Table 4: Manual evaluation on the random and biased test sets.

Model	Utterance Fluency		Persona Consistency		Context Coherency	
	Rand	Biased	Rand	Biased	Rand	Biased
Trans.	1.852	1.810†	0.997†	1.068†	1.428†	1.500
TTransfo	1.832†	1.890	1.015†	1.100†	1.498	1.517
TTransfo+P	1.802†	1.837†	1.125†	1.195†	1.217†	1.483†
LConv	1.863	1.882	1.028†	1.147†	1.490	1.550
LConv+P	1.832†	1.875†	1.093†	1.173†	1.238†	1.478†
Ours	1.837†	**1.912**	1.092†	1.198†	1.487	**1.563**
Ours, α=1	1.835†	1.900	**1.248**	**1.268**	1.303†	1.467†
Ours, α=0	**1.890**	1.880†	0.997†	1.085†	**1.535**	1.463†
Gold Resp	1.928	1.922	1.015	1.423	1.758	1.807

$\dagger$ significant difference with the best result (t-test, p-value<0.05)

context coherency.

Table 4 shows the manual evaluation results. Our model outperforms all the baselines in all the measures. Particularly for persona consistency, our full persona model (i.e., α=1) significantly outperforms all the baselines with a large margin. This indicates that our model can generate more persona-consistent responses that are fluent and context-coherent. Further observations also show that: **1)** Exhibiting too many persona-related features (i.e., obtaining higher persona consistency) hurts response fluency and context coherency. This is in line with the trade-off between the persona accuracy and perplexity as observed in the automatic evaluation results. Moreover, our dynamic weight predictor provides a better balance between the persona-consistency and context coherency, especially on the biased test set; **2)** The persona consistency of our full persona model (i.e., α=1) even surpasses the human-generated response on the random test set. This further proves that our model can incorporate richer persona-related features in the generated responses. **3)** Although directly fine-tuning on the noisy persona dense data (i.e., TTransfo+P and LConv+P) helps to produce more persona-consistent responses, our model still surpasses these baselines significantly. This verifies the effects of the proposed dynamic weighting scheme. This observation is also in line with the automatic evaluation results shown in Table 2 and 3.

Case Study

Figure 5 shows a sampled case, in which our model can generate coherent responses that reveal rich persona features, while responses produced by the baselines either do not exhibit persona-related features or are not grammatically fluent. This case also shows that the persona weight α can be effectively used to control whether to exhibit persona-related features or not. Specifically, our model with the full persona ($\alpha = 1$) reveals the location attribute in the response while our model without persona ($\alpha = 0$) does not exhibit persona related features. See the supplementary file for more cases.

Dialogue Context:	I am free this weekend. It that OK? (我这周末闲，好不) (Gender: Female, Location: Nanjing, Interest Tags: Cate)
Target Persona:	(Gender: Male, Location: **Nanjing**, Interest Tags: Null)
Trans. :	I'm also free, but I don't know what's going on. (我也闲，但是我不知道怎么回事)
TTransfo :	Great, come here and we can have a meal together. (好呀，你来了我们一起吃个饭呗)
TTransfo+P :	I am free this weekend. It that Okay? (我这周末闲，好不好？)
LConv :	It is not OK. (不好)
LConv+P :	Are you in **Nanjing** or **Nanjing**? (你在**南京**还是**南京**啊？)
Ours :	Ok, are you coming to **Nanjing**? (好啊，你来**南京**吗？)
Ours, $\alpha = 1$:	Come to **Nanjing**, I will treat you to dinner and film. (来**南京**，我请你吃饭看电影)
Ours, $\alpha = 0$:	Ok, where are you? I will go back tomorrow. (好啊，你在那呢？我明天就回去了)
Gold Resp :	OK, come to **Nanjing**! (好，来**南京**！)

Figure 5: Sample responses generated by baselines and our model.

Conclusion

In this paper, we present a pre-training based dialogue generation model that can produce coherent persona-consistent responses conditioned on explicitly represented personas. Our method can effectively utilize persona-sparse dialogue data in the fine-tuning stage. We add attribute embeddings in the encoder to model the persona of each speaker involved in the dialogue context and devise a dynamic weighting scheme in the decoder to balance the amount of persona-related features to exhibit in the decoded responses. Automatic and manual evaluation results show that our model can incorporate richer persona-related features in the generated responses compared to state-of-the-art baselines when the dialogues available at the fine-tuning stage are persona-sparse.

Acknowledgments

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