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
“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.

What is the best digital camera?
Do people like camera $X$? or dislike it?

Reviewers
- Poor picture quality
- Disappointing battery life
- The batteries are great
- It is a little expensive
- Lovely picture quality
- The battery life is OK
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.
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
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
Sample Questions in different types and forms

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Single/Comparative form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>S: What is the best digital camera?</td>
</tr>
<tr>
<td></td>
<td>C: Which digital camera works better than CanonX?</td>
</tr>
<tr>
<td>Attitude</td>
<td>S: What do people say about SamsungY?</td>
</tr>
<tr>
<td></td>
<td>C: Do people recommend CanonX or SamsungY?</td>
</tr>
<tr>
<td>Reason</td>
<td>S: Why do people recommend CanonX?</td>
</tr>
<tr>
<td></td>
<td>C: Why CanonX is better than SamsungY?</td>
</tr>
<tr>
<td>Yes/No</td>
<td>S: Does CanonX work fine?</td>
</tr>
<tr>
<td></td>
<td>C: Does SamsungY work better than CanonX?</td>
</tr>
</tbody>
</table>
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.
Sample of question patterns

<table>
<thead>
<tr>
<th>Question Type</th>
<th>Mined Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes/No</td>
<td>VB+NP+RB</td>
</tr>
<tr>
<td></td>
<td>VB+NP+VB+RB</td>
</tr>
<tr>
<td></td>
<td>VB+NN+VB+NP</td>
</tr>
<tr>
<td>Reason</td>
<td>WRB+VB+NN+VB+NP</td>
</tr>
<tr>
<td></td>
<td>WRB+VB+NP+VB+RB</td>
</tr>
<tr>
<td></td>
<td>WRB+VB+NP+RB</td>
</tr>
<tr>
<td>Target</td>
<td>WDT+NP+VB+NN+VB</td>
</tr>
<tr>
<td></td>
<td>WDT+NP+VB+RB</td>
</tr>
<tr>
<td></td>
<td>WP+VB+RB/JJ+NP</td>
</tr>
<tr>
<td>Attitude</td>
<td>WP+VB+NN+VB+NP</td>
</tr>
</tbody>
</table>
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
Low accuracy in Q-type detection and target extraction is mainly because of the low accuracy of the used POS tagger (84%).

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


5) V. Hatzivassiloglou and K. R. McKeown. Predicting the semantic orientation of adjectives. In ACL ’98.


8) B. Li, Y. Liu, A. Ram, E. V. Garcia, and E. Agichtein. Exploring question subjectivity prediction in community QA. SIGIR ’08.
References

16) H. Yu and V. Hatzivassiloglou. Towards answering opinion questions: separating facts from opinions and identifying the polarity of opinion sentences. In EMNLP ’03.