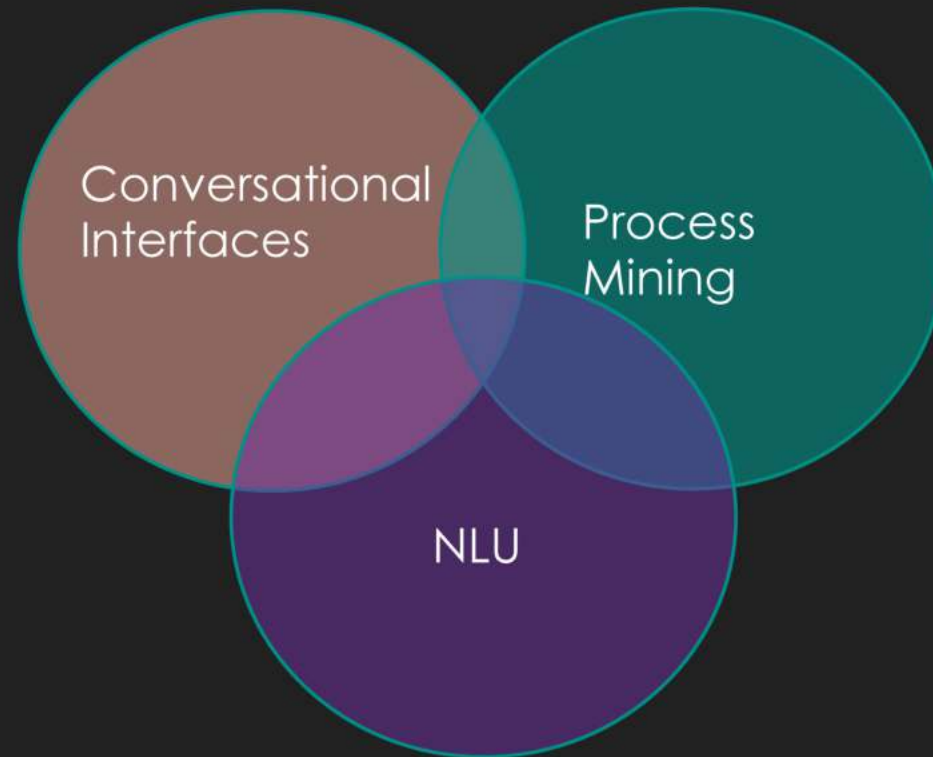


# Using Process Mining to Improve Conversational Interfaces

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# What is this Talk about?



# Conversational Interfaces

- Chatbots
- Voice interfaces
- Cognitive Search Engines



Pic source: unsplash



source: mythesisbot.com

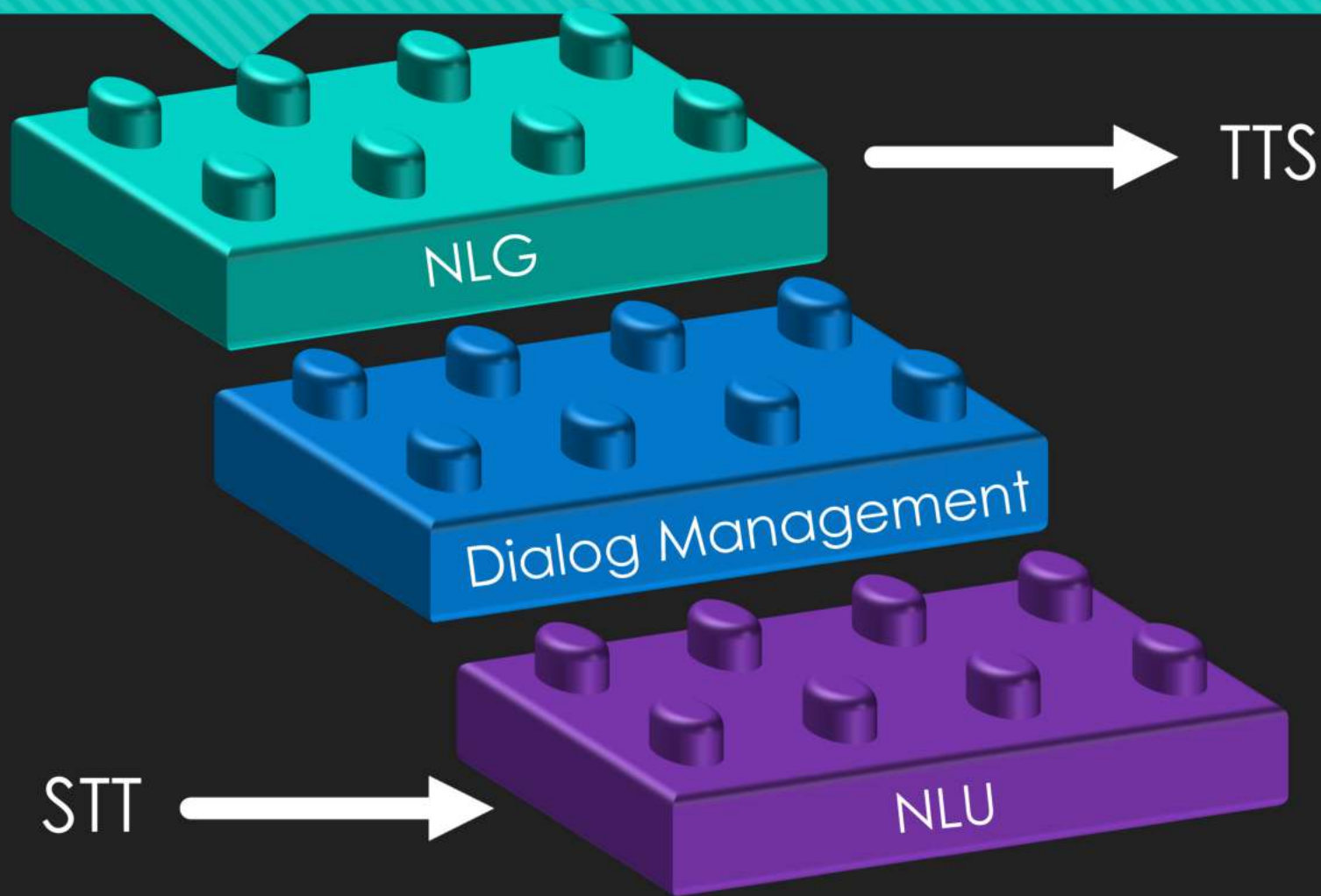
# Challenges For Designers of Conversational Interfaces

- Heterogeneous user base – diverse language use
- Actual user interactions != design
- Need constant refinement



Pic source: unsplash

# Common Architecture for Conversational Interfaces



# Common Natural Language Understanding Concepts

"What is the balance in my checking account?"

Entities



Intent:  
PersonalAccountsIntent

"Whom can I speak with regarding mortgages?"

Entities



Intent: OtherServicesIntent

# Datasets for NLU Models

- Define custom intents and entities
- Provide multiple examples for each intent and label entities

Utterance	Intent
Can you please give me quotes of mortgage rates	ExplorationIntent
I am interested in 15 years only for refinance	InformIntent
Excellent, I would be interested to proceed	ConfirmIntent
My email is x@x.com	ContactInfoIntent
Thank you, I will be waiting to hear back	EndConvIntent

# Training and Testing the Model

- Train machine learning algorithms for **intent classification** and entity recognition
- Test (interactive, batch)

The screenshot shows the Azure ML Studio interface for training and testing a machine learning model. The top navigation bar includes 'DASHBOARD', 'BUILD', 'PUBLISH', 'SETTINGS', 'Train', and 'Test'. The main content area is titled 'PersonalAccountsIntent' and features a 'Delete Intent' button. Below the title is a text input field for adding examples. A search bar and 'Reassign intent' dropdown are also present. The 'Filters' section shows 'Errors' and 'Entity' options, with 'Entities view' toggled on. The main table displays a list of utterances with their corresponding labeled intents and confidence scores. The bottom section shows 'Entities used in this intent'.

Utterance	Labeled intent
what is the balance in my checking account ?	PersonalAccountsIntent 0.97
what are annual rates for my savings accounts ?	PersonalAccountsIntent 0.59
when was the last cell phone auto pay processed ?	PersonalAccountsIntent 0.94
have i received my april salary yet ?	PersonalAccountsIntent 0.94
i would like my savings statement to be sent again	PersonalAccountsIntent 0.94
what is the latest transaction in my checking account ?	PersonalAccountsIntent 0.95
what is my savings account balance ?	PersonalAccountsIntent 0.94



# Scoring the Model (LUIS)

```
{
  "query": "what are annual rates for savings accounts",
  "topScoringIntent": {
    "intent": "OtherServicesIntent",
    "score": 0.577525139
  },
  "intents": [
    {
      "intent": "OtherServicesIntent",
      "score": 0.577525139
    },
    {
      "intent": "PersonalAccountsIntent",
      "score": 0.267547846
    },
    {
      "intent": "None",
      "score": 0.00754897855
    }
  ],
  "entities": []
}
```

# Transforming Conversational Data into Process Mining Format

- Looking at each conversation as sequence of intents (user interactions only)

Timestampnn	Conv ID	Utterance	Intent
2018-04-02 14:03:02	3	Can you please give me quotes of mortgage rates	ExpressionIntent
2018-04-02 14:03:05	3	I am interested in 15 years only for refinance	InformIntent
2018-04-02 14:03:08	3	Excellent, I would be interested to proceed	ConfirmIntent
2018-04-02 14:04:12	3	My email is x@x.com	ContactInfoIntent
2018-04-02 14:04:15	3	Thank you, I will be waiting to hear back	EndConvIntent

# Process Map ↔ Conversational Flow

msdn-dec-ver4 +16 Map Statistics Cases Evaluation zvitop@gmail.com Disco

Zoom: 114% search... Detail

Activities Paths

100% 0%

Frequency

Show: Case frequency

```
graph TD; Start(( )) -- 1 --> GreetingIntent[1]; Start -- 2 --> OperatorRequestIntent[2]; GreetingIntent -- 1 --> ExplorationIntent[4]; OperatorRequestIntent -- 1 --> ExplorationIntent; ExplorationIntent -- 3 --> SpecificQuestionIntent[8]; SpecificQuestionIntent -- 3 --> PositiveFeedbackIntent[3]; SpecificQuestionIntent -- 4 --> EndConversationIntent[7]; SpecificQuestionIntent -- 1 --> NegativeFeedbackIntent[1]; PositiveFeedbackIntent -- 2 --> ContactInfoIntent[2]; ContactInfoIntent -- 2 --> EndConversationIntent; EndConversationIntent -- 7 --> End(( )); NegativeFeedbackIntent -- 1 --> End; EndConversationIntent -.-> Start; EndConversationIntent -.-> OperatorRequestIntent; EndConversationIntent -.-> GreetingIntent;
```

6 4 3 1

3 2 1 0

Add secondary metrics

Performance

Filter TimeWarp Animation Copy Delete Export

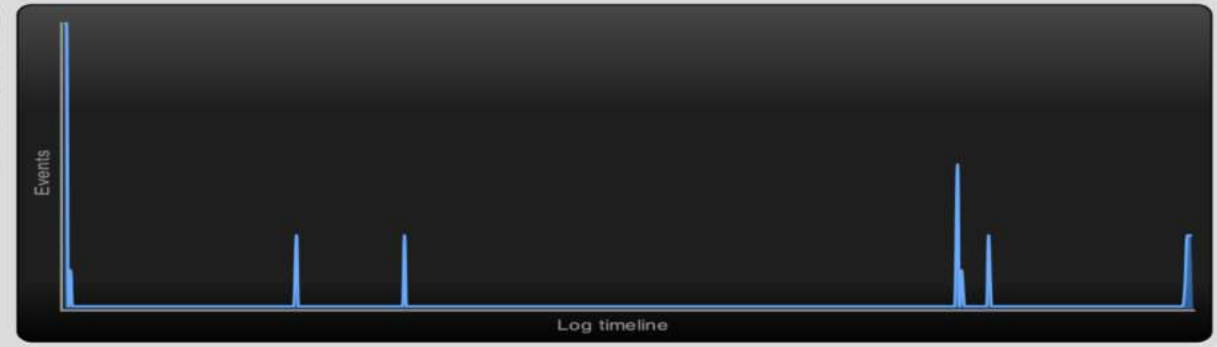
Version 2.2.1

# Summary Statistics About Conversations

- Statistics views
- Overview Global statistics
  - Activity Activity classes
  - Utterance Other attribute

Overview Global statistics

- Events over time
- Active cases over time
- Case variants
- Events per case
- Case duration



Events	32
Cases	10
Activities	8
Median case duration	7.5 secs
Mean case duration	29.3 secs
Start	02.04.2018 09:03:15
End	02.04.2018 14:04:15

Cases (10) Variants (9)

Case ID	Events	Variant	Started	Finished	Duration
3	5	Variant 4	02.04.2018 14:03:02	02.04.2018 14:04:15	1 min, 13 secs
1	5	Variant 2	02.04.2018 13:02:02	02.04.2018 13:03:11	1 min, 9 secs
8	4	Variant 9	02.04.2018 09:04:12	02.04.2018 09:05:16	1 min, 4 secs
5	5	Variant 6	02.04.2018 09:03:18	02.04.2018 09:04:20	1 min, 2 secs
10	2	Variant 1	02.04.2018 10:05:36	02.04.2018 10:05:45	9 secs
4	3	Variant 5	02.04.2018 09:03:15	02.04.2018 09:03:21	6 secs
9	2	Variant 1	02.04.2018 10:34:11	02.04.2018 10:34:16	5 secs
7	3	Variant 8	02.04.2018 09:04:12	02.04.2018 09:04:16	4 secs
2	2	Variant 3	02.04.2018 13:10:12	02.04.2018 13:10:13	1 sec
6	1	Variant 7	02.04.2018 09:04:10	02.04.2018 09:04:10	0 millis


# Conversational Flow Variants

msdn-dec-ver4 +16 Map Statistics Cases Evaluation zvitop@gmail.com Disco

search...

Variants (9)	Cases (10)
<b>Complete log</b> All cases (10)	<b>1</b> 5 events
Variant 1 2 cases (20%)	2 2 events
Variant 2 1 case (10%)	3 5 events
Variant 3 1 case (10%)	4 3 events
Variant 4 1 case (10%)	5 5 events
Variant 5 1 case (10%)	6 1 events
Variant 6 1 case (10%)	7 3 events
Variant 7 1 case (10%)	8 4 events
Variant 8 1 case (10%)	<b>9</b> 2 events
Variant 9 1 case (10%)	10 2 events

**9**  
Case with 2 events



Events: 2  
Start: 02.04.2018 10:34:11  
Duration: 5 secs

Graph Table

```
graph TD; 1[SpecificQuestionIntent  
started at 02.04.2018 10:34:11  
completed instantly] -- 5 secs --> 2[EndConversationIntent  
started at 02.04.2018 10:34:16  
completed instantly]
```

Filter TimeWarp Copy Delete Export

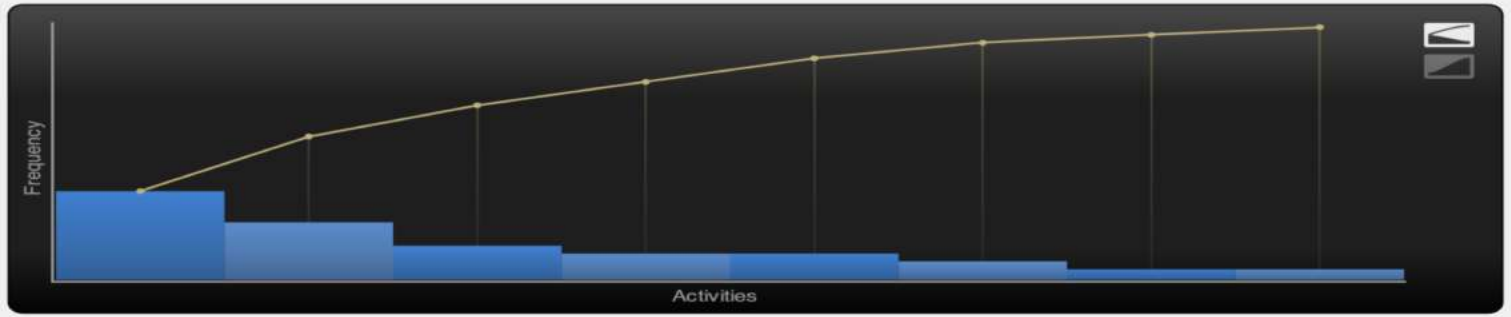


# Summary Statistics About Intents

- Statistics views
- Overview  
Global statistics
- Activity  
Activity classes
- Utterance  
Other attribute

## Activity

Activity event classes



Activities	8
Minimal frequency	1
Median frequency	3
Mean frequency	4
Maximal frequency	11
Frequency std. deviation	3.42

All activities (8) First in case (4) Last in case (4)

Activity	Frequency	Relative frequency
SpecificQuestionIntent	11	34.38 %
EndConversationIntent	7	21.88 %
ExplorationIntent	4	12.5 %
PositiveFeedbackIntent	3	9.38 %
OperatorRequestIntent	3	9.38 %
ContactInfoIntent	2	6.25 %
GreetingIntent	1	3.12 %
NegativeFeedbackIntent	1	3.12 %

# Additional Information

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- Questions

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