



Chatbot:
Controllable Response
Generation

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Controllable Response

How are you?



Chatbot

seq2seq

The same input can have different



你要如何貢獻社會？

有為青年：我要好好學習

惡魔貓男：你對社會貢獻的定義 ...

<https://youtu.be/qptqIndt64A>

Not limited to chatbot (e.g. TTS)

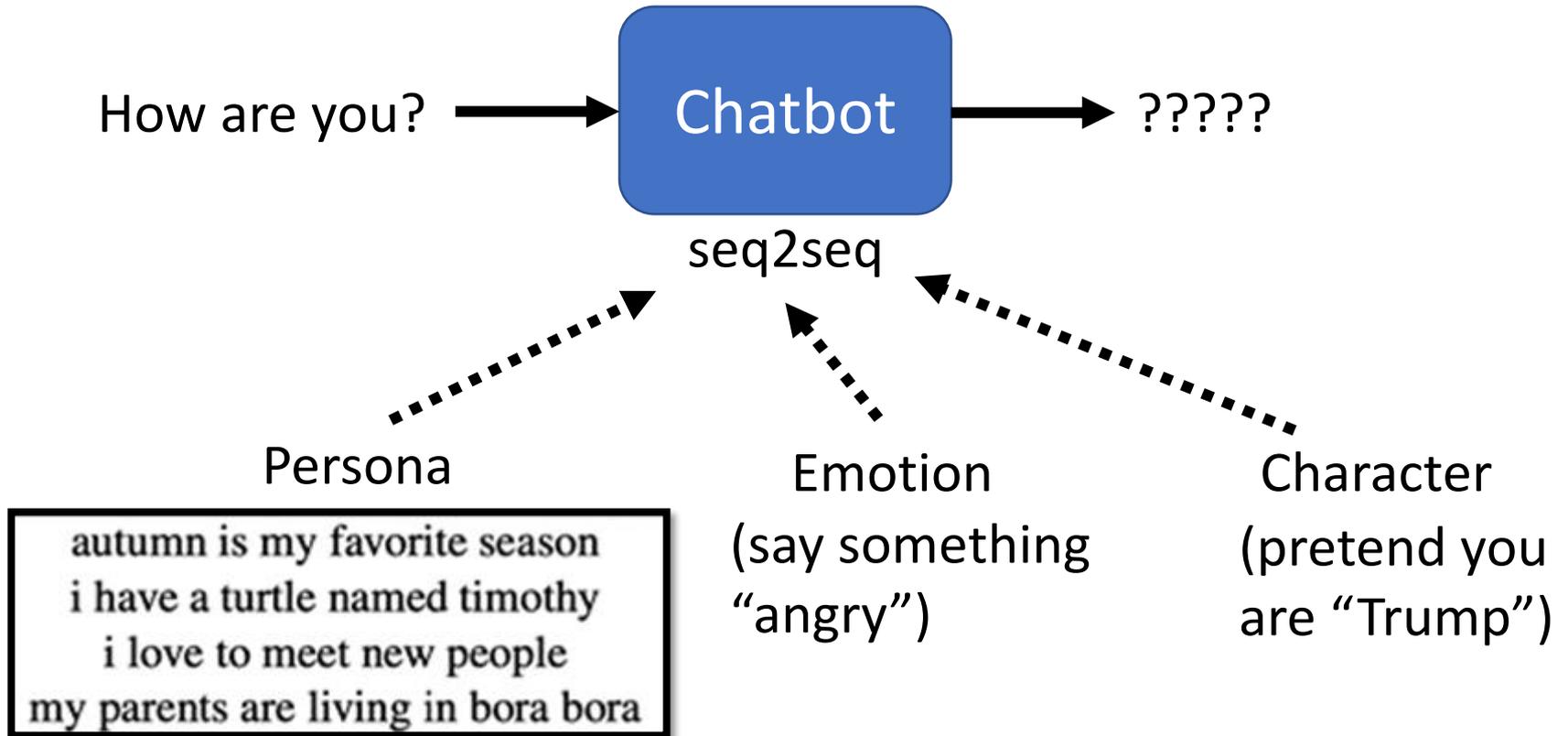
<i>message</i>	Where do you live now?
<i>response</i>	I live in Los Angeles.
<i>message</i>	In which city do you live now?
<i>response</i>	I live in Madrid.
<i>message</i>	In which country do you live now?
<i>response</i>	England, you?
<i>message</i>	Where were you born?
<i>response</i>	I was born in Canada.
<i>message</i>	Where are you from?
<i>response</i>	England, you?
<i>message</i>	Where did you grow up?
<i>response</i>	I grew up in Texas.
<i>message</i>	How old are you?
<i>response</i>	16 and you?
<i>message</i>	What's your age?
<i>response</i>	18.
<i>message</i>	What is your major?
<i>response</i>	I'm majoring in psychology
<i>message</i>	What did you study in college?
<i>response</i>	English lit.

Inconsistent

[Li, et al., ACL'16]

Chatbot usually chooses short and boring sentences (e.g. "I don't know").

Controllable Response Generation



Controllable Response Generation

User: Worst day ever. I arrived late because of the traffic.

Basic Seq2Seq: You were late.

ECM (*Like*): I am always here to support you.

ECM (*Happy*): Keep smiling! Things will get better.

ECM (*Sad*): It's depressing.

ECM (*Disgust*): Sometimes life just sucks.

ECM (*Angry*): The traffic is too bad!

Emotional
Chatting Machine

[Zhou, et al., AAAI'18]

chat context What are you doing?

Twitter bot i'm just chilling with my dad, i'm just sitting in the kitchen and listening to music

Star Wars bot i'm doing my magic solo.

Hillary bot i'm running for president, i'm going to be talking about some of these things

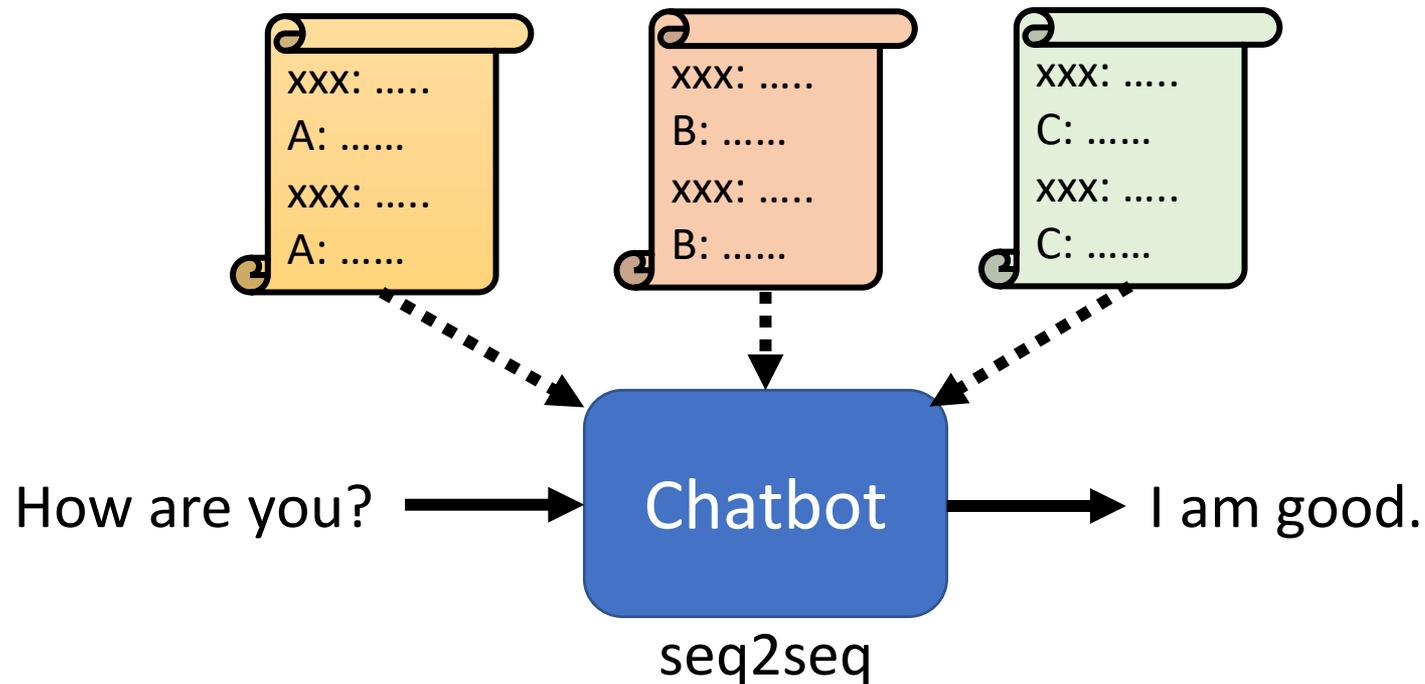
Trump bot i'm building a wall, right now

Kennedy bot today, i am asking the congress for a new program to make a new effort to increase the tax privileges and to stimulate

Characters

[Wang, et al., EMNLP'17]

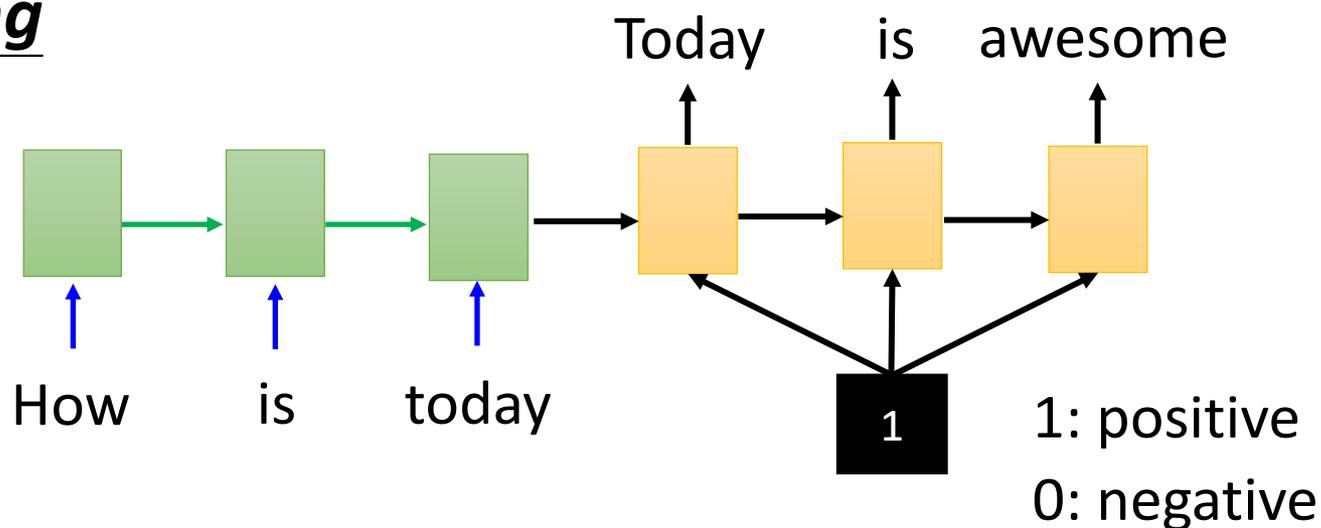
Approach 1: Directly Fine-tune



- Fine-tuning with limited data is easy to overfit.
- MAML: initial parameters only need a few dialogue samples to adapt.

Approach 2: Control by Condition

Training

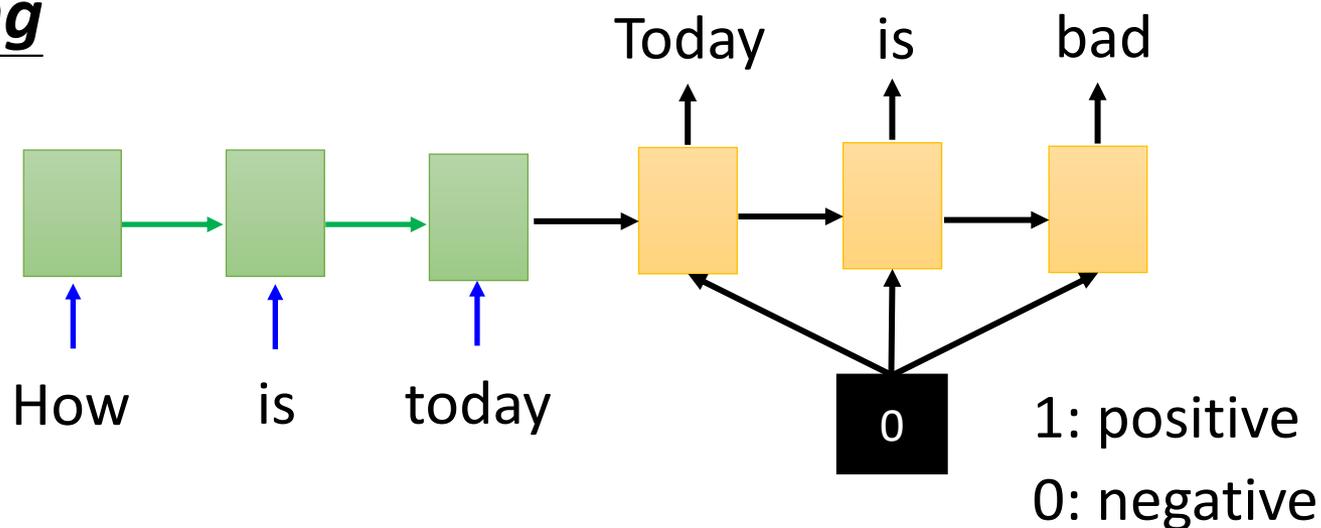


Input: How is today?
Response: Today is awesome.
(Positive)

Input: How is today?
Response: Today is bad.
(Negative)

Approach 2: Control by Condition

Training

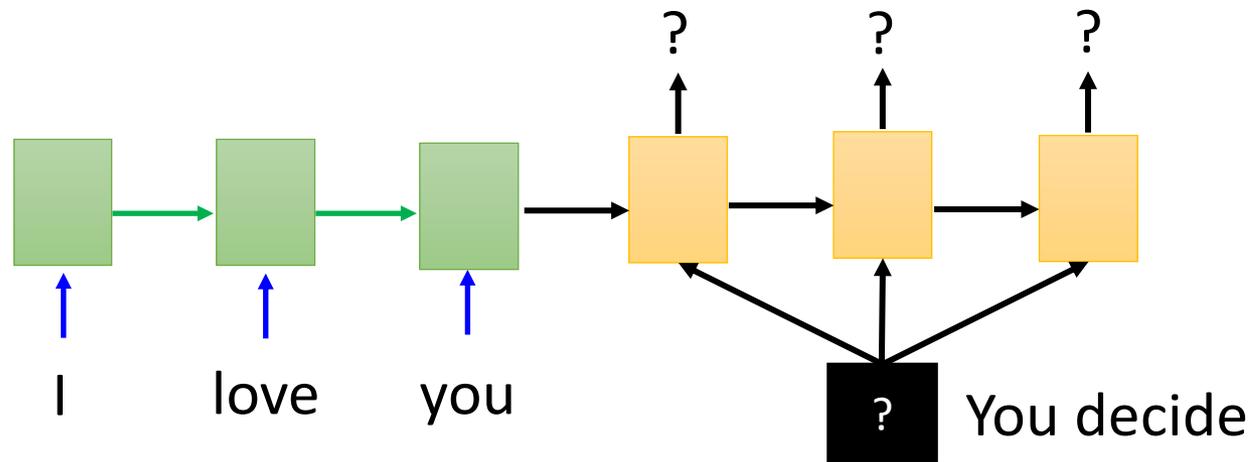


Input: How is today?
Response: Today is awesome.
(Positive)

Input: How is today?
Response: Today is bad.
(Negative)

Approach 2: Control by Condition

Testing

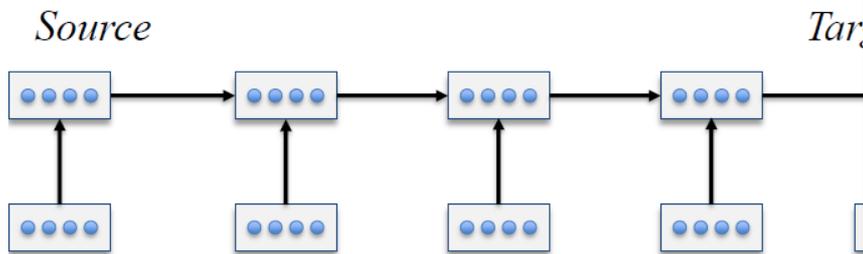


? = 1.0 Response: I love you, too.

? = 0.0 Response: I am not ready to start a relationship.

Approach 2: Control by Condition

- Persona-based model
[Li, et al., ACL'16]



<i>message</i>	Where is your hometown?
<i>baseline</i>	I was born in Canada.
<i>user1</i>	I'm from England.
<i>user2</i>	I'm from Manchester.
<i>user3</i>	I'm from Liverpool.
<i>user4</i>	England. You?
<i>user5</i>	My hometown.
<i>user6</i>	I'm from Texas.
<i>user7</i>	I'm from LA.
<i>user8</i>	England.
<i>user9</i>	I was born here.
<i>user10</i>	I was born in the us.

<i>message</i>	What did you have for dinner?
<i>baseline</i>	I had fish and chips.
<i>user1</i>	I had spag bol.
<i>user2</i>	Chicken and chips.
<i>user3</i>	Chicken and rice.
<i>user4</i>	Fish and chips.
<i>user5</i>	I had spag bol.
<i>user6</i>	I had Mexican food.
<i>user7</i>	Salad...
<i>user8</i>	I had chicken and chips.
<i>user9</i>	I had spag bol.
<i>user10</i>	Pizza.

<i>message</i>	What company do you work for?
<i>baseline</i>	I work for a company.
<i>user1</i>	I don't have a job.
<i>user2</i>	I'm a manager.
<i>user3</i>	I'm working. #
<i>user4</i>	I work for a company.
<i>user5</i>	I'm working. #
<i>user6</i>	Customer service.
<i>user7</i>	I work in retail.
<i>user8</i>	I work in a cafe.
<i>user9</i>	I work at a gas station.
<i>user10</i>	I don't know #

Approach 2: Control by Condition

- Emotional Chatting Machine

User: Worst day ever. I arrived late because of the traffic.

Basic Seq2Seq: You were late.

ECM (*Like*): I am always here to support you.

ECM (*Happy*): Keep smiling! Things will get better.

ECM (*Sad*): It's depressing.

ECM (*Disgust*): Sometimes life just sucks.

ECM (*Angry*): The traffic is too bad!

[Zhou, et al., AAI'18]

Approach 2: Control by Condition

- Conditional Transformer Language model (CTRL)

[Keskar, et al., arXiv'19]

Prepend the ***control code*** in front of token sequence.

Books w_1 w_2 w_3
http://speech.ee.ntu.edu.tw/~tlkagk/ w_1 w_2 w_3



Control Code	Description
Wikipedia	English Wikipedia
Books	Books from Project Gutenberg
Reviews	Amazon Reviews data (McAuley et al., 2015)
Links	OpenWebText (See Sec. 3.2)
Translation	WMT translation data (Barrault et al., 2019)
News	News articles from CNN/DailyMail (Nallapati et al. (2016), New York Times and Newsroom (Grusky et al., 2018))
multilingual	Wikipedias in German, Spanish and French
Questions	(Questions and answers only) MRQA shared task (See Section 3.1)
Explain	(Only main post) (Fan et al., 2019)

Sub-reddit data (Title, Text and Score/Karma) collected from pushshift.io.

A knife

~

Links <https://www.cnn.com/2007/09/20/us-president-meets-british-pm>

LONDON, England (CNN) – U.S. President George W. Bush met with British Prime Minister Tony Blair on Monday to discuss the war in Iraq, according to a statement from Blair’s office. The meeting was held at 10 Downing Street and lasted about an hour. “The two leaders discussed Iraq and other international issues of mutual concern,” said Blair. Bush, who is scheduled to meet Wednesday with Russian President Vladimir Putin, will also visit Germany for talks later this week. In his statement, Blair said, “We agreed that we should continue our efforts together to bring peace and stability to Iraq. We both reaffirmed our commitment to working closely together, as well as to continuing to work constructively toward achieving lasting security and prosperity throughout the Middle East region.” Bush’s trip comes after he visited Britain last week where he spoke out against terrorism while visiting Buckingham Palace. He has been criticized by some lawmakers over what they say are insufficient military resources being devoted to fighting terrorism.

Links <https://www.cnn.com/2014/09/20/us-president-meets-british-pm>

JUST WATCHED Obama meets with British PM MUST WATCH Story highlights President Barack Obama met with Britain’s Prime Minister David Cameron

Links <https://www.cnn.com/2018/09/20/us-president-meets-british-pm>

JUST WATCHED Trump and May meet for first time MUST WATCH Washington (CNN) President Donald Trump, who has been criticized by some in the UK over his decision to leave the European Union, met with British Prime Minister Theresa May, a White House official said on Thursday.

Approach 2: Control by Condition

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.

PERSONA-CHAT

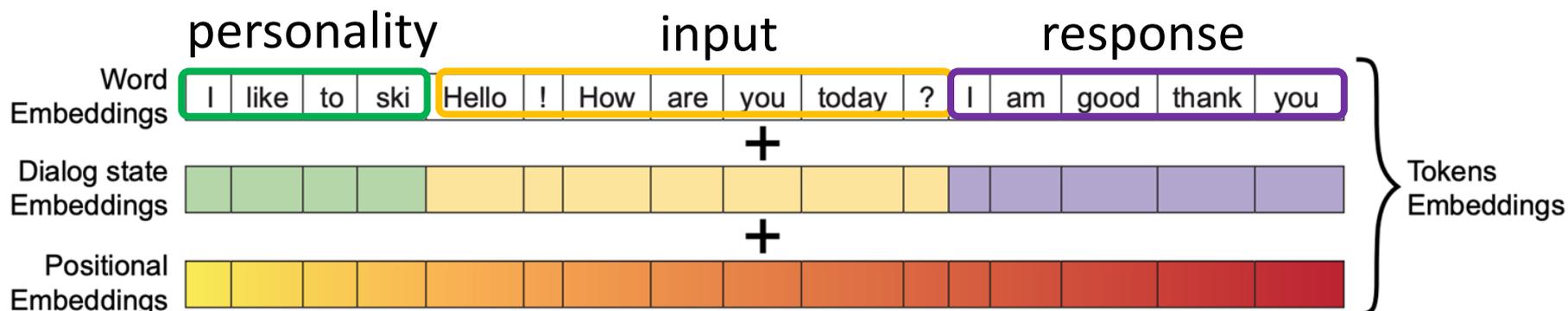
[Zhang, et al., ACL'18]

Approach 2: Control by Condition

- TransferTransfo [Wolf, et al., NeurIPS workshop'18]

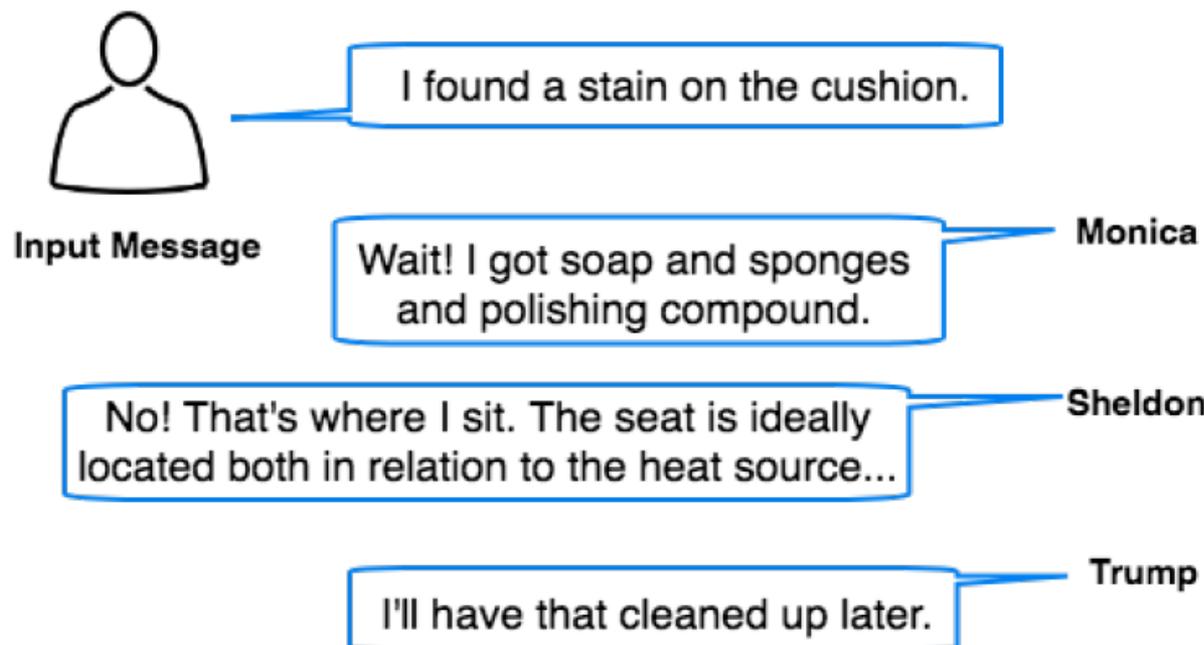
Persona	
	autumn is my favorite season
	i have a turtle named timothy
	i love to meet new people
	my parents are living in bora bora
Dialogue history	
<i>Usr:</i>	hi , tell me about yourself .
<i>Sys:</i>	i have a pet turtle that i love ! his name is timothy
<i>Usr:</i>	that is cool . i like fantasy videogames . do you play any ?
<i>Sys:</i>	not really . i like hanging out with people in person

- Order of personality sentences doesn't matter
- The dataset can be augmented by different orders

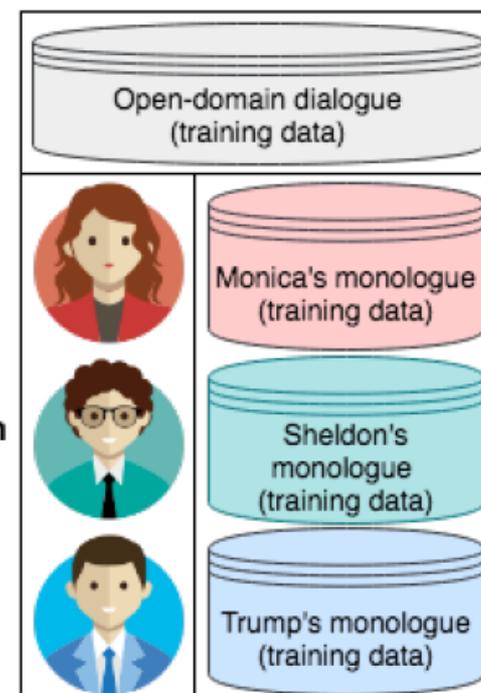


Approach 3: Monologues Only

- The previous approaches need the dialogues with specific characteristics.
- What if we **only have monologues**



Dialogue Generation model

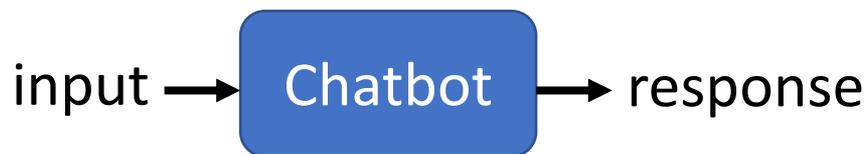


Approach 3: Monologue

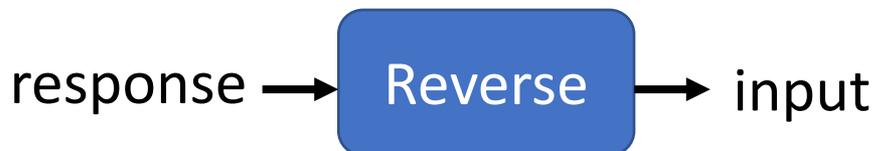


- Rank: selecting sentences
- Multiply:
 - Train a language model by monologue
 - Using the language model to influence chatbot response
- Pseudo Data:

Monologue → Dialogue



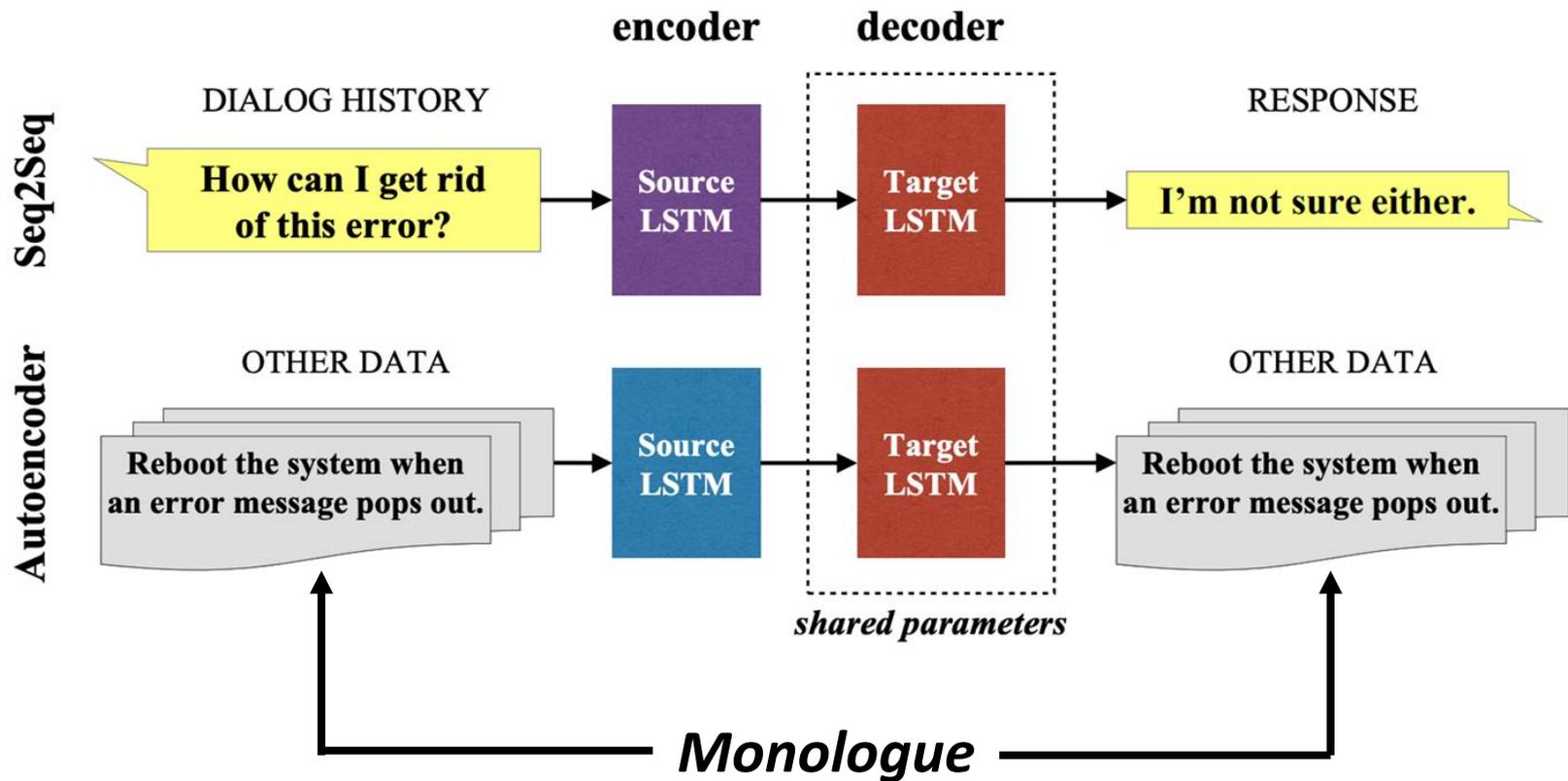
What's your goal in life?
Make America great again



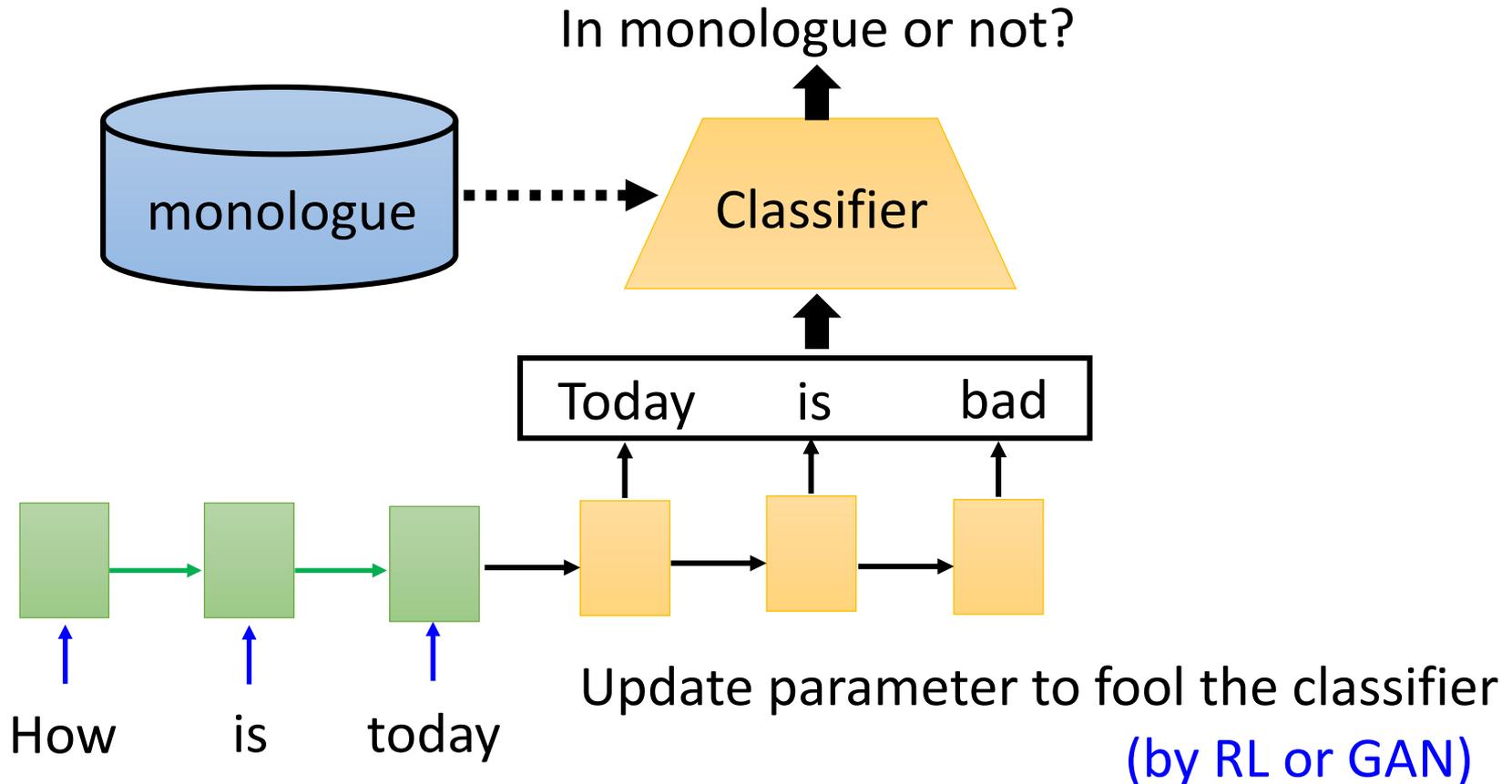
What do you want to do?
I want to build a wall.

Approach 3: Monologues Only

[Luan, et al., IJCNLP'17]



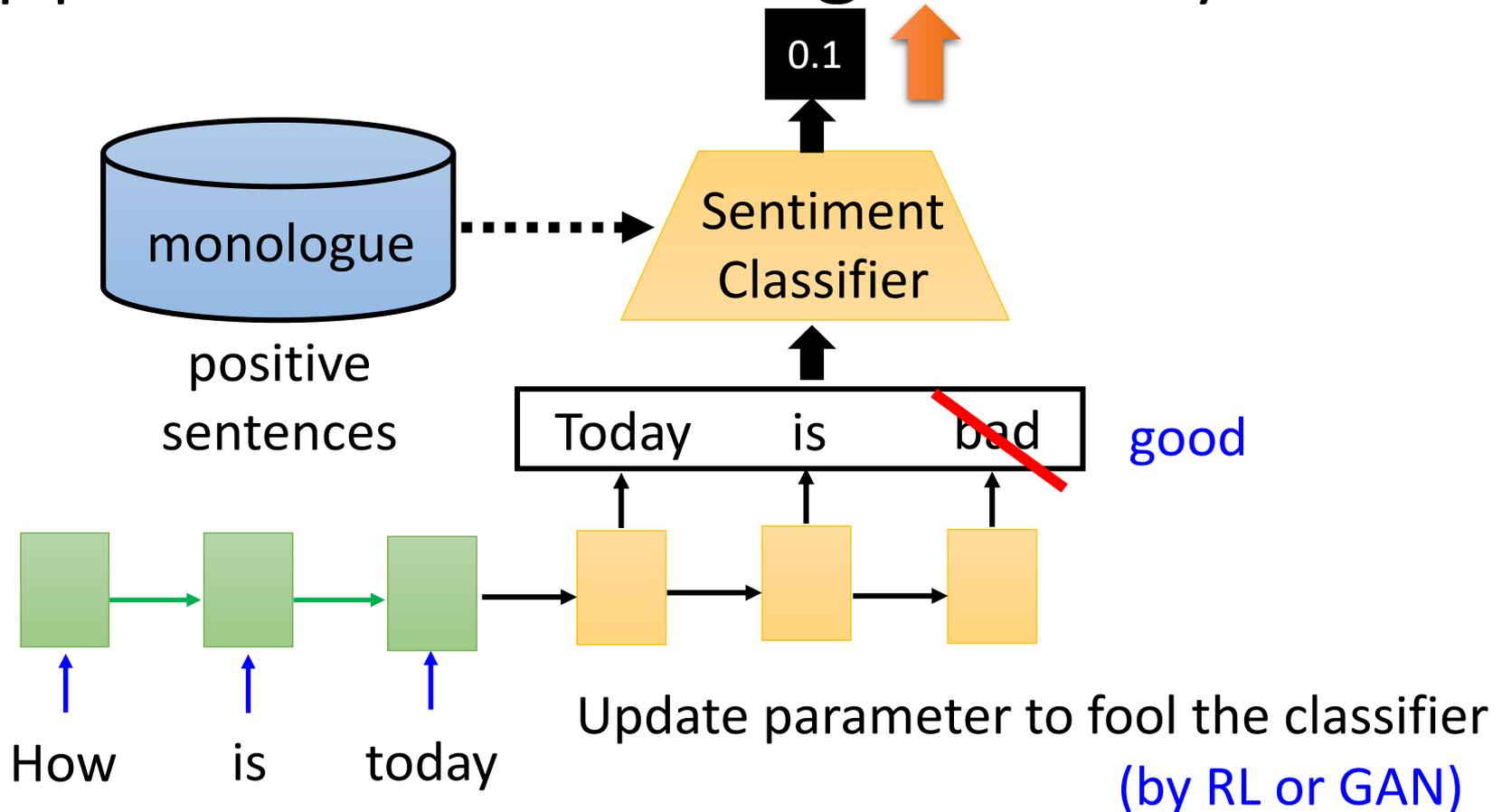
Approach 3: Monologues Only



Extra Constraint

- Constrain the amount of update
- Train a model to predict input from response

Approach 3: Monologues Only



Extra Constraint

- Constrain the amount of update
- Train a model to predict input from response

Demo

Positive sentences

[Lee, et al., ICASSP, 2018]

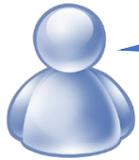
- Human: yeah, i'm just less interested in the how-to and more in the what and why of the things we build
- General Chat-bot: it's not a good thing .
- Positive Chat-bot : it's a good one

- Human: always learning and self improving is a huge turn on for me so believe me i understand
- General Chat-bot: i'm not sure if i can see you in a relationship
- Positive Chat-bot : i love you so much

More examples: <https://adelaidehsu.github.io/Personalized-Dialogue-Response-Generation-learned-from-Monologues-demo/>

[Su, et al., INTERSPEECH'19]

Demo



Do you like him?

No, just stop.



General
Response



No, I'm
sorry.



No.



He's a
good kid.



He's a
really good
friend.

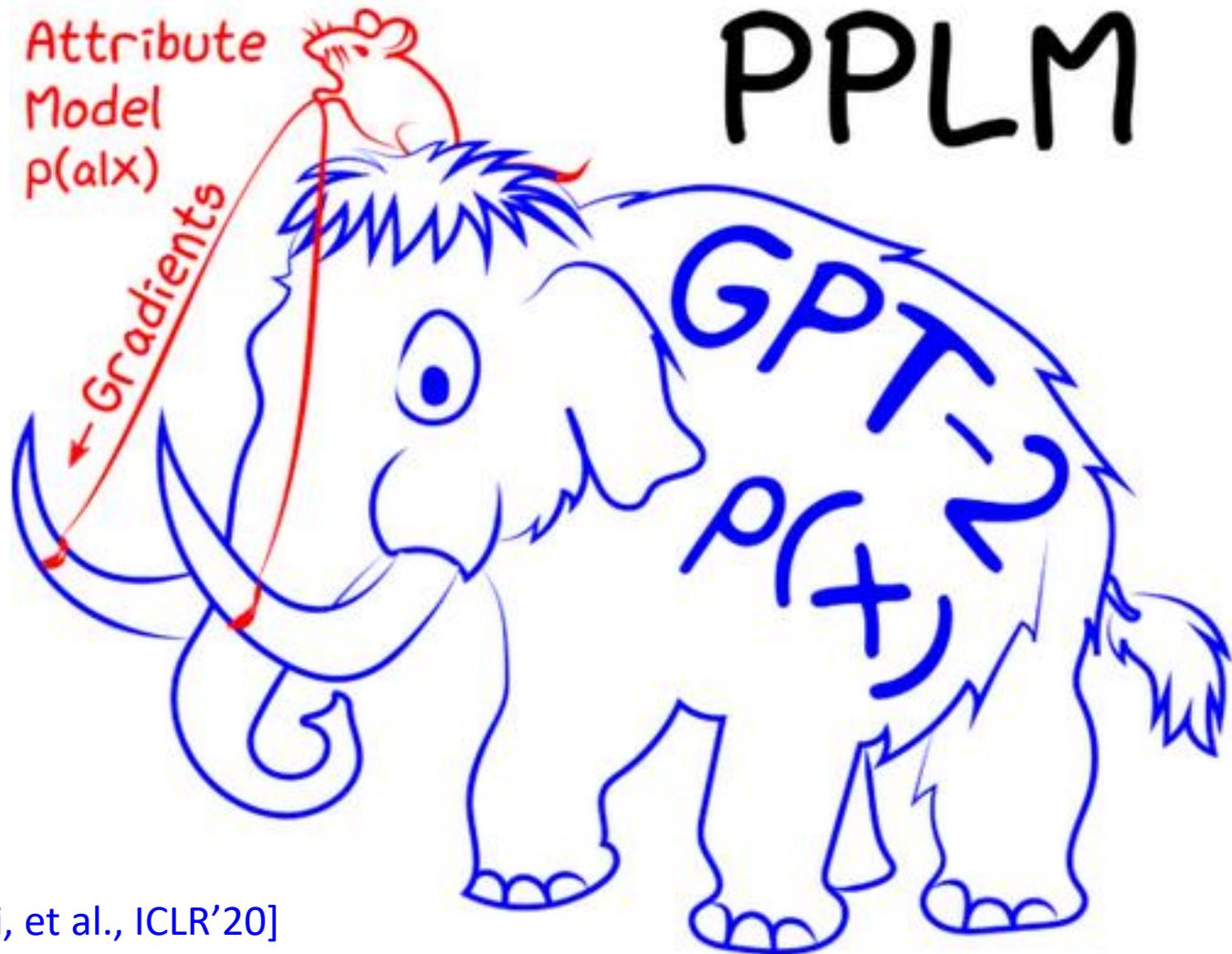


He's a
cool kid.

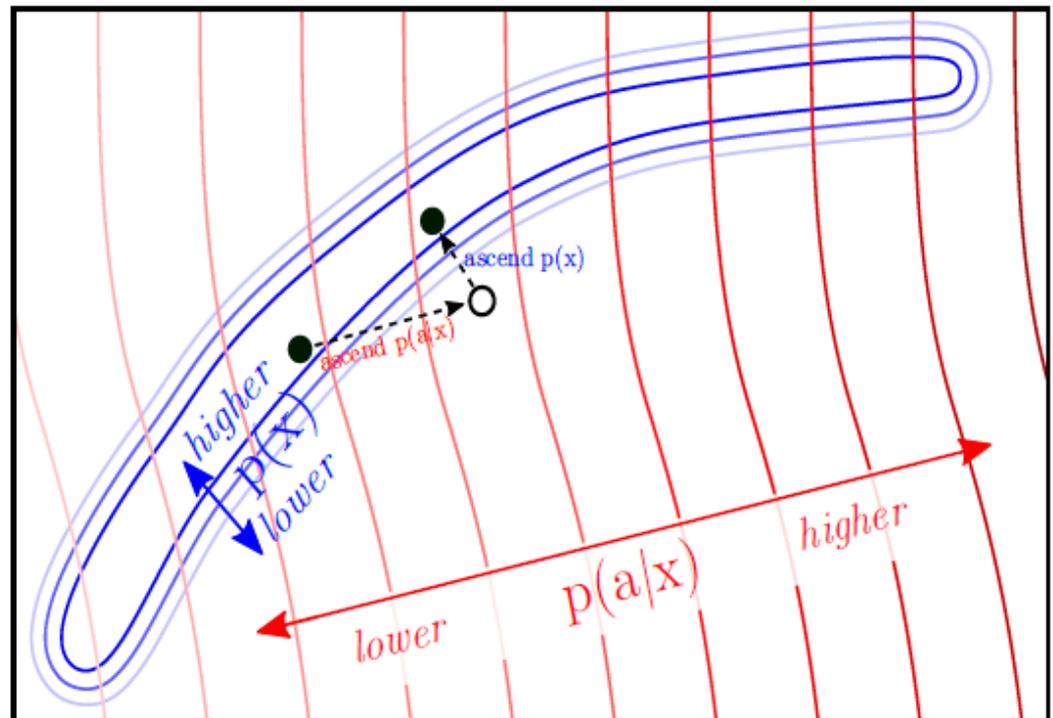
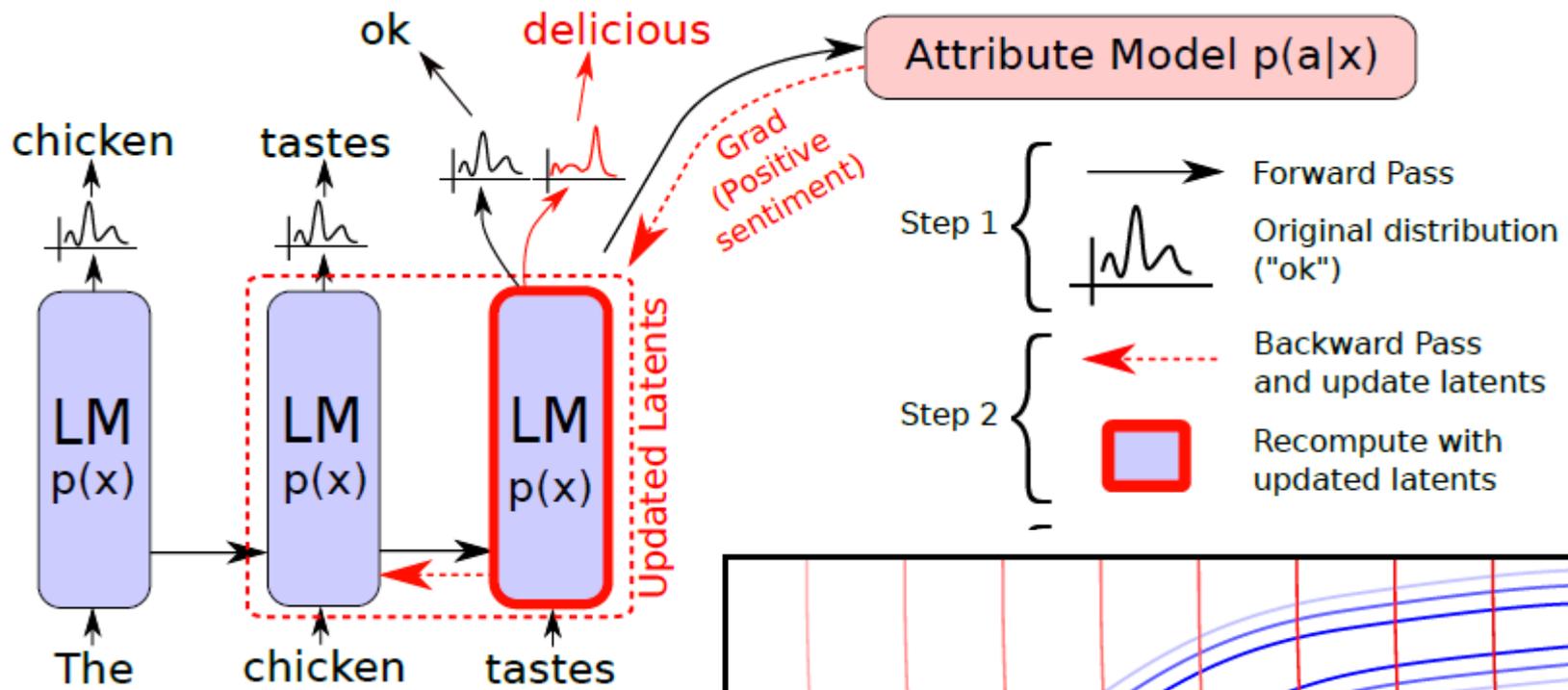


He's my
man.

Plug & Play Language Models



[Dathathri, et al., ICLR'20]

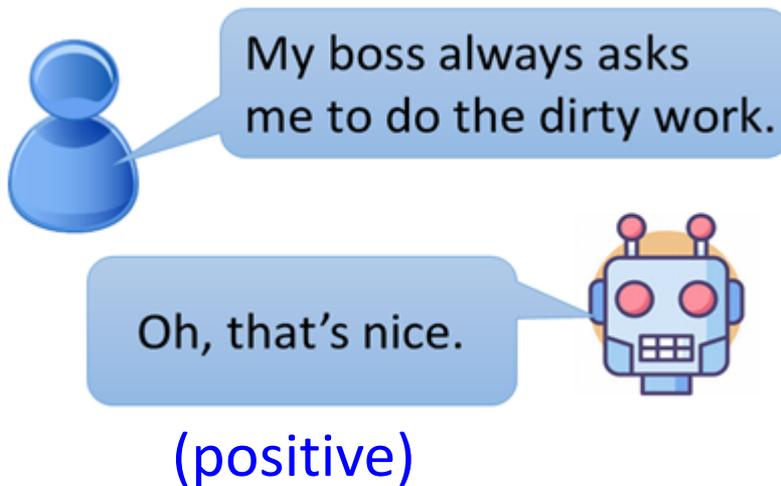


[Dathathri, et al., ICLR'20]

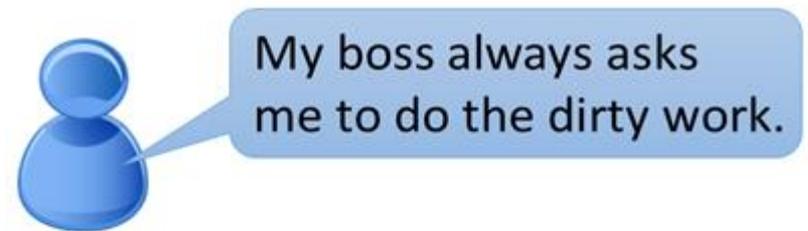
Next Step

Control the response of chatbot

e.g. always say something positive



Control the response of interlocutor



Concluding Remarks

Approach 1: Directly Fine-tune

Approach 2: Control by Condition

Approach 3: Monologue only

Reference

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- Thomas Wolf, Victor Sanh, Julien Chaumond, Clement Delangue, TransferTransfo: A Transfer Learning Approach for Neural Network Based Conversational Agents, NeurIPS Workshop, 2018
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- Nitish Shirish Keskar, Bryan McCann, Lav R. Varshney, Caiming Xiong, Richard Socher, CTRL: A Conditional Transformer Language Model for Controllable Generation, arXiv, 2019
- Saizheng Zhang, Emily Dinan, Jack Urbanek, Arthur Szlam, Douwe Kiela, Jason Weston, Personalizing Dialogue Agents: I have a dog, do you have pets too?, ACL, 2018
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- Hao Zhou, Minlie Huang, Tianyang Zhang, Xiaoyan Zhu, Bing Liu, Emotional Chatting Machine: Emotional Conversation Generation with Internal and External Memory, AACL, 2018
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