Neural Response Ranking for Social Conversation: A Data-Efficient Approach

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Outline

- Introduction. Amazon Alexa Prize
- Alana, HWU's Alexa Prize socialbot
- Training signals in conversational data
- Alana's neural response ranker
- Data efficiency aspect of the response ranker
- Results and discussion

Amazon Alexa Prize

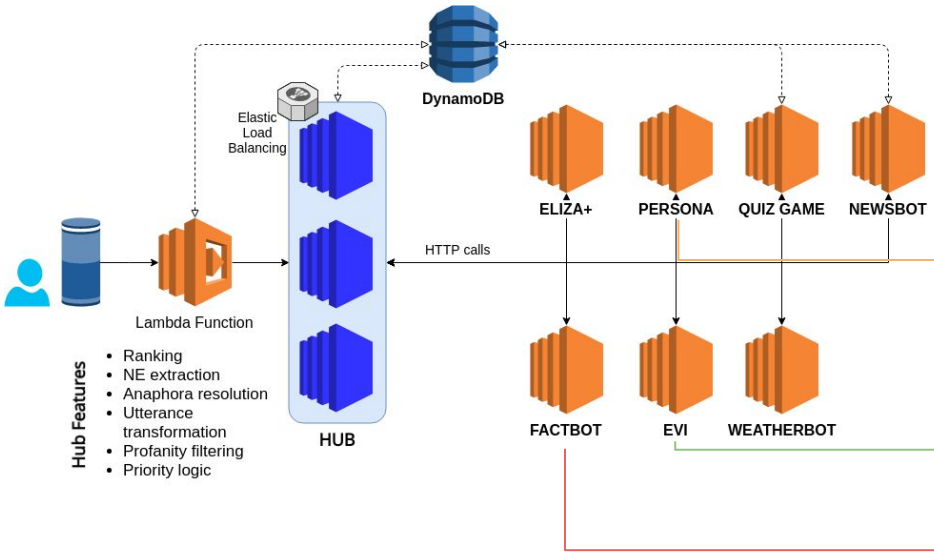
- **Goal**: long, coherent, and engaging conversations with the socialbot
- **Grand prize** ($1,000,000) - for a 20 minute-long engaging conversation
- **2017:** >100 applications → 12 teams competing → HWU took 3rd place
- **2018:** >200 applications → 8 teams competing→ **Finals Nov 2018!**

Alana
Heriot-Watt University
Edinburgh, Scotland
Faculty Advisor: Oliver Lemon

Alquist
Czech Technical University
Prague, Czech Republic
Faculty Advisor: Jan Sedivy

Gunrock
University of California Davis
Davis, CA, USA
Faculty Advisor: Zhou Yu

Alana, An Ensemble Dialogue Model with Ranking



Alana: Hi, [...] What would you like to talk about?
User: Music
Alana: Persona Great! Who is your favorite singer?
User: Bob Dylan
Alana: Evi + driver Bob Dylan is an American songwriter, singer, painter, and writer. What are your opinions on Bob Dylan?
User: When was he born?
Alana: Evi + anaphora resolution Bob Dylan was born on Saturday May 24th 1941.
User: I love him!
Alana: Persona Great! What else do you like?
User: Cooking
Alana: Facts I heard that every day, Americans eat an estimated 18 acres of pizza.

Rating: 2, Length: 11

Training Signals in Conversational Data

Signals correlation study (Pearson coefficient)

	User feedback (positive)	User feedback (negative)
Rating	0.11	0.04
Length	0.67	0.49

	Length
Rating	0.11

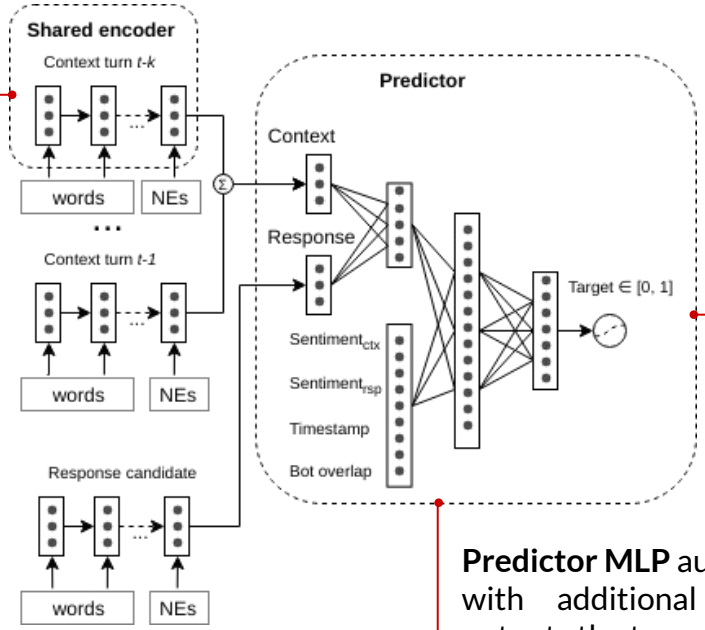
User feedback

that's pretty cool
you're funny
thanks buddy
you're smart
wow interesting

stop your stupid
you're bad
really harsh
stop stop stop telling this
stupid stuff

Alana's Neural Response Ranker

GRU with word_bot and NE features encodes context utterances (3 previous user+system turns) and response candidates



Target score is a point-wise prediction for a *<context, response_candidate>* pair

Predictor MLP augments the representation with additional dialogue features and outputs the target value

Training Details

Alana: Hi, [...] What would you like to talk about?
User: Music
Alana: [Persona] Great! Who is your favorite singer?
User: Bob Dylan
Alana: [Evi + driver] Bob Dylan is an American songwriter, singer, painter, and writer. What are your opinions on Bob Dylan?
User: When was he born?
Alana: [Evi + anaphora resolution] Bob Dylan was born on Saturday May 24th 1941.
User: I love him!
Alana: [Persona] Great! What else do you like?
User: Cooking
Alana: [Facts] I heard that every day, Americans eat an estimated 18 acres of pizza.

Rating: 2, Length: 11

dialog context

response candidate

target rating

target length

Evaluation Details

Alana: Hi, [...] What would you like to talk about?
User: Music
Alana: [Persona] Great! Who is your favorite singer?
User: Bob Dylan

dialog context

Alana: [Evi + driver] Bob Dylan is an American songwriter, singer, painter, and writer. What are your opinions on Bob Dylan?

gold response
target score: **1.0**

User: **You're so smart!** When was he born?
User's feedback

random response
target score: **0.0**

Alana: [Coherence] So, talking about movies, What famous actor or actress would you like to meet? I would love to meet Will Smith . He's just so funny!

Interim Results

Ranker	Precision@1
Handcrafted	0.478
Linear@length[1]	0.742
Linear@rating[1]	0.773
DualEncoder@length[2]	0.365
DualEncoder@rating[2]	0.584
Neural@length	0.824
Neural@rating	**0.847**

Training stage

Trainset size: 500,000 turns (for each target)

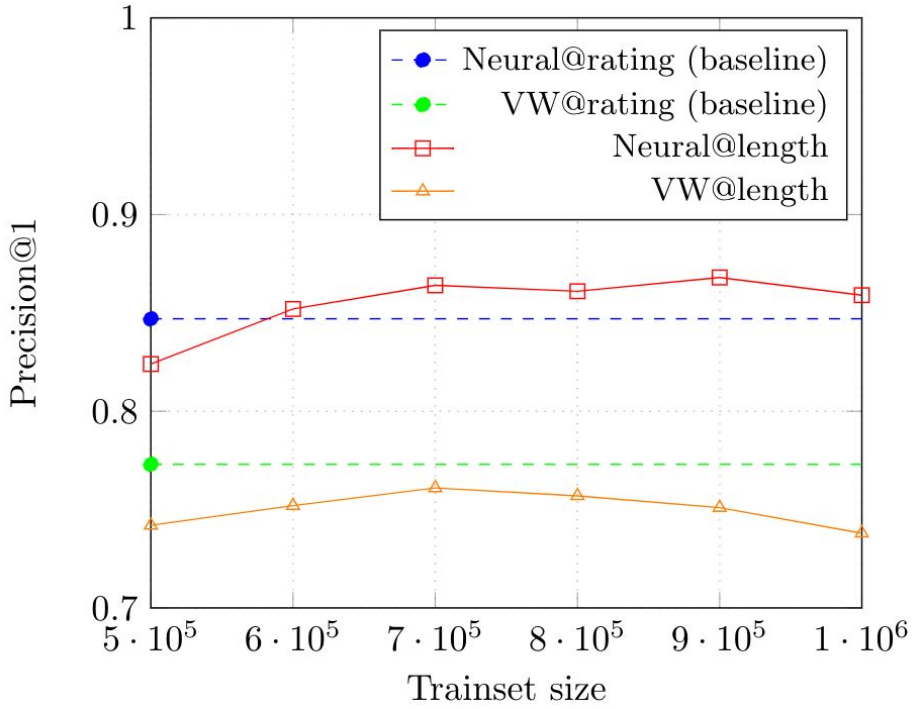
Evaluation stage

Eval set: ~24,000 tuples of the form *<context, gold answer, fake answer, target>*

Gold answers - those followed by explicit positive user feedback (prev. slide)

[1] VowpalWabbit library
[2] Lu et al. A practical approach to dialogue response generation in closed domains, 2017

Results on Extended Datasets



Discussion

- User ratings are very sparse and noisy, and expensive to obtain
- Length can be a proxy for user engagement
- A deep learning-based response ranker introduced
  - Ranking performance is superior to both handcrafted baseline and a perceptron-based (VowpalWabbit)
  - Training from two supervision signals explored
- Given a large amount conversational data, user ratings collection can be avoided if optimizing for user engagement

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Thank you!

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 bit.ly/alana_learning_to_rank

 @alanathebot

Microsoft Google facebook textkernel

References

1. Papaioannou et al. Alana: Social Dialogue using an Ensemble Model and a Ranker trained on User Feedback, 2017
2. Lu et al. A practical approach to dialogue response generation in closed domains, 2017
3. Venkatesh et al. On Evaluating and Comparing Conversational Agents, 2017