Dialog Systems and How to Score Them

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iPavlov Project

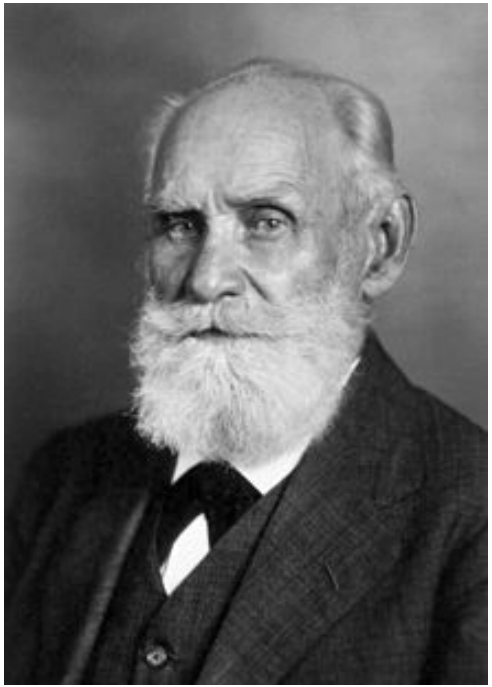
Devoted to develop a library with building blocks for (almost) any NLP task

Sponsored by National Technology Initiative and Sberbank

3 years

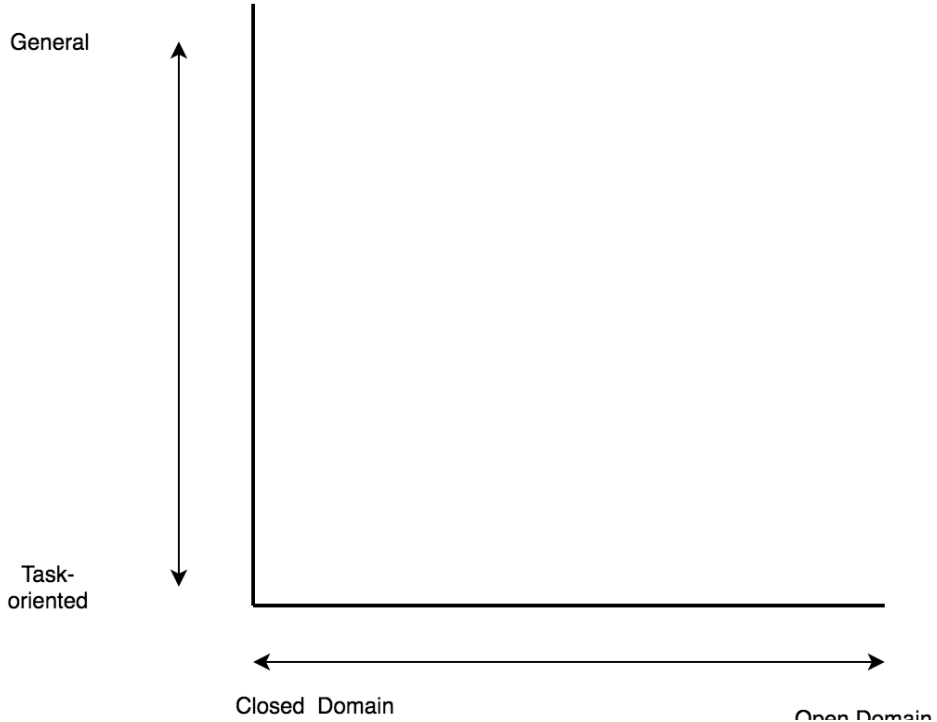
Open to collaboration

iPavlov.ai



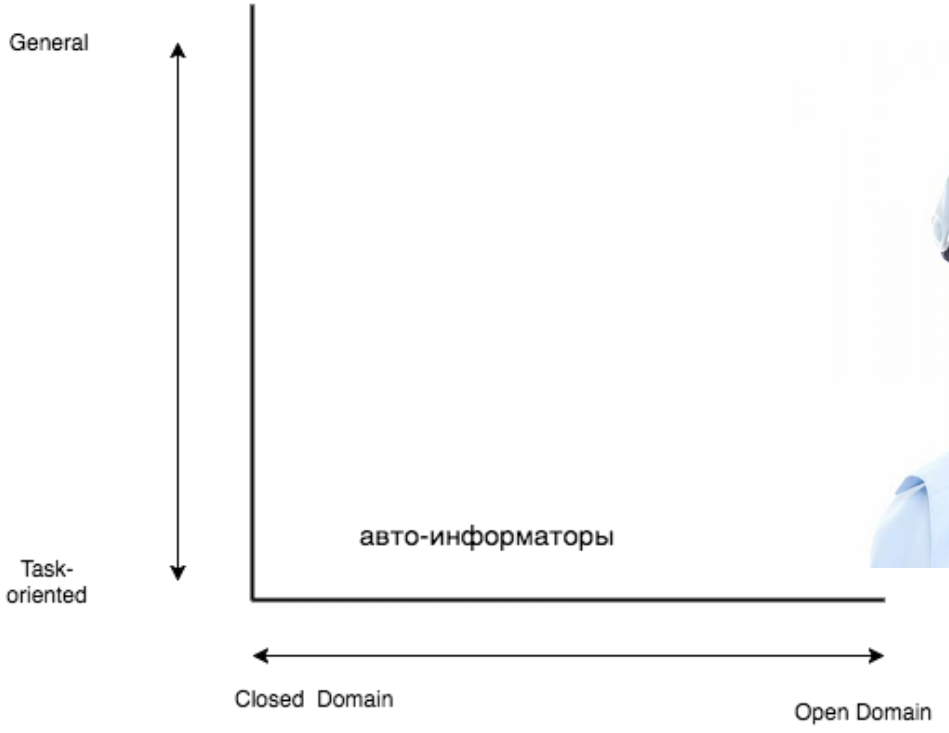
Dialog Systems: Where are they?

Dialog Systems: Examples



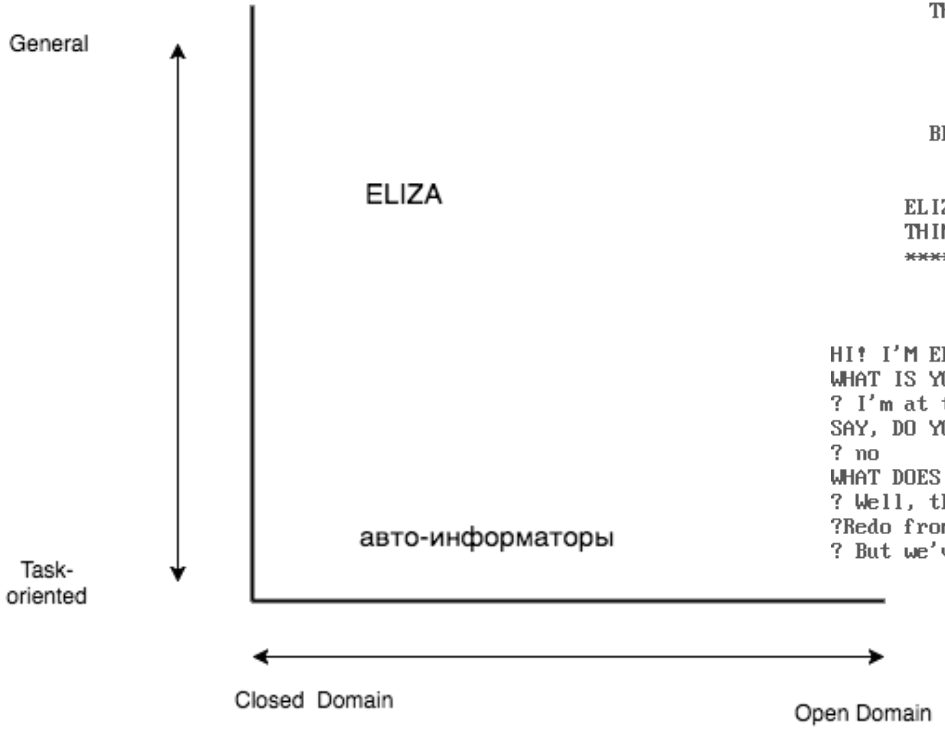
Dialog Systems: Examples

Auto-informer
- Closed-Domain
- Task-oriented



Dialog Systems: Examples

ELIZA
- Closed-Domain
- General

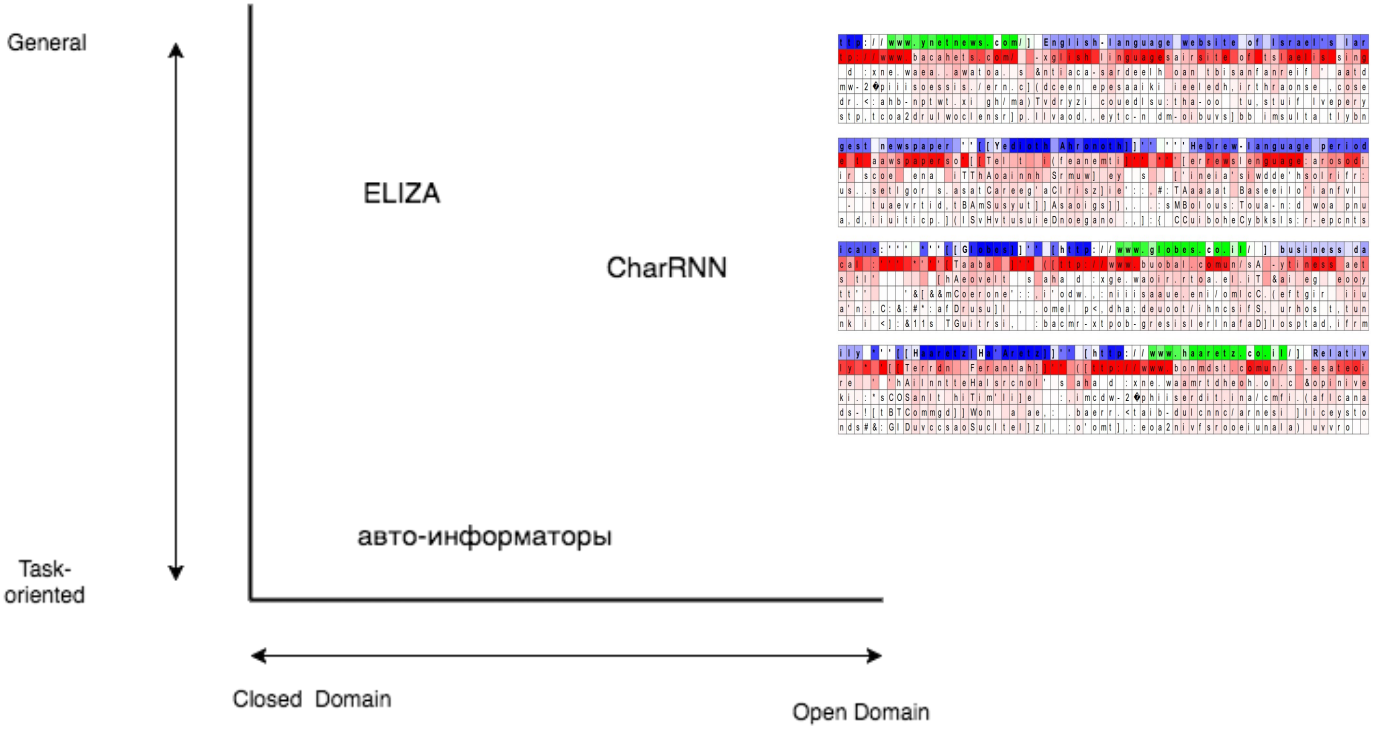



```
**********************************
   THE BROADCASTERS DATABASE
        PRESENTS:

              ELIZA

     BE SURE CAPS LOCK IS ON
       TYPE ! TO TERMINATE
         NO COMMAS PLEASE
   ELIZA TAKES A FEW SECONDS TO
   THINK BEFORE ANSWERING YOU.
   **********************************
```

```
HI! I'M ELIZA THE BROADCAST PSYCHIATRIST,
WHAT IS YOUR PROBLEM?
? I'm at the end of my rope.
SAY, DO YOU WORK IN BROADCASTING?
? no
WHAT DOES THAT SUGGEST TO YOU?
? Well, that I work in some other field.
?Redo from start
? But we've come so far!_
```

Dialog Systems: Examples

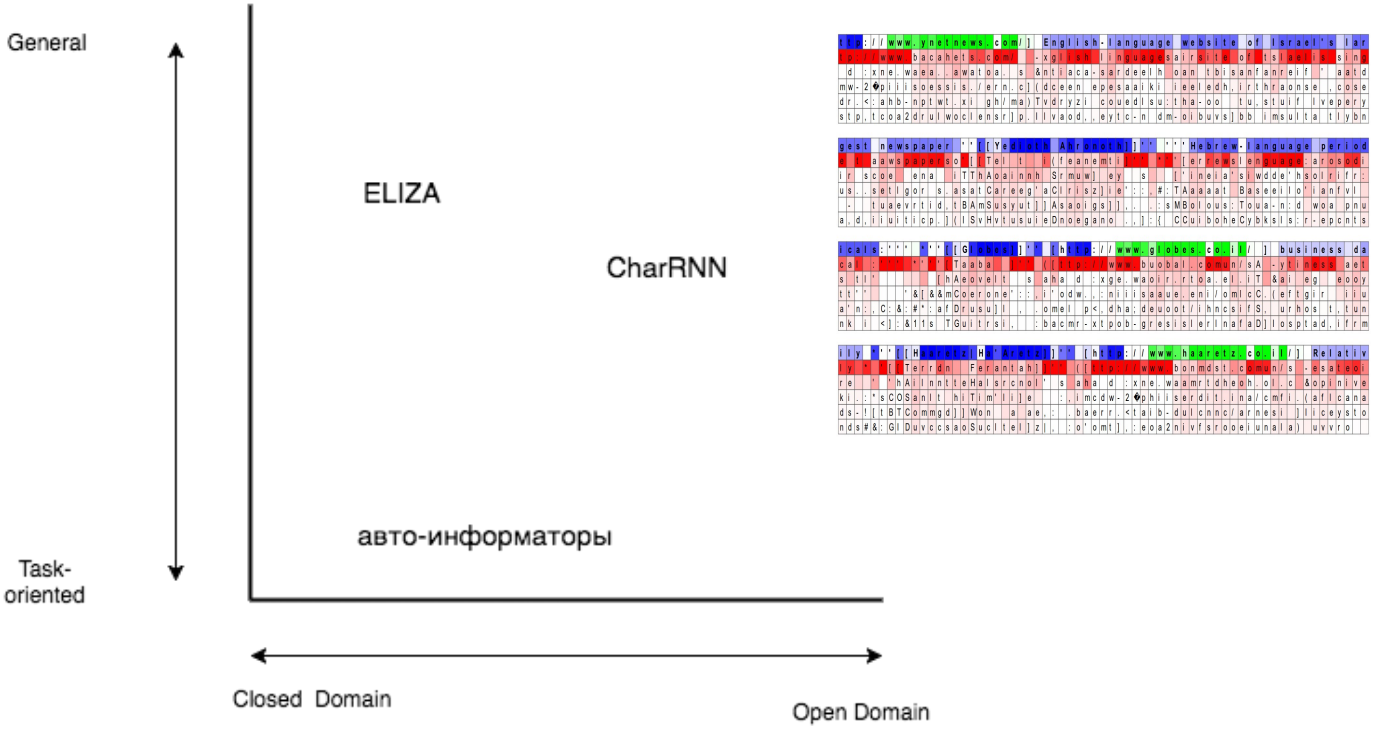
Karpathy's CharRNN
- Open-Domain
- General



Dialog Systems: Examples

Karpathy's CharRNN
- Open-Domain
- General

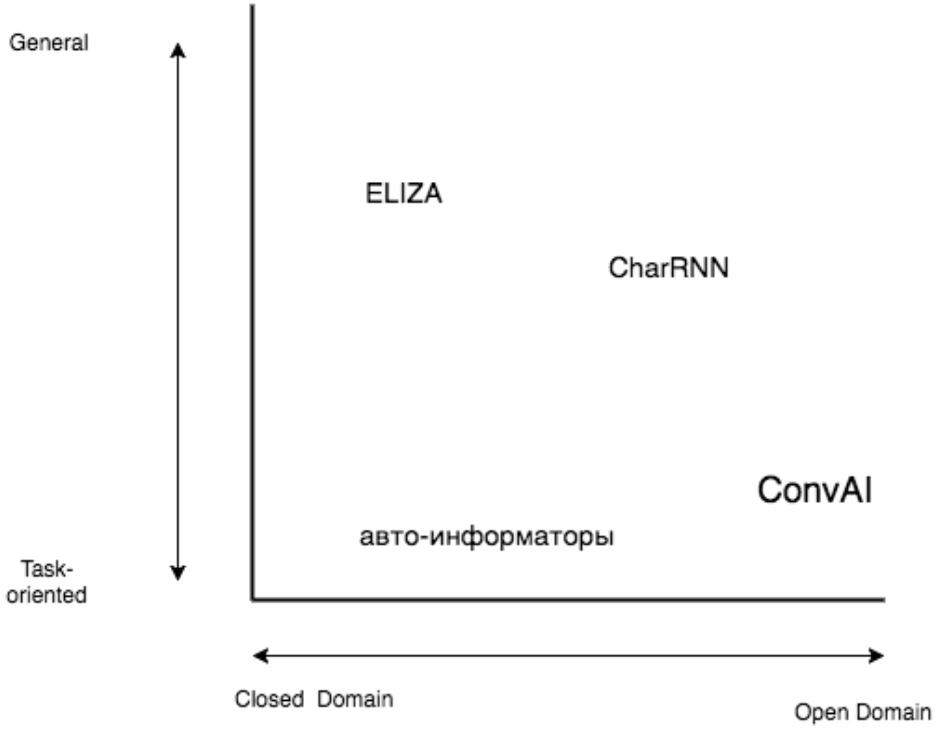
- Reactive
- Not that "smart"



Dialog Systems: Examples

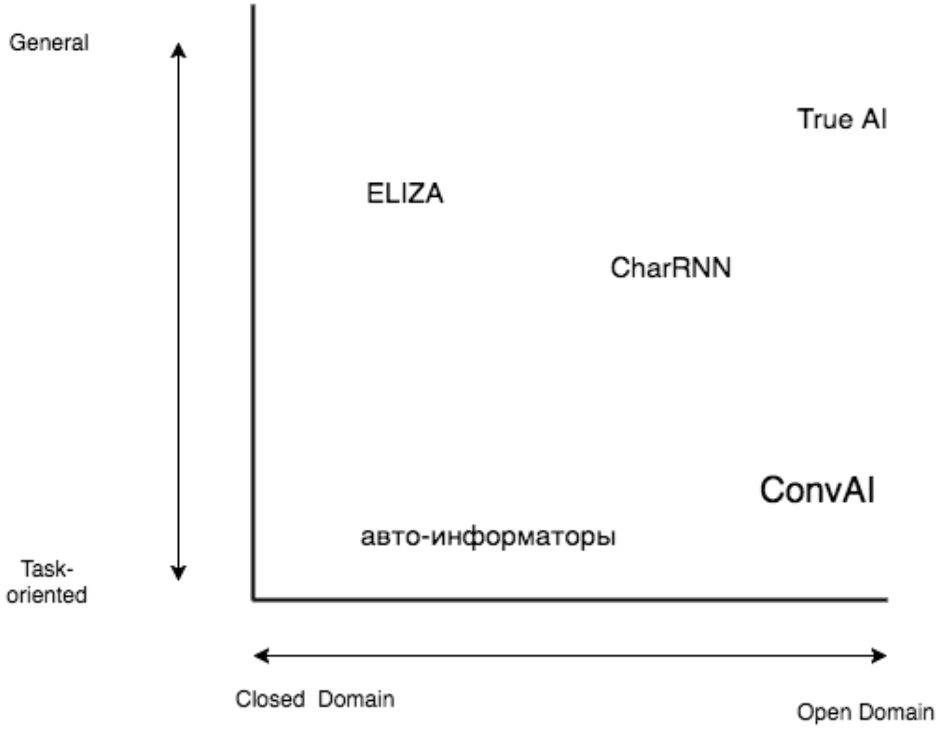
ConvAI Goal

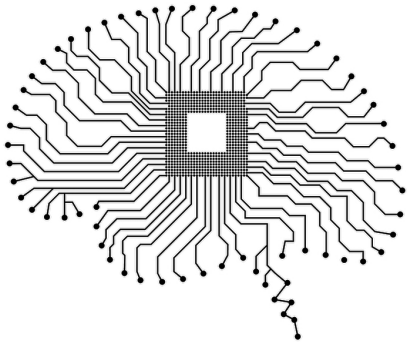
- Open-Domain
- Task-oriented



Dialog Systems: Examples

True AI
- Open-Domain
- Task-oriented

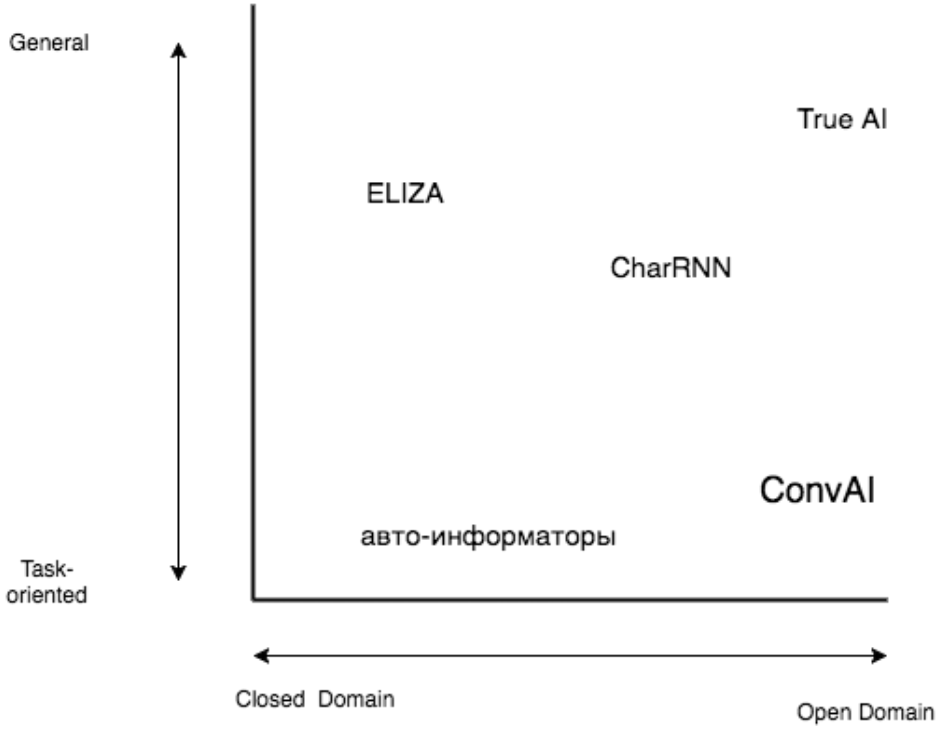


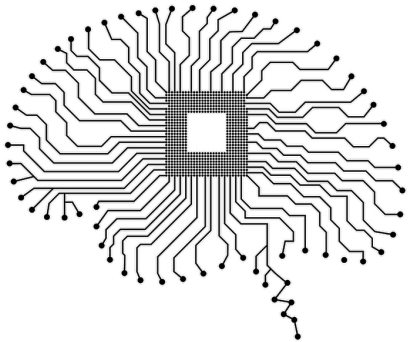


Dialog Systems: Examples

True AI
- Open-Domain
- Task-oriented

- Pro-active





Conversational Intelligence Challenge

- Task-oriented
- General

NIPS 2017 Live Competition

Presumed Dataset Size: 1000+ dialogs

convai.io

Conversational Intelligence Challenge

- Task-oriented
- General

Person chats with a bot (or another person)

convai.io

Conversational Intelligence Challenge

- Task-oriented
- General

Person chats with a bot (or another person)

They are discussing a news article

convai.io

Conversational Intelligence Challenge

- Task-oriented
- General

Person chats with a bot (or another person)

They are discussing a news article

Human judgment at the end (consistency, overall adequacy)

convai.io

Conversational Intelligence Challenge

The Judgement Scheme

- Like/dislike for each line of a bot
- End scoring:
  - quality
  - breadth
  - engagement

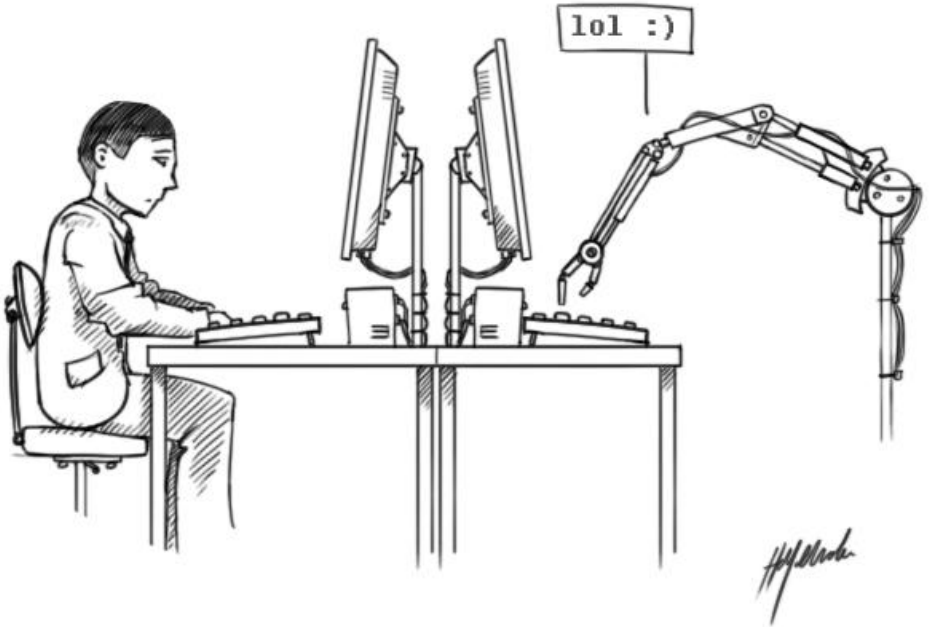
convai.io

Turing Test

Two persons are talking indirectly

⅔ of persons who talked to a bot

should say that it’s a human



DIalog Systems: How to Score Them?

Task-oriented Systems

Task Completion Rate (TCR)

$$\text{Task Completion Rate} = \frac{\text{\# Successful Runs}}{\text{\# All Runs}}$$

End-to-end LSTM-based dialog control optimized with supervised and reinforcement learning

Jason D. Williams, Geoffrey Zweig, *arxiv:1606.01269*

General Systems

- Word-Overlap
  - ROUGE
  - BLEU
  - METEOR

$$P_n(r, \hat{r}) = \frac{\sum_k \min(h(k, r), h(k, \hat{r}_i))}{\sum_k h(k, r_i)}$$

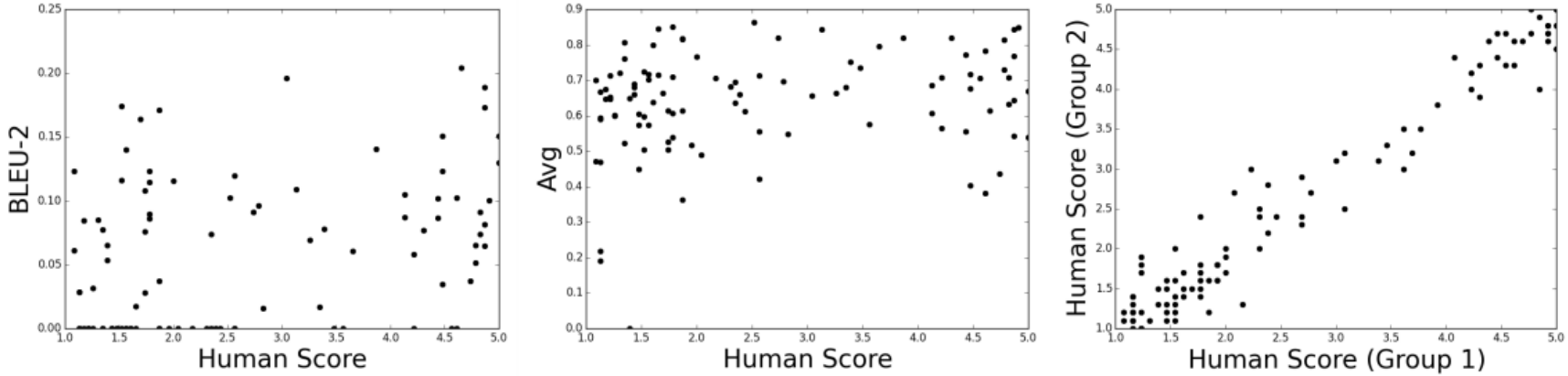
$$\text{BLEU-N} := b(r, \hat{r}) \exp(\sum_{n=1}^{N} \beta_n \log P_n(r, \hat{r}))$$

General Systems

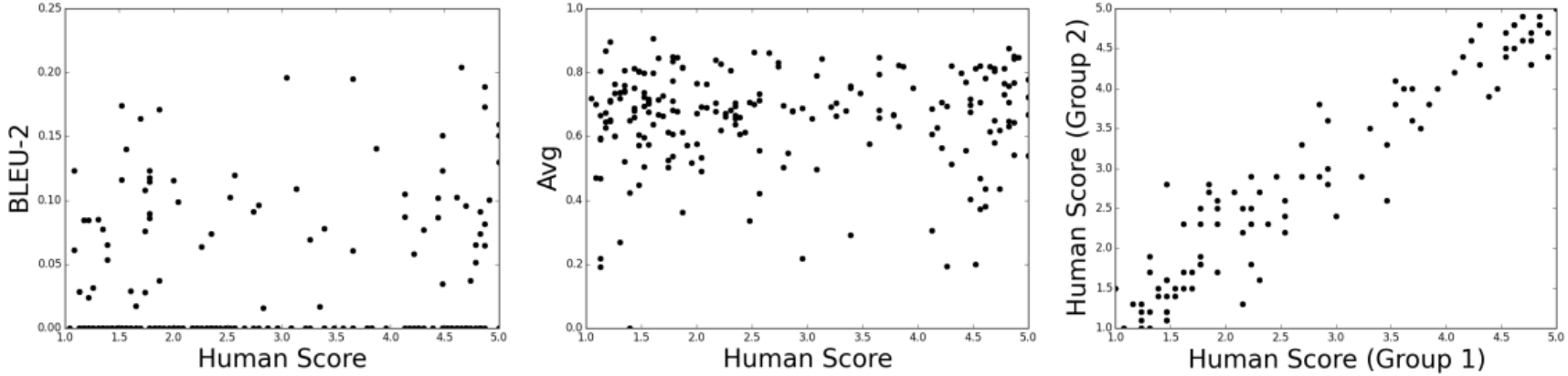
- Word-Overlap
  - ROUGE
  - BLEU
  - METEOR
- Embedding-based
  - Greedy Matching
  - Embedding Average
  - Extreme Vector

$$\bar{e}_r = \frac{\sum_{w \in r} e_w}{\left| \sum_{w' \in r} e_{w'} \right|},$$

$$\mathrm{EA} := \cos(\bar{e}_r, \bar{e}_{\hat{r}})$$



(a) Twitter



(b) Ubuntu

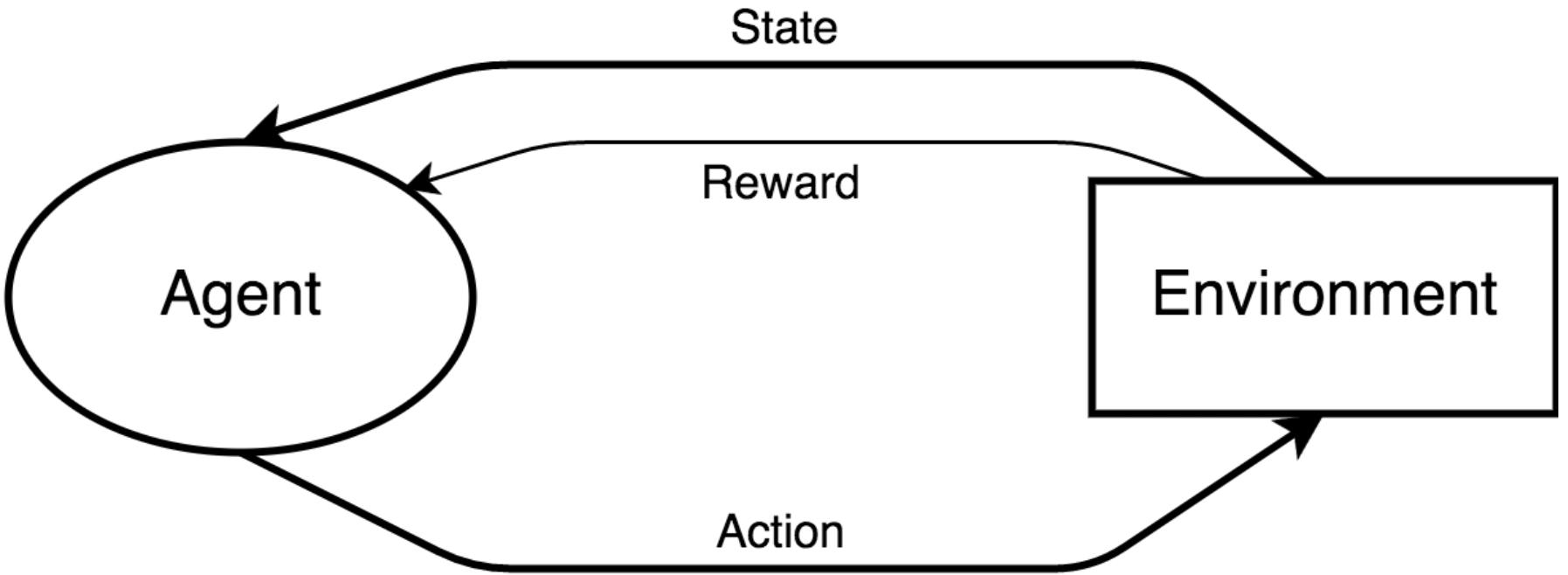
General Systems

How NOT To Evaluate Your Dialogue System: An Empirical Study of Unsupervised Evaluation Metrics for Dialogue Response Generation

Chia-Wei Liu, Ryan Lowe, Iulian V. Serban, Michael Noseworthy, Laurent Charlin, Joelle Pineau, *arxiv:1603.08023*

How to Live with That?

How to Live with That: Reinforcement Learning



How to Live with That

- Reward-based Imitation (RBI)
- Forward Prediction (FP)

Dialog-based Language Learning

Jason Weston, *arXiv:1604.06045*

How to Live with That

Model	$r = 0$	$r = 0.1$	$r = 0.5$	$r = 1$
Reward Based Imitation (RBI)	0.333	0.340	0.365	0.375
Forward Prediction (FP)	0.358	0.358	0.358	0.358
RBI+FP	0.431	0.438	0.443	0.441

Dialogue Learning With Human-In-The-Loop

Jiwei Li, Alexander H. Miller, Sumit Chopra, Marc'Aurelio Ranzato, Jason Weston, *arxiv:1611.09823*

How to Live with That

bAbI Task 6: Partial Rewards

Mary went to the hallway.
John moved to the bathroom.
Mary travelled to the kitchen.
Where is Mary? kitchen
Yes, that's right!
Where is John? bathroom
Yes, that's correct! (+)

WikiMovies Task 6: Partial Rewards

What films are about Hawaii? 50 First Dates
Correct!
Who acted in Licence to Kill? Billy Madison
No, the answer is Timothy Dalton.
What genre is Saratoga Trunk in? Drama
Yes! (+)
...

Questions?