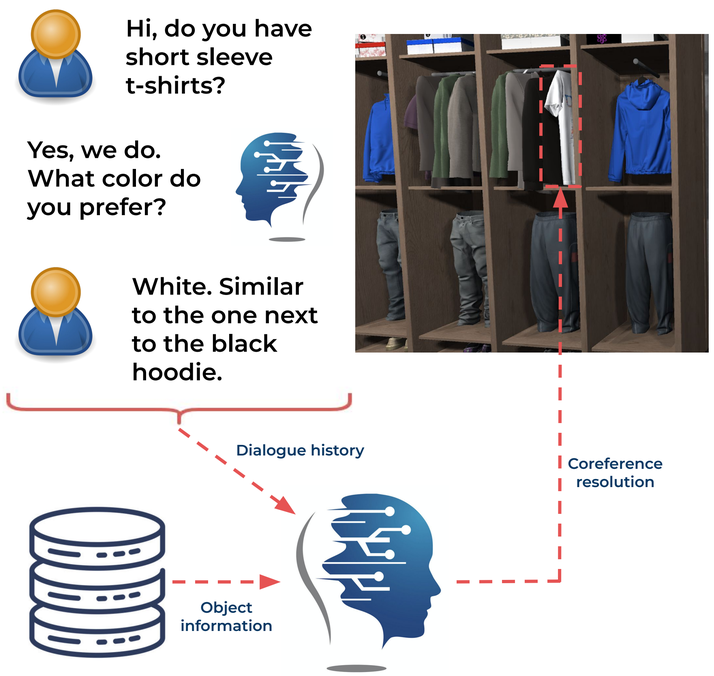
Multimodal Coreference Resolution

UNIVERSITY OF CAMBRIDGE

Alejandro Santorum Varela
Svetlana Stoyanchev, Kate Knill

TOSHIBA

Introduction

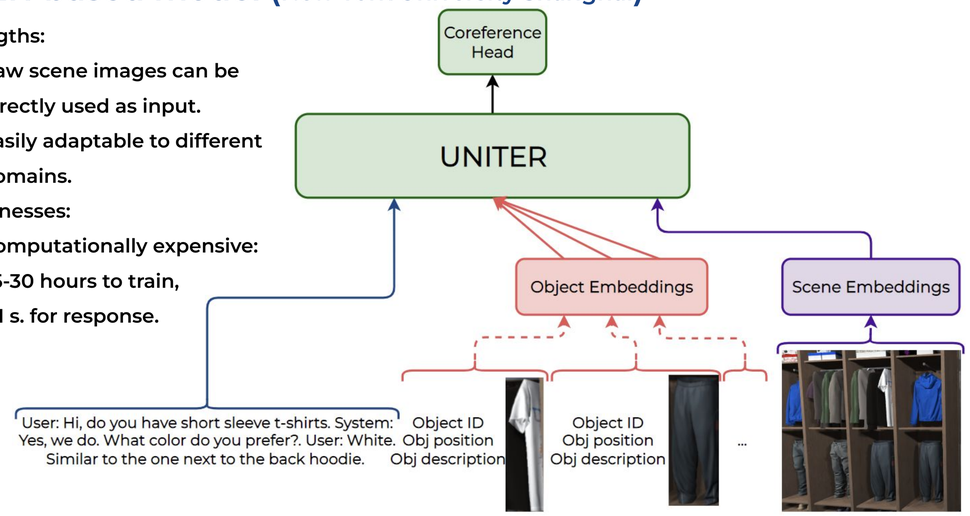


- Applications:
  - E-commerce virtual assistant: answer customer inquiries about objects.
  - Situated human-robot interaction.
  - Boost other natural language tasks, like question answering or generation.
- SIMMC2 dataset:
  - Published by Facebook Research.
  - It contains 11244 dialogues, 117236 utterances, object descriptions and 1566 scene images.
- The 10th Dialog System Technology Challenge (DSTC10) partially focused on the multimodal coreference resolution task.
  - SIMMC2 dataset was used for the competition.
  - Best performing systems are studied as a enhanced baseline.

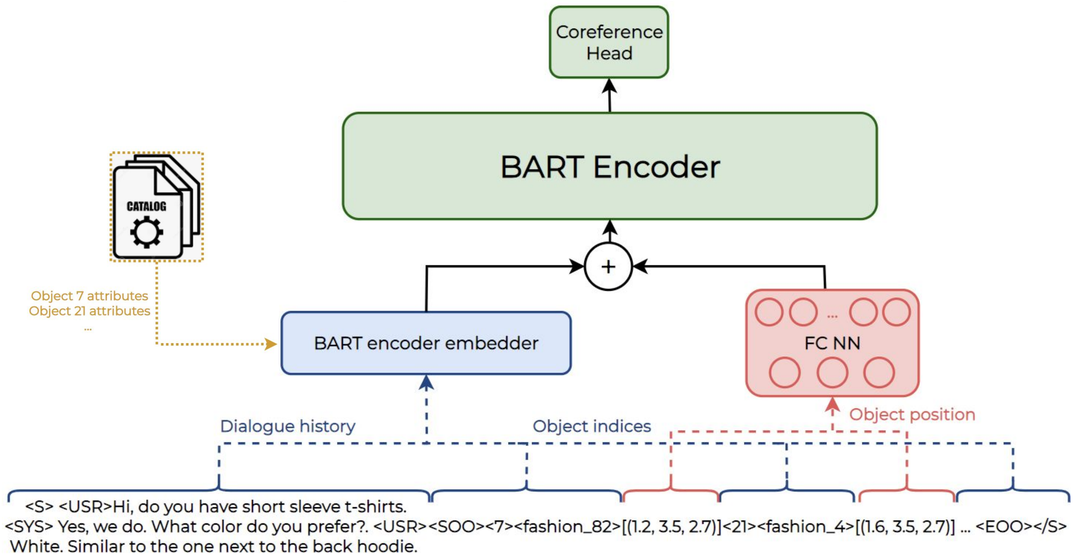
SOTA MMCR Systems

UNITER-based model (New York University Shanghai)

- Strengths:
  - Raw scene images can be directly used as input.
  - Easily adaptable to different domains.
- Weaknesses:
  - Computationally expensive: 25-30 hours to train, ~ 1 s. for response.



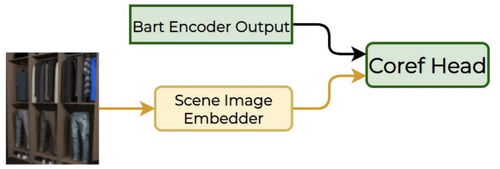
BART-based model (KAIST & Samsung Research)



- Strengths:
  - Winner of DSTC10 on this task.
  - Computationally cheaper: around 5 hours to train, <0.5 seconds for response.
- Weaknesses:
  - Bad at handling objects not seen in training.
  - Scene images need to be described in natural language to be used.

Proposed improvements

- Include object descriptions in the input of the BART-based model.
- Provide image embeddings to improve the coreference prediction of the BART-based model.



- Suppress object IDs in UNITER-based model to make it scene-independent.

Results

MODEL	DESCRIPTION	F1-Score
GPT-2-based	Baseline by Facebook Research	36.6 %
UNITER-based	DSTC10 submission	67.4 %
UNITER-based	DSTC10 submission improved including previously mentioned objects	72.8 %
UNITER-based (Ours)	**Our improvements on the previous model, removing object IDs from the input**	**75.8%**
BART-based	DSTC10 submission	74.3 %
BART-based (Ours)	**Our improvements on the previous model, using objects descriptions in the input**	**76.1 %**

References

[1] Satwik Kottur et.al. SIMMC 2.0: A Task-oriented Dialog Dataset for Immersive Multimodal Conversations. *Association for Computational Linguistics*. 2021.

[2] Yichen Huang et. al. UNITER-Based Situated Coreference Resolution with Rich Multimodal Input. *Computing Research Repository*. 2021.

[3] Haeju Lee et. al. Tackling Situated Multi-Modal Task-Oriented Dialogs with a Single Transformer Model. *Association for Computational Linguistics*. 2021.

Acknowledgments

Project carried out under the supervision of Svetlana Stoyanchev together with Rama Doddipatla and Simon Keizer from the Dialog group at Toshiba Europe Ltd., in collaboration with Kate Knill from the Engineering Department of the University of Cambridge.