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# QUERIES SNIPPET EXPANSION FOR EFFICIENT IMAGES RETRIEVAL

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**ABSTRACT**

Technological and dynamic growths of digital media have increased volume of the multimedia corpus. Due to this growth, it is strongly urged for a system that can efficiently and effectively compiles the user demand, and retrieving the relevant images. Keyword based system retrieves an image on syntactic matching, i.e. string matching not concept. Content Based Image Retrieval (CBIR) systems retrieve the image based on low level features and still exist a gap is called semantic. This paper discussed snippet technique that covers the semantic gap as well as Word Sense disambiguation problems. It extracts user queries for expansion with the help of Knowledgebase WordNet and ConceptNet. Experiments performed on the open benchmark image dataset LabelMe. A substantial improvement has been achieved in terms of precision and recall. Remarkably outperformed of Results and showed 84% corrects.
**Keywords:** *Query Expansion, Semantic Gap, LabelMe, WordNet, ConceptNet*

## 1. INTRODUCTION

For a few decades, there has been a phenomenal growth in the field of digital media. Growth of multimedia also increases the expectation that it will be easily managed and effectively search like a text. Finding the relative images from the large corpus of data are difficult for novel users. Most of the techniques used to find the relevant image is the keyword based search [1]. However, these systems retrieved images based on string matching not with a concept.

Secondly, a fundamental problem in Information Retrieval (IR) is wording mismatch. It occurs when the authors of a document and the user of an information retrieval use different words to describe the same concept [2], [3]. In study, most of the users are given one or two words for searching that not describe contents perfectly. CBIR [22] system most of used for images retrieval based on low level feature and search images based on colour, shape and texture. Their still a gap exists which is called semantic gap.

Query snippet technique is the remedy method to utilize IR [4] for these problems. Most of these techniques have been proposed for the text queries retrieval not for images. This paper introduces the novel approach query snippet. It converts the user sentence queries in to single terms for expansion.

A novel technique Queries Snippets that split user sentence query into single a piece of words and then noun, verb and adverb selected. These words are further process and expand through knowledge bases from WordNet and ConceptNet. Expanded words can be ranked through the well known retrieval model Vector Space Model (VSM). It ranked the quires and then retrieves a result from LabelMe Image dataset.

## 2. LITERATURE REVIEW

An expansion is one of the predictive methods for Information Retrieval (IR) system of user query. However, sometimes these techniques need to be more accurate to retrieve the information from IR system. Vocabulary gap is the dilemma by the IR system, where the same concept has been labeled with different words. Word Sense Disambiguation (WSD) [21] is another key factor of irrelevant information retrieval. Query Expansion is specifically used for these problems to reduce a vocabulary gap as well as WSD.

From the last few decades, different researchers have developed methods for query expansion to retrieve data from the IR system. Expansion of user query with minimal user interaction [5], initial retrieval results [6] and local and global document analysis [7].

Snippet technique applied by Lu et al. [8] on queries that user's manually select words for expansion. Ceccarelli et al. [11] used the snippet technique to catch text data from Websites.

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Translating Queries into Snippets [12], Query-Based Sampling [13], and Snippet Generation in XML [14] are the different technique for IR. These techniques showed an excellent performance of the text-based data. But for multimedia data still under processing.

WordNet [9] is a lexical dictionary of English words. It expands the user query with same meaning and solved the word mismatch problem, however, it not with conceptual meaning.

Proposed method has snippet user queries into pieces and passed for expansion. Expand can be done through lexically from WordNet and commonsense from ConceptNet Knowledge base. ConceptNet [15] is an Open Mind common sense reasoning system for common sense knowledge representation and processing. This knowledge base has been used by a few researchers in query expansions. Both knowledge bases have enhanced [16] the retrieval results.

## 3. METHODOLOGY

Proposed Queries snippet technique has included five steps. 1) Snippet, 2) Expansion, 3) Filtration, 4) Ranked and 5) Result. Overall structure of the proposed system is shown in the Figure 1.

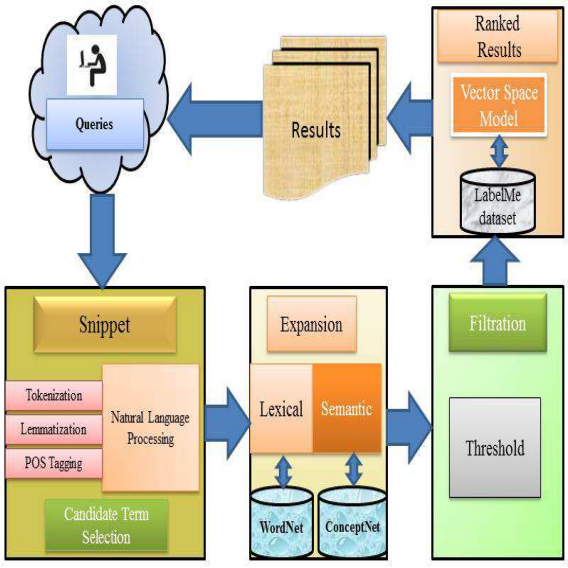


*Figure 1: Query Expansion Through Lexically and Semantically*

Q is the query that given to System. The query can be represented with different tokens in the type of T. Where Tn is representing the total number of tokens of the user query.

$$Q = T1, T2, T3, \ldots\ldots\ldots\ldots, Tn. \quad (1)$$

$$Q = \sum_{n=1}^{n} PT(L(Tn)) \quad (2)$$

L(Tn) represents lemma form of the tokens, and PT(L(Tn)) defined the Part Of Speech Tagging (POST) of the lemma from terms. In Snippet step user query applied Natural Language Processing (NLP) that converted into different tokens and based form with the help of Tokenization and Lemmatization. In based form the Part-of-speech Tagging (POST) applied that defined nouns, verbs and adverbs in query. Montilingua [10] used for lemmatization and POST words. Selected words (nouns, verbs and adverbs) are snippets from the user query with the help of Candidate term selection.

$$C = \sum_{n}^{n} C(PTn) \quad (3)$$

Here C(PTn) represents the total words of a snippet from the user original query. These selected words can be passed to expansion step. An expansion, adds the additional related words with the help of WordNet and ConceptNet. WordNet adds lexical terms, while ConceptNet adds semantic concepts in the user queries. Next step is defined the expansion of the candidate selected term.

$$LE = C \quad (4)$$

$$SE = C \quad (5)$$

LE showed expansion of the Lexical from WordNet. It adds synonym words from the knowledge base and solved the problems of words mismatched. SE showed the expansion terms from the ConceptNet. It resolved WSD problems.

$$CE = \coprod_{n=1}^{n} (C(\sum_{m=1}^{m} LEm, \sum_{i=1}^{i} SEi)) n \quad (6)$$

CE represented combined expansion of both knowledge bases. However, an expansion added lot of irrelevant words to the user query that affects retrieval results. Stop these unusual words filtration had applied that filter relevant words from the expansion.

$$Q' = \sum_{n=1}^{n} T'(CEn) \quad (7)$$

Q' represents the filters expanded terms. The filter expanded terms will be passed into retrieval and Ranked. The Ranked will be done through the well-known model Vector Space Model (VSM) [20]. VSM has retrieved the images based on concepts attach with it and ranked according to their frequency. The similarity between the filter expanded terms and the images along with user

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original query will be calculated in the form of cosine measurement.

$$\cos\Theta Ii = similarity(Q', Ii) \quad (8)$$

CosΘ calculated the similarity values between pruned query terms with LabelMe Image dataset. It displayed the result through with high-priority relevancies values. Top priority queries images will be displayed before the low priority.

$$Similarity\ (Q', Ii) = \sum_j WQ.i.WIi \Big/ \sqrt{\sum_j W2Qj}\sqrt{\sum_j W2i.j} \quad (9)$$

Similarity (Q', li) is calculating the relevancies values of the pruned queries and the images. It used for ranked the user results through on priority based.

The Vector Space Model (VSM) will be ranked the results based on priority. High relevancy images will be display before the lower relevancy and so on. It ranked through terms matching of images.

## 4. RESULTS AND DISCUSSION

Checked the efficiency of the snippet technique is by apply it on the open source available dataset for research and academia LabelMe [17], which provides digital images, with different annotations [18]. The corpus consists above 9,000 images. 66,000 annotated images and 30,886 images are still not annotated and remain for tagging.

For the evaluation of this technique, two most popular measurements have been applied Precision and Recall [19]. Precision is defined to the total numbers of retrieved images with all corpuses, while Recall is the specific related image with retrieval images. The highest value of both measurements is 1.

$$\textbf{\textit{Precision}} = \frac{[Relevent\ result] \cap [Retrieved\ Result]}{[Retrieved\ result]} \quad (10)$$

$$\textbf{\textit{Recall}} = \frac{[Relevent\ result] \cap [Retrieved\ Result]}{[Relevent\ result]} \quad (11)$$

Query snippets experiments have performed on the LabelMe image dataset. Figure 2 at the end of paper after references, shows the queries with their expansion. Retrieved results from the image dataset 100 and top ten of them are selected for the results.

Figure 2, showed the experimental results of the snippet technique that performed on the image dataset. An experiment 100 images had been retrieved from the image dataset. For query 'show me street light' in 100 images 92 images are relevant. So precision is 100%, and recall is 92%. 'Computer mouse' in 100 images 95 was relevant. 'Room window' 86 relevant, 'show me building in the street' 100 relevant images, 'person walking in the road' 88 relevant, and 'I want to see images of the computer speaker' 83 images related to user query. Figure 3 shown evaluation of this technique.

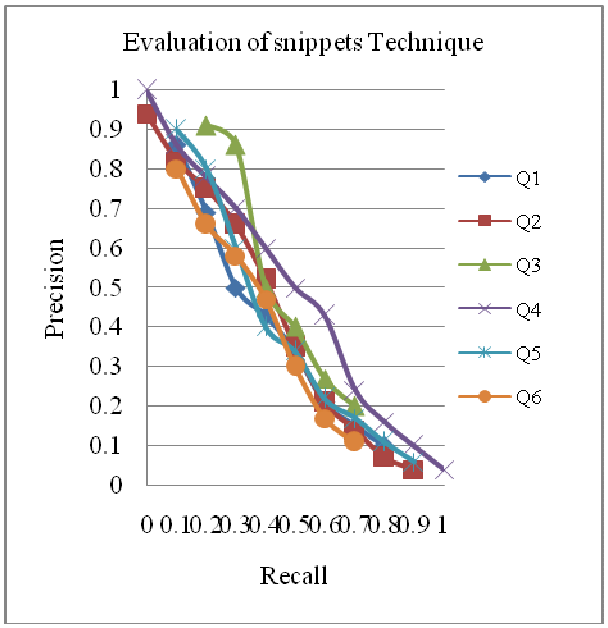


*Figure 3: Evaluation of Snippets Technique*

Evaluation of the query snippet technique showed that this technique had received images based on of different names as well as with concepts. Average of the result retrieval had 94% precision, and recall has 89% of correct images. Q1 illustrated query 'Show me Streetlight'. Q2 is 'Computer mouse'. Q3 is 'Room window'. Q4 is 'Show me building in the street'. Q5 is 'Person walking in the road', and Q6 is 'I want to see images of the computer speaker'.

## 5. CONCLUSION

This technique has given outperformed over the traditional system. It expands the query into lexical as well as semantic concepts that add additionally related words. It resolved the semantic gap. Experimental results confirmed that this technique achieved results 89% from LabelMe image dataset.

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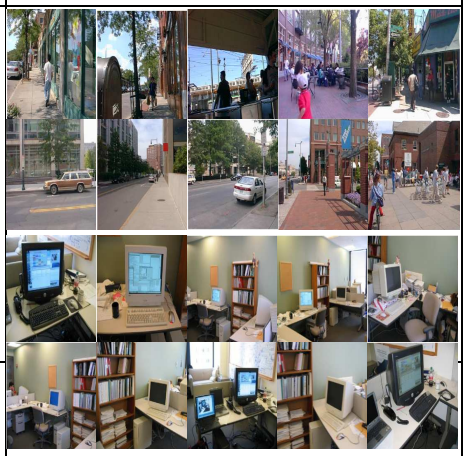
| Query | Expanded Filtration Words | Results |
|---|---|---|
| Show me streetlight | *show(1),streetlight(1),demo(1),exhibit(1),demonstrate(1),prove(1),establish(1),shew(1),testify(1),evidence(1),picture(1),depict(1),render(1),express(1),evince(1),indicate(1),point(1),reveal(1),display(1),show up(1), read( 1),register(1), record(1), usher(1),street lamp(0.9 3) ,character(0.5) ,clock(0.55), difference(0.62), hand(0.7 4), hour(0.46) ,joy(0.5) ,picture(1), psychology(0.47) ,seconds(0.7),ticket(0.5), voting(0.62),more star(0.47) ,person(0.44),star(0.47), wood(0.7)* |  |
| Computer mouse | *computer(1),mouse(1),computing machine(0.85), calculator(1),reckoner(1),figurer(1),estimator(1),shiner(1),computer mouse(0.91),computer program(0.72),e-mail(0.71),font(0.63),key(0.82), machine(0.94),network(0.71),route(0.62),service(0.62),animal(0.77),cancer(0.8),keyboard(0.82),mouse trap(0.94),rodent(0.96),small animal(0.77) ,small mammal(0.86)* | |
| Room window | *room(1),window(1),elbow room(0.87) ,windowpane(1), change(0.73),cozy room(0.87), dark reddish area rug(0.65),large window(0.67),medium brown wood(0.67),nice cozy looking room(0.67), pantry(0.89) ,rest(0.67),right side(0.67),that change be darkness(0.69),building(0.71),cloth(0.77),fireplace(0.67),fireplace and vase(0.64),hearth(0.67) ,item(0.67), large dog(0.74),pane(0.94) ,pillow(0.67),question-mark button(0.66) ,rope(0.71),* |  |
| Show me building in the street | *building(1),street(1),edifice(1),construction(1), aisle(0.8),apartment(0.8),apartment building(0.93), city(0.8) ,difference(0.63),one level(0.86),person 's own restaurant business(0.67),second floor(0.86) ,shape(0.71),tank(0.71),toilet(0.75) ,window(0.71),avenue(0.95),ball(0.62),driveway(0.82),flow(0.67),gas station(0.65),park(0.59), same street(1) ,subway(0.63), surface(0.67)* |  |
| person walking in the road | *person(1),walk(1),road(1),individual(1),mortal(1),soul(1),take the air(0.86),route(1),document and correspondence(0.45),medication(0.6) ,mexican restaurant(0.52),old notebook(0.45) ,person 's sibling(0.74),polite person(0.72),pop machine(0.77) ,two set(0.71),band aid(0.74) ,difference(0.67) ,encounter tree(0.63),foot(0.96), frisbee(0.67) ,front(0.62),front door(0.65) ,leg(0.91),other end(0.7) ,phone box(0.61) ,shelter(0.67),shoe(0.62),blue circle( 0.64), car(0.62),line(0.93),mirror image(0.65)* |  |

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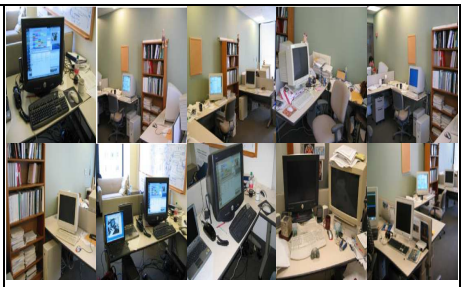
| | | |
|---|---|---|
| I want to see images of the computer speaker | *image(1),computer(1),speaker(1),picture(1),icon(1),ikon(1),persona(1),prototype(1),paradigm(1),epitome(1),trope(1),figure(1),double(1),effigy(1),simulacrum(1),computing machine(0.85), calculator(1), reckoner(1), figurer(1),estimator(1),talker(1),utterer(1),verbalizer(1), verbaliser(1),loudspeaker(1),brown bridge(0.65),child(0.8),focus(0.67),glass(0.62),mind(0.73), mirror(0.59),person 's camera(0.59),photograph(0.94) ,statue (0.67),unit state(0.67),water(0.67),animal(0.71), computer program(0.72),e-mail(0.71),font(0.63),key(0.82)* |  |

*Figure 2: Represent retrieval result of the proposed technique*