Neural-Network-based Dialog Agents: Going Beyond the Seq2seq Model

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The Conversational Intelligence Challenge 2 « ConvAI2 » (NIPS 2018 competition)

First submission results
(The 2nd is on its way with a +8 points improvement in Hits@1)

Model	Creator	PPL	Hits@1	F1
	🤗 (Hugging Face)	20.47🍎	74.7🍎	17.52🍎
	High Five	-	65.9	-
	Little Baby	-	63.4	-
	Happy Minions	32.94	52.1	14.76
	Cats team	-	35.9	-
	loopAI	-	25.6	-
	Mohd Shadab Alam	29.94	13.8	16.91
	1st-contact	31.98	13.2	16.42
	Tensorborne	38.24	12.0	15.94
	Team Dialog 6	40.35	10.9	7.27
	NEUROBOTICS	35.47	-	16.68
	Sonic	33.46	-	16.67
topicSeq2seq	Team Pat	-	-	16.11
	Roboy	-	-	15.83
	Lost in Conversation	55.84	-	15.74
	flooders	-	-	15.47
	IamNotAdele	66.47	-	13.09
	Salty Fish	38.86	-	-
	Pinta	37.85	-	-
Seq2Seq + Attention	ParlAI team	29.8	12.6	16.18
Language Model	ParlAI team	46.0	-	15.02
KV Profile Memory	ParlAI team	-	55.2	11.9

Validation set (public) Leaderboard – Test set (hidden) Leaderboard

Model	Creator	PPL	Hits@1	F1
	(Hugging Face)	23.05	74.3	17.85
	Team Pat	-	-	17.85
	Pinta	-	51.4	17.25
	Mohd Shadab Alam	35.57	14.8	16.94
	Sonic	38.87	-	16.88
	NEUROBOTICS	39.7	-	16.82
	Happy Minions	34.57	68.1	16.72
	1st-contact	36.54	13.3	16.58
	Tensorborne	44.64	12.1	16.13
	flooders	-	-	15.96
	Lost in Conversation	62.83	-	15.91
	High Five	59.83	78.2	15.34
	Little Baby	-	72.9	-
	loopAI	-	29.7	-
	Salty Fish	42.3	-	-

Model	Creator	PPL	Hits@1	F1
	(Hugging Face)	20.47	74.7	17.52
	Little Baby	-	61.0	-
	Happy Minions	32.94	52.1	14.76
	High Five	52.8	50.3	13.73
	Pinta	-	44.4	16.52
	loopAI	-	25.6	-
	Mohd Shadab Alam	30.97	14.4	16.44
	1st-contact	31.98	13.2	16.42
	Tensorborne	38.24	12.0	15.94
	Team Dialog 6	40.35	10.9	7.27
	NEUROBOTICS	35.47	-	16.68
	Sonic	33.46	-	16.67
	Lost in Conversation	55.84	-	15.74
	flooders	-	-	15.47
	Team Pat	-	-	13.23
	Salty Fish	45.87	-	-
Seq2Seq + Attention	ParlAI team	29.8	12.6	16.18
Language Model	ParlAI team	46.0	-	15.02
KV Profile Memory	ParlAI team	-	55.2	11.9

- Small dataset =>
  - Large models are overfitting
  - Small models are underfitting

Chit-Chat 😺

Persona 1	Persona 2
I like to ski	I am an artist
My wife does not like me anymore	I have four children
I have went to Mexico 4 times this year	I recently got a cat
I hate Mexican food	I enjoy walking for exercise
I like to eat cheetos	I love watching Game of Thrones

[PERSON 1:] Hi
[PERSON 2:] Hello ! How are you today ?
[PERSON 1:] I am good thank you , how are you.
[PERSON 2:] Great, thanks ! My children and I were just about to watch Game of Thrones.
[PERSON 1:] Nice ! How old are your children?
[PERSON 2:] I have four that range in age from 10 to 21. You?
[PERSON 1:] I do not have children at the moment.
[PERSON 2:] That just means you get to keep all the popcorn for yourself.
[PERSON 1:] And Cheetos at the moment!
[PERSON 2:] Good choice. Do you watch Game of Thrones?
[PERSON 1:] No, I do not have much time for TV.
[PERSON 2:] I usually spend my time painting: but, I love the show.

Example dialog from the PERSONA-CHAT dataset. Person 1 is given their own persona (top left) at the beginning of the chat, but does not know the persona of Person 2, and vice-versa. They have to get to know each other during the conversation.

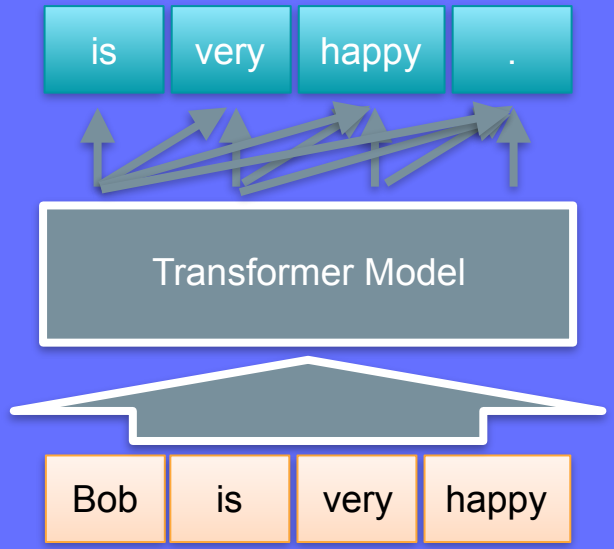
Open domain
Short conversation: <10 turns
Small talk: shallow topics, quick switches

What’s the difference? 

What’s the difference? 👻
Transfer Learning 🦄

A Transformer Model…

- **Long** fixed-length sequence model. In our case: 512 bpe tokens.
- Pre-train the model on the **language modeling task** on a large dataset (Toronto)



- We use the model of *Improving Language Understanding by Generative Pre-Training* by Radford et al. (2018)

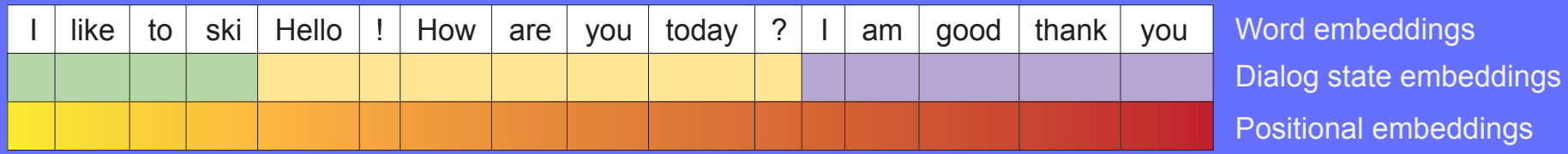
Encoding a Dialog 🤖

Encoding a Dialog and a Persona

- **Dialog**:
  - Alternating utterances
  - Dialog flow
  - Conditioning on a personality

- Transformers have positional embeddings

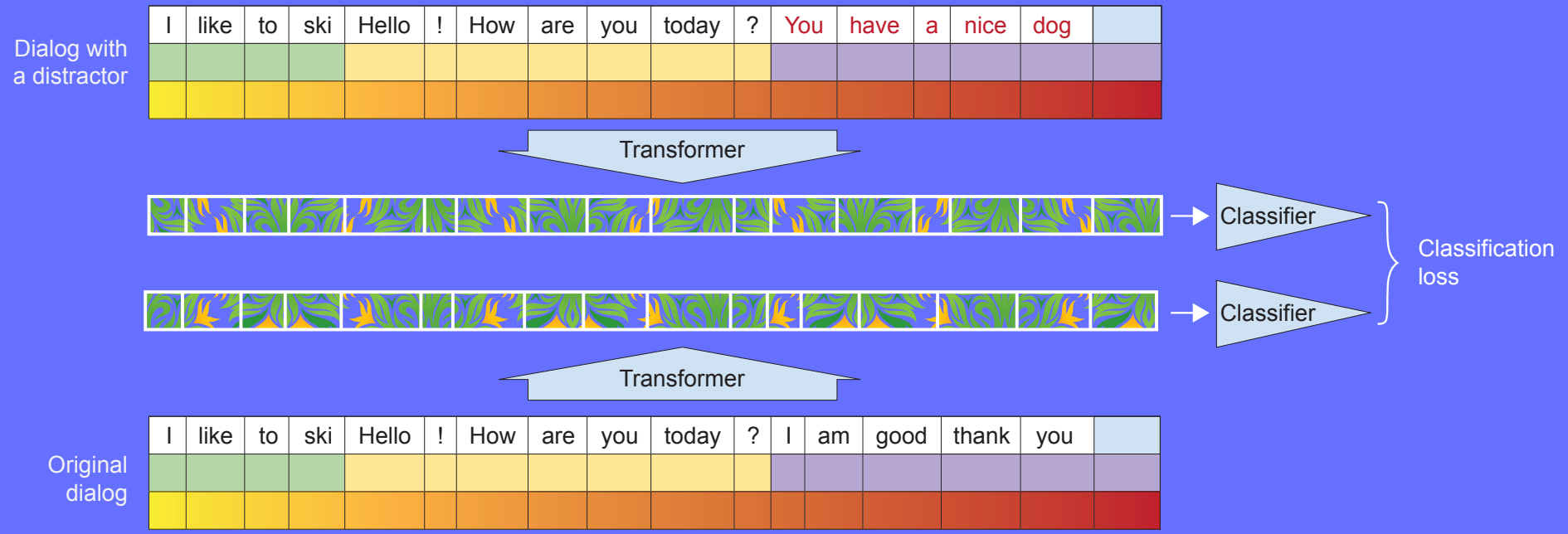
  ➡️ **Learn additional special embeddings** for utterances / personas



Learning Dialog Flow 

Semantic Learning on Dialog Utterances

- Learning to distinguish a real answer from a distractor.



Can be combined with language modeling fine-tuning in a multi-task fashion

That’s it for today
Thanks for listening!

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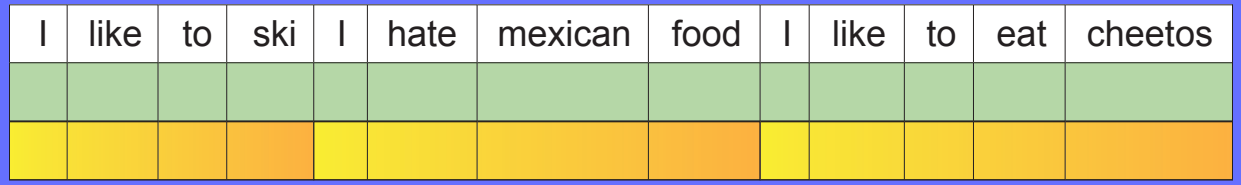
Encoding a Dialog and a Persona

- We can play with these embeddings to manipulate the notion of a sequence

Repeating specific embeddings to control positioning information



- We can also augment the dataset to bias towards positional invariance

Permutation augmented dataset to bias towards positional invariance