Improving Empathetic Response Generation

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1 Introduction

Empathy is the capacity to understand how another person is feeling and is an inherent part of person-to-person communication. For dialogue systems, however, empathetic response generation has been challenging. Yet the ability of an AI system to understand users' emotions and respond appropriately has broad applications in improving outcomes across various applications, from open-domain conversation AI chatbots to single-task systems serving emotional support, customer service, or other tasks.

Recent research has produced significant progress in empathetic response generation. Partially driving these breakthroughs is the creation of large empathy-focused datasets like EMOTIONAL SUPPORT CONVERSATION (ESConv, Liu et al., 2021a) dataset and EMPATHETICDIALOGUES (ED, Rashkin et al., 2018). ED in particular has been useful in developing the state-of-the-art empathy approaches MoEL (Lin et al., 2019) and MIME (Majumder et al., 2020). Some researchers have explored persona-based approaches (Zhong et al., 2020), while others implement a system to hierarchically balance factors like dialogue act and emotion to generate more empathetic responses (CoMAE, Zheng et al., 2021).

2 Literature Review

Empathy has proven to be an important factor in the performance of dialog systems when given emotional user input (Zhou et al., 2018; Li et al., 2017; Zhou and Wang, 2017; Huber et al., 2018; Huang et al., 2020), and researchers have attempted diverse approaches to generating empathetic dialogue.

2.1 Empathetic Conversational Model

MoEL (Lin et al., 2019) achieved state-of-the-art results on ED by strengthening the emotional understanding of the decoder component through user emotion classification during training. It employs emotion-specific decoders to generate empathetic responses for every emotion and combines output from all using a Meta listener. The success of MoEL affirms that conversational models trained on empathetic datasets presented stronger empathy than models trained on non-empathetic datasets.

MIME (Majumder et al., 2020), based on the theory of emotion mimicry, builds on top of MoEL and achieved superior results on ED, inspiring consideration on how understanding human psychology can guide dialogue systems development and enhance emotion emulation.

In addition, external knowledge including commonsense knowledge (Liu et al., 2021b) and emotion lexicons (Mohammad, 2018) have also proven beneficial for empathetic dialogue systems.

2.2 Persona-based Conversation Model

Other works focus on the exploration of how persona affects empathetic responding. Persona embeddings have been successfully implemented by Li et al. (2016) that result in persona consistency. Inspired by Mazaré et al. (2018), Zhong et al. (2020) created a novel large-scale multi-domain PERSONA-BASED EMPATHETIC CONVERSATION (PEC) dataset. PEC consists of conversations as well as up to 100 self-describing 'persona sentences' per user. They also proposed CoBERT, a BERT-based response selection model that obtains state-of-the-art performance on PEC and, more significantly, conducted the first empirical study on the impact of persona on empathetic responding, which shows a positive correlation between persona and empathy.

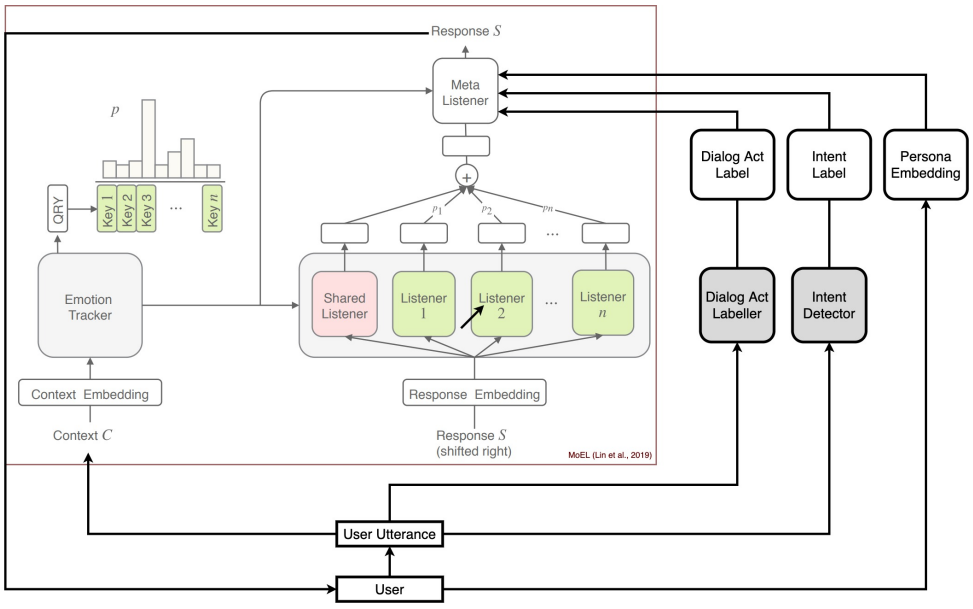

Figure 1: The proposed modified MoEL model with addition of Dialog Act, Intent Labeling, and Persona Embedding.

2.3 Dialog act-based Conversational Model

Another area of research in empathetic response generation includes additional factors besides emotion in constructing empathetic responses. Dialog acts have been useful in interpreting the cognitive aspect of the situation (Elliott et al., 2018). With CoMAE, Zheng et al. (2021) construct a hierarchical model in which emotion, communication mechanism, and dialog act work in tandem to guide response generation. Dialog acts can include congratulation, sadness, or questioning, to name a few examples, resulting in more empathetic and less repetitive responses by the system. These dialog acts function similarly to the seven 'strategies' (such as restatement, self-disclosure, and providing suggestions) of Liu et al. (2021a)'s ESC framework in guiding the conversation. The dialogue system would then progress through various dialog acts or strategies, as guided by the conversation, resulting in an effective emotional support dialogue.

2.4 Emotional Support Dialogue System

A robust emotional support conversational model should not only capture users' emotions and show empathy, but also improve users' emotional state. Similar to the development of an empathetic conversation model, emotional support systems have also benefited from the use of related datasets.

Medeiros and Bosse (2018) collected stress-related posts and response pairs from Twitter and classified replies into supportive categories. Hosseini and Caragea (2021) also collected a dataset, which includes annotated dialogue posts and responses from support groups as needing or expressing support.

Noting that dialogues in the above datasets consist of brief single-turn utterances, Liu et al. (2021a) proposed an emotional support conversation (ESC) framework as well as created a multi-turn dialogue dataset (ESConv). This framework is grounded on the Helping Skills Theory (Hill, 2009), and explores the relationship between emotional support and empathetic conversation. It proposes three stages of support and seven related strategies which show promise on improving users' emotional state.

3 Proposed Methodology

In this project, we aim to explore different methods of improving empathetic response generation on top of existing research. Of particular interest are integrating dialog act information, speaker intent and persona, amongst others. We plan to use MoEL as the basis for system design, as shown in Figure 1: we hope to add a component each for dialog acts, intent and persona which should help the Meta listener produce more empathetic results.

If time permits, we would like to explore how improved empathetic responses can help provide better emotional support, building on top of existing work (Liu et al., 2021b; Zheng et al., 2021; Zhou et al., 2022).

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