

Dialog Systems

Modern Perspective by Valentin Malykh valentin@ipavlov.ai

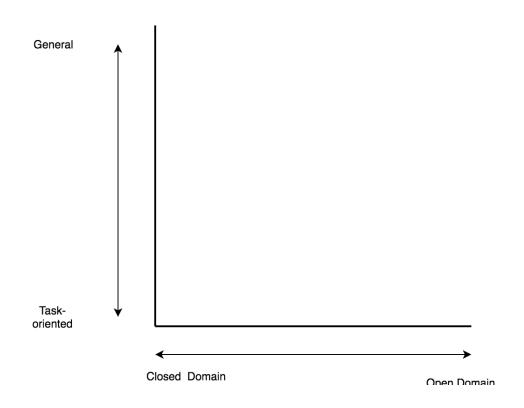
Dialog Systems: Where are they?



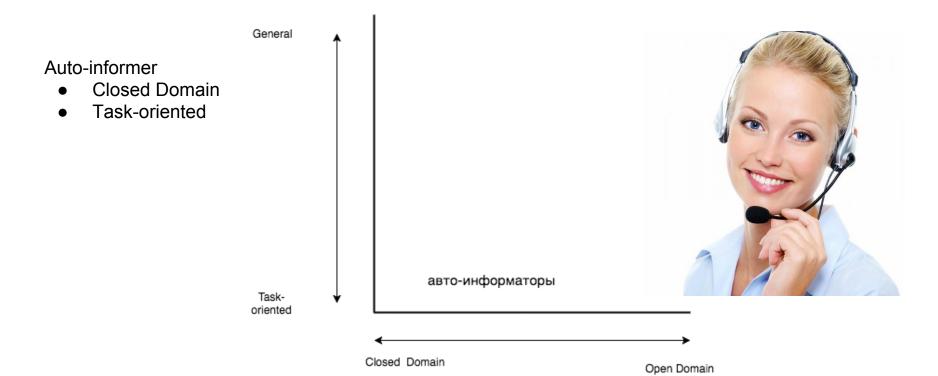




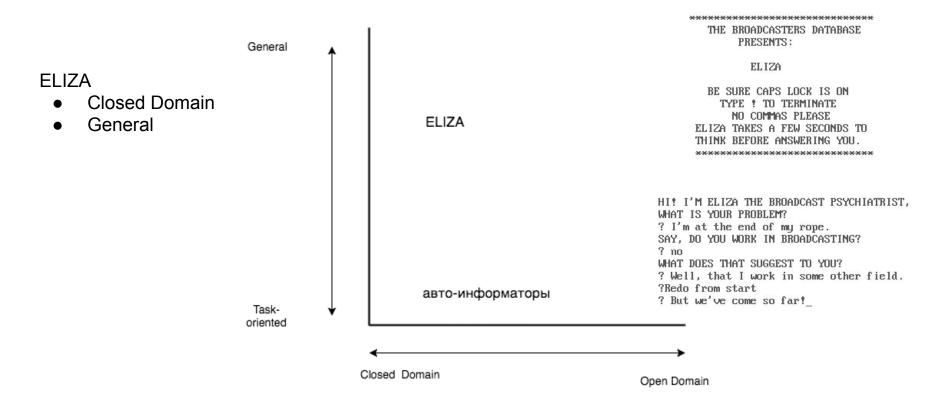




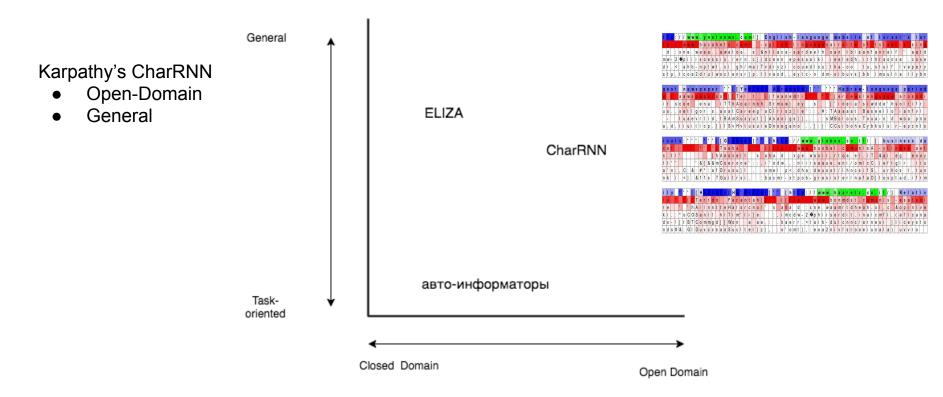




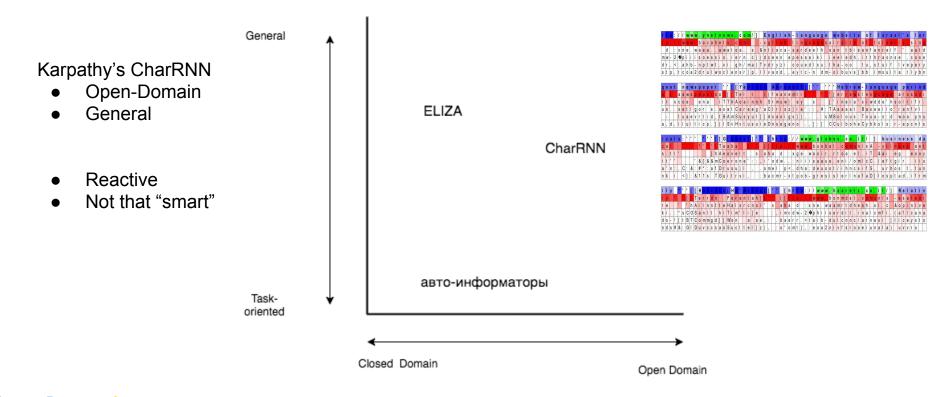




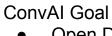




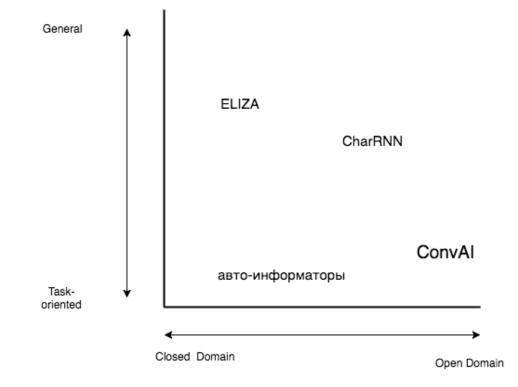




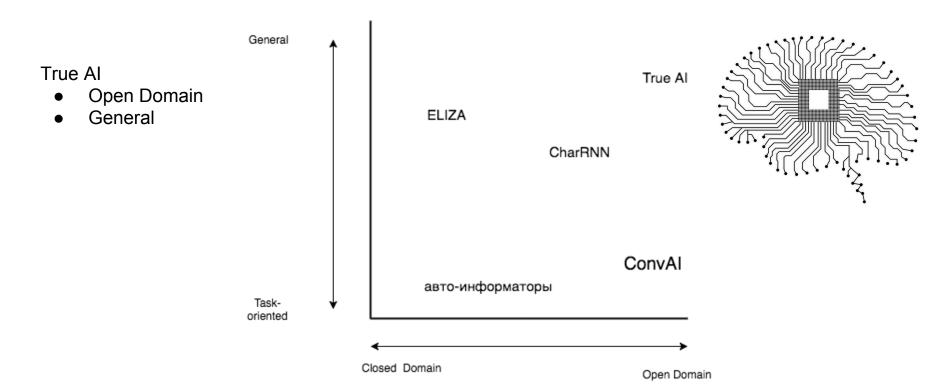




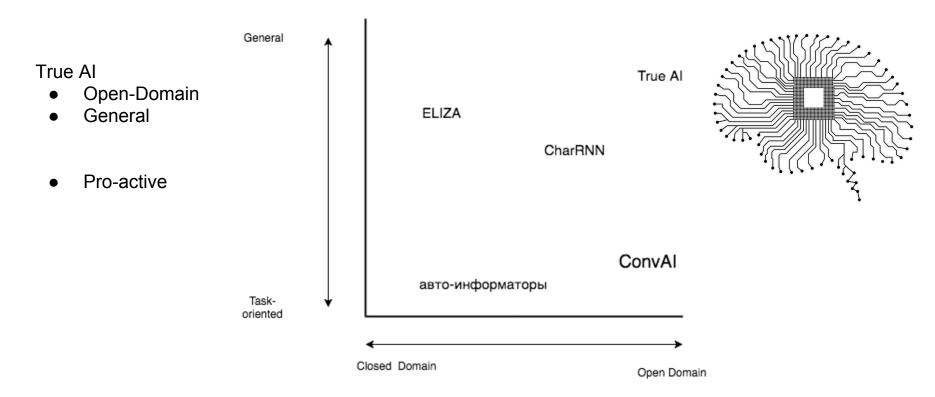
- Open Domain
- Task-oriented











Task-oriented Systems



Task Completion Rate (TCR)

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

Jason D. Williams, Geoffrey Zweig, arxiv:1606.01269
iPavlov.ai

Dialogue System



Task-Oriented

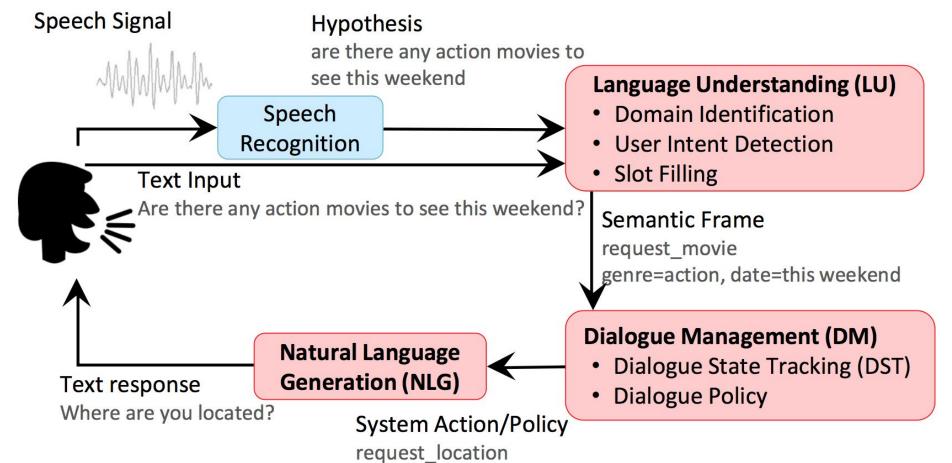
- Personal assistant, achieve a certain task
- Combination of rules and statistical components
 - POMDP for spoken dialog systems (Williams and Young, 2007)
 - Learning End-to-End Goal-oriented
 Dialog (Antoni and Weston, 2016)
 - An End-to-End Trainable Task-oriented
 Dialogue System (Wen el al., 2016)

Chit-Chat

- No specific goal, focus on conversation flow
- Work using variants of seq2seq model
 - A Neural Conversation Model (Vinyals and Le, 2015)
 - Deep Reinforcement Learning for Dialogue Generation (Li et al., 2016)
 - Conversational Contextual Cues: The Case of Personalization & History for Response Ranking (AIRfou et al., 2016)

Task-Oriented Dialogue System

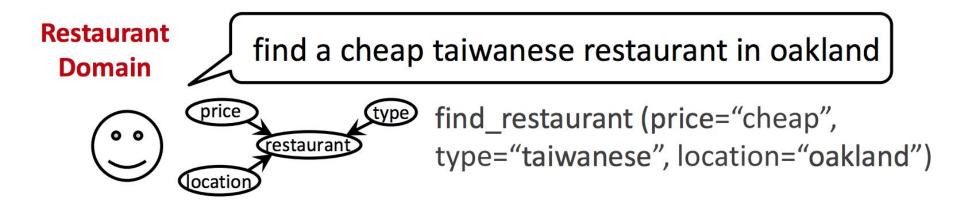




Semantic Frame Representation



- Requires a domain ontology
- Contains core content (intent, a set of slots with fillers)



Database / Ontology



Domain-specific table

Target and attributes

rating date movie name time

Task completion:

Finding the row that satisfies the constraints

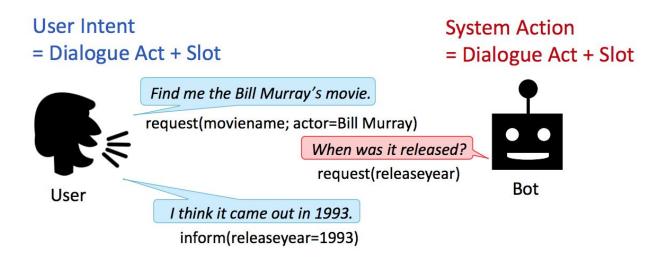
Dialogue Schema



Dialogue Act: inform, request, confirm (system only)

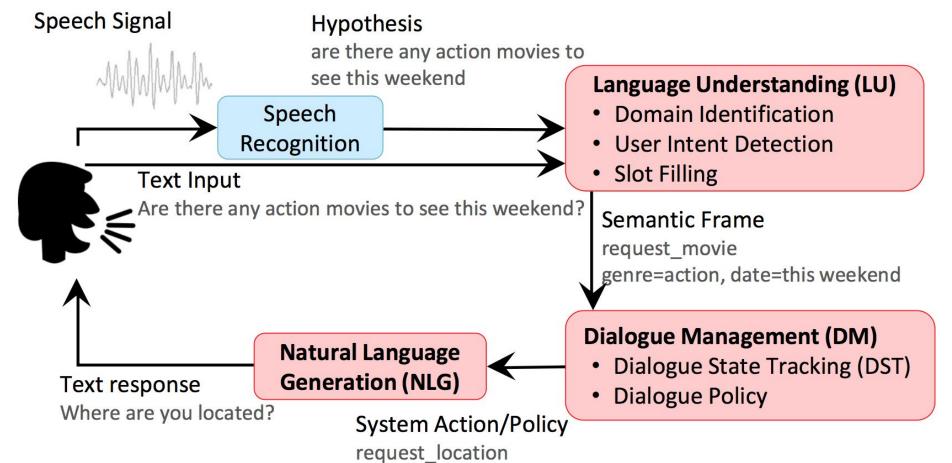
Task-specific action (e.g. book_ticket)

Others (e.g. thanks)



Task-Oriented Dialogue System





Natural Language Understanding Pipeline





Domain/Intent Classification



find me a cheap taiwanese restaurant in oakland

Movies Find movie

Restaurants Buy_tickets

Sports Find_restaurant

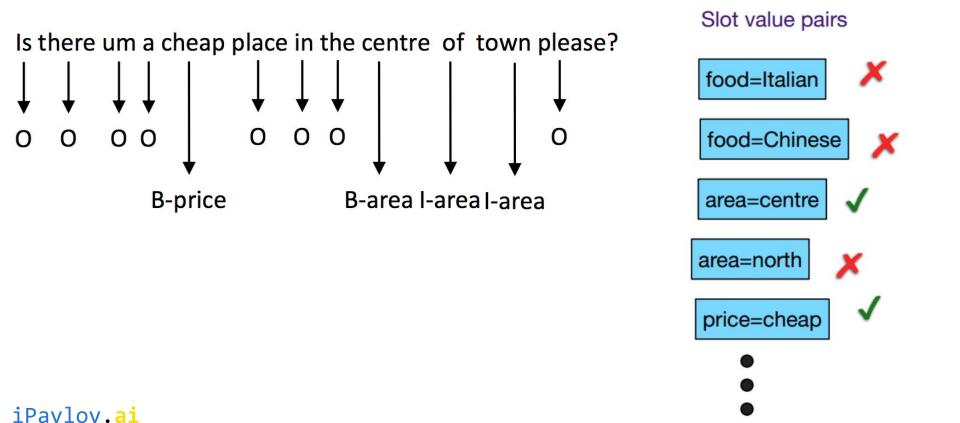
Weather Book_table

Music Find_lyrics

...

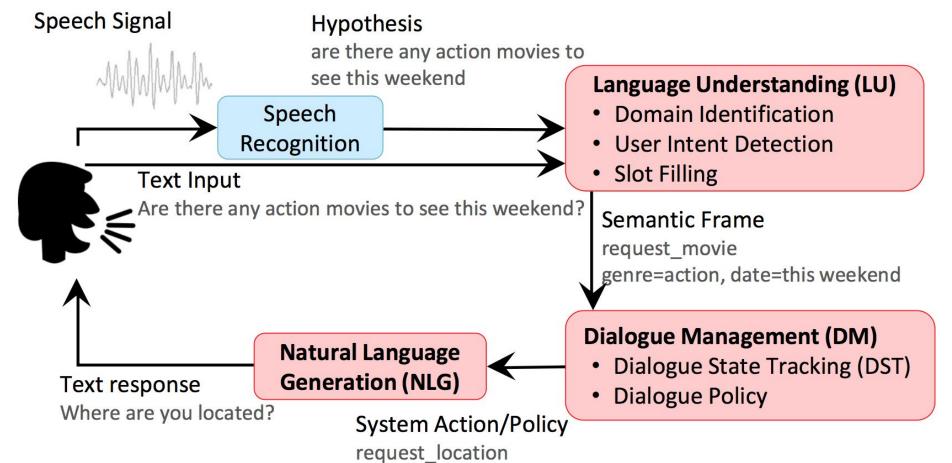
Slot Filling





Task-Oriented Dialogue System





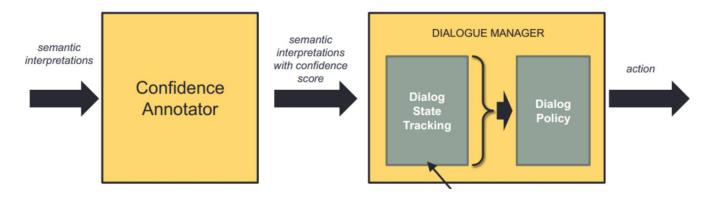
Dialog Management



```
S: where would you like to fly from?
U: [Boston/0.45]; [Austin/0.30]
S: sorry, did you say you wanted to fly from Boston?
U: [No/0.37] + [Aspen / 0.7]

Updated belief = ?

[Boston/?; Austin/?; Aspen/?]
```



Example Dialog



Hello, how may I help you?

I'm looking for a Thai restaurant.

request (restaurant; foodtype=Thai)

What part of town do you have in mind?

Something in the centre.

inform (area=centre)

Bangkok city is a nice place, it is in the centre of town and it serves Thai food.

What's the address?

request (address)

Bangkok city is a nice place, their address is 24 Green street.

Thank you, bye.

bye ()

Dialog State Tracker



Maintain a probabilistic distribution instead of a 1-best prediction for better robustness to recognition errors, ambiguous input, NLU errors

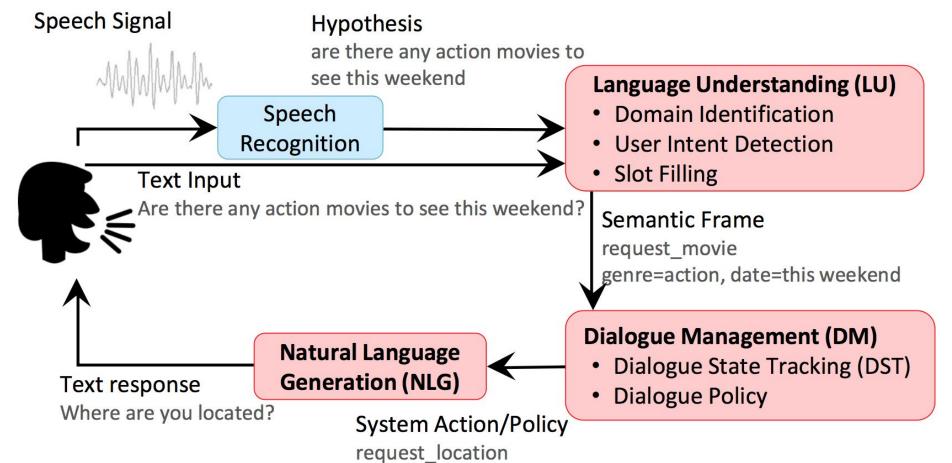
Slot	Value
# people	5 (0.5)
time	5 (0.5)

Slot	Value
# people	3 (0.8)
time	5 (0.8)



Task-Oriented Dialogue System





Template-Based NLG



Define a set of rules to map frames to NL

Semantic Frame	Natural Language
confirm()	"Please tell me more about the product your are looking for."
confirm(area=\$V)	"Do you want somewhere in the \$V?"
confirm(food=\$V)	"Do you want a \$V restaurant?"
confirm(food=\$V,area=\$W)	"Do you want a \$V restaurant in the \$W."

Pros: simple, error-free, easy to control

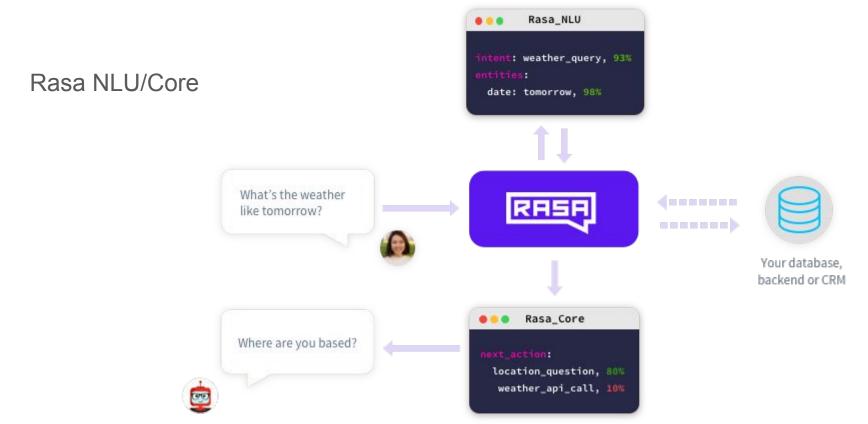
Cons: time-consuming, rigid, poor scalability

Existing Solutions



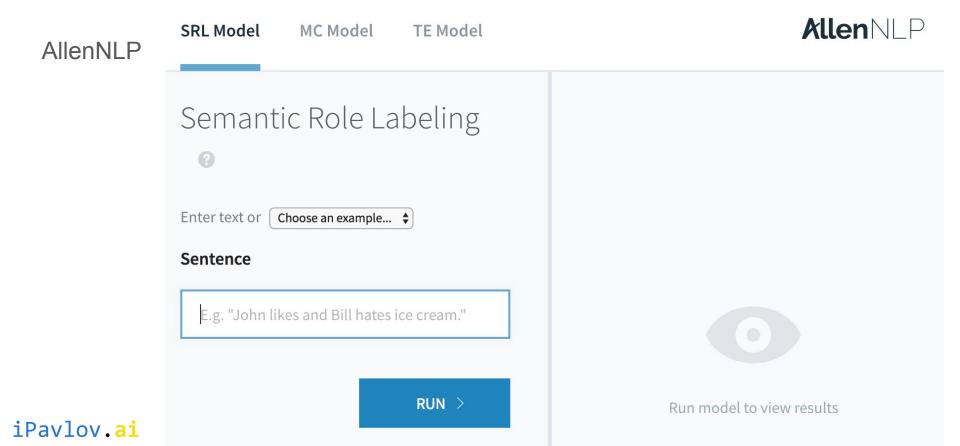
Existing Solutions





Existing Solutions



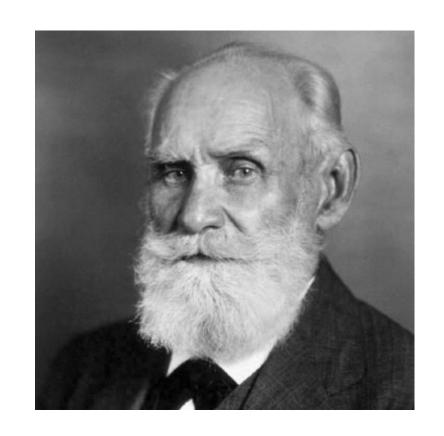


DeepPavlov



DeepPavlov





DeepPavlov





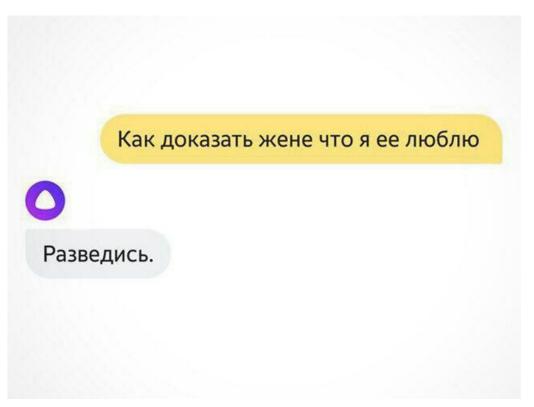




Alisa of Yandex

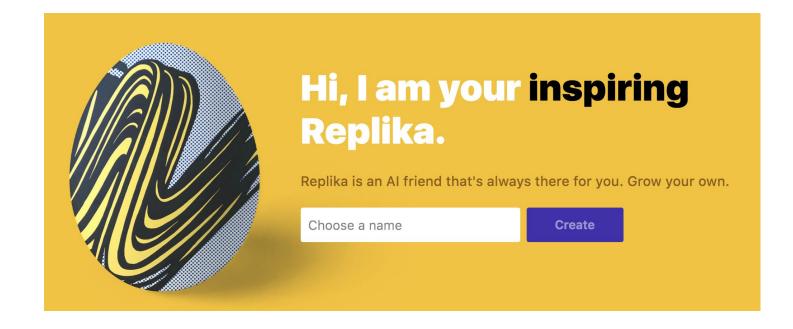


Alisa of Yandex





- Alisa of Yandex
- Replika.ai





- Alisa of Yandex
- Replika.ai
- Siri





- Alisa of Yandex
- Replika.ai
- Siri

Vera - HR-bot



- Alisa of Yandex
- Replika.ai
- Siri

- Vera HR-bot
- etc

