

# Build a chatbot

using Open source tools.



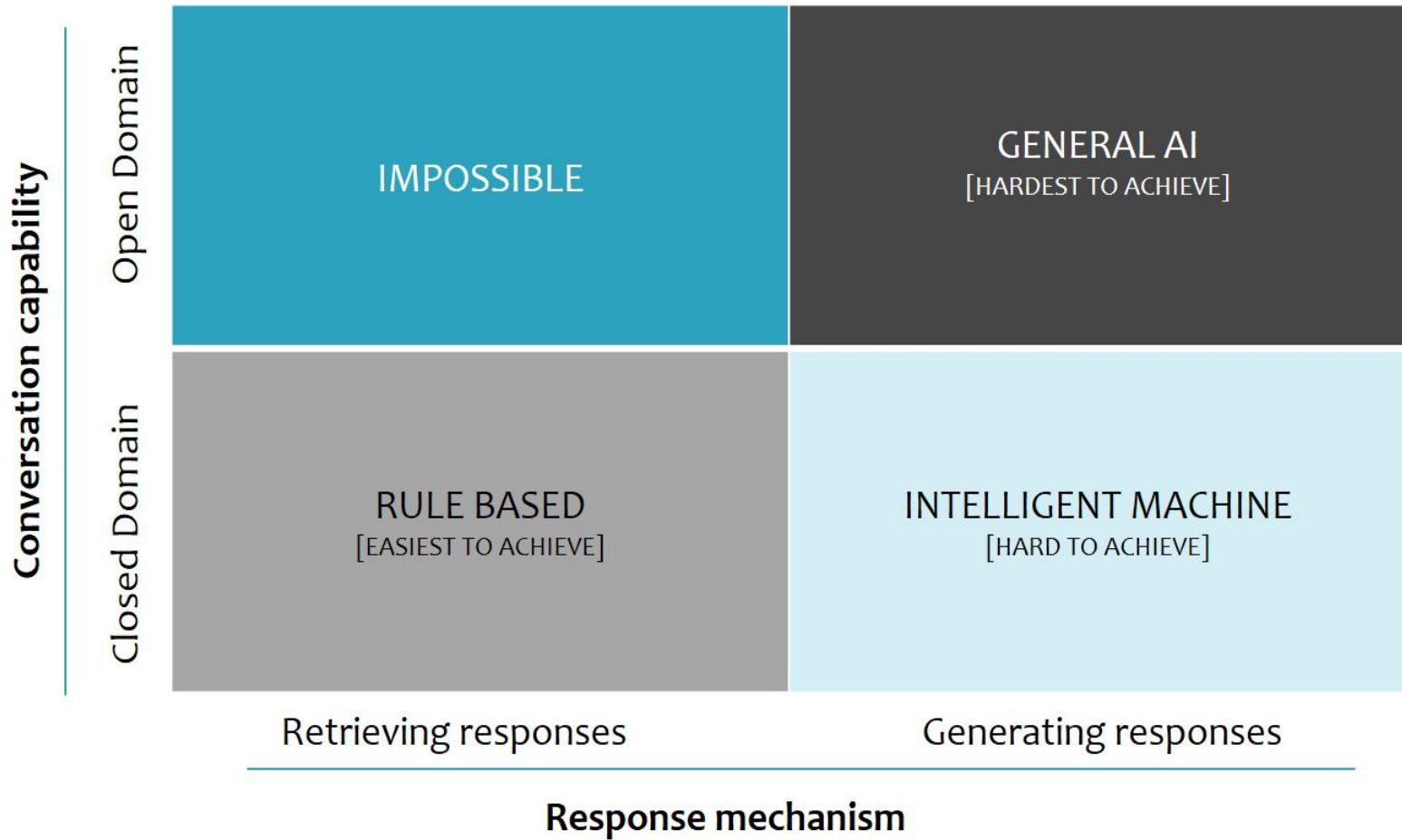
# Saikat Kumar Dey

Associate Data Scientist  
Endurance International Group

B.Tech, NIT Durgapur  
1+ year of experience in building predictive models related  
to customer segmentation/retention.

# Motivations for building your bot in-house

- Trade-off of handing over your customers' conversations to third parties.
- Rate-limiting for API requests.
- APIs are black-box. No control over the backend.
- Need to fine-tune your NLU capabilities based on your business domain.



Reference: <http://www.lempinenpartners.com/what-are-chatbots-and-how-they-impact-service-management/>

# Different Levels of Chatbot

**1**

**Constrained**

**2**

**Command based**

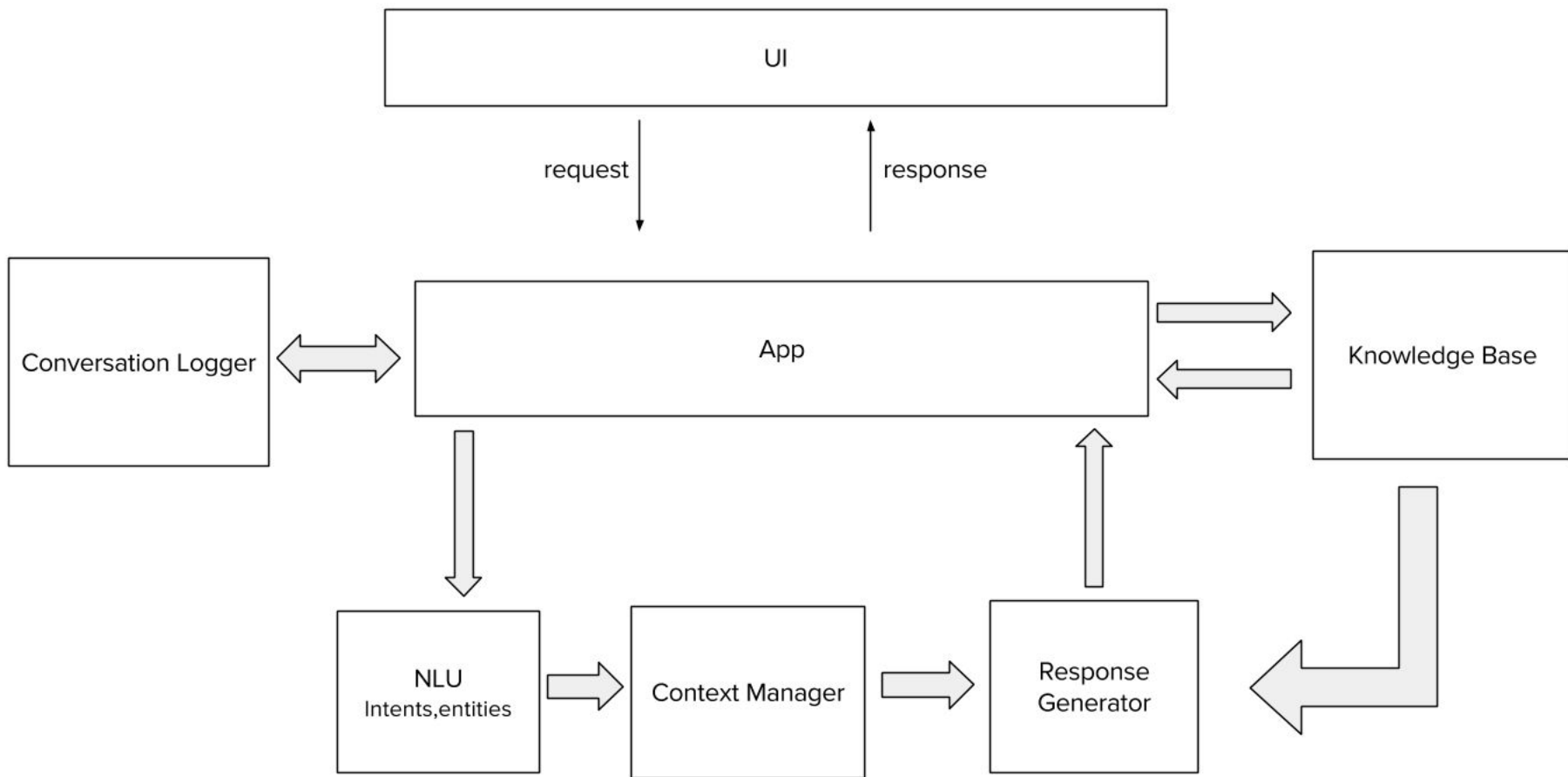
**3**

**Flow Diagram Based**

**4**

**Hybrid**

# Chatbot Architecture





# Chatbot Fundamentals

Chatbots generally have these components:

- Intent Classifier
- Entity Extractor
- Context Manager
- Response Generator

# Chatbot Fundamentals : Intent Classifier

```
{  
  "Input": "I want to book a flight from Bengaluru to Kolkata"  
  "Output": {  
    "intent": "book_flight",  
    "Confidence": 0.8  
  }  
}
```

```
{  
  "Input": "I want to cancel my flight",  
  "Output": {  
    "intent": "cancel_flight",  
    "Confidence": 0.9  
  }  
}
```

```
{  
  "Input": "I am not able to do web checkin",  
  "Output": {  
    "intent": "web_checkin_issue",  
    "Confidence": 0.9  
  }  
}
```

# Chatbot Fundamentals : Entity Extractor

```
{
  "Input": "I want to book a flight from Bengaluru to Kolkata",
  "Output": {
    "entities": [
      {
        "value": "Bengaluru",
        "name": "source"
      },
      {
        "value": "Kolkata",
        "name": "dest"
      }
    ]
  }
}
```

```
{
  "Input": "I want the 9am flight",
  "Output": {
    "entities": [
      {
        "value": "9am",
        "name": "time"
      }
    ]
  }
}
```

# Chatbot Fundamentals : Context Manager

User: hey I would like to book a flight to Bangalore tomorrow.

```
{  
  "intent": "",  
  "entities": [],  
  "State": "initial_state",  
  "States_visited": [  
    "Initial_state"  
  ],  
  "is_question": false,  
  "Is_terminal_state": false  
}
```

# Chatbot Fundamentals : Context Manager

User: hey I would like to book a flight to Bangalore tomorrow.

```
{
  "intent": "book_flight",
  "entities": [
    {
      "value": "Bangalore",
      "name": "destination"
    }
  ],
  "State": "Flight_Booking",
  "States_visited": [
    "Initial_state",
    "Flight_Booking"
  ],
  "is_question": false,
  "Is_terminal_state": false
}
```

# Chatbot Fundamentals : Context Manager

User: hey I would like to book a flight to Bangalore tomorrow.

Bot: Alright. Where would you like to catch the flight from?

```
{  
  "intent": "book_flight",  
  "entities": {  
    "value": "Bangalore",  
    "name" : "destination"  
  },  
  "state" : "Ask_Source",  
  "states_visited": [  
    "Initial_State",  
    "Flight_Booking",  
    "Ask_Source"],  
  "is_question": true,  
  "is_terminal_state" : false  
}
```

# Chatbot Fundamentals : Context Manager

User: hey I would like to book a flight to Bangalore tomorrow.

Bot: Alright. Where would you like to catch the flight from?

User: Kolkata

Bot: Here are some flights from Bangalore to Kolkata tomorrow. {list of flights with timings }

```
{
  "intent": "book_flight",
  "entities": [
    {
      "value": "Bangalore",
      "name": "destination"
    },
    {
      "value": "Kolkata",
      "name": "Source"
    }
  ],
  "State": "Show_flights",
  "States_visited": [
    "Initial_state",
    "Flight_Booking",
    "Ask_Destination",
    "Show_Flights"
  ],
  "is_question": false,
  "Is_terminal_state": false
}
```

# Chatbot Fundamentals : Response Generator

user: "hey, how are you?"

{Simple Greeting}

bot: "Greetings! How may I help you?"

user: "I am not able to do web-checking"

{Problem}

Bot: "I'll help you fix that. May I know your PNR ?"

User: "what is the cancellation charge for this flight?"

{Query}

Bot: "That would be Rs. 2000."

User: "Why is the sky blue?"

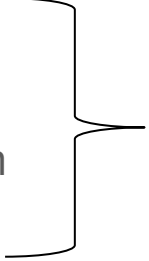
{Noise}

Bot: "Sorry. I did not understand that."



How to do it yourself?

# Open source Libraries

- Rasa.AI
  - spaCy
  - scikit-learn
  - MITIE
- 
- NLU
- Transitions
  - Chatterbot
  - Flask/Socket.IO

# Rasa.AI: NLU

Add example



please book a table for 4 people at BBQ Nation at 9 pm .

book\_slot

num\_people

4

4



time

9 pm

9 pm



restaurant

BBQ Nation

BBQ Nati  
on



add an entity for "BBQ Nation"

Cancel

add

# Rasa.AI: NLU

+

restaurant\_search

any good restaurants nearby?

+

restaurant\_search

any good places to eat out nearby?

+

restaurant\_search

show me some good places to eat out near me?

+

book\_slot

book table for the 8pm slot?

+

book\_slot

i want the 10pm slot

+

book\_slot

book for the 8 pm slot

```
{
  "rasa_nlu_data": {
    "common_examples": [
      {
        "text": "i want to book a table",
        "intent": "restaurant_search",
        "entities": []
      },
      {
        "text": "i want to book a table for 2 people",
        "intent": "restaurant_search",
        "entities": [
          {
            "start": 27,
            "end": 28,
            "value": "2",
            "entity": "num_people"
          }
        ]
      },
      {
        "text": "book a table to 2",
        "intent": "restaurant_search",
        "entities": [
          {
            "start": 16,
            "end": 17,
            "value": "2",
            "entity": "num_people"
          }
        ]
      }
    ]
  }
}
```

```
{
  "entities": [
    {
      "end": 18,
      "entity": "num_people",
      "extractor": "ner_crf",
      "start": 17,
      "value": "4"
    }
  ],
  "intent": {
    "confidence": 0.6890117398203803,
    "name": "restaurant_search"
  },
  "intent_ranking": [
    {
      "confidence": 0.6890117398203803,
      "name": "restaurant_search"
    },
    {
      "confidence": 0.11200408273908598,
      "name": "book_slot"
    },
    {
      "confidence": 0.09686087802638896,
      "name": "goodbye"
    },
    {
      "confidence": 0.06616080600603318,
      "name": "greet"
    },
    {
      "confidence": 0.0237357967043689,
      "name": "affirm"
    },
    {
      "confidence": 0.01222669670374291,
      "name": "negative"
    }
  ],
  "text": "book a table for 4"
}
```

```
{
  "entities": [
    {
      "end": 31,
      "entity": "restaurant",
      "extractor": "ner_crf",
      "processors": [
        "ner_synonyms"
      ],
      "start": 16,
      "value": "Barbeque nation"
    }
  ],
  "intent": {
    "confidence": 0.548566133351477,
    "name": "restaurant_search"
  },
  "intent_ranking": [
    {
      "confidence": 0.548566133351477,
      "name": "restaurant_search"
    },
    {
      "confidence": 0.204490216543297,
      "name": "goodbye"
    },
    {
      "confidence": 0.1166472292386735,
      "name": "greet"
    },
    {
      "confidence": 0.0680681493854794,
      "name": "book_slot"
    },
    {
      "confidence": 0.048154351433603255,
      "name": "affirm"
    },
    {
      "confidence": 0.014073920047469443,
      "name": "negative"
    }
  ],
  "text": "book a table at Barbeque Nation Restaurant"
}
```

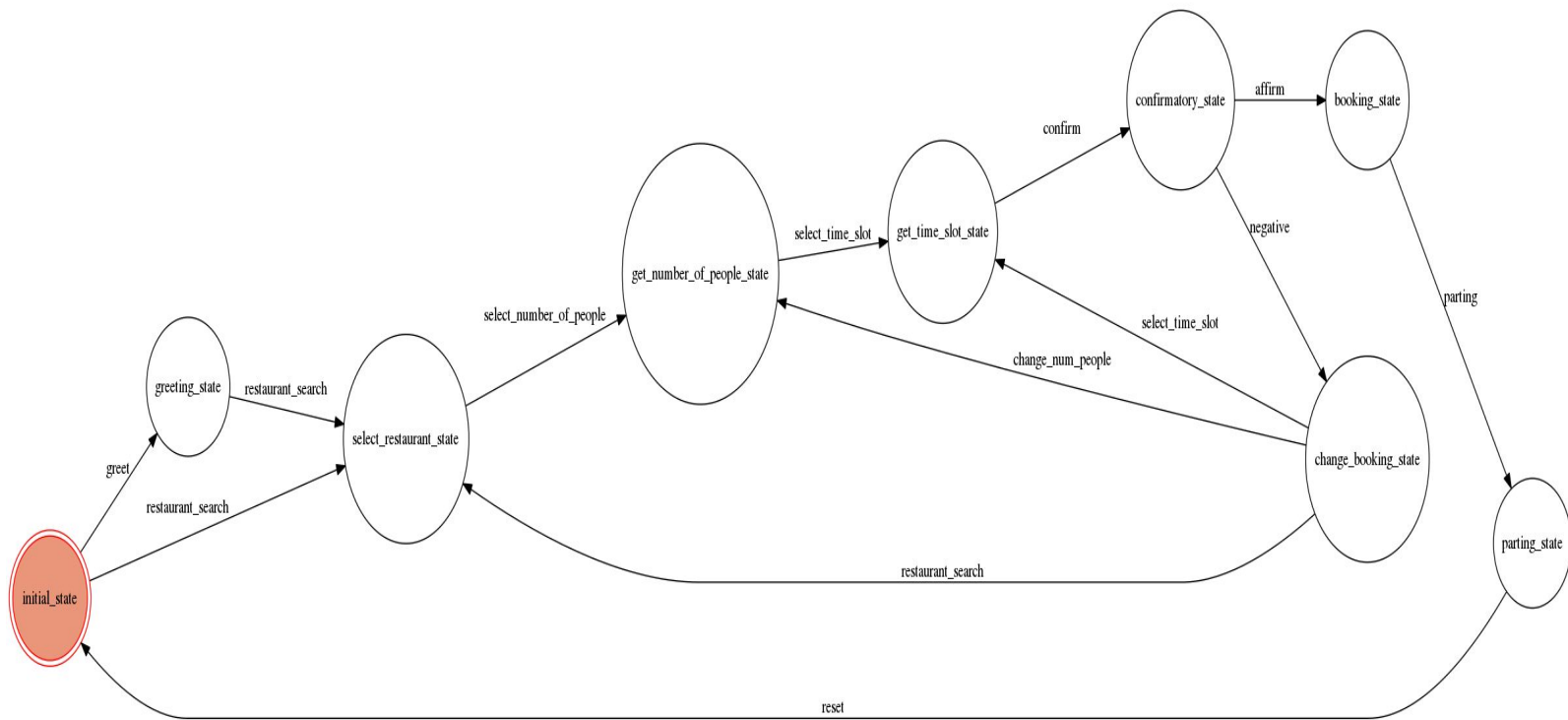
```
{
  "entities": [
    {
      "end": 23,
      "entity": "time",
      "extractor": "ner_crf",
      "start": 18,
      "value": "10 pm"
    }
  ],
  "intent": {
    "confidence": 0.794398255522084,
    "name": "book_slot"
  },
  "intent_ranking": [
    {
      "confidence": 0.794398255522084,
      "name": "book_slot"
    },
    {
      "confidence": 0.09870944661765226,
      "name": "restaurant_search"
    },
    {
      "confidence": 0.04706415372379593,
      "name": "greet"
    },
    {
      "confidence": 0.031364275696809725,
      "name": "goodbye"
    },
    {
      "confidence": 0.016394307335809096,
      "name": "affirm"
    },
    {
      "confidence": 0.012069561103849002,
      "name": "negative"
    }
  ],
  "text": "book the table at 10 pm"
}
```

## Transitions: Context Manager

```
states = ['initial_state',  
          'greeting_state',  
          'select_restaurant_state',  
|         'get_number_of_people_state',  
          'get_time_slot_state',  
          'confirmatory_state',  
          'booking_state',  
          'parting_state']
```

```
transitions = [  
    {  
        'trigger': 'greet',  
        'source': 'initial_state',  
        'dest': 'greeting_state'  
    },  
    {  
        'trigger': 'restaurant_search',  
        'source': ['initial_state', 'greeting_state'],  
        'dest': 'select_restaurant_state'  
    },  
    {  
        'trigger': 'select_number_of_people',  
        'source': 'select_restaurant_state',  
        'dest': 'get_number_of_people_state'  
    },  
    {  
        'trigger': 'select_time_slot',  
        'source': 'get_number_of_people_state',  
        'dest': 'get_time_slot_state'  
    },  
]
```

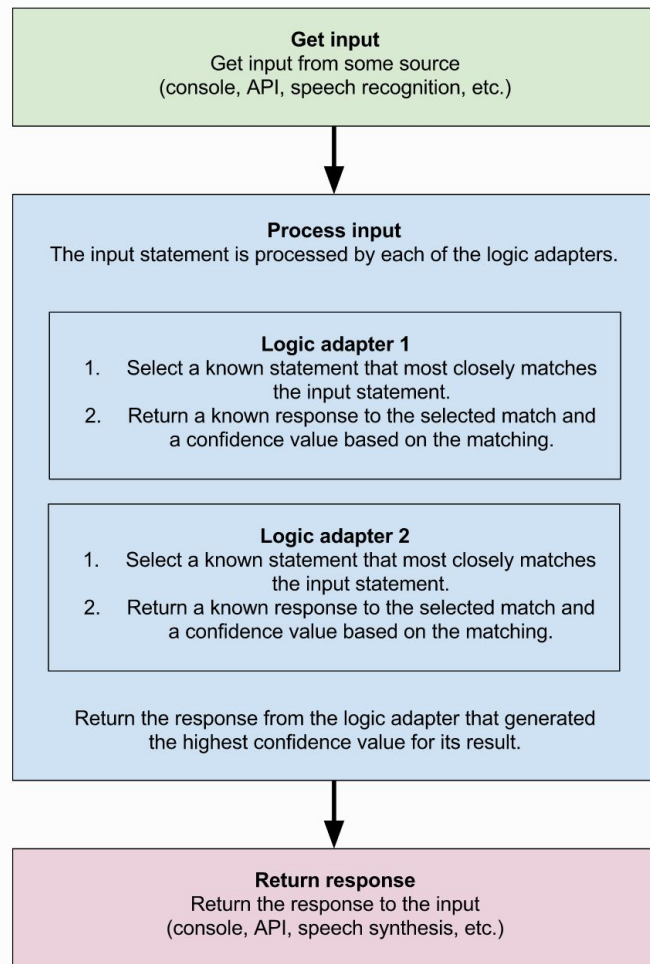




ChatBot

# Chatterbot: Response Generator

- Generate automated response based on historical conversation.
- Works well if you have past chat logs.
- Can be used to generate responses for FAQ-type queries.
- Customizable: can plug in your own Similarity Search algorithms that could be optimized for your corpus.



Reference: [https://chatterbot.readthedocs.io/en/stable/\\_images/chatterbot-process-flow.svg](https://chatterbot.readthedocs.io/en/stable/_images/chatterbot-process-flow.svg)

# Socket.IO : Real-Time communication

```
@socketio.on('connect',namespace='/chat')
def connect_event(message):
    room = session.get('room','/')
    join_room(room)
    # create new context
    # start tracking current conversation
    message = {'data': 'welcome! How may I Help you?'}
    emit('text',message,room=room )
```

Server

```
var socket;

socket = io.connect('http://' + document.domain + ':' + location.port + '/chat');

//this is fired on receiving a response from server
socket.on('response', function(data) {
    var message = data.msg + '\n';
    insertChat(data.user_name, message); //display the response on the page
});
```

Client



```

1 {
  "task_completed": "Booking completed! Enjoy :)",
  "task_message": "bye",
  "context": {
    "current": "happy",
    "response": {}
  },
  "booking_confirmed": true,
  "booking_completed_time": 10
}
2 {
  "restaurant": "bawarshi",
  "current_state": "booking state",
  "next_state": {}
}
3 {
  "value": "8",
  "entity": "book people"
}
4 {
  "value": "bawarshi",
  "entity": "restaurant"
}
5 {
  "value": "8 pm",
  "entity": "time"
}
6 {
  "restaurant": "bye",
  "next_state": {}
}
7 {
  "initial_state",
  "opening_state",
  "select_restaurant_state",
  "get_number_of_people_state",
  "get_time_and_date",
  "confirmatory_state",
  "confirmation_state"
}

```



```

{
  "name": "John",
  "age": 25,
  "gender": "male",
  "location": "New York",
  "status": "single",
  "interests": ["reading", "travel", "cooking"],
  "current_state": "idle",
  "next_state": "idle",
  "actions": [
    {
      "name": "Book a table",
      "description": "Book a table at BBQ nation for you",
      "parameters": {
        "restaurant": "BBQ nation",
        "time": "7 pm",
        "people": 3
      }
    },
    {
      "name": "Send confirmation",
      "description": "Booking completed! Enjoy :)",
      "parameters": {}
    }
  ]
}

```

Hi I am Otho. I can help you with restaurant bookings. :) 

10:00 27/12

 Book a table at John's restaurant

10:00 27/12

For how many people do you want to book? 

10:00 27/12

3 people. I want the 7 pm slot

10:00 27/12

John's restaurant for 3 people at 7 pm.  
Should I go ahead with the booking? 

10:00 27/12

 yeah

10:00 27/12

Booking complete! Enjoy :) 

10:00 27/12

bye 

Stop Over

```

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# Questions?

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## Saikat Kumar Dey

Website : <http://saikat कुमार dey.com/>

Medium : <https://medium.com/@saikat कुमार dey>

Twitter : <https://twitter.com/deysaikat कुमार>

GitHub : <https://github.com/saikat कुमार dey/>

LinkedIn : <https://www.linkedin.com/in/saikat कुमार dey/>

Email : deysaikat कुमार@gmail.com