What are Chatbots? Beginner's Guide To Chatbots

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Topics

• Chatbot 101
  • Chatbot Rudiments
  • Types of Chatbot

• Conversational Interface - Chatbots

• Natural Language Processing (NLP), Artificial Intelligence (AI), Machine Learning (ML)

• Rise of the Chatbot economy

Disclaimer: Data is curated from different sources and references are mentioned
Chatbot Use On The Rise

**Gartner**, the usage of chatbots (called virtual customer assistants by Gartner) will triple through 2019 as enterprises seek to increase customer satisfaction and reduce operating costs.

*Source: “Seven Decision Points for Success with Virtual Customer Assistants,” Gartner, July 26, 2016.*
Can I book a room tonight?

Hi Kashif, we have a room available tonight, room rate $379.
Chatbot Rudiments

Talkbot, Chatterbot, Bot, Chatterbox, Artificial Conversational Entity?
“Chatbot” refers to a broad range of technologies that allow consumers to use a conversational interface to accomplish tasks.

“A chatbot is a service, powered by rules and sometimes artificial intelligence, that we interact with through a chat interface.”

A chatbot (also known as a talkbot, chatterbot, Bot, chatterbox, Artificial Conversational Entity) is a computer program which conducts a conversation via auditory or textual methods. – Wikipedia
A Brief History of Chatbots

1950 - The Turing Test

Alan Turing theorized that a truly intelligent machine would be indistinguishable from a human during a text-only conversation. Turing’s ideas helped lay the groundwork for the chatbot revolution.

1966 - ELIZA

The world’s first chatbot, ELIZA, could mimic the responses of a psychotherapist and -- for short spurts -- carry on convincingly human conversations.

1972 - PARRY

In the 1970s, ELIZA met its first (non-human) patient: PARRY, a chatbot that could imitate a person with paranoid schizophrenia.

1988 - Jabberwacky

Developed in the 1980s and released online in 1997, the Jabberwacky chatbot was designed to “simulate natural human chat in an interesting, entertaining and humorous manner.”

1995 - ALICE

The “Artificial Linguistic Internet Computer Entity” chatbot served as the inspiration for the 2013 film Her, in which a human falls in love with a computer program.

2001 - SmarterChild

The first chatbot to achieve widespread adoption, SmarterChild joined the buddy lists of millions of AIM and MSN Messenger users in the early 2000s.

The SmarterChild approach -- building a chatbot for popular messaging platforms -- is the blueprint that most modern chatbot builders are now following.

Source: drift.com
The term "ChatterBot" was originally coined by Michael Mauldin (creator of the first Verbot, Julia) in 1994 to describe these conversational programs – Wikipedia
Today, chatbots are part of virtual assistants such as Google Assistant, and are accessed via many organizations' apps, websites, and on instant messaging platforms such as Facebook Messenger – Wikipedia
Examples of Chat Bots
Weather bot. Get the weather whenever you ask.
Grocery bot. Help me pick out and order groceries for the week.
News bot. Ask it to tell you when ever something interesting happens.
CNN Chatbot on Facebook

I can message you the latest news from around the world. Do you want me to send you top stories every day?

Can you share top stories

Today's news

Hi Kashif. Let's get started.

I can message you the latest news from around the world. Do you want me to send you top stories every day?

Can you share top stories

Today's news

Here's a story I thought you might like, based on what you've been reading

Nuclear tests will 'never stop,' North Korean government official says

The N is on

Here's something about oracle corporation

News on oracle corporation

Here's something about oracle corporation

Find emoji, stickers and GIF's here

Read this Story

Find emoji, stickers and GIF's here
Personal finance bot. It helps me manage money better.
Life advice bot. I’ll tell it my problems and it helps me think of solutions.
Scheduling bot. Get me a meeting with someone on the Support team at .....
A bot that’s your friend. In China there is a bot called Xiaoice, that over 20 million people talk to...
Bots are created with a purpose.

A retail store will likely want to create a bot that helps you purchase something, where someone like Services org might create a bot that can answer customer support questions.
How do they engage with customers?
You start to interact with a chatbot by sending it a message

**Reactive:** Customers can select chatbots from a menu or a button on a web page or in a mobile app. Other approaches include chatbots as “listeners” (for example, twitter, Facebook, or SMS) that react to inquiries as customers enter these channels.

- **Proactive:** Intelligent chatbots can operate in real time and predict customer intentions—offering specific help when they detect that a customer may need assistance. For example, a client has visited several mortgage pages and pauses on a specific page whereby the chatbot can proactively engage the client.
How Chatbots Work

Chatbot that functions based on rules:
• This bot is very very limited. It can only respond to very specific commands. If you say the wrong thing, it doesn’t know what you mean.
• This bot is only as smart as it is programmed to be.

Chatbot that functions using machine learning:
• This bot has an artificial brain AKA artificial intelligence. You don’t have to be ridiculously specific when you are talking to it. It understands language, not just commands.
• This bot continuously gets smarter as it learns from conversations it has with people.
How an Intelligent Chatbot Works...

1. Captures data in real time
2. Uses internal data
3. Combines data to predict customer intentions
4. The chatbot develops
5. Engages customers
6. Understands what is said
7. Formulates a response
8. Determines follow-up actions

Reference: Your Best Agent Is a Chatbot by www.247-inc.com
What are the stages of Chatbot Maturity?

1. Informational
   - Understands natural language to provide answers to questions posed.

2. Personalized
   - Presents user-specific responses by connecting to enterprise systems and clarifies user intent using menus or simple questions.

3. Transactional
   - Guides the user through a series of steps to complete a task (can also be conversational) and can integrate customer data.

Reference: Your Best Agent Is a Chatbot by www.247-inc.com
Chatbot Maturity Framework

Informational
- Natural Language maps user request to simple intent
- Intent maps to the best response in the content data base

Personalized
- Presents user-specific responses by connecting to enterprise systems
- Personalized responses include results from back-end systems (e.g., CRM)
- Clarifies user intent using menus or simple questions

Transactional
- Emulates human conversation and understands context to complete transactions
- Executes transactions on behalf of user
- Handles complex intents
- Expedites resolution through proactive service

Reference: Your Best Agent Is a Chatbot by www.247-inc.com
Drivers for deploying Enterprise Chatbots?

1. Changing customer expectations
2. Decreasing customer satisfaction
3. Losing sales
4. Increasing volume
5. Reducing operating costs
6. Increasing visibility

Reference: Your Best Agent Is a Chatbot by www.247-inc.com
CURRENT UNDERLYING CHATBOT TECHNOLOGY

MACHINE LEARNING
When a program is given data to analyze to help it form context, being pointed to the relevant aspect of the data to focus on.

ARTIFICIAL INTELLIGENCE (AI)
Software programs that allow a chatbot to ‘learn’ appropriate responses based on the data it receives (from databases, from customer interactions).

Processes

Outcomes

DEEP LEARNING
Sub-category of machine learning
When a program is given data to analyze to help it form context, but without being ‘told’ what the relevant aspects of the data are.

NATURAL LANGUAGE PROCESSING
A program mimics human speech patterns to simulate a human tone in computer-human interactions.

PREDICTIVE ANALYTICS
A program uses techniques including statistics, modelling, and data mining to generate information proactively, rather than in response to a prompt from human interlocutors.

SENTIMENT ANALYSIS
A program uses language analytics to determine an interlocutor's attitude or emotional state in a given situation.

Source: Business Insider
Pattern matchers

• Early chatbots used pattern matching to classify text and produce a response. This is often referred to as “brute force” as the author of the system needs to describe every pattern for which there is a response.

• A standard structure for these patterns is “AIML” (artificial intelligence markup language). Its use of the term “artificial intelligence” is quite an embellishment, but that’s another story.
Algorithms

• The brute-force mechanism is daunting: for each unique input a pattern must be available to specify a response. This creates a hierarchical structure of patterns, the inspiration for the idiom “rats nest”.

• To reduce the classifier to a more manageable machine, we can approach the work algorithmically, that is to say: we can build an equation for it. This is what computer scientists call a “reductionist” approach: the problem is reduced so that the solution is simplified.

• A classic text classification algorithm is called “Multinomial Naive Bayes”, taught in courses at Stanford and elsewhere. Here is the equation:

\[
\hat{P}(t|c) = \frac{T_{ct} + 1}{\sum_{t' \in V}(T_{ct'} + 1)} = \frac{T_{ct} + 1}{(\sum_{t' \in V} T_{ct'}) + B'}
\]
Neural Networks

• Artificial neural networks, invented in the 1940’s, are a way of calculating an output from an input (a classification) using weighted connections (“synapses”) that are calculated from repeated iterations through training data. Each pass through the training data alters the weights such that the neural network produces the output with greater “accuracy” (lower error rate).
Retrieval-based vs. Generative models

Retrieval-based models (easier) use a repository of predefined responses and some kind of heuristic to pick an appropriate response based on the input and context. The heuristic could be as simple as a rule-based expression match, or as complex as an ensemble of Machine Learning classifiers. These systems don’t generate any new text, they just pick a response from a fixed set.

Generative models (harder) don’t rely on pre-defined responses. They generate new responses from scratch. Generative models are typically based on Machine Translation techniques, but instead of translating from one language to another, we “translate” from an input.

Generative models

- Generative models are the future of chatbots, they make bots smarter. This approach is not widely used by chatbot developers, it is mostly in the labs now.
Retrieval-based models

• Retrieval-based models are much easier to build. They also provide more predictable results. You probably won’t get 100% accuracy of responses, but at least you know all possible responses and can make sure that there are no inappropriate or grammatically incorrect responses.

• Retrieval-based models are more practical at the moment, many algorithms and APIs are readily available for developers.
Open domain vs. Closed domain

Chatbot Conversation Framework

<table>
<thead>
<tr>
<th>Open Domain</th>
<th>Closed Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impossible</td>
<td>General AI [Hardest]</td>
</tr>
<tr>
<td>Rules-Based [Easiest]</td>
<td>Smart Machine [Hard]</td>
</tr>
<tr>
<td>Retrieval-Based</td>
<td>Generative-Based</td>
</tr>
</tbody>
</table>

Example: Airport Wifi Bot

Hey Kashif, I'm Airport Wifi Bot (I'm changing my name to Porter soon to avoid a lawsuit).

I'm here to help you get wifi at any airport you're at. All you need to do is type in the airport code (for example: DEN) and I will give you the information I have on it.

Feel free to submit info below and it will be added to my list of information!

— To restart me press the menu in the bottom left or type restart —

Submit Wifi Password

Some information may be incorrect seeing that it has not been updated recently.

Some passwords with inclusion of the a year may also be incorrect. If that is the case, try the current year in the password!

Go ahead! Type the airport code or type show me examples!

You need to find one of the following:

The Emirates Lounge

The password is:

ekloungekb

The British Airways Lounge

The password is:

vancouver
Natural language processing (NLP)
Natural language processing (NLP) is a field of computer science, artificial intelligence and computational linguistics concerned with the interactions between computers and human (natural) languages, and, in particular, concerned with programming computers to fruitfully process large natural language corpora. Wikipedia
The process of NLP consists of roughly 5 steps.

1 / The first step is lexical analysis. The lexicon of a language is, simply put, a collection of words and phrases in a language. As a first step, the computer will thus analyse the text and divide it into paragraphs, sentences and words.

Example of lexical analysis

The quick brown fox jumps over the lazy dog.

article adj. adj. subst. verb prep. article adj. subst. punct.
The process of NLP consists of roughly 5 steps.

2 / The second step is the syntactic analysis: the computer analyses the grammatical role of each word in a sentence and identifies the relationship between each word. This is something you probably learned in school: what is the subject of the sentence? Is there a predicate?

Example of syntactic analysis

http://www.icapps.com/the-linguistics-behind-chatbots/
The process of NLP consists of roughly 5 steps.

3 / In the third step, the semantic analysis, the computer checks the intrinsic meaning of the words, so that means looking up the meaning of the words as stated in the dictionary. A word can have several meanings, so the computer also needs to map this with the syntactic structures analysed in the previous step to derive the correct meaning.

Example of different meanings of a word. Source: Oxford Dictionaries

http://www.icapps.com/the-linguistics-behind-chatbots/
The process of NLP consists of roughly 5 steps.

4 / The fourth step is discourse integration, which means looking at the meaning of a sentence compared to the sentence that comes before it. We can assume that there is cohesion between the different sentences in a text, so NLP must also take this into account.

Example of discourse integration

The quick brown fox jumps over the lazy dog.

He jumps very high.

http://www.icapps.com/the-linguistics-behind-chatbots/
The process of NLP consists of roughly 5 steps.

Finally, there is the pragmatic analysis, which is also the most difficult step for a computer. The pragmatic analysis involves re-interpreting what is said as what was actually meant. This involves taking knowledge from the real world into account because as humans, what we say is not always what we mean. Take for example the sentence: “There’s beer in the fridge”. If you say this to a guest entering your house, you are not simply describing the contents of your fridge, you are actually offering them a drink. This ambiguity is hard for a computer to handle.

Example of discourse integration

http://www.icapps.com/the-linguistics-behind-chatbots/
Machine Learning

Machine learning makes bots smarter

Machine learning (ML) can be defined as an algorithm of making systems learn, by using observations or past experience. Instead of hand-coding large sets of rules, NLP can rely on ML to automatically learn these rules by analysing a corpus. A corpus can be a book, news articles, reports or even conversations. If a bot contains algorithms for machine learning, it becomes smarter the more people talk to it.
Rise of the Chatbot Economy
**Millenials**

Is your business ready to serve the “me me me generation”? 2020

- 38% prefer to use instant messaging to communicate with brands, compared to 39% of Generation X.

**Millenials to brands:**

“I won’t come to you, but I might meet you half way”

- 69% of them say they feel good about the company when they solve a problem without talking to customer service. They’re experience-loyal than brand-loyal.

- $700 billion in annual buying power by 2017

**Siri gets over 1 billion requests a week**

Do better than meeting your customers halfway.

- Give them their own personal intelligent customer service agent who knows and addresses them personally and available 24/7 in their pocket.


Sources: Goldman Sachs Millenials Research • US Chamber Foundation Millenials Research • Deloitte Autonomous • Eorn Goes to School

They want brands to be aware of them as individuals rather than a name or number on a list.
Millennials don’t use email

THEN
Email / Semi-inflexible messaging tools

NOW
Slack, FB Messenger, WhatsApp, Instagram, Snapchat, WeChat
Gartner Hype Cycle

• Machine Learning
• Natural-Language question answering
Conversational Systems: The Post-App Digital Mesh Experience

Chatbots and Personal Assistants as Conversational Intermediaries With Intelligent Cloud Services

... Just the Beginning

Conversational +
Gartner predicts that artificial intelligence will amount for 85% of customer relationships by 2020.
A McKinsey survey from 2015 estimated that digital-care channels (e.g. web chat, social media, and email) accounted for 30 percent of customer-care interactions and that by 2020 it is expected to grow to 48 percent.
In the future, customer-care organizations will balance personal interactions with automation.

Service description by segment

- **High-value interaction, often of higher complexity**
  - Maintain high-level service, increase automation, and decrease complexity
  - Fulfill high-value transactions with lower-cost solutions

- **Low-value interaction, often of lower complexity**
  - Use digital tools to increase and complete automation
  - Ensure existing channels meet customer needs

- **Direct employee interaction through phone or video with customer**
  - No employee involvement; automated interaction with customer
Chatbots – the virtual customer service assistant

2016 witnessed many retailers experimenting with their own virtual chatbots and in total, 34,000 different bots have emerged. Chatbots, powered by a combination of machine learning, natural language processing, and live operators, can provide customer service, sales support and make suggestions for what to buy at a much greater level of detail than ever before.
Messaging Apps Have Surpassed Social Networks

Monthly active users for top 4 social networks and messaging apps

- Big 4 Messaging Apps
- Big 4 Social Networking Apps

Source: Companies, BI Intelligence
SO YOU WANT TO BUILD YOUR OWN?