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4395.001 NLP
April 8 2023
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Summary of ACL Paper

Title: Unsupervised Extractive Opinion Summarization Using Sparse Coding

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The Problem:

The authors sought to develop a better tool for opinion summarization, or the task of creating short summaries for products by scraping user opinions. Prior to this research, existing approaches often required tremendous amounts of expertly-annotated data in the form of reference studies, which can be difficult to come by if you are not part of a mega-corporation like Amazon or Google. Instead of doing further work on supervised summarization techniques, the authors pursued unsupervised opinion summarization, which would require little to no annotated summaries. Approaches had been researched in this direction as well, though most of these were abstractive, and thus they struggled with many of the same issues other generative models encounter. These include, but are not limited to, topic drift and a lack of contextual awareness. Instead, the authors worked to develop an extractive summarization tool, which would select a subset of sentences from existing opinions to form a summary.

Prior Work:

There had been numerous strides in supervised opinion summarization starting in 2015 and unsupervised abstractive opinion summarization starting in 2019. Abstractive summarization attempts to abridge opinions using novel phrases, and these approaches can be tackled with typical statistical methods or neural networks. Within the realm of extractive opinion summarization, Quantized Transformer is an approach that uses vector quantization, a grouping method used for data compression, to assign input texts in such a way that there is a coherent semantic sense. Quantized Transformer is what the authors drew the most inspiration from, as its structure laid the groundwork for Semantic Autoencoder, the software introduced in this paper. Other extractive summarization techniques include more primitive tools that calculate relevance based on term frequency, lexical similarity across all collected sentences, and perceived sentiment polarity. Additionally, other direct influences are cited to be topic-modeling methods that categorize data based on semantic relationships.

Unique Contributions of this paper:

The paper presents a new approach called Semantic Autoencoder (SemAE) for unsupervised extractive opinion summarization. SemAE uses dictionary learning to capture semantic information from user reviews and learns a latent representation of each sentence over semantic units. This can be split up into three stages: sentence encoding, reconstruction, and sentence decoding. The sentence encoder passes a non-terminal sentence token, which represents the entire sentence in the final quantization layer, and splits it into several

contiguous vectors, which can be normalized to form a multi-head representation. These heads can be reconstructed using a dictionary into a vector that captures some meaning and a latent representation that captures the extent of that meaning. Finally, the sentence decoder takes the reconstructed vectors as input and ranks the sentence representations in order to identify representative opinions among hundreds of reviews. SemAE can perform general summarization, but it can also perform aspect summarization, where an aspect is some topic defined from a small set of manually assigned keywords, with no additional training. The authors show that SemAE outperforms previous methods using automatic and human evaluations. They also perform analysis to understand how the learned representations align with our (human) semantics.

How the authors evaluated their work:

The authors assessed their work by conducting experiments on two datasets, SPACE and AMAZON, and reported robust performance. Additionally, they performed experiments to explore their model's functionality. For automatic evaluation, they employed ROUGE (Recall Oriented Understudy for Gisting Evaluation), a widely accepted metric for evaluating text summarization systems. The authors used ROUGE-1, ROUGE-2, and ROUGE-L scores to measure the quality of the summaries produced by SemAE.

For human evaluation, the authors utilized the Amazon Mechanical Turk (AMT) platform to gather judgments from human evaluators. They asked the evaluators to rate the quality of summaries generated by SemAE and compare them to those produced by other methods. Furthermore, the authors conducted an analysis to comprehend how the learned representations aligned with human semantics and carried out experiments to investigate their model's inner workings.

Number of citations the authors have received on Google Scholar:
Somnath Basu Roy Chowdhury: Cited by 162
Chao Zhao: Cited by 280
Snigdha Chaturvedi, Assistant Professor, Cited by 1447

Conclusion:

In conclusion, the research presented in this paper is significant as it introduces a novel approach to extractive opinion summarization without the need for labeled data. The SemAE method employs dictionary learning to capture semantic information and then utilizes these representations to identify opinions among numerous reviews. This dictionary learning technique proves effective in opinion summarization and enables SemAE to generate aspect-specific summaries in a controllable manner. The authors demonstrate that SemAE surpasses existing methods in performance and can generate aspect-specific summaries with precision.

The SemAE approach holds great promise, particularly in situations where labeled data is scarce or costly to acquire. This research has the potential to enhance the efficiency and effectiveness of opinion summarization tasks, which could prove valuable for review analysis and market research across various applications. For instance, the approach could be employed in product review analysis to help companies better understand

customer feedback and improve their offerings, in sentiment analysis of social media posts or online forums to assist researchers in gauging public sentiment on diverse topics, in market research to summarize survey responses and enable decision-makers to make informed choices about their services, and in news article summarization by pinpointing key points and opinions expressed in articles, allowing readers to quickly grasp the content and save time.