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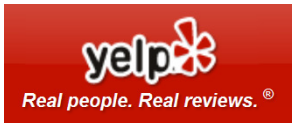
AQA: Aspect-based Opinion Question Answering

Outline

- Introduction
- Opinion Question Answering
  - Current techniques and their weaknesses
- Aspect-based Opinion QA (AQA)
  - Basic notation
  - AQA phases
- Experimental Results
- Summary and Future work

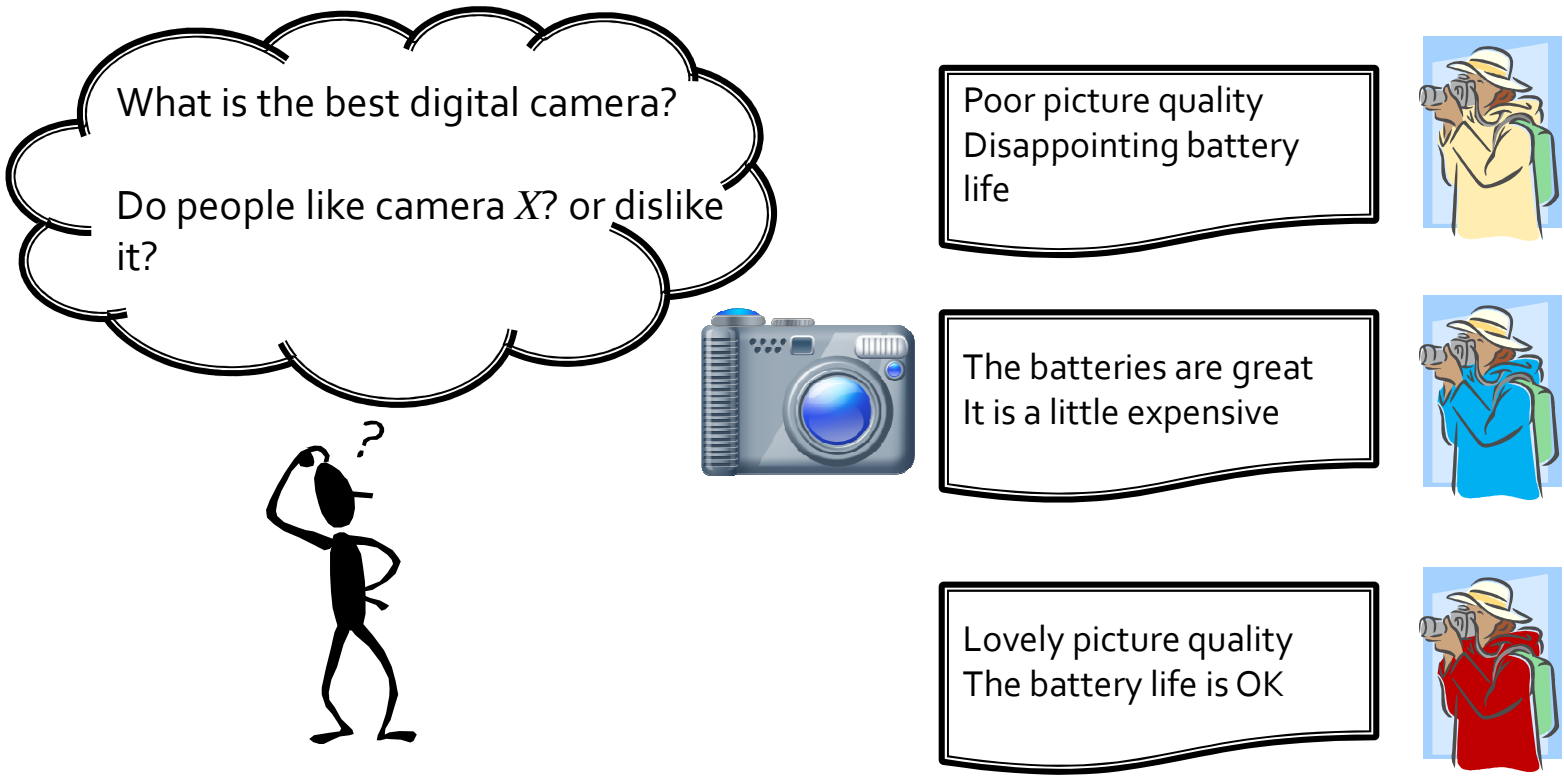
Introduction

- "What other people think" is an important piece of information during the decision-making process.
- More and more product reviews online.
  - Generic sites such as Epinions, and Cnet.
  - Specialized sites such as TripAdvisor.



Introduction (Contd.)

- There are too many reviews to read.



Opinion Question Answering

- Answer opinion-based questions
  - e.g., Do people recommend CanonX or SamsungY?
- More complicated than traditional QA
  - e.g., What is the longest river in the world?
- Why?
  - Opinion questions usually do not have unique answers.
  - Answers of opinion questions are usually longer and more likely to be partial.

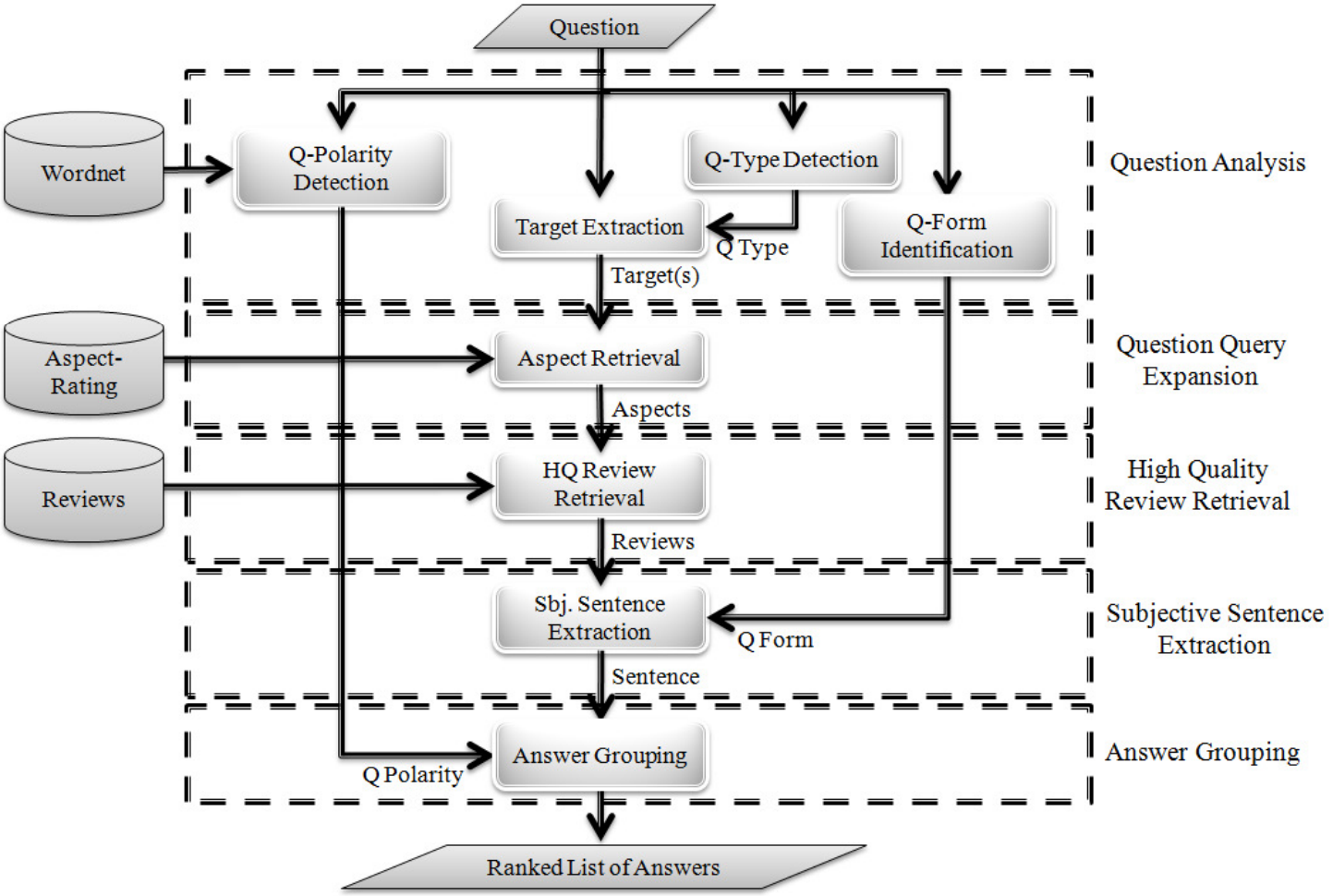
Current Opinion QA methods

- Contain two phases:
  - Retrieve and rank document fragments with respect to the question
    - Typically invoke an IR subsystem, which employs traditional text similarity measures (e.g. tf/idf).
  - Filter text fragments based on question polarity and/or question type

Current Works Weaknesses

- Fail in answering majority question
  - e.g., What is the best digital camera?
- Fail in answering comparative questions
  - e.g., Why SamsungY works better than CanonX?
- Fail in comprehensive answering
  - e.g., Is CanonX good?
- Low precision and recall in answer retrieval

AQA at a glance



Basic Notation

- **Target item**, a product or a category that has been reviewed.
  - e.g., 'CanonX' or 'digital camera'
- **Aspect (features)**, an attribute or component of the target item.
  - e.g., `picture quality', 'zoom' and 'flash' for 'digital camera'
- **Rating**, a numerical value ([1, 5]) indicating the quality of aspect.
  - e.g., "excellent zoom" –> "zoom: 5"
- **Question polarity**, indicates the direction of the question
  - e.g., positive, negative, neutral

Basic Notation (Contd.)

- **Question type**, (Ku et al. 2007):
  - Holder: who the expresser of the specific opinion is.
  - Target: what the holder's attitude is toward.
  - Attitude: what the attitude of the holder to a target is.
  - Reason: asking the reason of holder's attitude.
  - Yes/No: whether their statements are correct.
  - Majority: which option is the majority opinion.
- **Question from**, shows whether the question is asked about one or more than one target.
  - Single, comparative

Basic Notation (Contd.)

- Sample Questions in different types and forms

Question Type	Single/Comparative form
Target	S: What is the best digital camera? C: Which digital camera works better than CanonX?
Attitude	S: What do people say about SamsungY? C: Do people recommend CanonX or SamsungY?
Reason	S: Why do people recommend CanonX? C: Why CanonX is better than SamsungY?
Yes/No	S: Does CanonX work fine? C: Does SamsungY work better than CanonX?

Preprocessing

- AQA adopts an opinion mining technique in the preprocessing phase (OpinionDigger)
  - Collects frequent noun phrases as potential aspects.
  - Extracts opinion POS patterns to filter out non-aspects
  - Estimates the rating of aspects based on the sentiments used to describe it (in the range [1, 5]).
- Populate the aspect-rating dataset

Phase 1: Question Analysis

- Identifying question type
  - Determines question type using pattern matching
  - Applies "pos_tagger", a built-in POS tagger in Python.
    - e.g., "what_WP is_VBZ the_DT best_JJS MP3_NNP Player_NNP?" → pattern: "WP+VBZ+DT+JJS+NNP+NNP"
  - Applies Generalized Sequential Pattern (GSP) mining algorithm (Srikant 1996) on the POS patterns to find the frequent POS patterns.

Phase 1: Question Analysis (Contd.)

- Sample of question patterns

Question Type	Mined Patterns
Yes/No	VB+NP+RB VB+NP+VB+RB VB+NN+VB+NP
Reason	WRB+VB+NN+VB+NP WRB+VB+NP+VB+RB WRB+VB+NP+RB
Target	WDT+NP+VB+NN+VB WDT+NP+VB+RB WP+VB+RB/JJ+NP
Attitude	WP+VB+NN+VB+NP

Phase 1: Question Analysis (Contd.)

- Determining question polarity
  - Aggregates the polarity of its adjectives.
  - Applies a classifier to determine the polarity of each adjective
    - Compare the effectiveness of naive Bayes, SVM, and KNN
  - Uses WorldNet dictionary and two seed sets of positive and negative words (Hatzivassiloglou et al. 1998)
  - Questions do not contain an adj. are considered neutral
    - e.g. "What do people say about CanonX?"

Phase 1: Question Analysis (Contd.)

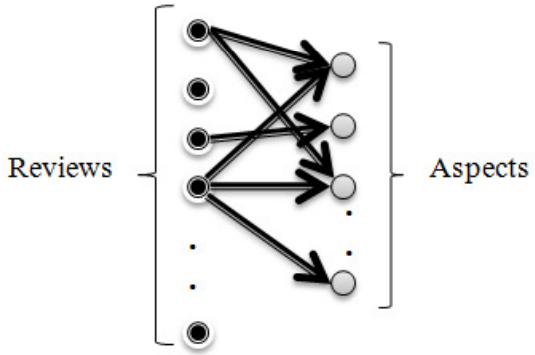
- Identifying question form
  - Comparative if it uses comparative adj. or adv.
    - Determined by POS tags `JJR' and `RBR'
- Extracting target item(s)
  - Uses question pattern to extract target products.
  - Retrieves two target items for comparative questions.

Phase 2: Question Expansion

- Uses target's aspects to expand the question.
  - SearchSet={CanonX} → SearchSet={CanonX, picture quality, shutter lag, zoom, etc.}
- Retrieves all of the reviews about the target item(s) .
- By expanding the question
  - Answer comparative and majority questions by comparing the rating of the common aspects.
  - Increase recall of answer retrieval

Phase 3: Quality Filtering

- Uses a modified version of HITS (reviews-aspects) to rank reviews.
- Weight of each edge is the number of appearances of that aspect in the review.
- High authority reviews will be kept since they cover more related aspects.



Phase 4: Subjective Filtering

- Example: "Why do people not recommend CanonX?"
  - "I test my new CanonX camera yesterday. I took a couple of photos without flash. The picture quality was disappointing."
- AQA assumption
  - Relevant if an aspect has been commented on
  - Subjective if there is a sentiment describing the aspect
- Subjective filtering measure
  - Existence of a target aspect and its related sentiment .

Phase 5: Answer grouping

- Uses the polarity of the question for grouping answers by grouping opinions.
- Provides a complete set of answers for the user.
- Example: "Why do people recommend CanonX?"
  - Answer includes snipped with positive aspects of that item first, and snipped with negative points at the end

Experimental Results

- Dataset

  - Epinions.com reviews dataset
  - 2500 reviews about 40 products

- Evaluation
  - Current works are evaluated using a manually created gold standard set.
  - We follow the same approach

Evaluation of Question Analysis

	Accuracy
Q-Type detection	94%
Target extraction	88%
Q-Form identification	100%

- Low accuracy in Q-type detection and target extraction is mainly because of the low accuracy of the used POS tagger (84%).

Classifier	Naïve Bayes	SVM	KNN
Accuracy	89%	93%	98%

- The better performance of KNN over the other classifiers is mainly due to the small number of classes

Evaluation of Answer Retrieval

- Filtering techniques
  - Polarity filtering returns a sentence as answer if it has the same polarity as the question.
  - Quality filtering returns sentences of high quality reviews.
  - Subjective filtering filters out objective and non-relevant sentences from retrieved reviews.
  - Quality-subjective filtering applies subjective filtering on high quality review.

Evaluation of Answer Retrieval

	Precision	Recall	F-measure
No Filtering	37%	100%	0.54
Polarity Filtering	62%	54%	0.58
Subjective Filtering	61%	78%	0.68
Quality Filtering	72%	66%	0.69
Quality-Subjective Filtering	78%	86%	0.82

- Polarity filtering improves precision of non-filtered results by 68% and decreases recall by 46%.
- Quality-subjective filtering improve precision and recall of polarity-filtered results by 26% and 60% respectively.

Summary and Future Work

- Proposed AQA to address the problem of opinion QA
  - Question analysis and expansion
    - Answer majority and comparative questions
    - Increase the recall of answer retrieval
  - Quality and subjective filtering
    - Increase precision of answer retrieval
  - Answer grouping
    - Provide comprehensive answers
- We consider more complicated quality filtering algorithm as a potential future work.

Thanks

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