Empathy-enriched and Personality-conditioned Spoken Dialogue System with Causality Reasoning

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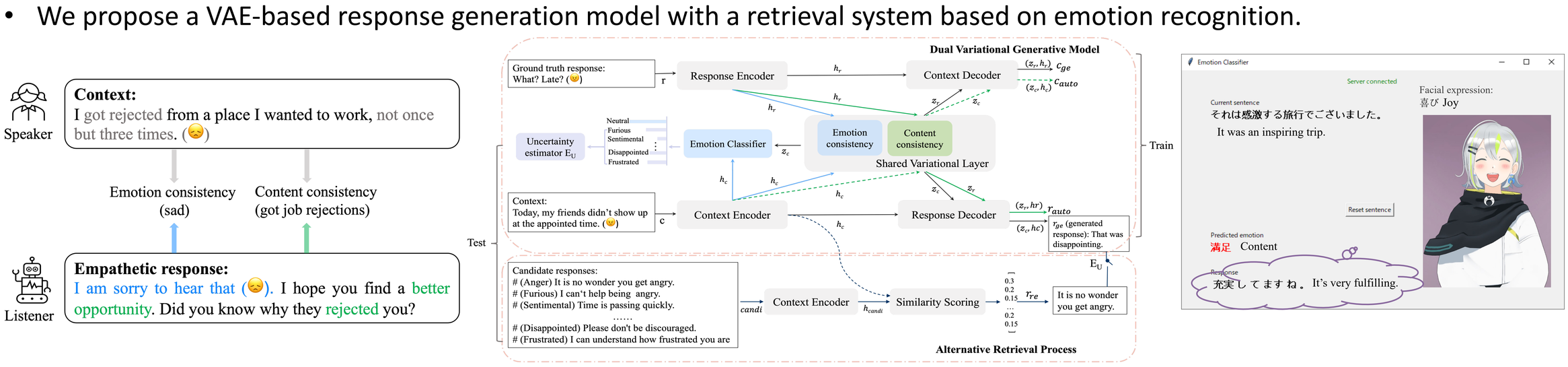
1. Dual Variational Generative Model and Auxiliary Retrieval for Empathetic Response Generation by Conversational Robot

- Incorporating empathy into the dialogue system is essential for improving human-robot interaction experiences, as empathy is the emotional bonding among humans.
- Empathy is embodied in both contextual understanding and affective expression, which occur when there exist **content and emotion consistencies** between context and response
- We propose a VAE-based response generation model with a retrieval system based on emotion recognition.



- We integrate our system into a virtual agent Gene, objective automatic evaluation and subjective evaluation via human-agent interaction experiments demonstrate our system's effectiveness.

Ref: [1] Yahui Fu et al. Improving Empathetic Response Generation with Retrieval based on Emotion Recognition. *IWSDS 2023.*
[2] Yahui Fu et al. Dual Variational Generative Model and Auxiliary Retrieval for Empathetic Response Generation by Conversational Robot. *Advanced Robotics (under review).*

2. Reasoning before Responding: Integrating Commonsense-based Causality Explanation for Empathetic Response Generation

- We propose a commonsense-based causality explanation approach for diverse empathetic response generation that considers both the **user's perspective (user's desires and reactions)** and the **system's perspective (system's intentions and reactions).**
- We integrate the commonsense-based causality explanation with both ChatGPT and a T5-based model. Experimental evaluations demonstrate that our method outperforms other comparable methods on both automatic and human evaluations.

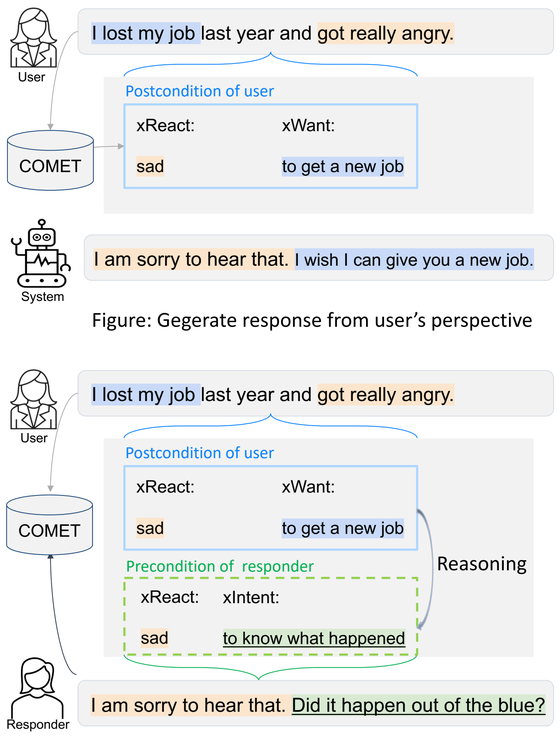


Figure: Gegerate response from user's perspective

Figure: Response from the actual responder's perspective, based on reasoning reaction and intent to mimic humans.

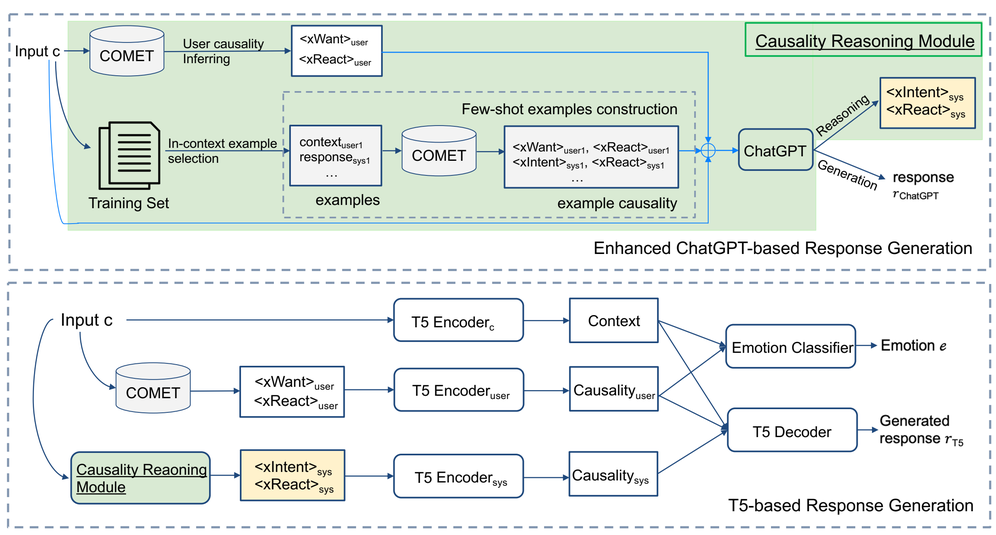


Figure: Proposed method

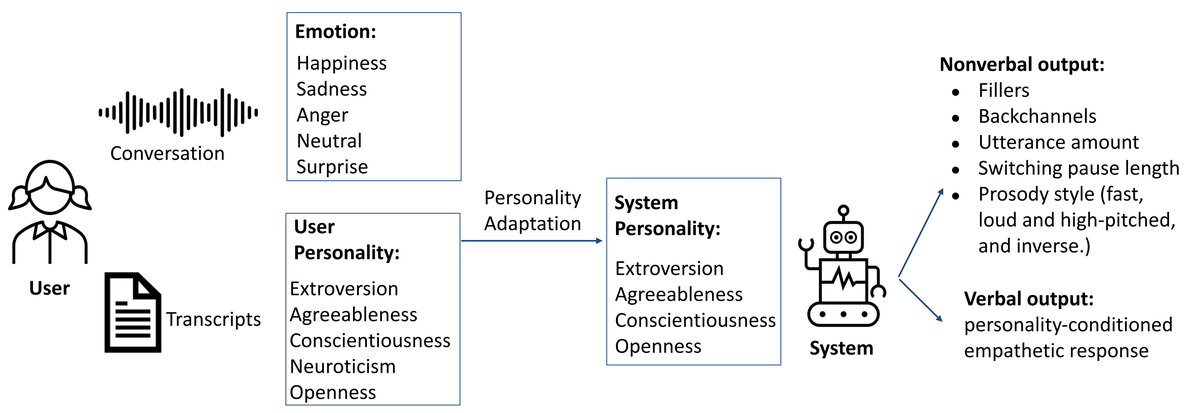
Comparisons	Aspects	Win	Loss	Tie
ChatGPT+Causality$_{user,sys}$ vs. ChatGPT (k=2)	Emp.	**50.7**	36.0	13.3
	Coh.	**42.7**	42.0	15.3
	Inf.	**51.3**	37.3	11.3
ChatGPT+Causality$_{user,sys}$ vs. ChatGTP (k=4)	Emp.	**49.3**	32.7	18.0
	Coh.	20.0	24.0	**56.0**
	Inf.	**43.3**	40.7	16.0

	Context		user: I think that the girl of my dreams likes somebody else. I feel very sad about it.
Baselines	MOEL		I am sorry to hear that. I hope you can find a new one.
	MIME		I am sorry to hear that. I hope you can find a good relationship with her.
	EmpDG		I am sorry to hear that.
	CEM		I am sorry to hear that.
	LEMPEx		I understand that. it's really stressful.
Ours	T5		I'm sorry to hear that. I hope you can find a new job.
	T5+Causality$_{user}$	Causality$_{user}$	user wants: to find a new girlfriend; to ask her out. user reacts to: sad; upset; unhappy; disappointed; angry.
		Response	sys: what did he buy you?
	T5+Causality$_{user,sys}$	Causality$_{sys}$	sys's intent: to comfort; to encourage; to help find a new love. sys reacts to: sympathetic; caring; supportive; encouraging.
		Response	sys: I know how you feel. I have been there before and it is hard to find a new one.
Baseline	ChatGPT		sys: I'm sorry to hear that. It's tough when we have feelings for someone who doesn't feel the same way.
Ours	ChatGPT+Causality$_{user,sys}$		sys: I'm sorry to hear that. Maybe it's time to move on and find someone who appreciates you.

Ref: [3] Yahui Fu et al. Reasoning before Responding: Intergrating Commonsense-based Causality Explanation for Empathetic Response Generation. *SIGDIAL 2023.*

3. Personality-conditioned and User-adaptable SDS

- Step1: Accurately detecting the user's personality, the accuracy of personality (such as big-five traits) recognition is still not good even with the assistance of LLMs.
- Step2: Exploring the mapping between user personality traits and corresponding system.
- Step3: Personalized response generation which is tailored to the user's unique personality



4. Research Interest

❑ *What are the the subsequent advancements in knowledge reasoning for SDS.*

- Knowledge reasoning is essential for both emotion/personality recognition and empathetic/personalized response generation to make the recognition/generation progress explainable.

❑ *The interplay between personality and emotion in personality recognition and response generation.*

- Individuals with diverse personality traits tend to exhibit distinct empathetic styles in their responses. Extroverts, for example, may frequently employ positive emotional words compared to introverts.
- Personality and empathy recognition/generation are the tasks that can improve each other.