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Chapter 9: Designing intelligent virtual assistants and artificial intelligence chatbots for enhanced financial service delivery and customer retention

9.1. Introduction

Financial markets are one of the strongest and most diversified aspects and a necessary part of the world economy, ranging from providing simple products like bank accounts to very complex products where small changes in the conditions may risk the wellbeing of the company and the economy. The ties of financial organizations with big corporations and with the political circuit make them necessary actors in the economy; hence their services have to be reliable, transparent, and affordable. At the same time, these services move huge amounts of money, in which individuals have invested their entire life, and should therefore be safe from hackers or incompetent personnel. It is a well-known fact that the consumers do not want to have any reply in the recovery of the damage, and that they require the services to run flawlessly (Egbuhuzor et al., 2021; El-Shihy et al., 2024; Kyrylenko, 2024).

Some banks have started to use privacy-preserving data-mining techniques to develop models that help predict beforehand the decision to take in specific situations, such as refinancing, so as to lower the risk both for the consumer and for the organization, but the success of this application depends on the acceptance of intelligent systems by the consumer. A possible explanation is that banks have tried to create consumer profiles based on data collected passively and used to predict the move of the user when he or she interacts with the organization, and a user-centric data sharing scheme is necessary for building up and enhancing user trust. This situation can be expanded to other financial services delivered by other organizations, especially fintech. The introduction of Intelligent Virtual Assistants and AI Chatbots can improve the quality of the dialogue with the consumer, as the peer to peer nature of the conversation, along with the quickness of the answer and the informal style adopted, reinforce the adoption of these technologies by the user.

The advent of generative pre-training transformers has triggered a chatbot avalanche and changed the channel mix between self-service and agent-assisted service. This growing reliance has allowed customers to expect instant feedback and quick resolution of their questions and queries. A report shows that over 35% of consumers worldwide prefer to use chatbots for customer care and services. Service automation via intelligent virtual assistants and AI chatbots helps organizations to cut costs of support services, improve service efficiency, and enhance customer experience (Satpathy et al., 2024; Shad & Potter, 2024).

Fig 9.1: Designing Intelligent Virtual Assistants

9.1.1. Background and Significance

Artificial Intelligence (AI) has become a buzzword in recent times. Its wide application has a diverse range of unpredictable effects ranging from displacing workers and improving health services to influencing court rulings and changing how organizations work. The financial services industry is one of the most used channels for AI, where intelligent virtual assistants and AI chatbots are vastly employed at a vast scale for

service delivery and support. More than three-fourths of consumers use a range of financial services, thus a large number of financial service providers use various digital channels such as email, search engines, mobile applications, websites, interactive voice responses, and chat applications to communicate with their customers.

AI chatbots are one of the most prominent channels in business organizations because they employ natural language processing, machine learning, and a vast array of technologies to provide automated services to their customers. Intelligent virtual assistants and AI chatbots, with their 24/7 service coverage, have become a popular mode for customer service engagement. Now they are not only deployed by business firms for repetitive queries resolution but also used to drive and close sales, provide recommendations and expertise, and resolve disputes and complaints.

9.2. Understanding Virtual Assistants and Chatbots

Virtual assistants and chatbots are two of the branches that contain the name conversational agent, a system that interacts with users using a natural language. These agent systems converse with the users to accomplish user tasks using capabilities such as a specialized dialog, tailored interfaces, and operations with intelligent user models. In other words, they have the following characteristics: they perform tasks; they understand natural language; they have a user model and conversational memory; they lead the conversation; they can use vision and gestures; and they interact with the user using various modalities such as a text/display, speech, vision, haptics. The VA represents the technology within the concept and the Chatbot is a client application specifically designed to achieve tasks in a textual input/output environment. We can say that VA is a specialist conversation agent that uses dialog as a principle communication modality, although it may also be accomplished using other modalities, which we define "multimodal conversational assistants".

Chatbots are VA clients defined as conversational agents that are instantiated into interactive software systems to accomplish specific user tasks through dialog in a conventional text mode. Currently, this segment of assistant clients is very populous because it supports the easiest and fastest way to experiment and develop an intelligent service using dialog and is extremely popular in the mobile applications arena. One should be careful because not all chatbots are smart; some do only script processing and are easily fooled ones. However, services are rare or nonexistent for these script execution systems, with most of the chatbot clients being connected to natural language processing servers that generate intelligent semantic-based responses.

Semantics is an essential feature and its availability generates natural dialogs and conversations that attract users to use Text Chat tools more and more; in this way

allowing the generation of a vast volume of user generated content with a variety of formats such as text, video, audio, and photos. It is important to note that nowadays Chatbots are presented as Virtual Agents.

9.2.1. Definition and Types

Despite a period of development of over 60 years, no standard definition of chatbots or virtual assistants was established. Instead, a multitude of definitions exists, often depending on context and discipline. In the following, we will propose a definition of chatbots and the different levels of complexity in chatbot development. In general terms, chatbots or virtual assistants are software solutions or AI programs that, through a text or voice interface, interactively converse with users within a dialogue system and help them fulfill certain tasks. Although today's chatbots remain far from having a natural-like conversation, chatbots utilize Natural Language Processing techniques to a certain extent, and they often rely on other AI-specific technologies such as speech recognition and synthesis, information retrieval, machine learning, and semantics.

Different categories or types of chatbots exist today, which can be classified along a wide variety of dimensions. For example, we can classify chatbots along the following parameters, such as automation, domain knowledge, type of conversation, processing of messages, or type of service provided. The classification usually reflects only some specific aspects of chatbots, and we support experts in deciding along which parameters they want to classify chatbots. With regard to the level of automation, we differentiate between decision support and fully automated chatbots. Decision support chatbots assess questions and, when necessary, forward users to an expert agent for decision or service completion. Fully automated chatbots are capable of independently completing a user-related task or decision process within their predefined domain of conversation.

9.2.2. Historical Development

The evolution of virtual assistants is projected to follow along the extremes of the general artificial intelligence research aspirations. Advances in AI, cognitive systems research, plus the recent developments in the areas of intelligent machines and the science of human computer interaction, has made the extension of models of symbol manipulation based systems feasible to far less crude implementations. The first large-scale successful commercial applications of intelligent virtual assistants and intelligent chatbots in e-commerce originated in large-scale transaction systems. The long sought goal of the e-commerce vendors to realize the perceived value of their on-line relationships with their customers was enabled by the creation of systems capable of conversing with customers guided by elaborated knowledge bases of information and reasoning.

Some virtual assistants are 'fully automated,' e.g. offering human-like natural conversations with the customers. Others are merely offering e-mail flows in a limited user friendly way. In the personal assistance niche there are specific implementations of scheduled task reminders, daily planning, search assistance using Agendas, Roadblocks, Human Actors, or very recently implemented as smart notifications using often decision systems in smartphones with integrated localized search capabilities. In the business intelligence niche, intelligent agents implemented in various products perform services that human business experts can provide still.

9.3. The Role of AI in Financial Services

Although the concept of AI was conceived in the late 1950s by computing pioneers who envisioned intelligent machines capable of original human thought, creativity, and emotion, the current element of real time sophisticated interaction between man and machine has made chatbots particularly popular in the last few years.

Fig 9.2: Role of AI in Financial Services

Development of AI can be divided into the following broad phases: computing systems that are programmed and designed to follow logical rules; expert systems that process

symbolic knowledge; AI that can learn without a teacher; and interactive AI that can learn by experience from human engagement in many forms (not without ethical considerations). Today's chatbots fall into this last category, leveraging recent exponential advances in general computing magnitudes, available datasets, and machine learning algorithms. Accompanying these technological changes are several economic factors, such as the rise of software-based incumbent market leaders and the consequent industry dynamics of adopting advanced technology in order to defend an existing business or grow market share faster. Another economic factor is the skills shortage related to the high number of unfilled quantitative and technological jobs due to the confluence of advances in technology and the smooth functioning of the free-market economy.

In finance, AI has been successfully applied for price predictions, parameter selection, trading strategies, portfolio management, risk assessment, capital management, derivative pricing, and credit scoring problems. Major banks and fintech firms have utilized AI technologies in the form of language processing, decision trees, neural networks, and machine learning in order to enhance their economic value. Institutional and individual investors have exploited technological advances in order to gain insights or information advantages. Why is finance usually at the forefront of new technologies? The answer obviously stems from the very nature of the industry. What financial professionals do is create, analyze, and trade in information and use it for wealth creation and management. Thus, they can be expected to lead the drive toward greater automation and the integration of man and machine.

9.3.1. AI Technologies in Finance

To support computer reasoning about financial data and business relationships, researchers have designed financial ontologies. The Financial Industry Business Ontology provides a framework of business concepts as they occur in the financial service industry, such as the terminology used in financial products, institutions, and transactions. The ontology is a reference point for document semantics in high-dimensional data compression and semantics-aware indexing and searching. The eXtensible Business Reporting Language is a specification for exchanging business information using XML and using the terminology and structured format of financial statements.

Machine learning is an artificial intelligence application that provides computers with the capability to automatically learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it to learn for themselves. The core idea of the technology is to connect data to conclusions and predictions using a model that makes those inferences. Traditionally,

identifying the model has been the job of a skilled human, but with the introduction of machine learning the identification of the model can be made the job of a computer system. The process of training a machine learning model can be very complex. Given the pace at which computer performance improves, the most frequently encountered machine learning systems will use statistical techniques that rely on large data sets and resources to solve problems in that solution sector.

The term Chatbot refers to an automated interactive dialogue system operated by a computer program. Directed towards the information technology sector, its primary objective is to simulate dialogue patterns with the capacity to support or assist individuals that have inquiries about one specific topic, do transactions, make payments, and more. Chatbot implementations have been developed with natural language processing techniques, generating interaction capabilities in natural language and are usually announced as conversational agents.

9.3.2. Benefits of AI Integration

The demand for personalized services that grow in scale with the growth of the customer base necessitates improved customer engagement, customer satisfaction, and toolkits at the banks' disposal. Without these intimate, compelling touch points, the banks cannot hope to build and sustain long-term customer relationships. AI integration into finance has a lucrative effect as it effectively utilizes a huge amount of customer data to gain key insights into customer behavior and preferences, and finance organizations are better positioned to track, predict, and address customer expectations at crucial times.

Such use has triggered demand for intelligent virtual assistants and chatbots across a wide spectrum of services and markets. The slow, repetitive, and transactional traditional channels are being replaced by dynamic, always-on help. Not only do intelligent chatbots upgrade the bank's proposition, but they also free human employees from routine tasks to use their time to focus on the more complex needs of customers. With advances in NLP and machine learning, customers are now as comfortable talking to chatbots as they would be conversing with a human. Chatbots have become the preferred platform for performing various transactions, as they seamlessly integrate with the customers' existing communication channels, enabling customers to complete their transactions within the same app. Chatbots for transactions enjoy higher success and acceptance than those for customer service as the latter are prone to experience high "fall-back" rates, where the conversations fail and have to be handed over to human agents for resolution. As chatbots evolve with AI integration, efficiently addressing customer service queries will also be within their ambit.

9.4. Design Principles for Effective Chatbots

For an end-user or customer, a chatbot is an independent interface. Customers do not see or yet need the machinery of AI behind the curtain, and thus the effectiveness of chatbot conversations is heavily dependent on the knowledge, consideration, and diligence of designers and business stakeholders required to produce cohesive and complete experiences. A customer will ultimately form an opinion based upon the quality of the conversation, whether good or bad, and a user-centered approach to chatbot design will serve to lessen the likelihood of negative opinions. Understanding the general principles of interaction design and the more specific principles of conversation design is the first step in designing effective conversational bots.

One thing is obvious: A well-designed conversational interface feels like a conversation that occurs on its own terms, making it easy and natural to perform specific tasks or achieve specific goals. Although design principles for conversational interactions are still being formulated, there are some design ideas that when followed can avoid most of the common pitfalls that have been found in improper chatbot design or implementation. During the design process, careful consideration should be given to defining boundaries of conversational topics and the potential for concern. A well-defined task will significantly enhance the overall chatbot experience, as conversation is simply the manifested vehicle to create a user experience. Conversational UI is just a view: The core or guts of any app or web experience lies in a defined task and the ability to accomplish that desired task — easily and clearly. Without a defined task that a customer would want to accomplish with a chatbot, the utility or overall reason for the existence of such a service is moot.

9.4.1. User-Centered Design

For a more effective virtual assistant taxonomy that serves diverse customer needs in financial service delivery, we combine the meta; semantic; goal-oriented; and behavioral taxonomic levels informed by multi-disciplinary perspectives centered on user-centered taxonomical ontology design. We emphasize user-centered design as the design of information systems or applications with a focus on how users will interact with and influence the system. We present key ingredients for user-centered chatbot design such as knowledge of organizational culture, nature of user request, bot character, bot personality, conversational style and topic, as well as user sensorial performance capabilities and limits. Ontology-based UI design allows us to capture functional-specific aspects of design in a manner that localization and internationalization is more tractable. We identify the importance of the various levels of an internal taxonomy/ontology to taxonomical design for a virtual assistant agent within an organization that mirrors company values and culture such as clearance levels, and

access to data and procedural knowledge to perform services based on predicted goal-specific user-intent. User performance of virtual assistants and chatbots in engaging users are also critical design factors to consider. Moreover, people are often led to believe that their conversations with chatbots will be similar to those with humans, leading to this anthropomorphism of engineered systems. Our emphasis on affordances adds another dimension to the conversation volume, and conversation testing within the taxonomy will dictate success in initial, and recurring engagements.

9.4.2. Conversational UX

A conversational user experience (CUX) can enhance user engagement and satisfaction with chatbots. CUX uses natural conversation as the primary interface through which the user interacts and communicates with the system in order to achieve tasks, get assistance, and achieve goals. CUX is important because it directly influences the user's feelings about the interaction and the delivery of user experience during the interaction. Achieving excellent CUX is more than just implementing voice and text inputs: differentiating intent and entity types, mistaken query recovery flows, content suggestions, error messaging, optimizing small talk, establishing conversation history, and incorporating user background knowledge are other important design factors to consider. Above all, CUX design is focused on user touch point behaviors. It accounts for user input patterns, their system-guided action paths, expectations for feedback and system responses, their prior context and experiences, and the nature of the target tasks. Effective CUX design recognizes that conversations with voice or text interfaces are not like conversations with a person. It intentionally explores how people and a chatbot can best communicate in service of a task or goal. It is an important design aspect of commercial voice applications.

Voice and text lost and unrestrained conversations utilize the low-threshold enablement of human-like attribute and behavior enactment that NLP makes available, but these natural interfaces must connect with the specific content and tasks needed by a business for CUX to work well. With a strong CUX design, the chatbot can better give you back what you requested, handle the expected errors, augment your choices, choose the right next move, and lead the interaction over time. CUX design decisions help a well-defined chatbot application interface connect with the user behind the terminal, avoiding disillusionment and self-play, so that both you and the chatbot can achieve the target interaction goals, even when Conversational AI's latent variables are not well defined.

9.5. Natural Language Processing in Financial Chatbots

In recent years, there has been a dramatic increase in the number of financial chatbots that employ Natural Language Processing to facilitate financial service delivery. NLP is an interdisciplinary subject in its own right, but it is also a component of linguistics and AI. As a result, implementations of chatbots made possible by techniques in NLP are an increasingly popular technology in contemporary economics, marketing, and finance. With greater advances in NLP implementations and techniques over the last two decades, increasingly intuitive chatbots are being developed, which have been able to successfully handle substantial aspects of financial service delivery. One role of chatbots assisted by NLP applications is to act as 'front-office' applications that handle aspects of customer service and service delivery. The incorporation of chatbots in online financial service delivery is a viable response by finance practitioners to the ever-growing preference of customers for digital banking.

One of the main difficulties that financial sector practitioners must currently address is the problem of inconsistency in customer expectations with regard to service and service quality, especially as compared to earlier 'traditional' delivery formats. Not only do financial institutions feel pressure to keep up with competitor investments in cutting-edge NLP chatbot technologies, but they also feel the added pressure of being required to use chatbots not only during 'business hours', but on a 24/7 basis. As a result, increasingly complicated bot architectures must be designed on the back-end in order to reduce instances of inappropriate or incomplete replies. NLP is the more descriptive term for what was formerly called 'natural language understanding'. NLU represents the task of text comprehension and problem resolution. The 'problem' in the case of financial chatbots might be a customer request seeking clarification of some detail of a specific financial product. However, there are many other forms of user input.

Another viable technique is more advanced machine learning methods, such as deep learning or LSTM networks, which try to derive the meaning of a user phrase without explicit rule specification but simply use a large gathered set of example questions from users to train the system. These techniques can be effective and achieve very high accuracy levels when enough representative training data can be collected, focused specifically on the customer support query. Both the fuzzification-based regular expression and the grammar-based systems cannot provide semantic access to the depth of the financial products. This full accessibility of various logical levels of a financial product is within the full language understanding potential of deep learning-driven solutions.

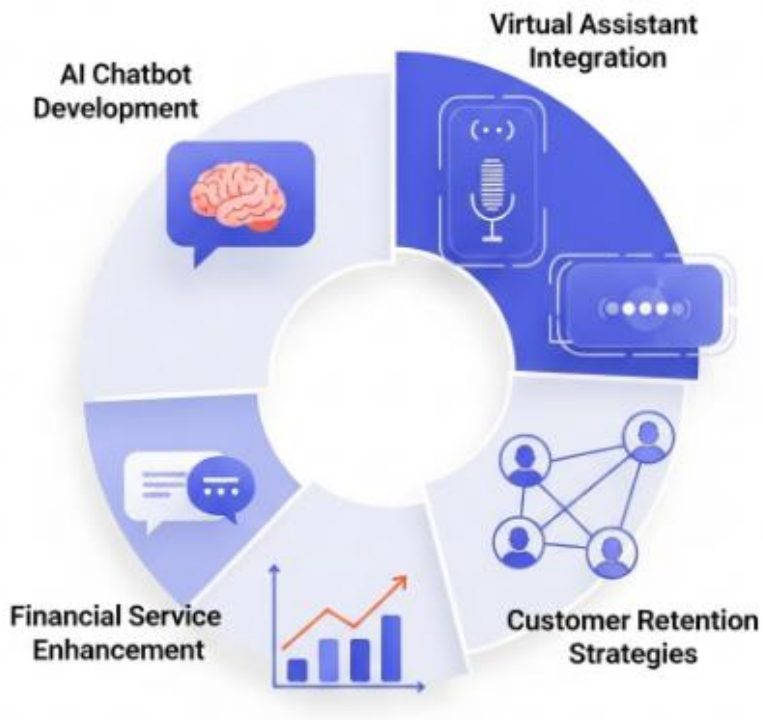

Fig : AI Chatbots for Enhanced Financial Service Delivery and Customer Retention

9.5.1. NLP Techniques

Natural language processing (NLP) is a sub-field of AI that studies how computers can comprehend, interpret, and manipulate natural language, be it spoken or written. NLP is now a key component of existing virtual assistants and AI chatbots. One of the challenges in creating virtual assistants and chatbots for the financial domain is that financial service delivery is, to a large extent, still a manual process. Hence, the corporations in this sector still do not have sufficient amounts of past financial service interaction data such that the implementation of machine learning techniques for intent recognition and natural language understanding tasks becomes a viable option. Machine language and natural language understanding problems are clearly defined and well stated.

Several NLP techniques are available for chatbots and intelligent virtual assistants. First, there is a way to use simple regular expressions, often augmented with fuzzy logic, to create virtual assistant services for simple support operations on a limited set of questions and requests from clients. This is effective for a restricted area of content; however, it will soon become insufficient, as many more queries can come in on other subjects. Next, we can use formal grammars that define exactly the way a user phrase is supposed

to be structured, either syntactically or with domain-specific words specified in semantically defined locations of the query. This traditional but low-dynamic solution gives people unlimited freedom in defining what they want but does not allow the specification of anything semantically deeper than a binary keyword association with an object.

9.5.2. Challenges in Financial Contexts

Despite improvements, challenges remain in building reliable chat systems. For financial chatbot applications, these challenges tend to represent more significant issues because the financial domain often requires highly constrained dialogue designs, and also because the costs of misspecified dialogue responses can be very high. Possible implications include leaking sensitive information, confusing a customer, or explaining complicated policies and procedures unclearly. Note that many of the major identified technology challenge areas are common across chatbot domains. We include such challenges here - including natural language understanding and generation, and dialogue and response management - with an eye towards assessing how they relate to the financial domain. We also include some specific financial challenges, including data issues, design and ethical issues, and keeping up with the fast-moving industry jetsam. Our goal, whenever possible, is to give references that can aid the reader in going deeper into these important areas of study. Recent advances in machine-language understanding - especially deep learning - have enabled systems that can carry on open-domain chat on many topics. For other domains, like finance, heavy NLU assistance with carefully trained models to recognize intents and extract valuable entities might still be needed. Also, in many cases, the needed intent or entity is rare and expensive to train models in supervised or semi-supervised learning are still at best relatively shallow for understanding complex sentences, and naturally so for NLG. Financial customers, like others, want their bots to carry on conversations with a real natural flow.

9.6. Personalization and Customer Engagement

Personalization is often hailed as the holy grail of marketing because it enables brands to deliver tailored experiences meant to not only meet customer needs but also delight at various, potentially emotional, stages of their journey. Personalization starts with an in-depth understanding of customers' demographics and interests, but it is typically centered on the behaviors they exhibit when interacting with the brand. We categorize personalization into structural, experiential, delivery, and calamitous personalization. These four types of personalization vary by how much interaction with the customer has taken place. The first three types, even when executed imperfectly, can have a strong

positive impact when compared to a generic offer. Calamitous personalization – an impressive engagement level that results in a miscalibrated offer – can evoke such a strong negative reaction that customers refuse to engage further with the brand.

Financial and other services that are predominantly consumer or customer-facing, performed primarily or traditionally through the provision of services through branches opening for extended hours, are now delivered on-line through PCs and mobile devices and other such technology. The traditional functions of banks, insurance companies, investment companies, superannuation funds, and other customer service businesses are performed across communications technologies that are always on, always available, but without the personal interaction and relationship built through face-to-face contact at the branch service counter or via telephone. Customers expect more from financial services technology and technology-delivered services. Customers want empowered engagement, which technology has brought through websites and portals, mobile notifications and alerts, text and chat, digital newsletters and email, content and context, service and support, and increasingly personalized experiences.

9.6.1. Data-Driven Personalization

Designing Intelligent Virtual Assistants and AI Chatbots for Enhanced Financial Service Delivery and Customer Retention

When a customer and a chatbot interact for the first time, they have no prior knowledge of each other. The user's comprehension of the chatbot's expertise and objectives will be based on the customer's initial questions and the response it provides. Chatbots, such as virtual assistants, gather a variety of information, including text structure and embedding, message context, and metadata, which includes the number of conversations under consideration, customer information, device type, and location, as well as intent recognition, object reference evaluation, and sentiment analysis, in order to build user confidence and convince customers that they can trust the virtual agents.

To accumulate knowledge, chatbots continuously query business processes and customer information databases. Chatbots use personalized dialogue for both public and private information. Personalization makes chatbots more engaging, which can lead to customers viewing the company or brand in a favorable light. The personalization score is calculated based on message similar density and similarity-induced perceived order adjustment. The strategy improvement process identifies key strategy elements for different users, including response strategy, message content, and a specific phonetic component for verbalized dialog.

9.6.2. Enhancing Customer Experience

The overall quality of the customers' interactions with a firm defines the customer experience. High-quality experiences implicitly drive a customers' perception of the brand as well as emotion-driven actions and lead to advocacy. Customer relationship management by virtual assistants and chatbots can collectively define the sum of the customers' interactions given that they are their most common daily touchpoints with the firm. As a human interface component, the virtual assistant technology and AI capabilities make customer engagement possible and provide unique features. Personalized content delivered to the customer at the right moment can contribute significantly to the relationship and build strong brand ownership that is perceived by customers, supported by the AI-enabled resources on the background delivering it.

Customers interact with the virtual assistant mostly in the stages of maintenance, eating the most resources across the lifetime. The virtual assistant therefore needs to collect vast behavioral, demographic or contextual and psychographic data to good quality, combine it like a pie rather than a stack, model cross-category interest prediction, and translate that learning into content recommendations that assist customers in product selection. These recommendations may even deviate from hypothesis-based or rule-based targeting plans leaving it up to machine learning to define the right product for the right customer at the right time. This element of surprise can hit the reward in the eye, thus preventing supply and demand from striking a balance. Dynamic budgeting that assigns allocation units on a real-time basis to the customer clusters that the AI technology identifies as the most responsive at a given moment can be one step further optimizing margin.

9.7. Conclusion

The digital financial landscape has been notably augmented by the growing avidity for AI-vocal technologies for improving customer assistance, loyalty and banking performance. The persuasive applications for intelligent virtual assistants, capable of real-time speech processing and auditory display, are significant and varied, including voice banking, customer and internal support, outages and transaction alerts, card support, personal financial management, conversational commerce, and more.

In the life of a banker, everything depends on the trust of customers towards them. It is of utmost importance that all tools introduced into the trust-dynamic bank-customer equation should work seamlessly; banks can build higher levels of Essential Trust with customers by promoting trustworthiness through their ethos, policies, and capabilities. Deploying intelligent virtual assistants and AI chatbots may be a major pillar in the strategic plan of digital financial institutions, covering essential customer service needs

with automated conversational services in the most efficient possible way. The dialog experience has to be enriched with new naturalizing contact scenarios and complementary interaction with human agents, over multi-channel and multi-device environments.

In this aim, banks must emphasize on breaking into competitors' mass consumer segments through the provision of secure, uncomplicated and proven dialog-based interactions; realize customer service for efficient bank-customer interface management; capture transaction supervision automation and the pointers in market surveillance; foresee and mitigate social and subscription churn; deploy chatbots servicizing capabilities to the deaf, blind, dumb, and addled. Agile and scalable platforms, cognitive automation with machine learning and NLU capabilities, enabling auto-asynchronous interaction on mass enterprises; consumer-centered design; text-messaging and voice-directed input for the converse-driven process sequences; ubiquitous operation; spur intelligent virtual assistants scalable creation to be used throughout the service scruple; inspect intelligent virtual assistants for quality assurance; assess results and optimize overall procedure efficiency.

9.7.1. Emerging Trends

Several new trends are emerging in the chatbot space that will drastically change chatbots and how they function. There are many newer companies who are building internal tools that modify the behavior of generative AI. These are likely to be the guardrails which prevent Typos of AI from creating inaccurate data. Plugins will be a major milestone, allowing the user to find solutions to infinite wants. This would increase the use of such tools and usher usage at scale. As users learn how such tools raise their productivity, they will continue to use and spread the word about typed AI agents. Within a few short years, based on recommendations, these typed AI agents will be as ubiquitous as the mobile calculator is today. Just about everyone will have access to these tools and use them daily to accomplish tasks. Chat tools will be replacing search engines, and AI Integrations will enable industry-specific information.

Conversational and generative AI technologies are likely to continue to develop rapidly. Many areas within the natural language field remain unresolved, such as multilingual, multimodal input and output, low-resourced languages, and domain-specific fine-tuning. The question of strengthening language models will likely compound, where research teams that can afford hundreds of petaflops a second of computing – and experiment with models with trillions of parameters – will create more and more capable models. Over time, we will invest in generating compact versions of large language models, that together with retrieval or code-generation capabilities can be even more effective than just scaling the language model parameter count. Language Models will be offered the

same way smartphones are. Close to final products will be sold for a premium and will become more powerful over time as they introduced algorithmic improvements.

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