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Effectiveness of automated chatbots for operational support and self-service based on fuzzy classifier for autism spectrum disorder (ASD)

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By

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Agenda

- Introduction to AI/ML Chatbots
- Understanding Autism Spectrum Disorder (ASD)
- Communication Challenges in ASD
- How AI/ML Chatbots Work
- Role of Artificial Intelligent Chatbots
- Benefits for ASD Kids with Chatbots
- Benefits for Healthcare Providers
- Success Stories, Challenges and Future Directions
- Closing Thoughts
- Q&A

Introduction to AI/ML Chatbots



Introduction to AI/ML Chatbots

A chatting bot also called as chatbot is a piece of programming that takes after a person. The bot will react to the client's content-based inquiries or sentences as human. A useful or a fruitful bot is that it can react to the contents having higher level of similarity to a person's reactions. The historical backdrop of improvement of chatbots is the length of some other bit of programming. While chatbots are presently accessible for various kinds of PCs just as stages—from Personal Computer to smart phones using either Android and Apple iPhone—it is not unexpected to take note of that their fundamental utilization is in diversion and as a talking application pursued by their utilization as a virtual help operator on different sites as a subsequent use.

Intent Recognition with ML:

- *Example:* A customer interacts with a banking chatbot, saying, "What's my account balance?" The chatbot, through ML models, recognizes the intent as "Check Account Balance."
- *How:* ML models are trained on vast datasets to recognize patterns in user inputs. These models categorize inputs into predefined intents, enabling the chatbot to understand user goals.
 - ❖ In the context of chatbots, machine learning is often used to train the models that understand and generate responses. This involves training the chatbot on large datasets to improve its ability to interpret and respond to human language. Techniques such as supervised learning, reinforcement learning, and deep learning are commonly used to train these eApply chatbot models.
 - ❖ **Rule-based Systems:** Rule-based systems involve predefined rules and patterns for generating responses based on specific input patterns. By continuously refining and expanding the rule set, the chatbot can improve its responses over time.
 - ❖ **Supervised Learning:** Supervised learning involves training the chatbot using labeled data, where inputs and their corresponding correct responses are provided. The chatbot learns to map inputs to the correct responses through the training process, allowing it to generate accurate responses for unseen inputs.
 - ❖ **Deep Learning:** Deep learning techniques, particularly Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, and Transformers, can be employed to process and understand sequences of text (conversations) effectively. Deep learning models can capture complex patterns and relationships, enhancing the chatbot's ability to generate more contextually appropriate responses.
 - ❖ **User Feedback Integration:** Integrating user feedback mechanisms into the chatbot allows it to learn from its mistakes and continuously refine its responses. This feedback loop is crucial for iterative improvements and enhancing user satisfaction.

Understanding Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by deficits in social interaction and social affiliation, as well as a constrained, repetitive pattern of behaviors. It may also be linked to a variety of situations characterized by some amount of **obstructed social behaviors, correspondence, and language, a restricted scope of hobbies and workouts, as well as activities like anger, self-harm, and fits that are both fresh to the individual and repeated**. ASDs typically begin in childhood and continue into adolescence and adulthood. Often, the issues become apparent within the first 5 years of life. Early intervention is essential for promoting the optimum development and success of people with ASD. It is advised that normal prenatal and pediatric medical treatments include monitoring of child development. It is crucial that when identified, children with an ASD and their families get important information, services, referrals, and effective treatment based on their unique requirements. Negligence during pregnancy Formative screening assessment Exhaustive diagnostic evaluation Associated medical and mental health conditions.

Communication Challenges in ASD

Here are some common communication challenges associated with ASD:

1. Limited Verbal Communication:

- **Delayed Speech Development:** Many individuals with ASD experience delays in acquiring spoken language. Some may not speak at all.
- **Echolalia:** Repetition of words or phrases without necessarily understanding their meaning. This can be immediate (immediately repeating what someone else says) or delayed (repeating words or phrases heard at an earlier time).

2. Difficulty with Social Communication:

- **Lack of Eye Contact:** Individuals with ASD may struggle to make and maintain eye contact during conversations.
- **Limited Facial Expressions:** Difficulty displaying a range of facial expressions that typically accompany verbal communication.
- **Difficulty Interpreting Social Cues:** Challenges in understanding non-verbal cues such as body language, gestures, and tone of voice.

3. Literal Understanding of Language:

- **Difficulty with Figurative Language:** Taking language very literally and struggling with idioms, metaphors, and sarcasm.
- **Concrete Thinking:** A tendency to interpret language in a concrete and literal manner, which may affect comprehension.

4. Repetitive and Stereotyped Language:

- **Scripted Speech:** Using memorized scripts or phrases in communication, often from TV shows, movies, or books.
- **Preoccupation with Specific Topics:** Engaging in monologues or one-sided conversations about specific, narrow interests without considering the listener's interest or response.

5. Non-Verbal Communication Challenges:

- **Limited Gestures:** Challenges using and understanding gestures to support communication.
- **Unusual Body Movements:** Repetitive or stereotyped body movements that may interfere with typical communication.

6. Difficulty Understanding and Expressing Emotions:

- **Limited Emotional Expression:** Challenges in expressing a wide range of emotions through facial expressions, gestures, and body language.
- **Difficulty Identifying Others' Emotions:** Struggling to recognize and understand the emotions of others.

7. Sensory Sensitivities Impacting Communication:

- **Over reactivity or Under reactivity:** Individuals with ASD may be overreactive or under reactive to sensory stimuli, impacting their ability to engage in communication in certain environments.

8. Difficulty with Pragmatics:

- **Challenges in Turn-Taking:** Difficulty understanding and adhering to the rules of turn-taking in conversations.
- **Inappropriate Social Responses:** Difficulty understanding social norms and providing appropriate responses in social situations.

How AI/ML Chatbots Work

Proposed autism prediction using Machine Learning (ML) algorithms:

A chatbot may be helpful in these conditions so the reason for this underlying determination is to have a harsh gauge the way that client is influenced or not before a genuine specialist is included.

1. Make a table in the Excel sheet which goes about as a **database**; we can use any chatbot stage or utilizing python a chatbot can be made tweaked to our needs.
2. The chatbot is a conversational bot that associates with the patient effectively.
3. Images are likewise used to associate with the ASD individual.
4. Conversation is put further away for use by the **Doctor**.

Algorithm to create a simple chatbot:

- Start
- Arbitrary choose the message (User message first or Chatbot's)
- Hang around for client's info
- Respond with solution
- Divide the given message into sentence
- Next divide each sentence into tokens
- Acquire equivalent words for every token

How AI/ML Chatbots Work

- Utilize equivalent words for producing new sentences
 - Explore for inquiries in cerebrum
 - If query discovered at that point produce reply and put on screen.
 - If no query is discovered pose bot's individual inquiry.
 - else to step 2.
 - End.

Process to create a chatbot technically:

- **Natural language processing** (NLP) is used to process the response to the query posed by the user in diagnosis process.
- Tokenization Sentence is **split into tokens**, and these tokens are put something aside for correlation.
- Extraction of keyword Every token is verified and contrasted with the words which can clarify force of any manifestation or watchwords.
- Similarity coordinating of sentence After every token correlation, the entire sentence's closeness is likewise coordinated for affirming whether the watchwords are utilized in a similar setting to clarify the manifestation power or in some different implications.
- Understanding importance of keywords After the comparability coordinating, the catchphrases are mapped to the seriousness of side effect; here, four degrees of indication seriousness are utilized, for example ordinary, minor, normal and serious.

How AI/ML Chatbots Work

➤ Framework of the Chatbot:

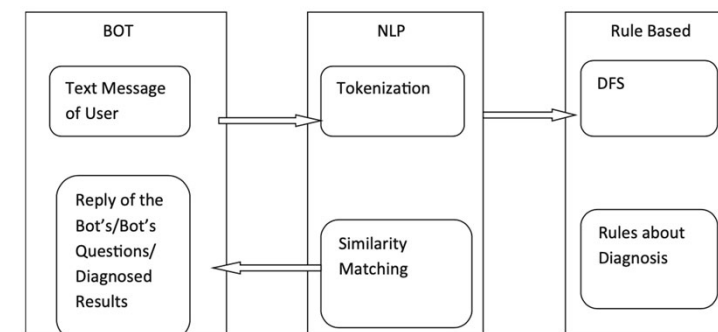
The framework comprises of various modules, however can be partitioned into three center modules as represented as below: **User's Question:** "What's the weather like in New York today?"

Tokenization:

- Break down the user's question into individual words or tokens.
- Example: ["What's", "the", "weather", "like", "in", "New", "York", "today", "?"]

1. User will enter instant message into visit window.
2. Message will be part into sentences.
3. Then, independently each sentence is further split into expressions.
4. Synonyms of expressions are taken from information base—New sentences are produced utilizing equivalent words (max 20–30 sentences)—Search for inquiries in mind.

Fig. 1 Framework of the chatbot



How AI/ML Chatbots Work

Flow of system :

- Generate an answer of client's information.
- Process client info and navigates the choice tree until you reach the leaf.
- The Decision tree itself.

Example database of the questions that are to be framed:

What is your name.

How are you doing

Had your breakfast

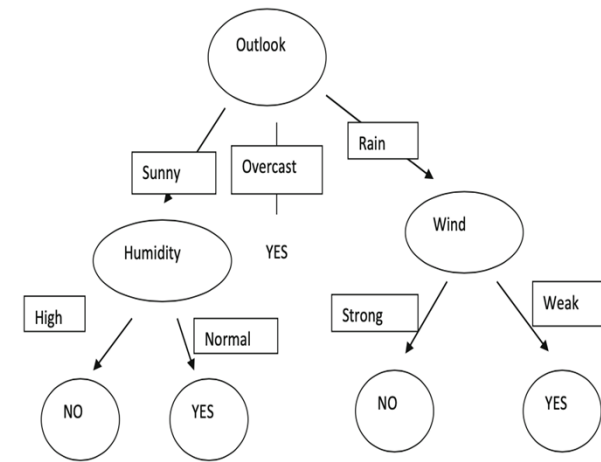
Oh! It is already time for the break fast

Taken the medicines in the morning

You have earned a star for this.

1. **Decision trees** are quick, effectively executed, and easy to get it. They are one of the least complex basic strategies accessible. One of the generated questions will match, serve one of its answers at random otherwise if no question matches, topic will be changed.

- User: What's the weather like today?
- Bot: Sure, where are you located?
- User: New York.
- Bot: Great! What time frame are you interested in? Morning, afternoon, or evening?
- User: Afternoon.
- Bot: The current weather in New York this afternoon is 72°F with partly cloudy skies. Is there anything else you'd like to know?
- User: No, that's it. Thanks!
- Bot: You're welcome! If you have any more questions, feel free to ask.



Role of Artificial Intelligent Chatbots

- AI Chatbots had become a part of the increasing the business by providing the customer service. These chatbots can respond to the customer at any time to their queries, fast, dynamic and effective in real time. **They are also cheap and easy to maintain.** The major point is that it is very easy to deploy the Chatbot and takes only a few minutes to integrate. There are also a lot of advantages in using the Artificial Intelligent chatbots for the service. The effectiveness of these chatbots is that they can predict the queries and prepare a suitable response for it.
 - **Autism persons require a trained personal to take care of them. The parents are also trained how to interact with them. In reality, it is difficult to maintain the trained personal for middle-income group families also.** In this part, it is to bring to the notice that the autism is present all over the world. One of the main problems identified in the countries like India and other **developing countries is the parents do not come out boldly at least to speak to the doctors also thinking of the social aspect** where they will be problems with the society. The child had to mainly spend in the house only without having any interaction with the outside world. The parents also unable to bear the cost of the medications and the doctors fee as these type of things are handled by the professionals only. **Here, the problems are addressed keeping in mind all section of people in the world.**
1. Creating a simple Chatbot to diagnose the disease and saving the data.
 2. Creating a simple dashboard where the doctor (Helper) can send the text messages to the patient directly and can interact with him.
 3. Creating the Dashboard with the Chatbot for the Doctor to interact with the patient in the webpage.
 4. Creating an 3D chatbot with the AI features using the machine learning algorithms to make it learn and interact so that the doctor need not spend the time to chat and also can check afterward the chat details.
 5. Research is being done to create the Interactive Robo's so that the patient can play with it, and also it changes the color with the mood of the patient. But these cannot be afford by the poor people and also this type of technology may not reach the third world countries and other developing countries for a low cost. Even though they were sponsored by someone to the poor families, the maintenance can be also an issue as represented in Fig. 3.

Role of Artificial Intelligent **Interactive** Chatbots

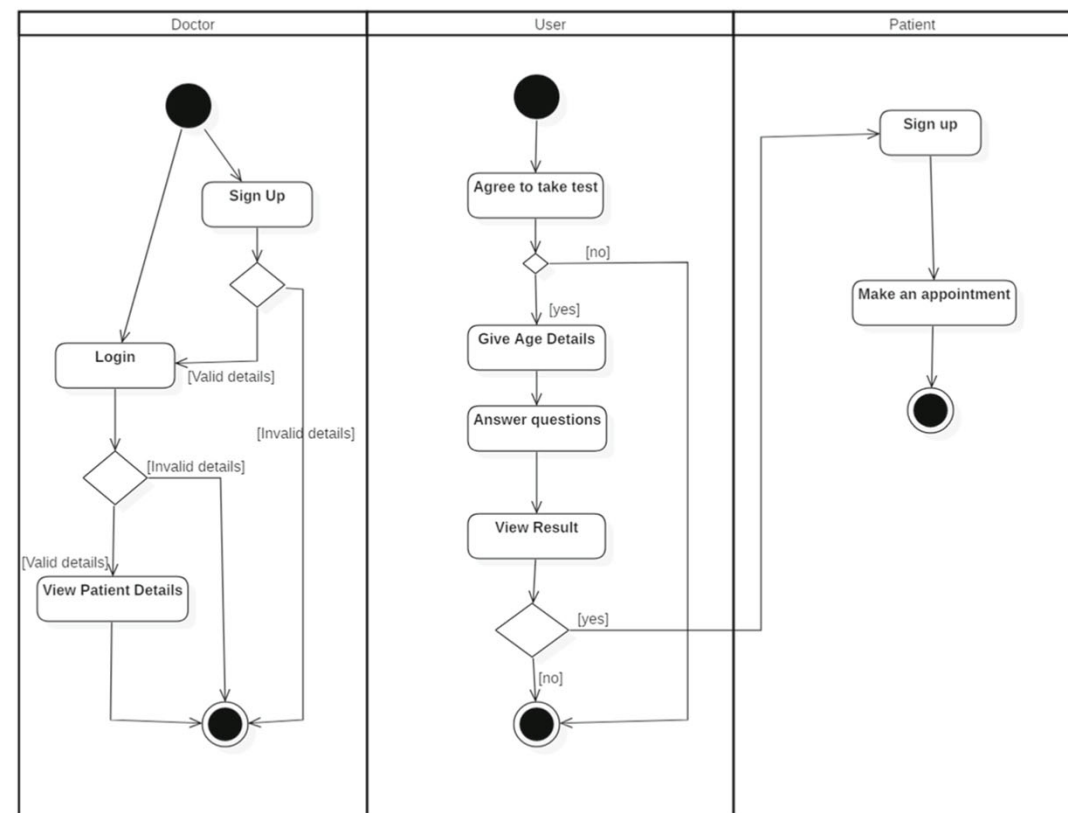


Fig. 3 Flow of the developed model

Benefits for ASD Kids with Chatbots

Benefits for ASD Kids with Chatbots:

- 1. Personalized Interaction:** Chatbots can adapt their communication style to match the preferences and needs of each child. This personalization fosters a more comfortable and engaging environment for the child.
- 2. Consistency and Predictability:** ASD children often thrive in structured and predictable settings. Chatbots provide a consistent communication style, reducing anxiety and promoting a sense of security.
- 3. Visual and Textual Support:** Incorporating visual elements into conversations, such as images, symbols, or text, accommodates the diverse learning styles of ASD children. This multi-modal approach enhances comprehension.

Benefits for Health Care providers:

- 1. Healthcare Providers:** Chatbots enable healthcare providers, such as doctors and therapists, to receive real-time updates on a child's progress, challenges, and interventions. This information helps in making informed decisions during appointments and adjusting treatment plans as needed. Establishing effective communication is a key component of successful interventions. However, the diversity of communication styles within the ASD population often poses a significant challenge for healthcare providers.
- 2. Educators:** Teachers and special education professionals can use chatbots to share insights about a child's performance, behavior, and learning preferences. This real-time exchange ensures that educators are aware of any developments that may impact the child's educational experience.
- 3. Caregivers:** Parents and caregivers can provide immediate feedback to healthcare providers and educators through chatbots. This two-way communication allows for a more comprehensive understanding of the child's well-being in different environments.

Success Stories, Challenges & Future directions

- Numerous initiatives have successfully integrated chatbots into ASD care. These initiatives range from interactive educational tools to virtual companions providing emotional support. Positive outcomes include improved communication skills, reduced anxiety, and increased engagement.
- While the potential benefits are substantial, it's essential to acknowledge challenges such as privacy concerns, the need for ongoing improvements in emotional understanding, and ethical considerations related to data security.
- Looking ahead, the integration of advanced technologies like artificial intelligence and machine learning holds promise. Collaborative efforts between healthcare professionals and developers can drive continuous improvements in chatbot capabilities, leading to more sophisticated and effective interventions.

Closing Thoughts

- ❖ A study is done on the Autism Spectrum Disorder and the ill effects of it. No medicines are available for treating the autism but there are some effects due to the autism, and they can be cured with the help of medicines. **Artificial Intelligence and Machine Learning had shown a great progress which can also be used to predict the autism at the early stage. AI chatbots can be designed to have an interaction between the kid and the doctor, and also bot can chat with the kid even though the doctor is not available.** Interactive ROBO's with emotions are also designed to have interaction with the ASD persons based on fuzzy classifier. This not only helps to reduce the burden of the parents or care takers, but also they help the doctors to treat these people as all emotions can be recorded and proper reading can be done, and decision can be taken by the doctor.
- ❖ **In the developing countries, the parents are so much afraid of the society such that they are scared to discuss the problem and even meet the doctor regarding the problem faced by their children. Hence, it is difficult in the developing countries to screen the disease at the early stage.** As of now, there is an increase in the literacy and availability of **the internet and smart phones**, and **these type of application can help to screen at the early stage.** In the further scope, the screening of autism can be done using the videos rather than taking the test since there may be some fluke answers given at the time of answering the questions. The videos shot on their children at different situations can be uploaded, and using these videos, the screening should be done although the questionnaire exists. There is also a need to extend the services such that it should also able to help control other disorders that occur due to the autism. The enhanced system should warn the parents of the consequences and able to detect the disorders asking the questions related to those disorders, and thereby, it becomes easy for the doctors also to screen them.
- ❖ Chatbots represent a transformative force in the landscape of ASD care, offering innovative solutions for both children and healthcare providers. **By leveraging the strengths of technology, we can create more inclusive and personalized approaches to communication and support.** As we continue to explore and refine the role of chatbots in ASD care, the potential for positive impact is vast, fostering a future where every child, regardless of their unique abilities, receives the support they deserve.



Thank you / Q&A