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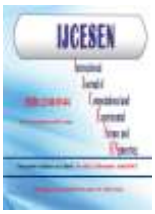

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Research Article

Improving customer service through the use of Artificial Intelligence

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Abstract:

This paper focuses on strategies to improve customer service through the use of artificial intelligence. The aim is to suggest ways with which businesses can keep their customers happier by use of latest advancements in the field of artificial intelligence. If businesses learn how to use artificial intelligence to provide faster and efficient responses to customers' questions, suggestions and complaints, customers will be happier with the business and this should result in greater customer retention. This paper explains the gaps that exist in customer service today and suggests ways to improve it by using AI[4,5].

1. Introduction

How many times have you called a customer service phone number and listened to music longer than you wanted to? I had that experience quite a few times. Each time I had the experience, I wondered why businesses can't provide faster service while ensuring that the service is satisfactory (if not excellent). It does seem like a simple wish, but I do understand businesses have their own challenges. Once they get successful, they have many customers and quite a few of them might call in at the same time to get answers to their questions or ask for refunds and so on.

So how can customers provide quick and efficient customer service even as their customer base grows? I want to explore some options in this paper. I think good customer service will result in a win-win situation for customers, business owners and employees which makes any effort to improve customer service worth it.

2. Intelligent IVR Engineering and Accent Training

To begin with, I think intelligent use of IVR is a must for good customer service. I don't think businesses can afford to have a human answer every call unless they make customers wait for a long time (which I don't think any customer will like). I know businesses use IVR today, but they don't seem to be smart or good enough to handle voice interactions with humans. IVRs often don't understand what the caller is saying and ask the caller to keep repeating their choices. For some reason, a not-so-smart IVR is worse than a not-so-smart human being.

To provide good customer service, first we need IVR to do a good job with understanding what the customer is saying, which means IVRs should be trained well to understand different accents. This would be a good first step and hopefully this will help prevent a situation wherein the IVR is repeatedly asking the calling customer to repeat what they are saying[12].

3. Smart Call Routing and CSR Augmentation Pipelines

Once the IVR has been trained well to understand different accents and is capable of routing customer's call intelligently to the concerned department, the IVR will be helpful with providing good customer service. The IVR needs to provide options to customer to understand what they are calling about and route the call to the concerned

department. At this stage, the business has two options:

- Human CSR Augmentation: Have adequate number of CSRs available who can then use AI chatbots and help customers quickly and efficiently reducing the overall turnaround time.
- Automated AI IVR Takeover: Have another IVR take over, use AI chatbots and help the customers. So far, I haven't encountered an IVR which is capable of helping customers quickly and efficiently without irritating the customer. When it comes to customer service, I have a feeling people will always prefer to speak to people instead of machines. The overall turnaround time[13] and customer satisfaction depends on the smartness of the tools the business can provide its CSRs. The smarter and well trained the tools are, the easier it becomes for the CSR to help the customers and it will make CSRs' life easy. This will result in better experience for the CSRs and for the customers and should help a lot with customer retention[10].

4. Custom Knowledge Base Curation and Few-Shot Chatbots

Usually customers call businesses to get support with some specific areas like billing, payments, order fulfillment, returns or general inquiries. A lot of questions and requests for support are repetitive in nature. If a knowledge base can be curated which is specific to the business and the products and services it offers to the customers, an intelligent and useful AI chatbot can then be trained on the custom knowledge base and CSRs can use the AI chatbot to efficiently serve the customers[6,8].

- Billing Complexities: Customers might be calling in frequently to complain about not being able to understand their bill. If the custom knowledge base has explanation about each line item in the bill, an AI chatbot can be trained on the custom knowledge base with few shot prompting. CSRs can then use the AI chatbot to help customers who are calling in with questions about their bill.
- Return Policy Operations: Customers might be calling in frequently with questions about the return policy. The AI chatbot can be trained extensively on the return policy and CSRs can make use of the AI chatbot to guide customers with their returns.

This knowledge base can be extended to include information about payments coming in from customers, various stages of order fulfillment and some general inquiries as well.

5. Request Processing Automation and Self-Service Video Integration

Businesses should use automation not only to answer questions coming from customers but also to actually process the requests. For example, a CSR should have tools which will help not only with providing information about refunds to customers but also with processing of refunds. Businesses should aim to process customer requests quickly and efficiently to ensure customer satisfaction[4]. Customers will be happy if they don't have to spend too much time for their requests and don't have to follow up.

Businesses should value customers' time and do their best to provide useful and efficient customer service in shortest amount of time possible. Here's where technology can come in handy. It's being used now but there does seem to be a lot of scope for improvement. In my opinion, businesses focus more on quality of products and time to market but there is scope for improvement with respect to customer service and improving customer satisfaction.

Businesses can also create videos with answers to frequently asked questions. The videos can be made available to customers who want to help themselves. This should reduce some calls to customer service department. However, not every customer will want to watch videos and fix their issues. Some of them will call. A CSR should be able to quickly retrieve solutions to common problems and provide the solutions to customers in a quick and efficient manner. This would mean that common issues faced by customers and common requests coming in from customers should be well documented and CSRs should have tools to easily retrieve and provide the solutions to customers when they are on call with the customers. Since time is of the essence, the speed with which the tools can provide relevant information to the CSRs is very important. This would mean the database that stores common problems with solutions must be easy to query and the tool's performance must be good.

6. Continuous Machine Learning and Dynamic Frequency Scoring

The common issues faced by customers and common questions asked by customers change over time. So do common requests coming in from customers. It's important to slice and dice the data around issues reported by customers, requests made

by customers and questions asked by customers and keep identifying the most common ones. This is important as things change over a period of time and sometimes change rapidly in short periods of time. Businesses can't afford not to keep updating the common issues and requests database as the database will become less and less useful over time if it's not continuously updated.

Here's where machine learning can come in handy. It's good at identifying patterns from unstructured data. It's advisable to continuously feed data about issues reported by customers and requests coming in from customers to machine learning algorithms and have the algorithms identify the most common ones. This data can then be leveraged by the AI chatbots which help CSRs with assisting customers[9]. Like with humans, AI can only help if it keeps learning continuously from ever changing data.

I think it's a good idea to attach a score to commonly asked questions and common requests from customers. The score will keep changing over time.

- High Frequency Escalation: If a question gets asked more and more, the score keeps getting higher and higher.
- Low Frequency Deprioritization: If fewer customers ask the question now as compared to last year, the question's score today should be less than what it was last year.

If machine learning could be used to achieve this, it will help with sorting the questions and requests based on their frequency and we could then adjust the database indexes accordingly to make it easier for the AI chatbot to retrieve the most frequently asked questions along with their answers and also most frequent requests along with information about how to fulfill them[15].

I think it's worth investing time and effort to keep customers happy. A happy customer is likely to continue to be a customer and also likely to recommend the products and services to other customers. In my view, money invested in customer service serves two purposes – customer service and marketing. That's the best way of marketing in my opinion. Rather than sending emails and making calls to prospective customers and keep asking them to buy products and services, I think it's wise to spend time, effort and money for improving the quality of the products and services and improving the quality of customer service. These ideas may seem simple but solutions are simple a lot of times. They don't need to be complicated. They just need to be effective.

7. Strategic Human-AI Synergy

Another important aspect of customer service is the human touch. I think humans love to interact with humans more than interacting with machines. All of us have spoken to humans and interacted with IVRs. I think speaking with an IVR is never the same experience as speaking with a human, especially so if the human is empathetic and willing to help. I think an empathetic and helpful CSR can provide far better customer service than an IVR ever can.

Cutting costs shouldn't come at the expense of customer service. Customer service has a direct impact on revenue, so it shouldn't be underestimated. Providing tools, especially smart tools to CSRs is a great strategy. I am not sure replacing CSRs with IVRs is a great strategy. A combination of a smart, empathetic and helpful CSR and a smart, efficient and quick tool which can search various knowledge bases and help the CSR with customer service is a great combination to have. Every disappointed customer will explore other options and that's never a good situation to be in for a business that wants to grow.

8. Document Cluster Organization and Vector Database RAG Pipelines

Organizing knowledge base documents effectively and retrieving them efficiently is key to success when it comes to customer service. Here's where retrieval augmented generation (RAG) can help. Vector databases can be used to store related documents in clusters so that retrieval is easier. AI chatbots can integrate with vector databases and can figure out which documents need to be searched to answer a query from a customer[11]. The documents can then be supplied to the LLM (Large Language Model) as context for the query.

With this approach, we can get the best answers from the knowledge base. This is particularly helpful to answer customer questions but can also be used to answer employees' questions. There is always a need to store information intelligently so that retrieval is efficient and easy. This approach will make the life of CSRs easy as they don't have to go through the pressure of searching multiple documents or databases when they are on call with customers.

As business processes evolve over time, knowledge base documents will need to be updated regularly. Technology can only be useful if the data it refers to is up to date. If the knowledge base documents are outdated, the AI tools CSRs use won't be able to provide useful information to the CSRs. Instead, they will provide old information which is no longer relevant and the CSRs won't be able to help the customers efficiently. Whenever businesses

update their business processes and standard operating procedures, they will need to update knowledge base documents and test and confirm that the AI tools are providing information by referring to the most recently updated versions of the knowledge base documents.

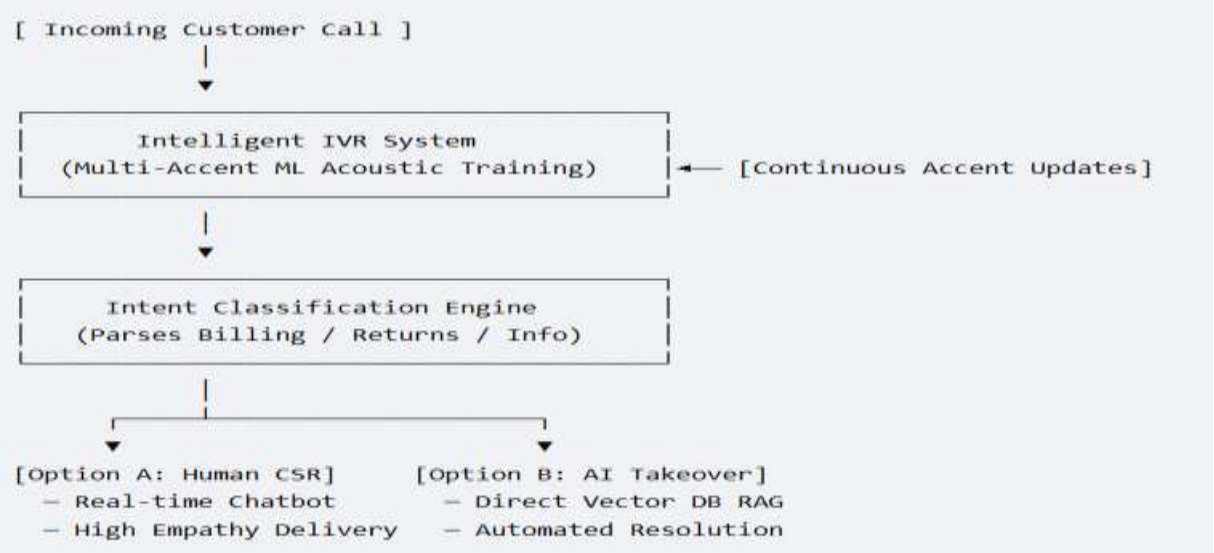
9. Iterative Optimization, Hallucination Management, and Scope Boundary Control

If customers report that the information provided to them was inaccurate, it's probable that the AI tools aren't always providing correct information. Each complaint from customers about accuracy of the information provided to them must be evaluated and the root cause must be determined. If the information isn't accurate in the source document itself, the information must be updated. If for some reason, the information is accurate in the source document but the AI tools didn't provide correct information, the reason must be evaluated and the AI tools must be trained accordingly. This is an iterative process. Not a one and done process[14].

While AI tools will augment productivity and provide by and large sensible and useful results, they might occasionally hallucinate. Human intervention is necessary to detect incorrect outcomes and take necessary action to prevent incorrect outcomes.

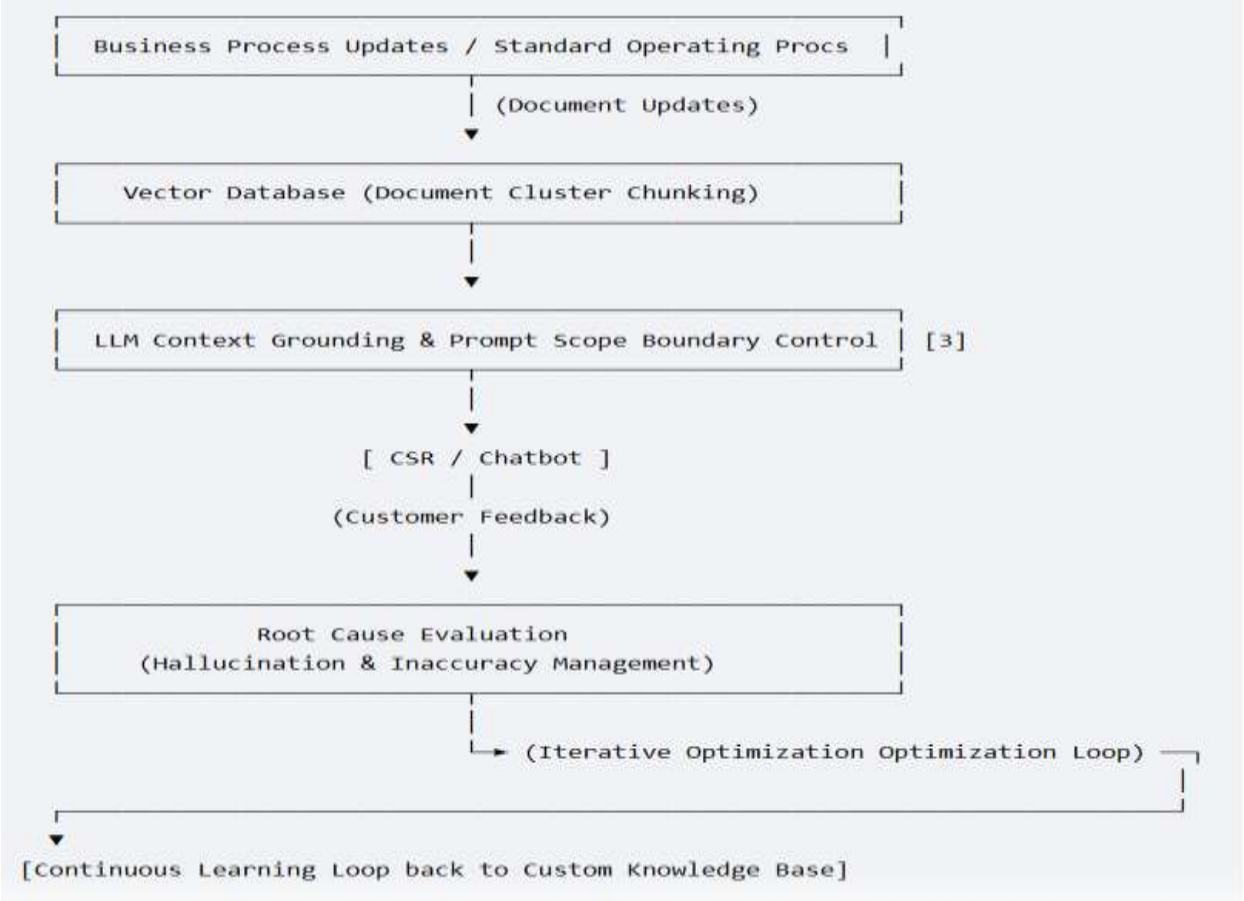
While it is challenging to test AI tools given that input is free text and can be anything, there is a need for a lot of testing to make sure the tools are providing answers only to relevant questions, the answers are useful and that they are up to date. Several use cases must be tested to make sure that the answers provided are production grade and can be rolled out to customers. It is important to make sure that the AI tools aren't providing information that is outside the scope of the business. Customers will not trust an AI tool that provides information which it isn't supposed to provide.

Metric / Attribute	Traditional IVR Routing	Option A: Human CSR Augmentation	Option B: Automated AI IVR Takeover
Primary Interaction Agent	Rigid touch-tone menu	Human CSR + AI Chatbot	Autonomous AI Voice Bot
Customer Experience	High friction; repetitive	High empathy; high satisfaction	Fast; potentially lower empathy
Turnaround Time (TAT)	High (due to hold queues)	Significantly Reduced	Instantaneous / Near-Zero
Knowledge Retrieval	Manual searching by agent	Real-time AI database query	Direct Vector DB Integration
Best Suited For	Initial department sorting	Complex, empathetic issues	Repetitive, standard requests



Domain Category	Repetitive Customer Pain Point	Custom Knowledge Base Content	Few-Shot Chatbot Training Focus
Billing Complexities	Line-item confusion on statements	Granular breakdown of item fees	Explaining complex charges simply
Return Policy Operations	Inquiries on return windows/fees	Step-by-step return guidelines	Guiding step-by-step return setup
Order Fulfillment	Tracking delayed or split shipments	Real-time shipping stage logs	Providing exact dispatch timelines

Trend Scenario	Dynamic Score Trigger	ML Algorithm Action	Database Index Optimization
High Frequency Escalation	Rapid increase in user queries	Boosts frequency score automatically	Re-indexes query for faster retrieval
Low Frequency Deprioritization	Drop in queries vs. prior period	Decreases priority score	Moves data to cold/lower storage



10. Conclusions

The integration of Artificial Intelligence into customer service frameworks represents a paradigm shift from reactive dispute resolution to proactive, efficient user engagement. As demonstrated throughout this paper, the most successful implementations do not seek to entirely eliminate human personnel, but rather to construct a strategic Human-AI synergy. By deploying accent-aware, intelligent IVR systems at the perimeter, utilizing vector database RAG pipelines to eliminate information latency, and applying continuous machine learning with dynamic frequency scoring, businesses can drastically compress turnaround times while maintaining contextually accurate information.

Ultimately, maintaining rigorous controls over scope boundaries and proactively managing system hallucinations ensures that automated tools remain enterprise-ready and reliable. Embracing an iterative, data-driven optimization process allows modern organizations to cultivate a customer support ecosystem that simultaneously improves operational efficiency, elevates the CSR workflow, and enhances long-term customer retention.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
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- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.
- **Use of AI Tools:** The author(s) declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

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