinko every 5th day of the month where all drinks (except for bottles) are half priced...
Tube Station Pizza	True, Kro's Nest pizza is ridiculously big... We ordered Garlic Bread, a salad, Pizza(Medium variety),local beer ,onion rings.As were were 3 of us... It was enormous and handle ample crust, cheese, sauce and toppings in the right proportions...
Bookworm	Library: borrow all the books you wish 7... Events: interesting authors, book talks, musical evenings, open mic night, etc... Who else has the International Literary festival... This place is a haven for people watching, and having the world go past you...
Ganges Indian Restaurant	Chicken Tikka Masala,The Butter Chicken and Cottage cheese Spinach curry with Rice and Nan Breads... Go here for the lunch buffet... My staple Indian dishes - Garlic Naan, Lamb Curry- I can't recall the exact name of it, but it is AMAZING and Tandoori Chicken...
Blue Frog	burgers are yummy, especially the blue cheese burger... The food and drinks are a little over priced however the happy hour and two for one burgers on the Monday are good value... The hamburgers are tasty but the fries are almost better...
The Tree	Proper pizza - thin crust, not too many toppings... Amazing wood fired pizzas with a bevy of beers at your beck and call... Their beer menu is longer than their food menu and offers a huge range of Belgian beers, some that you won't find anywhere else in Beijing...

Figure 1: Some suggestions for dinner in Beijing.

requirement for lightweight and dynamic captioning. Our primary innovation is our use of a background model to help identify the unique characteristics of a target entity, such as a restaurant.

We assume the existence of two document collections. The first collection $\mathcal{C}_x$ provides information regarding an entity x, which forms the target of our captioning efforts. For our example, we use a collection of reviews about a specific restaurant. The second collection $\mathcal{C}$ provides information regarding other entities in the same class as x, providing a background model against which we may contrast x. For our example, we use reviews for a wide range of restaurants (including the reviews for x).

From these collections we estimate two probabilities for each term t appearing in the collections:

$$p(t) = \text{probability a document from } \mathcal{C} \text{ contains } t,$$
$$p_x(t) = \text{probability a document from } \mathcal{C}_x \text{ contains } t.$$

For both probabilities, we use maximum likelihood estimates with additive smoothing. From these probabilities we compute a score for each term based on its contribution to K-L divergence, ignoring values below zero.

$$\text{score}(t) = \begin{cases} p_x(t) \log(p_x(t)/p(t)) & \text{if } p_x(t) > p(t), \\ 0 & \text{otherwise.} \end{cases} \quad (1)$$

Rather than the contribution to K-L divergence, which provides the desired contrast, most variants of this approach use $p_x(t)$ only.

We then apply a four-step algorithm to extract sentences from $\mathcal{C}_x$, which together form the caption.

1. Compute an overall score for each sentence s in $\mathcal{C}_x$:

$$\frac{\sum_{t \in s} \text{score}(t)}{length(s) + l},$$

where $l > 0$ is a constant intended to encourage sentences of reasonable length. We use $l = 25$.

2. Add the sentence with the highest score s' to the caption.

3. Set score$(t) = 0$ for all $t \in s'$, to avoid redundancy.

4. Repeat steps 1-3 until the caption is complete.

Figure 1 provides results for the six restaurants having the most reviews on `localnoodles.com`.

4. CONCLUDING DISCUSSION

Context, contrast, and novelty are the keys to contextual suggestion. When making a suggestion, a system must clearly communicate how it differs from similar suggestions, and how it might have particular appeal to the user. We explore one simple method for lightweight, dynamic and flexible captioning, providing an example directly addressing the primary goal of the workshop. Future work might extend the method to include personalization, develop evaluation methodologies, and adapt other summarization approaches.

5. REFERENCES

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