MPCHAT: Towards Multimodal Persona-Grounded Conversation

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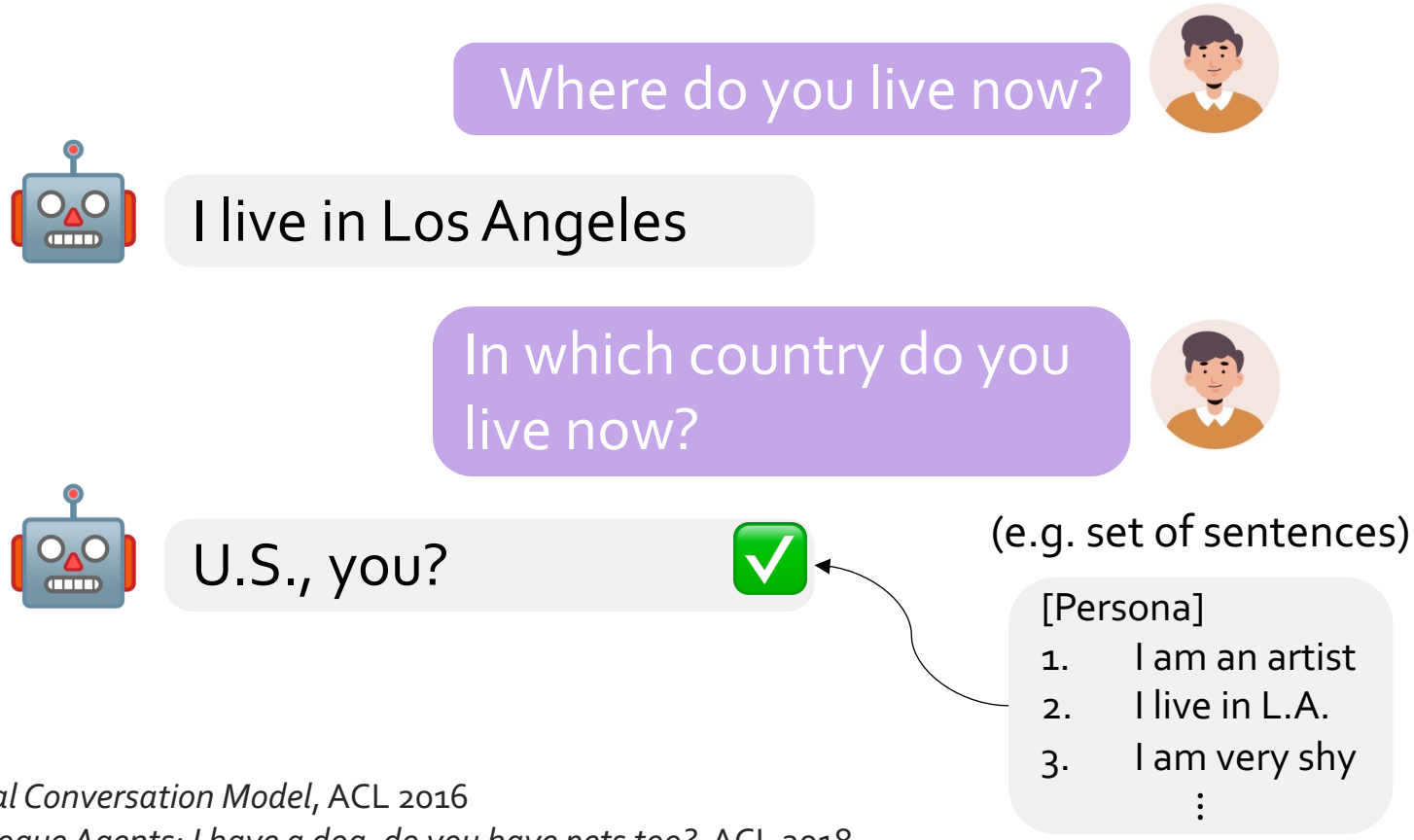
Persona-Grounded Dialogue?

- Dialogue models tend to produce inconsistent responses[1]

[1] Li et al., *A Persona-Based Neural Conversation Model*, ACL 2016
[2] Zhang et al., *Personalizing Dialogue Agents: I have a dog, do you have pets too?*, ACL 2018

Persona-Grounded Dialogue?

- Dialogue models tend to produce inconsistent responses[1]
- Incorporating persona to generate consistent responses[2]



[1] Li et al., *A Persona-Based Neural Conversation Model*, ACL 2016
[2] Zhang et al., *Personalizing Dialogue Agents: I have a dog, do you have pets too?*, ACL 2018

Persona Type

- Previous works have focused on textual persona
  - Personal Facts
  - Personalities

Persona Type (Dataset)	Personal Facts (PersonaChat[2])	Personalities (PELD[3])
Format	Character description using 5 sentences	Strength of big-five personality: Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism
Example	1. I like to ski 2. My wife doesn't like anymore 3. I am an artist 4. I am on a diet now 5. I have a cat	[0.648, 0.375, 0.386, 0.58, 0.477]

[2] Zhang et al., *Personalizing Dialogue Agents: I have a dog, do you have pets too?*, ACL 2018
[3] Wen et al., *Automatically Select Emotion for Response via Personality-affected Emotion Transition*, ACL Findings 2021

Persona Type

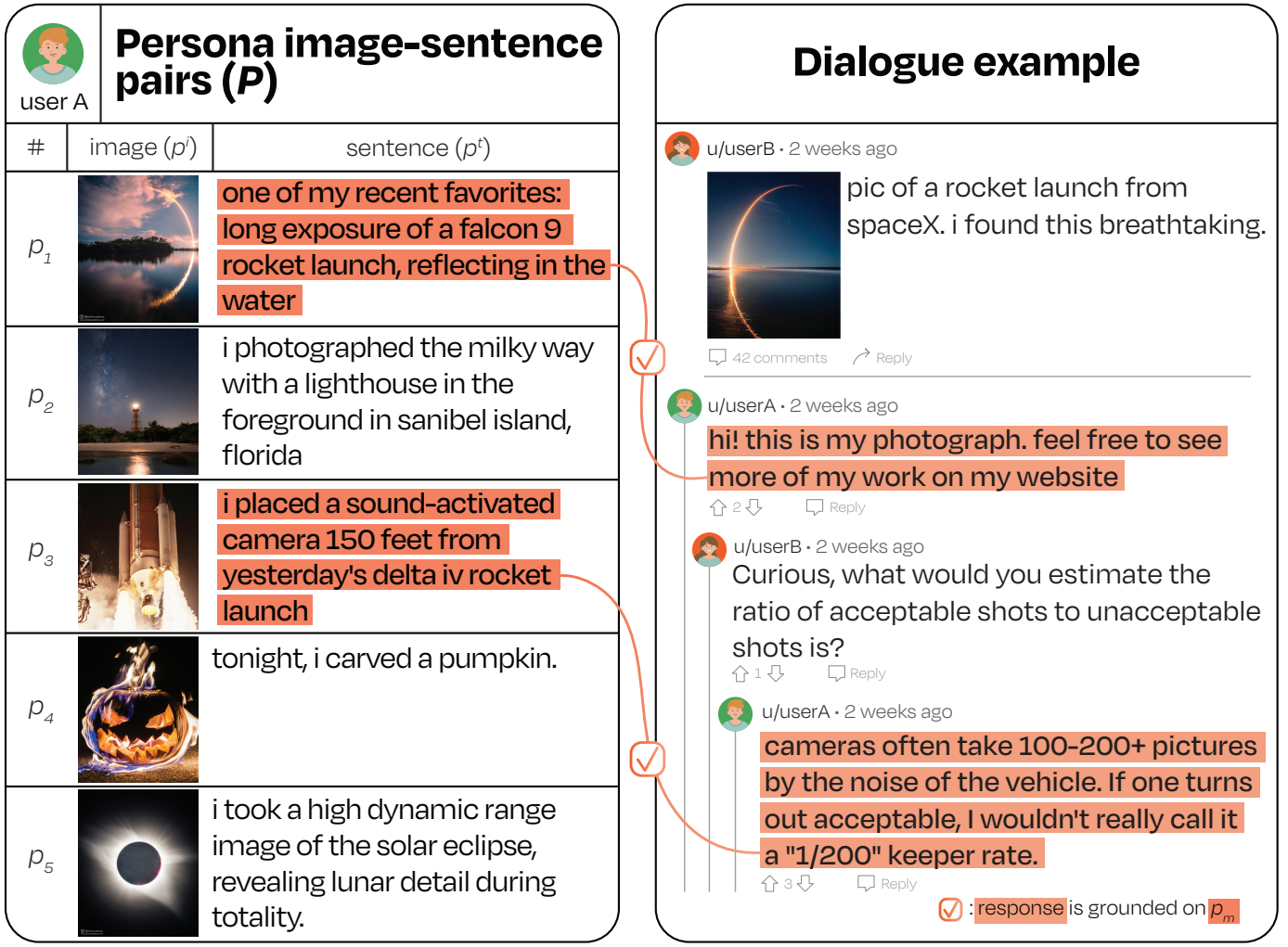
- However, persona should be explored in multi-faceted ways[4]
  - Episodic memory is important in shaping personal identity[5]
    - Memory of everyday events or personal experiences[6]
    - Represented in the form of visual images[7]
- We propose multimodal persona, a set of image-sentence pairs

MPCHAT	PersonaChat
• i gave my computer setup a christ-mas themed overhaul 	• i love computers • i work as a computer programmer • i work at home on my computer • i love rpg computer games . . .
• i think we found doggie uptopia. 	• i have a dog • i love dogs • i walk dogs for a living • i enjoy log walks with my dog . . .

[4] Moore et al., *Five dimensions of online persona*, Persona Studies 2017
[5] Wilson and Ross, *The identity function of autobiographical memory: Time is on our side*, Memory 2003
[6] Tulving, *Episodic and Semantic Memory*, Organization of Memory 1972
[7] Conway., *Episodic memories*, Neuropsychologia 2009

Towards Multimodal Persona-Grounded Dialogue

- MPCHAT dataset
  - Sourced from reddit
  - Multimodal persona reveals one's episodic memories
  - Responses are grounded on persona image-sentence pairs



MPCHAT: Data Construction

1) Subreddit curation

r/pics

r/cats

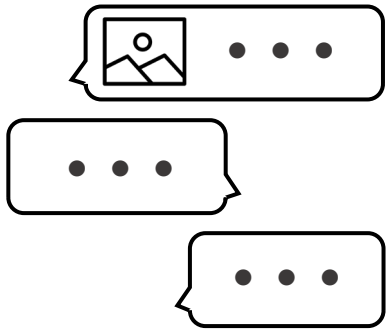
r/itookapicture

⋮

2) Persona collection

+ automatic filtering

3) Dialogue collection



+ automatic filtering

4) Additional filtering

privacy

nsfw

5) Human labeling

MPCHAT: Statistics

- Total of 15K multi-turn dialogues
- Avg. # of persona: 17.87
- Avg. length of persona sent.: 10.14
- Avg. length of utterances: 18.49

	Train	Valid	Test
# Dialogue	11,975	1,516	1,509
# Speaker	21,197	2,828	2,797
# Utterance	34,098	4,189	4,244
# Persona Speaker	8,891	1,193	1,162
# Grounded Response	6,628	709	676
# Avg. Persona	15.89	25.6	30.76
# Avg. Subreddits	4.2	5.97	5.88
Avg. Utterance Length	18.39	18.74	19.05
Avg. Persona Length	10.16	10.23	10.02

MPCHAT: Multimodal Persona

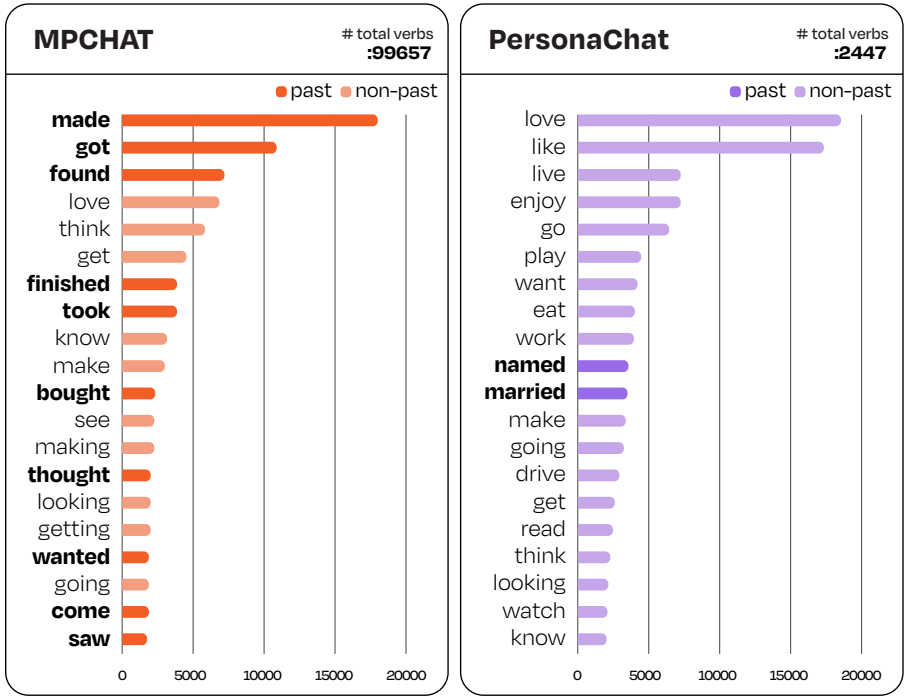
- Only MPCHAT supports both textual and visual persona
- MPCHAT provides persona entailment labels

Dataset	# Dialogue	Data source	Persona type	Persona modality	Entailment label
LIGHT[8]	11K	Crowd-sourced	Fact	T	No
PD[9]	20.8M	Weibo	Fact	T	No
PEC[10]	355K	Reddit	Thought	T	No
PELD[3]	6.4K	TV shows	Personality	T	No
PersonaChat[2]	13K	Crowd-sourced	Fact	T	Post-Hoc
FoCus[11]	14K	Crowd-sourced	Fact	T	Yes
MPCHAT	15K	Reddit	Episodic memory	V, T	Yes

[2] Zhang et al., *Personalizing Dialogue Agents: I have a dog, do you have pets too?*, ACL 2018
[3] Wen et al., *Automatically Select Emotion for Response via Personality-affected Emotion Transition*, ACL Findings 2021
[8] Urbanek et al., *Learning to speak and act in a fantasy text adventure game*, EMNLP 2019
[9] Zheng et al., *Personalized dialogue generation with diversified traits*, arXiv 2019
[10] Zhong et al., *Towards persona-based empathetic conversational models*, EMNLP 2020
[11] Jang et al., *Call for customized conversation: Customized conversation grounding persona and knowledge*, AAAI 2022

MPCHAT: Persona Statistics

- Episodic-memory-based persona
  - Lots of past tense verbs
  - Lexically diverse

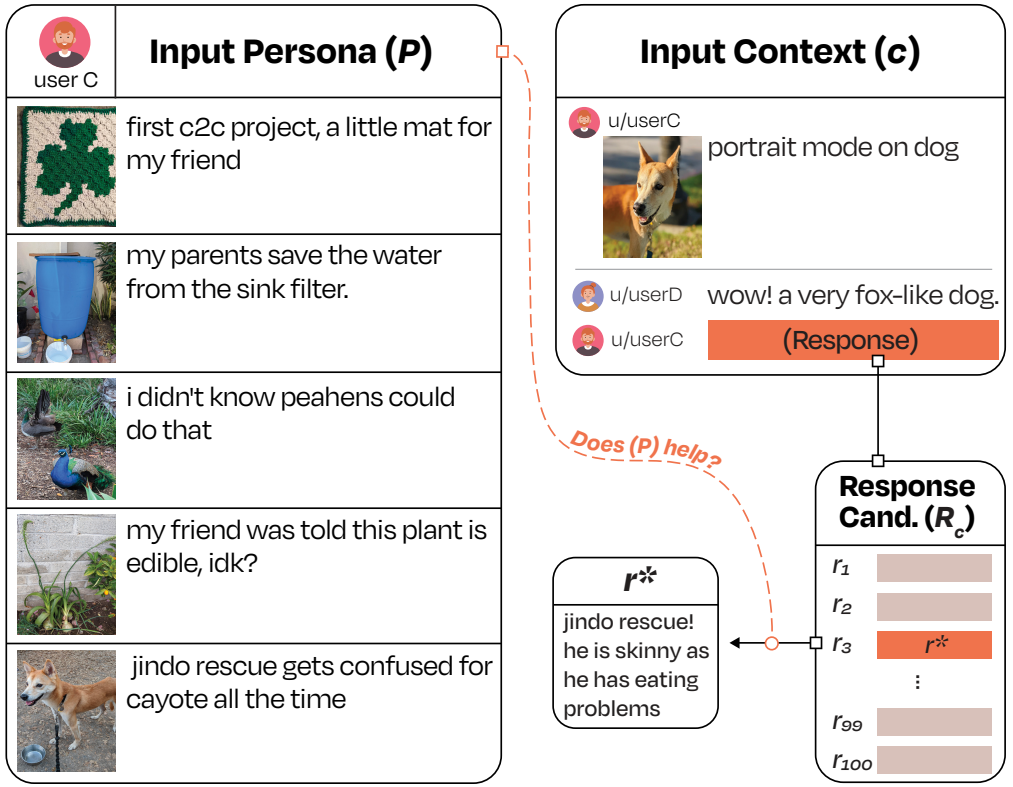


Dataset	# 2-grams	# 3-grams	# 4-grams	MTLD	MATTR	HD-D
PersonaChat[2]	15,263	27,631	36,063	78.08	0.7791	0.7945
PEC[10]	34,051	54,649	62,290	111.39	0.811	0.8315
MPCHAT	**39,694**	**60,199**	**66,732**	**171.91**	**0.8534**	**0.8674**

[2] Zhang et al., *Personalizing Dialogue Agents: I have a dog, do you have pets too?*, ACL 2018
[10] Zhong et al., *Towards persona-based empathetic conversational models*, EMNLP 2020

MPCHAT: Three Benchmarks

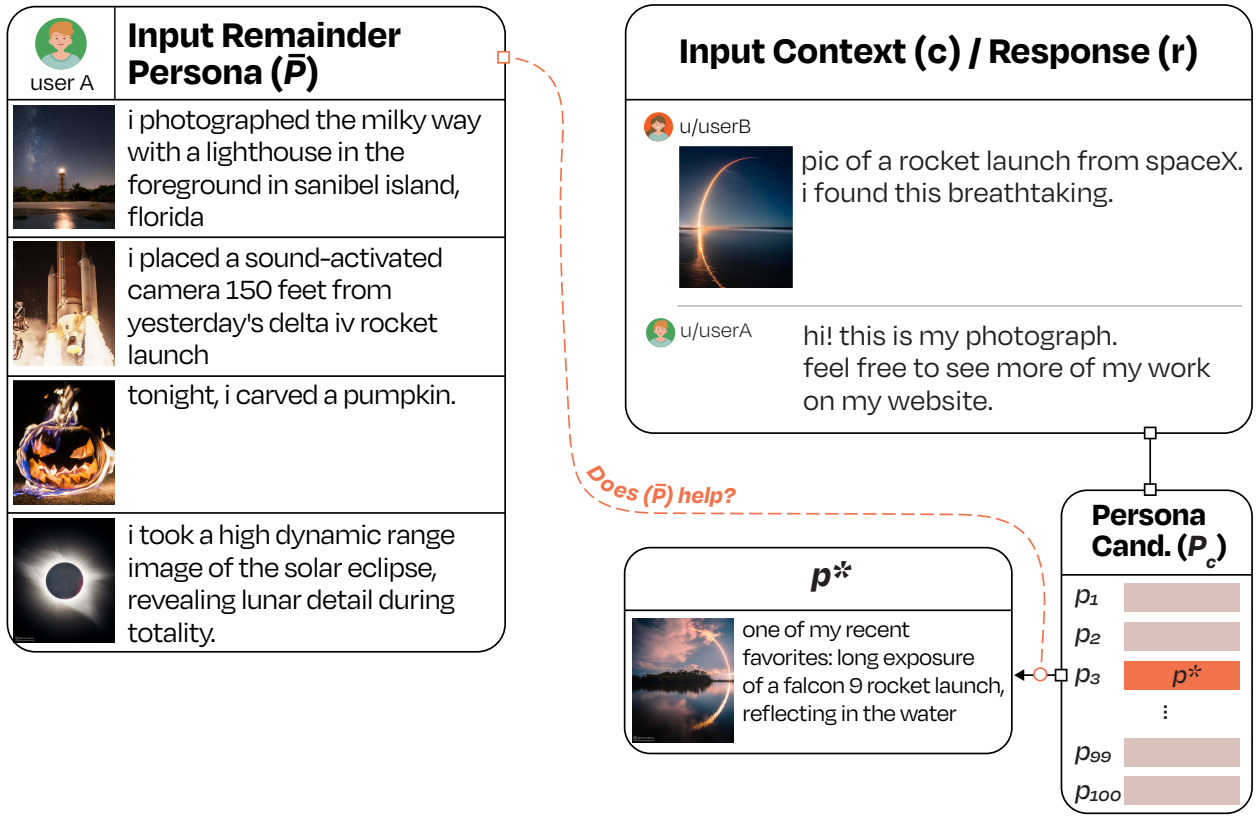
1) Next Response Prediction (NRP)
   - Input: context c, multimodal persona P, response candidates R_c
   - Output: response r



MPCHAT: Three Benchmarks

2) Grounding Persona Prediction (GPP)

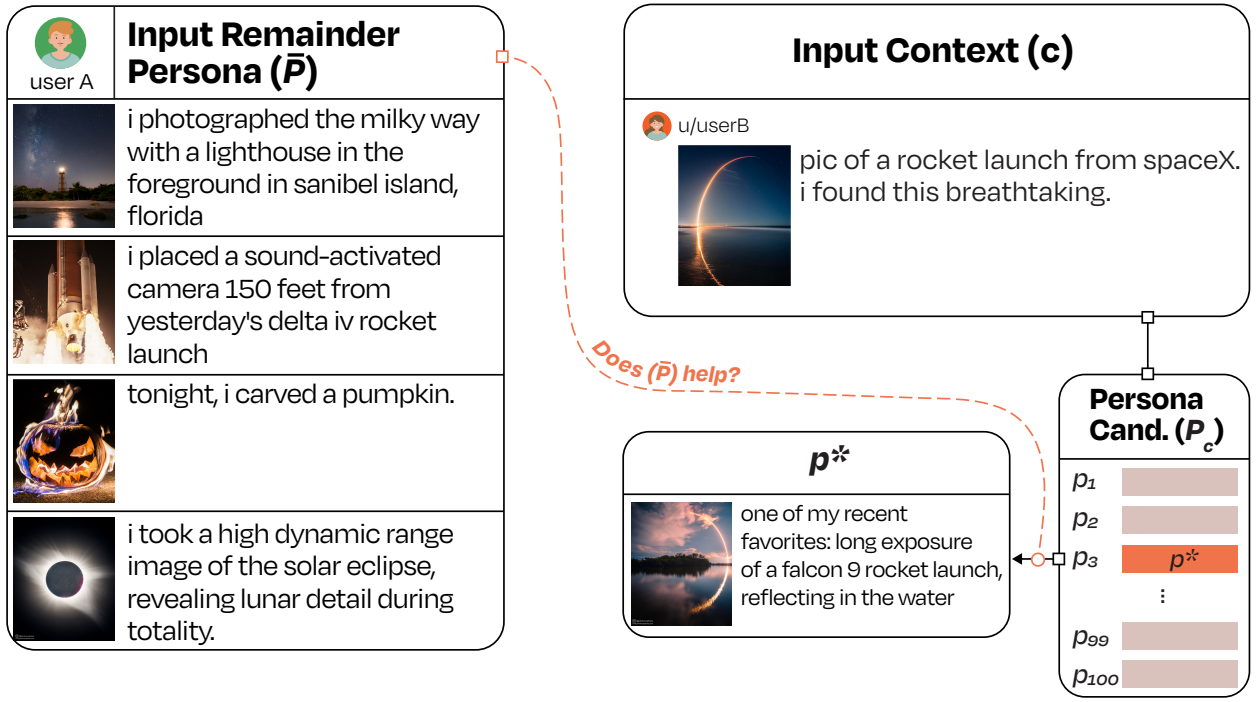
- Predict speaker's grounding persona element based on dialogue info
- "response" case
  - Input: context c, response r, remainder persona set $\bar{P}$, persona candidates P_c
  - Output: persona element p



MPCHAT: Three Benchmarks

2) Grounding Persona Prediction (GPP)

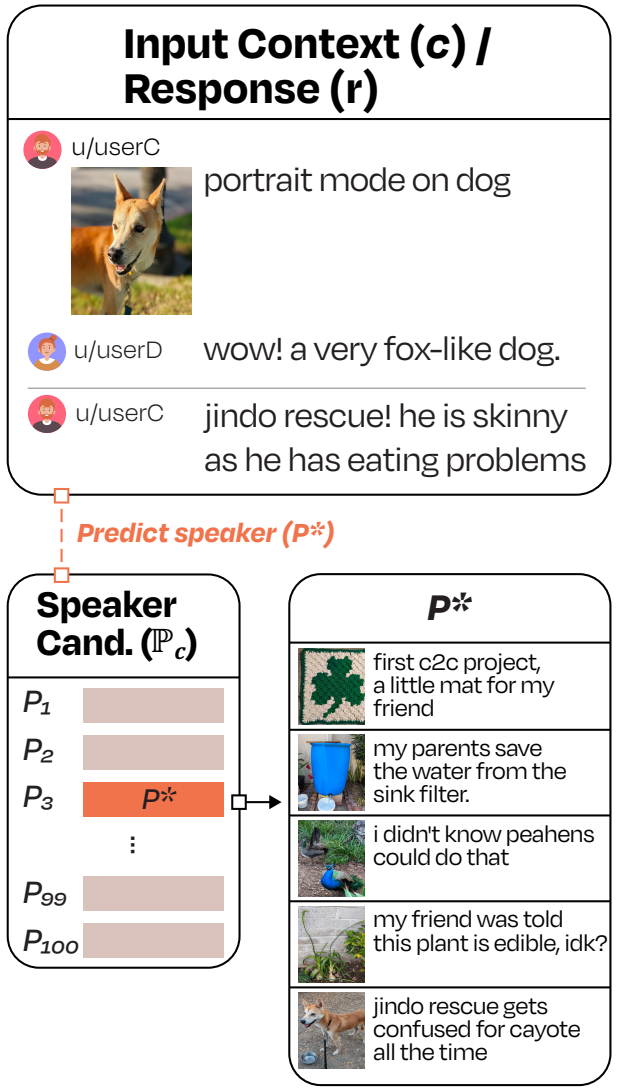
- Predict speaker's grounding persona element based on dialogue info
- "no-response" case
  - Input: context c, ~~response r~~, remainder persona set $\bar{P}$, persona candidates P_c
  - Output: persona element p



MPCHAT: Three Benchmarks

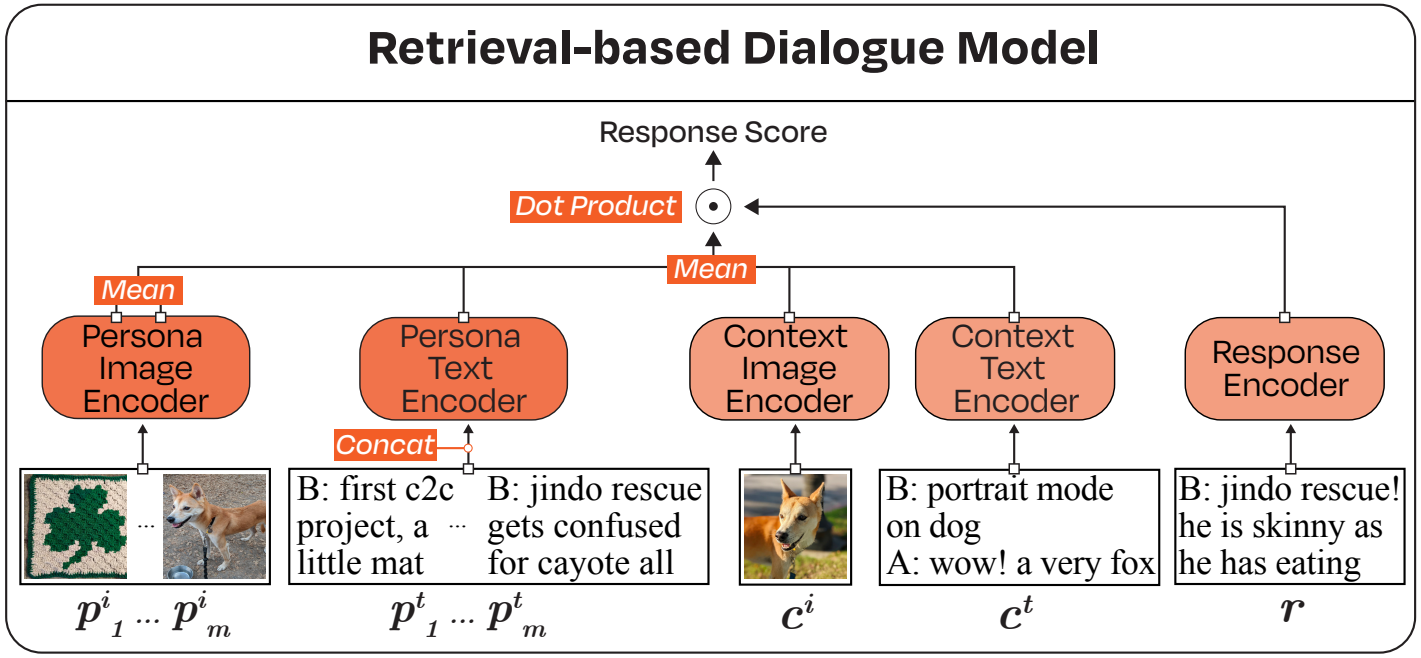
3) Speaker Identification (SI)

- Predict speaker based on dialogue info
- Input: context c, response r, speaker candidates $\mathbb{P}_c$
- Output: speaker P



MPCHAT: Models

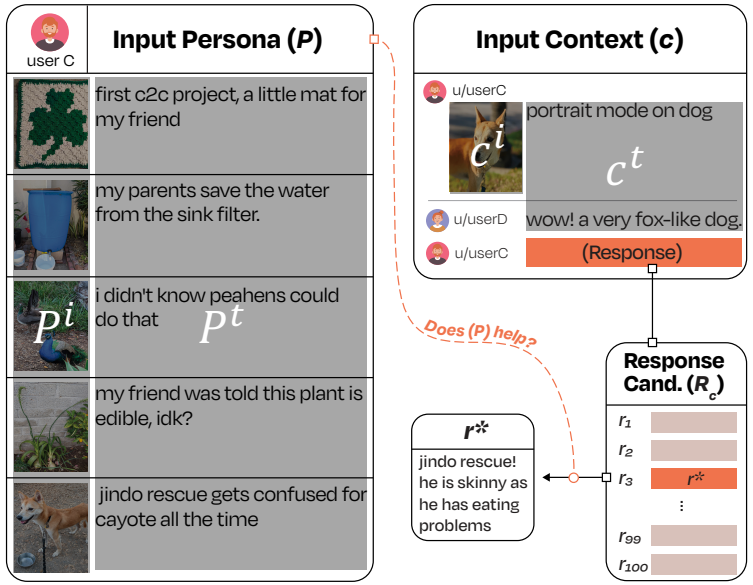
- Separate encoders for each input
  - Image encoder: ViT-B/32[12], CLIP-ViT-B/32[13] vision model
  - Text encoder: SBERT[14], CLIP-ViT-B/32 text model

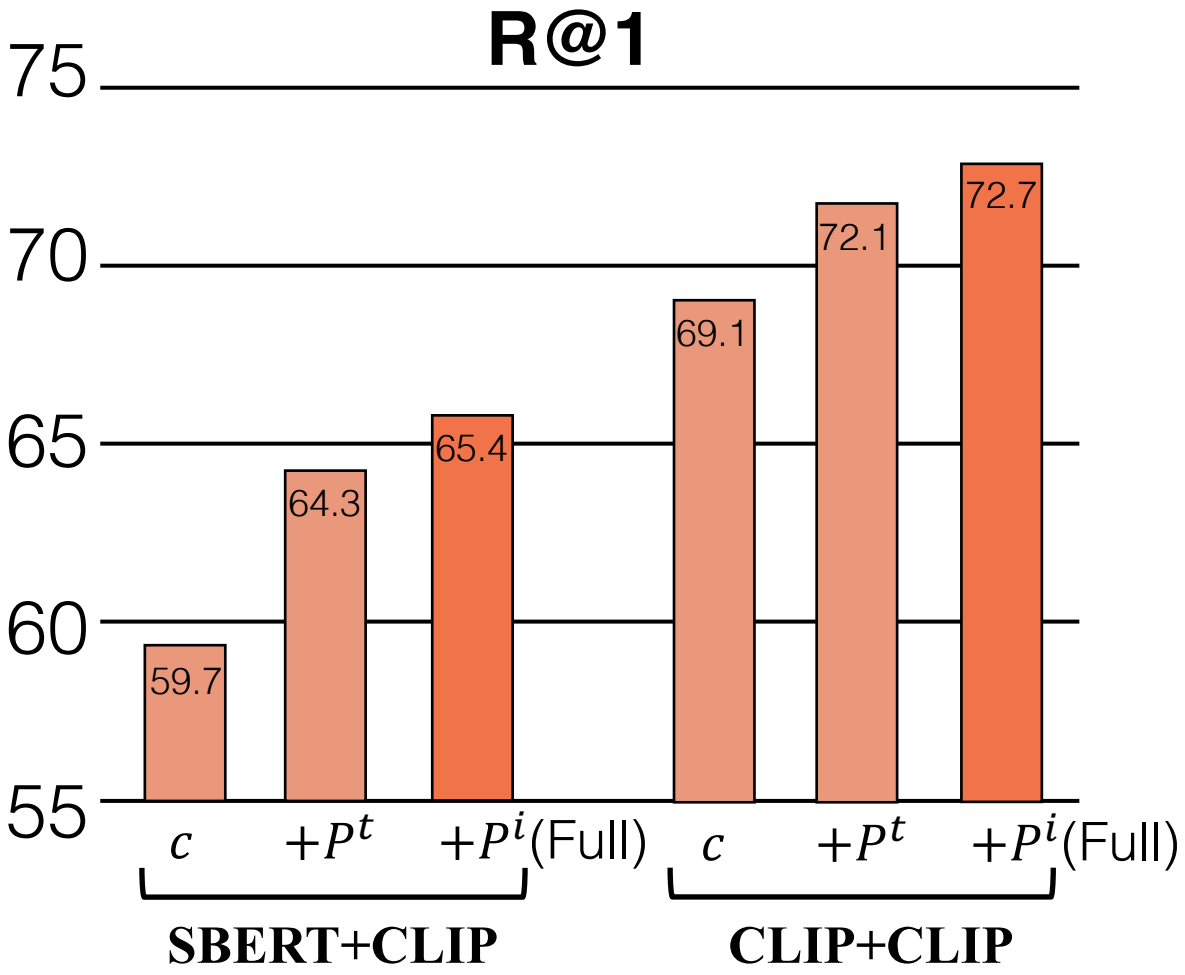


[12] Dosovitskiy et al., *An image is worth 16x16 words: Transformers for image recognition at scale*, ICLR 2021
[13] Radford et al., *Learning transferable visual models from natural language supervision*, ICML 2021
[14] Reimers and Gurevych, *SentenceBERT: Sentence embedding using Siamese BERT-Networks*, EMNLP 2019

Quantitative Results on NRP

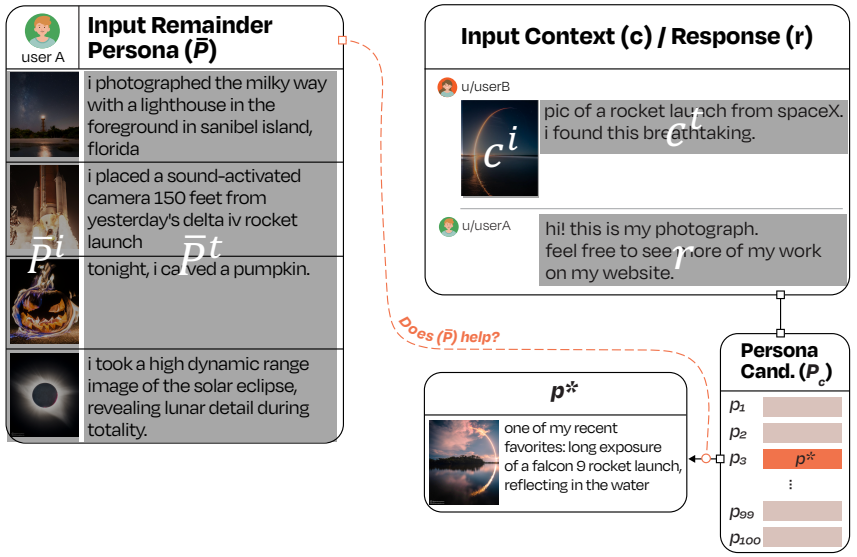
- Model w/ multimodal persona outperforms baseline

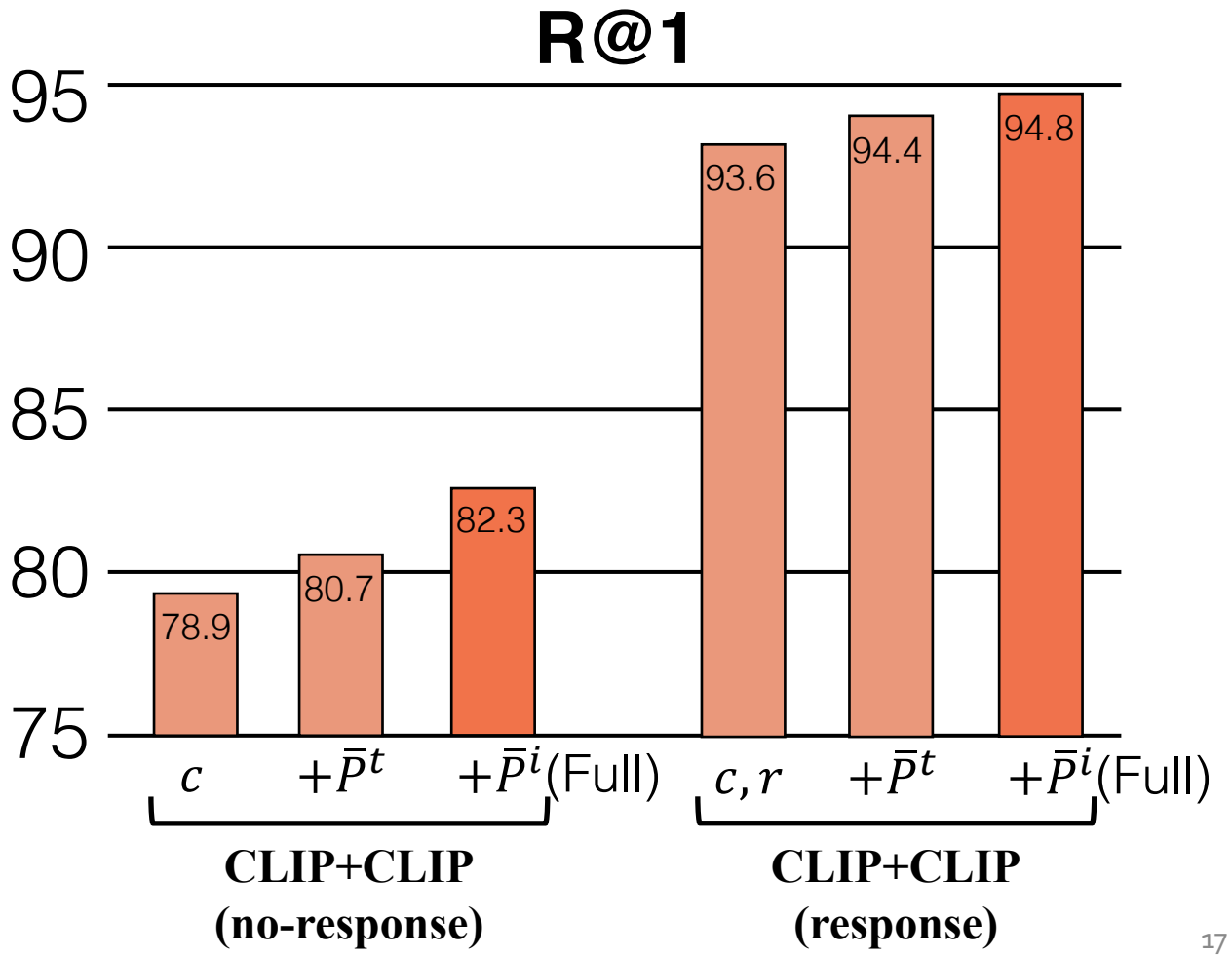




Quantitative Results on GPP

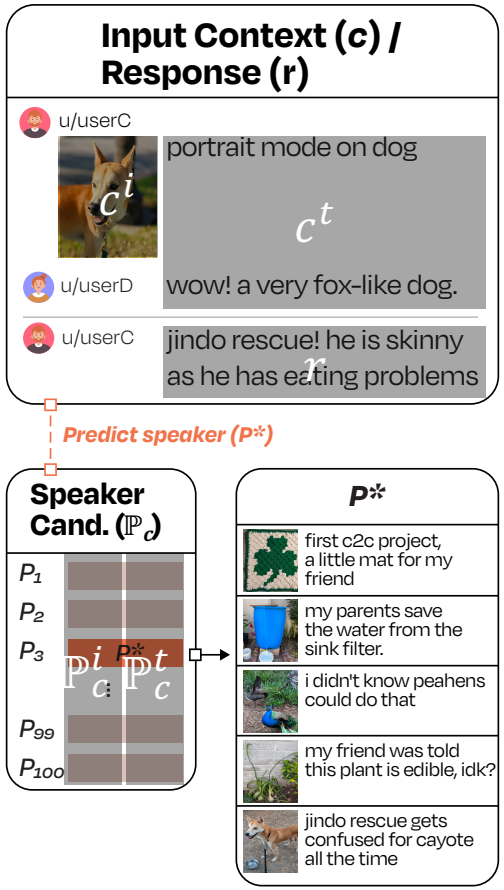
- Model w/ multimodal persona outperforms baseline

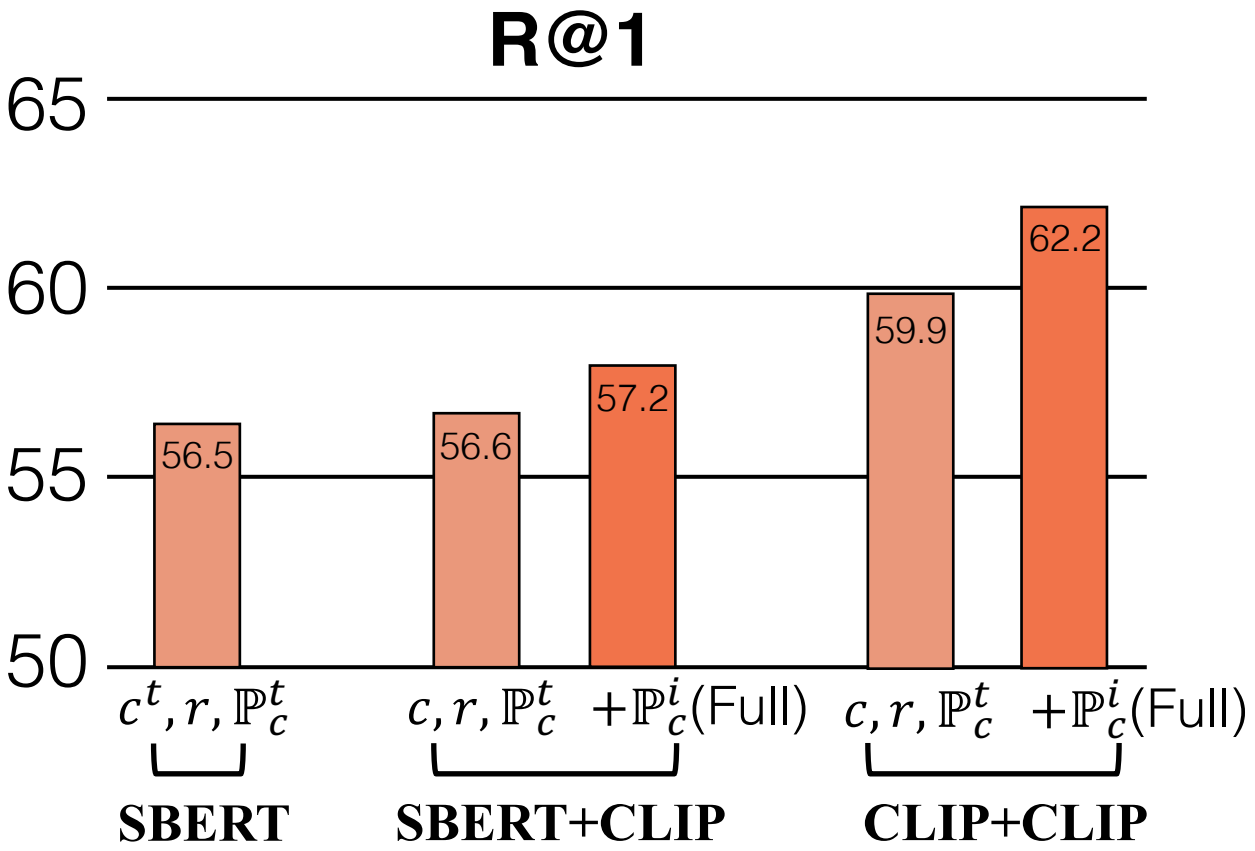




Quantitative Results on SI

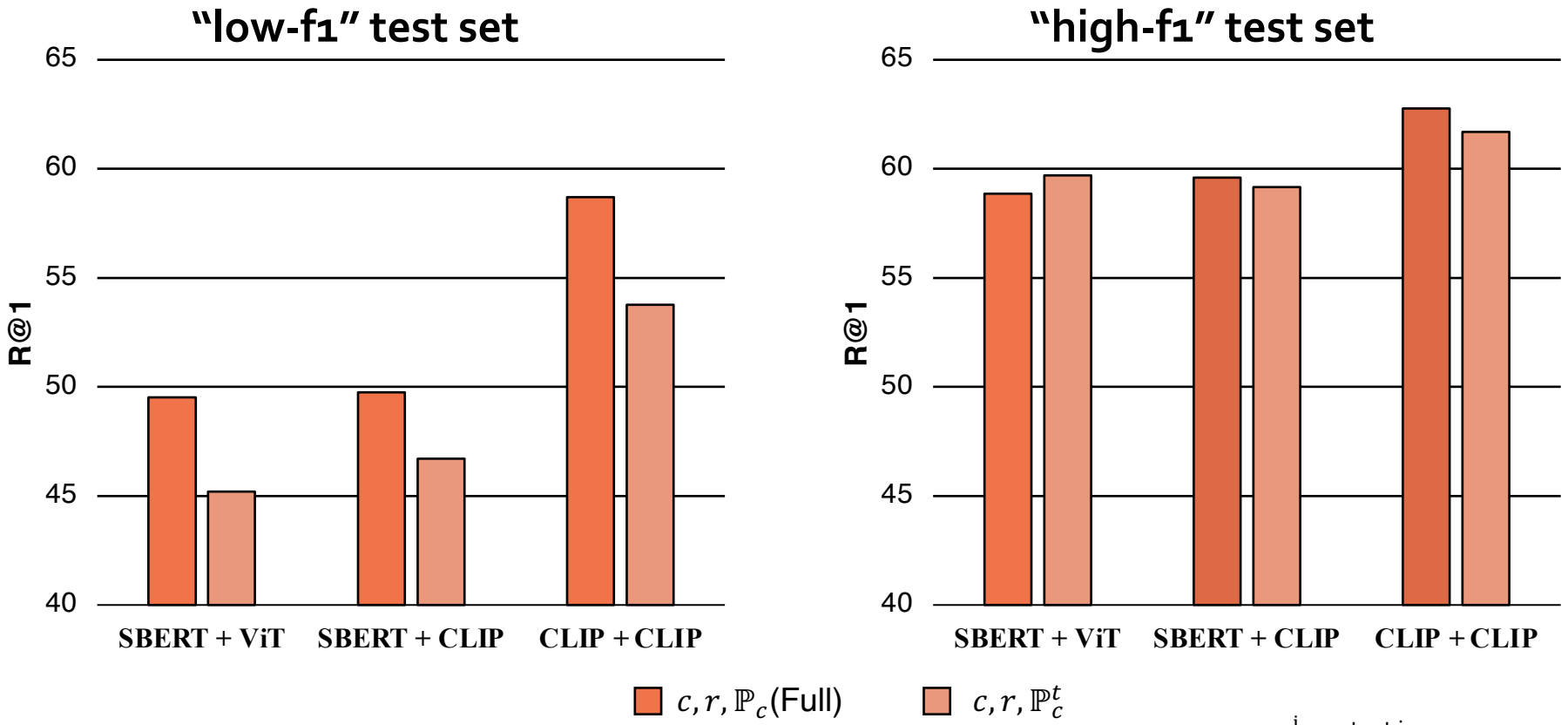
- Model w/ multimodal persona outperforms baseline





When is multimodal persona helpful?

- SI: Larger gap in "low-f1" test set (same trend in NRP)



c^i: context image
c^t: context text
c: $c^i \cup c^t$
r: response

$\mathbb{P}_c^i$: speakers' persona images
$\mathbb{P}_c^t$: speakers; persona sentences
$\mathbb{P}_c$: $\mathbb{P}_c^i \cup \mathbb{P}_c^t$

Error Analysis

- Randomly sampled 30 examples from CLIP+CLIP "incorrect" prediction
  - Main challenges in understanding both multimodal persona and context

NRP	Context & persona	Context-only
Multimodal understanding	**14 (47%)**	5 (16%)
Text understanding	7 (23%)	2 (7%)
Task ambiguity	2 (7%)	

GPP (no-response)	Context & persona	Persona-only
Multimodal understanding	**15 (50%)**	2 (7%)
Text understanding	7 (23%)	2 (7%)
Task ambiguity	4 (13%)	

Concluding Remarks

- Limitations of persona type and modality

  → Represent personal facts or personalities through textual persona

- Towards episodic-memory-based multimodal persona

  → MPCHAT: Multimodal persona-grounded dialogue dataset
  & propose three benchmarks: NRP, GPP, SI

- Outperforms baselines on all tasks w/ multimodal persona

  → MPCHAT is a high-quality resource, given its well-grounded dialogues on multimodal personas

Thank you

Code https://github.com/ahnjaewoo/mpchat

Paper https://arxiv.org/abs/2305.17388

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