
tdx
Conversation Topic Classification at Talkdesk
Pedro Verruma
Engineering Manager
powered by
talkdesk

Who am I?

Pedro Verruma

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Engineer Manager at TDX

talkdesk.com/tdx

NLP Background

10 years of experience in AI and ML

Agenda

Meet the Company

Talkdesk, TDX

Conversation Topics?

Context and Motivation

Sentences

Classification

Moments

Classification

MEET THE COMPANY

TALKDESK & TDX

Company

talkdesk

Empower companies to continuously improve customer experience.

Mission

1.800+

Customers

30.000+

Users

900+

People

Innovation

tdx | INNOVATION R&D LAB

TDX is an Innovation Lab to fast-track key technology initiatives and accelerate technological responses to business issues.

Mission

Coimbra | Aveiro

Location

1/2019

Founded

100+

People

CONVERSATION TOPICS?

CONTEXT AND MOTIVATION

Context

Talkdesk handles a **lot** of calls.

Calls are transformed into text, called **transcripts**.
This allow for easier manipulation and information extraction.

What are **conversation topics**?

Motivation

Why should we get topics from conversations?

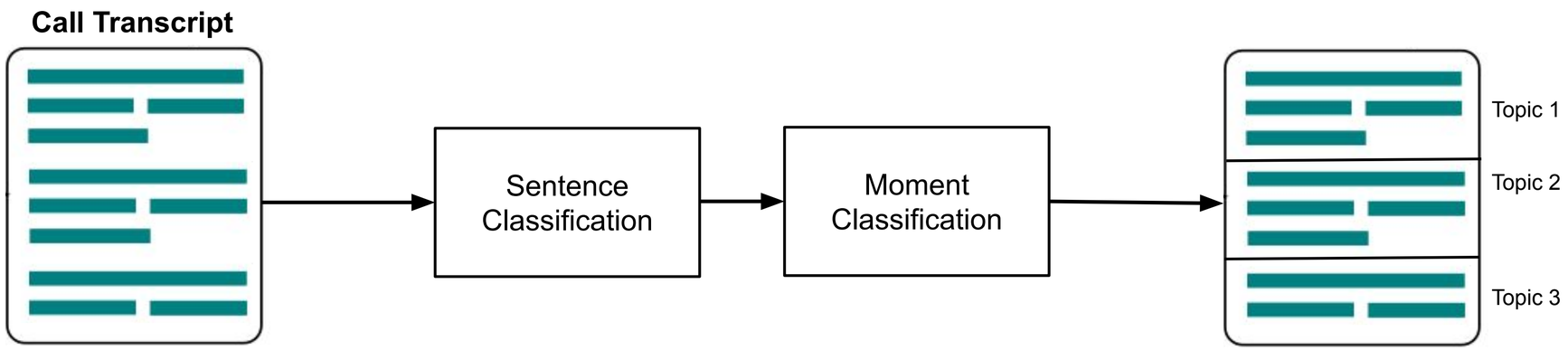
Human agents already do this but is prone to **errors** and **time consuming**.

We want to automate it, allowing extraction of **metrics**:

Number of calls about a specific topic.
Number of calls with multiple topics.

How to handle it?

Sentence and **Moment** Classification



SENTENCES

CLASSIFICATION

What do we have?

Call **transcriptions**.

Separated by **Agent** and **Customer**.

Splitted into **sentences**.

Each sentence is **classified** individually.

What do we do?

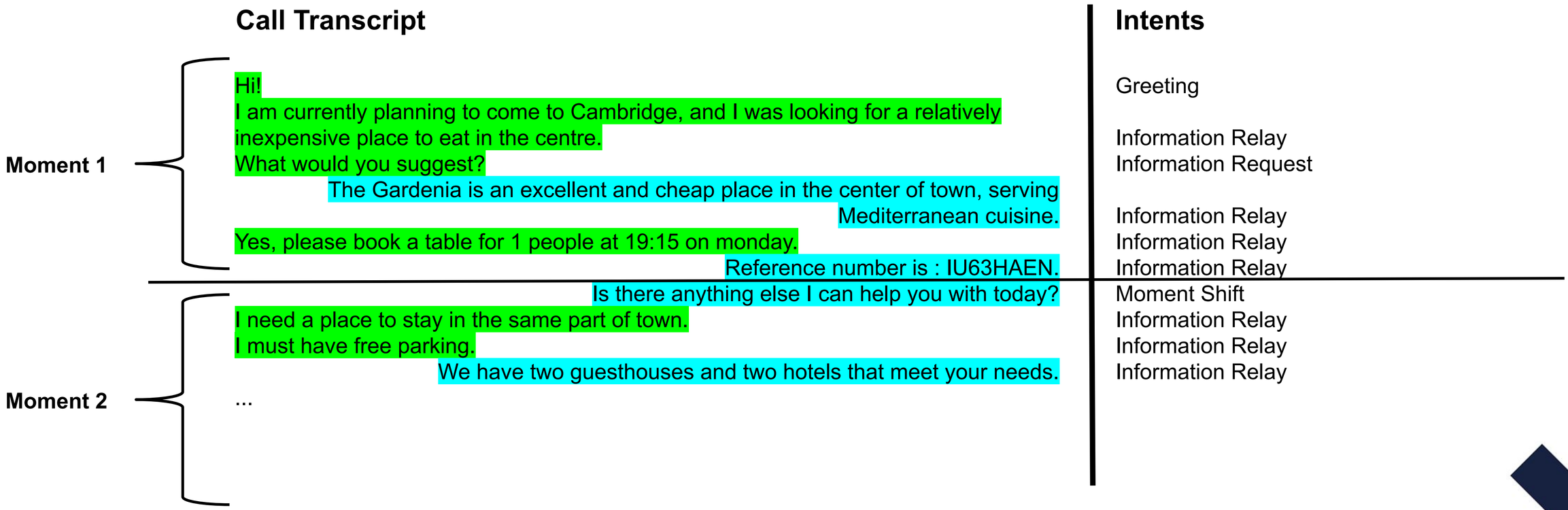
For each **sentence** we classify it with an **intent**:

GREETING
FAREWELL

INFORMATION_REQUEST
INFORMATION_RELAY
INFORMATION_ACKNOWLEDGEMENT

MOMENT_SHIFT

Real Scenario



Approach

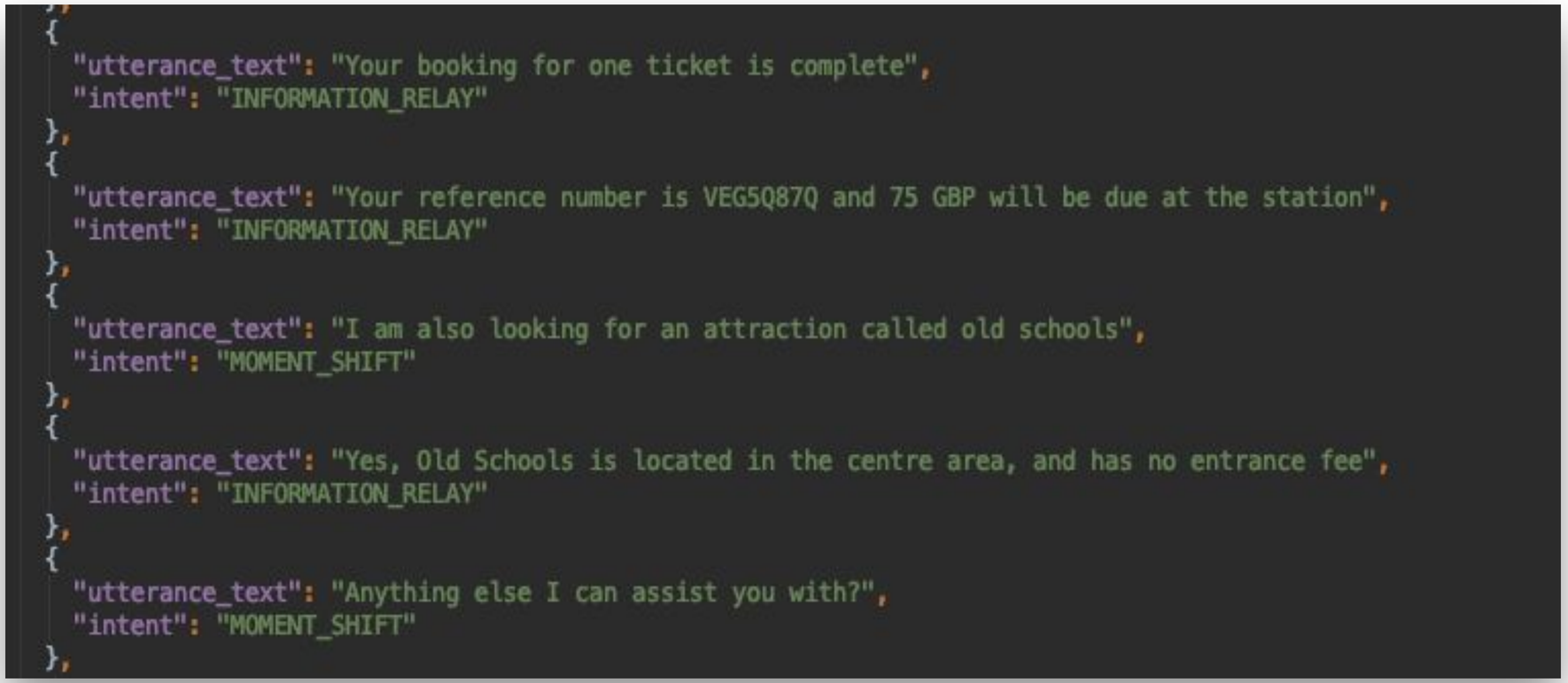
Dataset

MultiWOZ

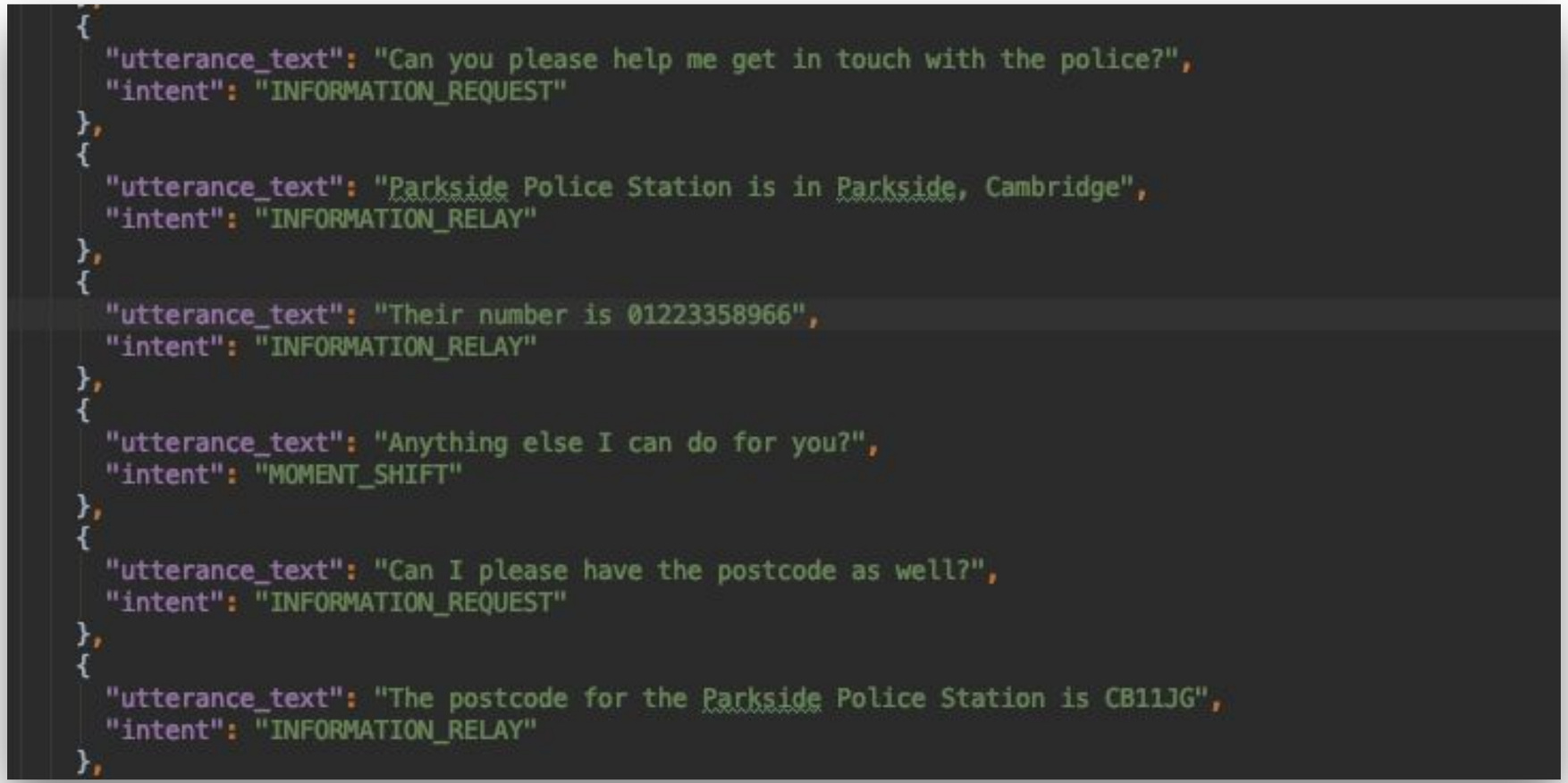
Fully-labeled collection of written conversation spanning over multiple domains and topics.

https://github.com/budzianowski/multiwoz

MultiWOZ

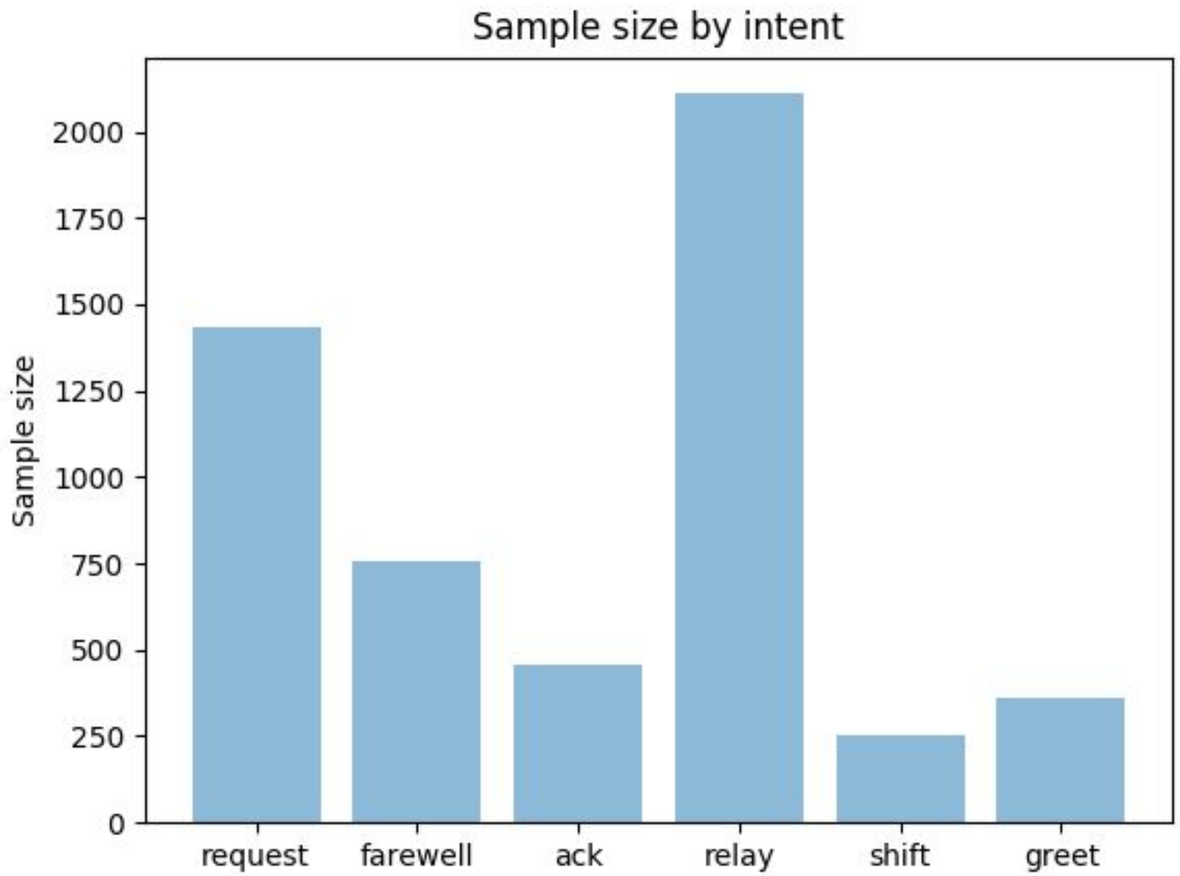

{
"utterance_text": "Your booking for one ticket is complete",
"intent": "INFORMATION_RELAY"
},
{
"utterance_text": "Your reference number is VEG5Q87Q and 75 GBP will be due at the station",
"intent": "INFORMATION_RELAY"
},
{
"utterance_text": "I am also looking for an attraction called old schools",
"intent": "MOMENT_SHIFT"
},
{
"utterance_text": "Yes, Old Schools is located in the centre area, and has no entrance fee",
"intent": "INFORMATION_RELAY"
},
{
"utterance_text": "Anything else I can assist you with?",
"intent": "MOMENT_SHIFT"
},

MultiWOZ

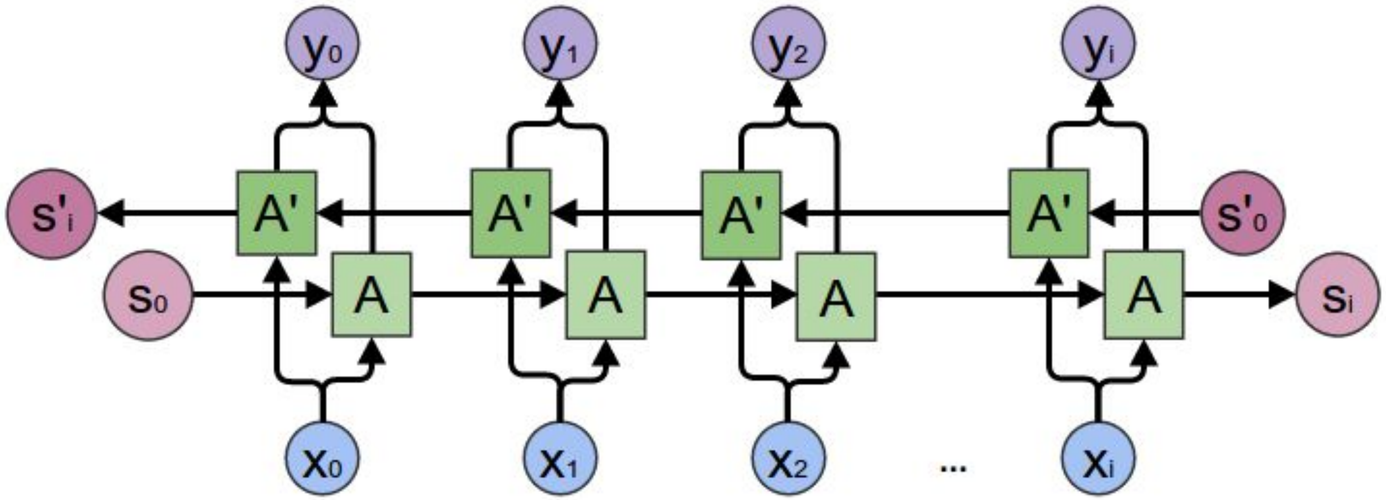


```
{
  "utterance_text": "Can you please help me get in touch with the police?",
  "intent": "INFORMATION_REQUEST"
},
{
  "utterance_text": "Parkside Police Station is in Parkside, Cambridge",
  "intent": "INFORMATION_RELAY"
},
{
  "utterance_text": "Their number is 01223358966",
  "intent": "INFORMATION_RELAY"
},
{
  "utterance_text": "Anything else I can do for you?",
  "intent": "MOMENT_SHIFT"
},
{
  "utterance_text": "Can I please have the postcode as well?",
  "intent": "INFORMATION_REQUEST"
},
{
  "utterance_text": "The postcode for the Parkside Police Station is CB11JG",
  "intent": "INFORMATION_RELAY"
},
```

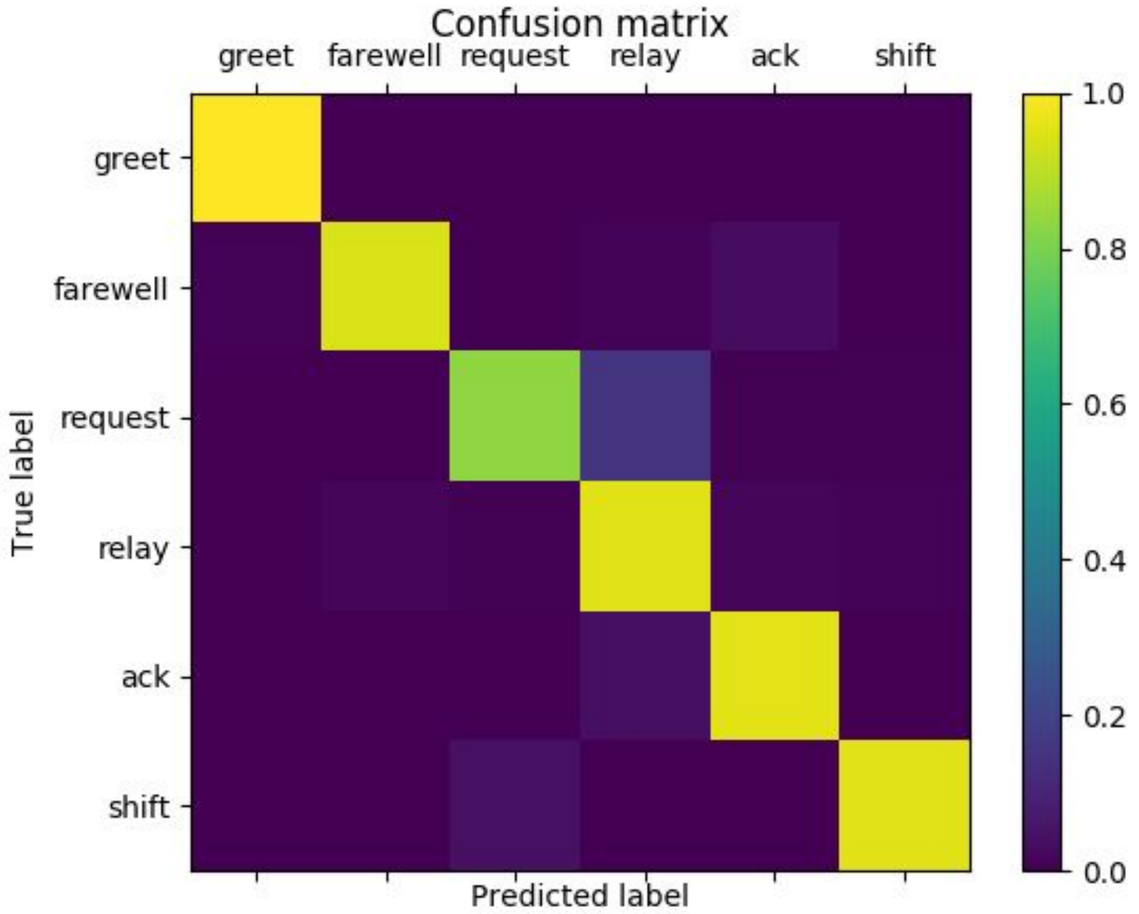
Dataset by intent



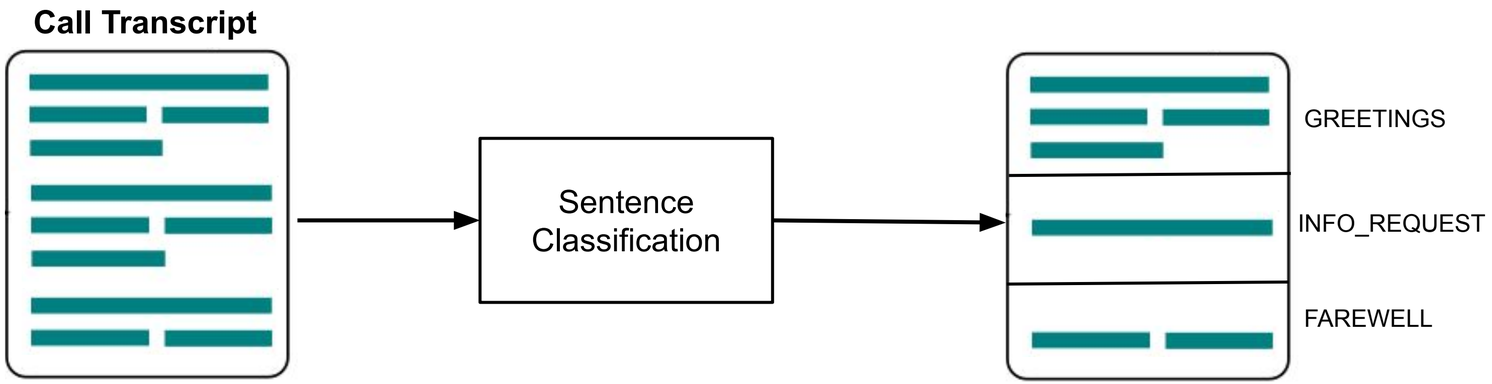
Model



Results


Confusion matrix
greet
farewell
request
relay
ack
shift
True label
Predicted label
1.0
0.8
0.6
0.4
0.2
0.0

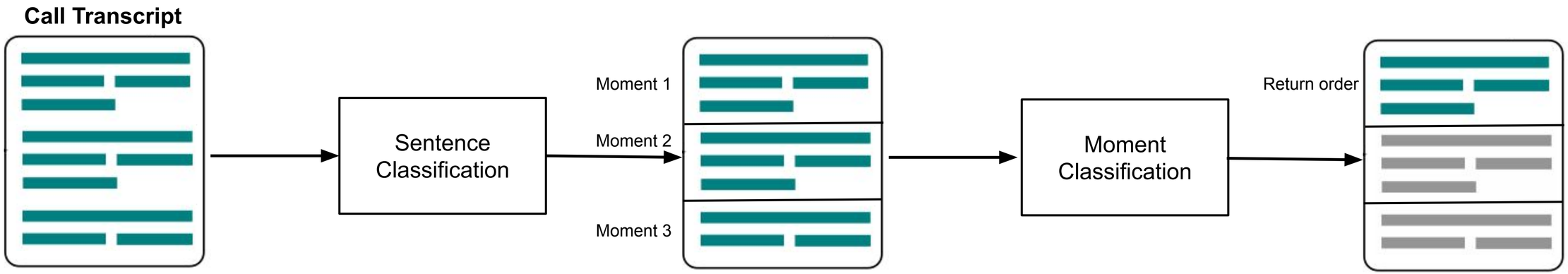
Recap


Call Transcript
Sentence Classification
GREETINGS
INFO_REQUEST
FAREWELL

MOMENTS

CLASSIFICATION

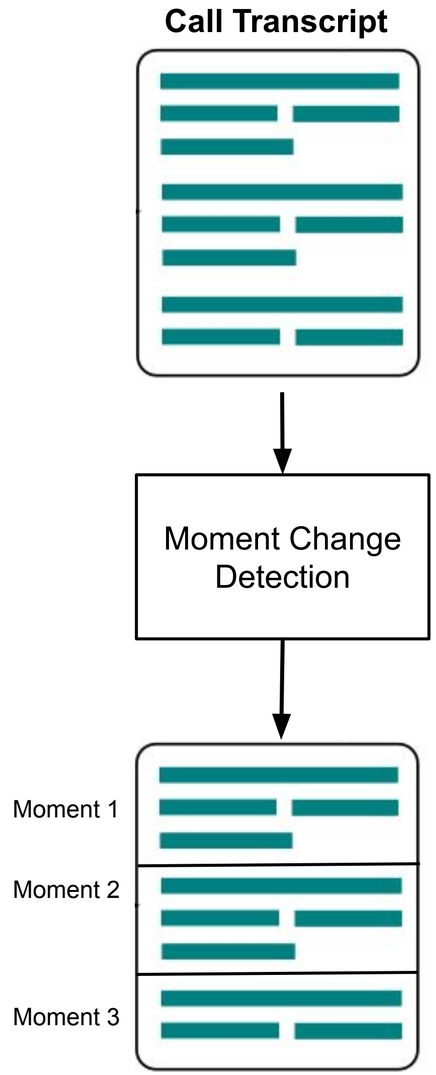
Context & Goal



Moment Change Detection

Uses the **Sentence Classification** to detect the intent of each sentence, and splits the transcripts in **Moment Shift intents**.

Model to detect intents trained a priori.

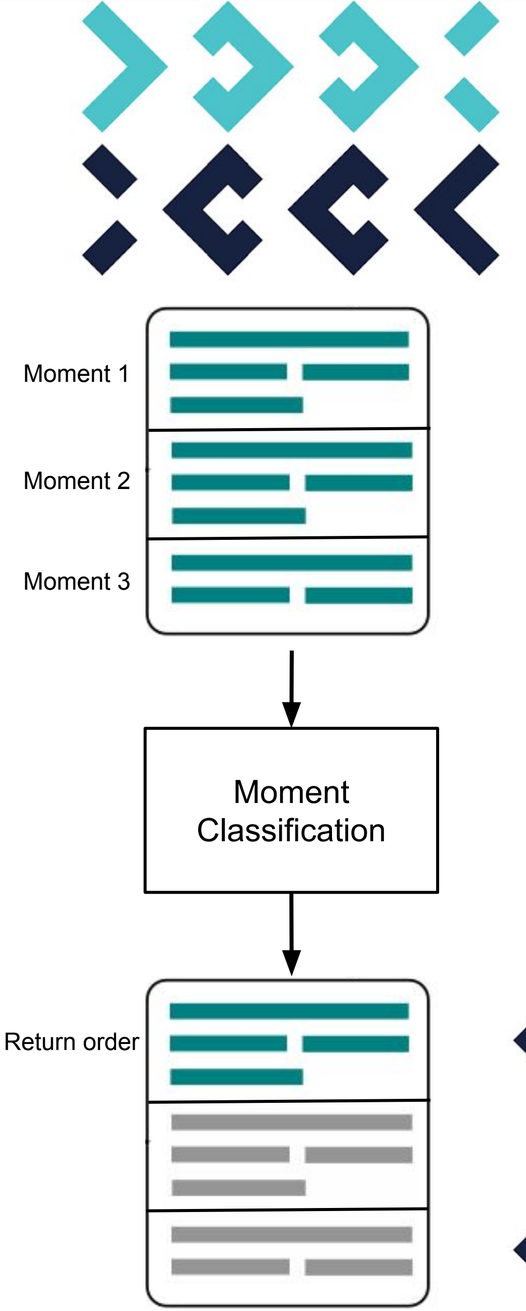


Moment Classification

Contains an algorithm to calculate **embeddings** of moments.

Stores pre-calculated embeddings for **predefined classes** of moments.

For each **moment**, calculate the **embedding** and **classify** it by comparing with the pre-calculated embeddings for different classes.



Approach

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Models

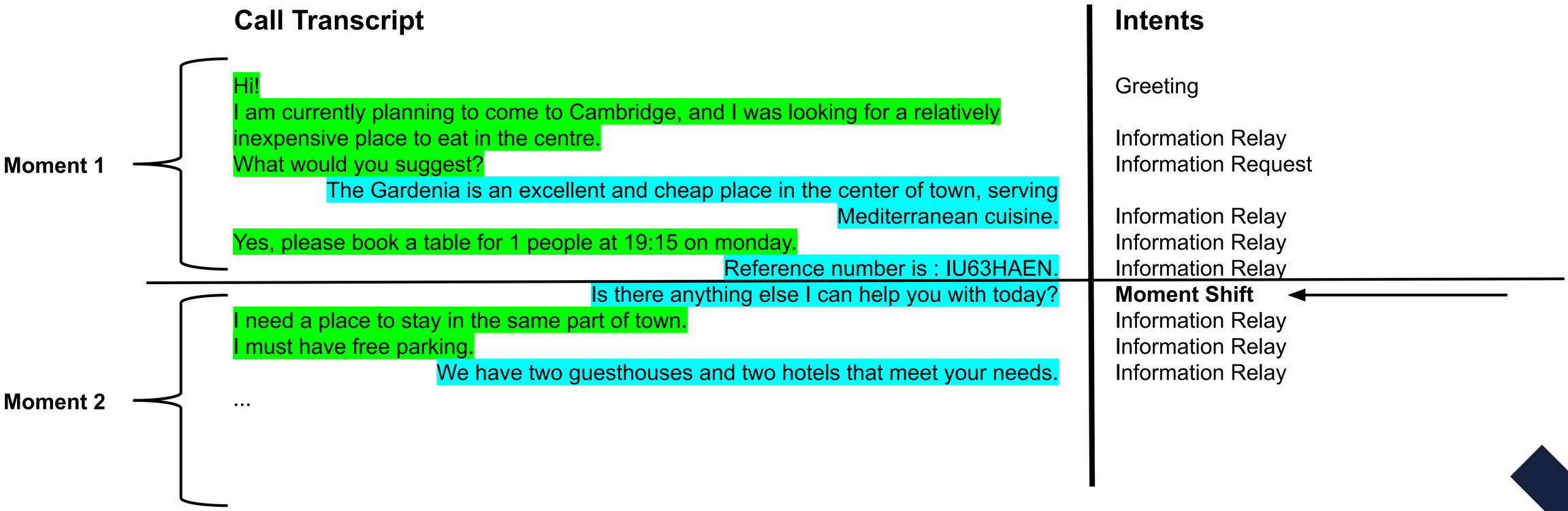
Using embeddings

BERT
https://github.com/UKPLab/sentence-transformers

InferSent
https://github.com/facebookresearch/InferSent

Universal Sentence Encoder
https://tfhub.dev/google/universal-sentence-encoder-large/3

Real Scenario - Moment Change Detection



Real Scenario - Moment Classification

Moment transcript

Hi!
I am currently planning to come to Cambridge, and I was looking for a relatively inexpensive place to eat in the centre.
What would you suggest?

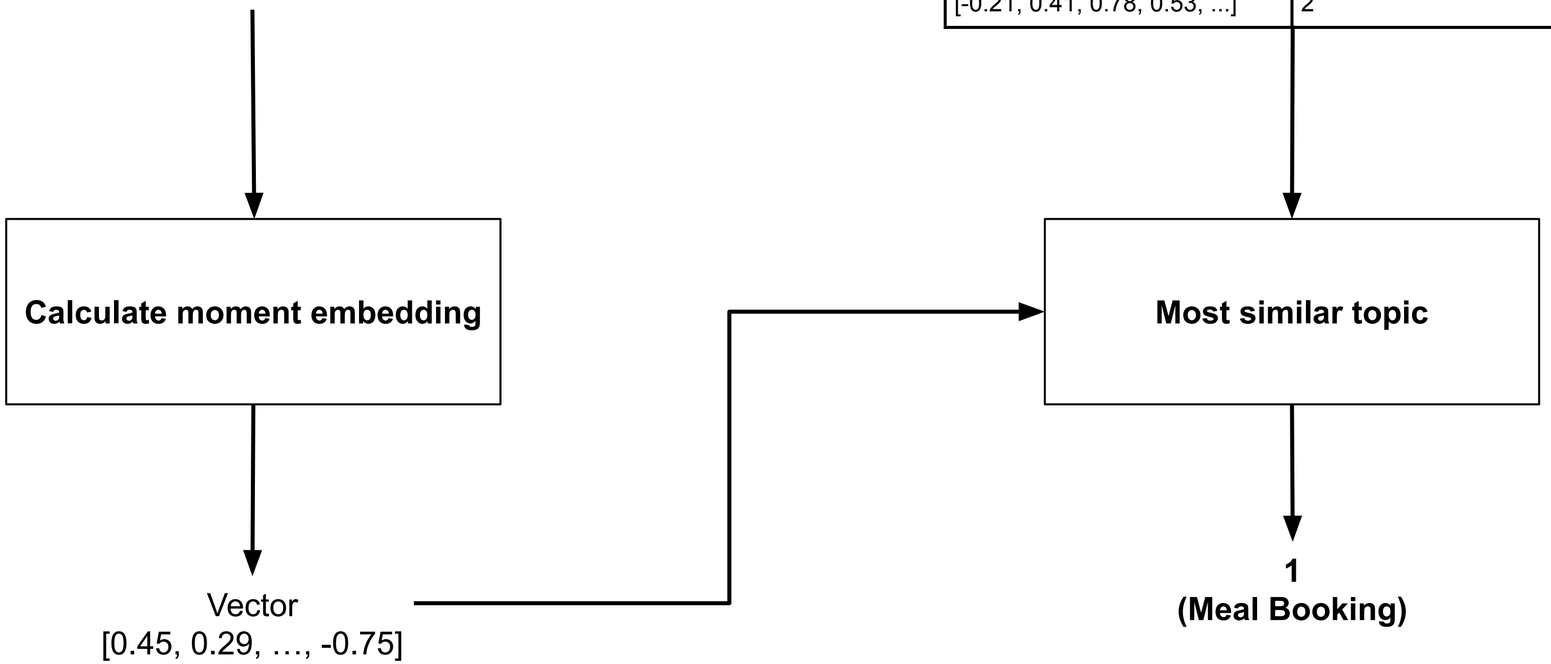
The Gardenia is an excellent and cheap place in the center of town, serving Mediterranean cuisine.

Yes, please book a table for 1 people at 19:15 on monday.

Reference number is : IU63HAEN.

Reference moment embeddings

Moment Embedding	Topic
[0.24, 0.86, 0.12, -0.84, …]	1
[0.21, -0.32, -0.53, 0.43, ...]	2
[-0.42, 0.32, 0.32, 0.54, …]	1
[0.54, -0.68, 0.96, -0.12, ...]	4
[-0.67, 0.94, -0.76, -0.42, ...]	3
[-0.21, 0.41, 0.78, 0.53, ...]	2

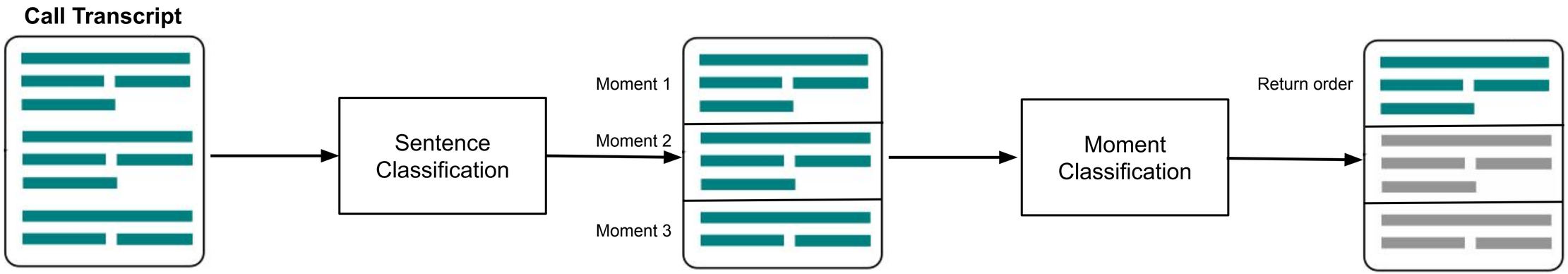


Results

	Accuracy	Prediction time (s)
BERT	83.76%	1.5076
InferSent	70.06%	0.869
Universal Sentence Encoder	82.48%	4.6024
TF-IDF	79.62%	0.22

Using moment embeddings.

Recap


Call Transcript
Sentence Classification
Moment 1
Moment 2
Moment 3
Moment Classification
Return order

Special Thanks

Diogo Soares Ferreira

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Fernando Pais

fernando.pais@talkdesk.com

Thank You!

Pedro Verruma
Engineering Manager

 pedroverruma

 @pmav

You don't
understand embeddings!

[0.23, 0.74, 0.12]