

# Optimizing Enterprise Conversational AI: Accelerating Response Accuracy with Custom Dataset Fine-Tuning

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## Abstract

As the realm of enterprise-level conversational AI continues to evolve, it becomes evident that while generalized Large Language Models (LLMs) like GPT-3.5 bring remarkable capabilities, they also bring forth formidable challenges. These models, honed on vast and diverse datasets, have undoubtedly pushed the boundaries of natural language understanding and generation. However, they often stumble when faced with the intricate demands of nuanced enterprise applications. This research advocates for a strategic paradigm shift, urging enterprises to embrace a fine-tuning approach as a means to optimize conversational AI. While generalized LLMs are linguistic marvels, their inability to cater to the specific needs of businesses across various industries poses a critical challenge. This strategic shift involves empowering enterprises to seamlessly integrate their own datasets into LLMs, a process that extends beyond linguistic enhancement. The core concept of this approach centers on customization, enabling businesses to fine-tune the AI's functionality to fit precisely within their unique business landscapes. By immersing the LLM in industry-specific documents, customer interaction records, internal reports, and regulatory guidelines, the AI transcends its generic capabilities to become a sophisticated conversational partner aligned with the intricacies of the enterprise's domain. The transformative potential of this fine-tuning approach cannot be overstated. It enables a transition from a universal AI solution to a highly customizable tool. The AI evolves from being a linguistic powerhouse to a contextually aware, industry-savvy assistant. As a result, it not only responds with linguistic accuracy but also with depth, relevance, and resonance, significantly elevating user experiences and operational efficiency. In the subsequent sections, this paper delves into the intricacies of fine-tuning, exploring the multifaceted challenges and abundant opportunities it presents. It addresses the technical intricacies of data integration, ethical considerations sur-

rounding data usage, and the broader implications for the future of enterprise AI. The journey embarked upon in this research holds the potential to redefine the role of conversational AI in enterprises, ushering in an era where AI becomes a dynamic, deeply relevant, and highly effective tool, empowering businesses to excel in an ever-evolving digital landscape.

## Keywords

Fine-Tuning, Dataset, AI, Conversational, Enterprise, LLM

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## 1. Introduction

The integration of Artificial Intelligence (AI) into enterprise operations marks a fundamental shift in modern business strategy. According to a white paper published by Deloitte, Conversational AI is defined as “a programmatic way of offering a conversational experience to mimic conversations with real people, through digital and telecommunication technologies” [1]. A chatbot is a real life implementation of conversational AI that understands natural language and identifies meaning, emotion and design for meaningful responses [2].

In no arena is this shift more pronounced than in customer service and interaction, where AI-driven conversational systems are revolutionizing the way businesses engage with their clientele. The advent of these systems, underpinned by sophisticated Large Language Models (LLMs) such as GPT-3, promises a new era of customer engagement characterized by intelligence, responsiveness, and interactions that approach the seamlessness of human conversations. Conversational Artificial Intelligence refers to the use of messaging apps, speech-based assistants and chatbots to automate communication and create personalized customer experience at scale [3]. However, as the adoption of conversational AI gains momentum across industries, it has unveiled a fundamental challenge—the generalist nature of LLMs. These models, trained on extensive and varied datasets from the internet, possess remarkable linguistic prowess but often fall short in meeting the specific, niche requirements of individual businesses. It is important to enlighten how well a platform performs according to different criteria when evaluating platforms as a potential investment for a company as it can have a significant impact on their business. Recently, many homes have become smarter with the help of smart assistants such as Google Home, Siri and Alexa, the market for smart assistants grew by approximately 70% in 2019 [4].

In this rapidly evolving landscape, the solution lies in fine-tuning LLMs with business-specific data. While current implementations of LLMs excel in linguistic complexity, they often lack the capacity to comprehend specialized terminologies, address unique customer inquiries, or navigate the intricate terrain of industry-specific knowledge that characterizes many business sectors.

To address this challenge, I propose a transformative approach—empowering

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enterprises to seamlessly integrate their own data into the LLM framework. This approach goes beyond linguistic enhancements; it entails training the AI to resonate with the industry-specific context, making it not just linguistically proficient but also contextually and commercially astute.

By ingesting data from a diverse array of sources such as internal reports, industry publications, customer interaction logs, and regulatory guidelines, the fine-tuned AI transcends the boundaries of generality. It emerges as a domain expert capable of delivering responses that are not just linguistically accurate but also deeply relevant and effective within a business-specific context.

The profound significance of this fine-tuning process lies in its potential to redefine how conversational AI is deployed in enterprise environments. It represents a shift from deploying a standardized, one-size-fits-all AI model to harnessing a highly customizable tool. This tool becomes finely tuned, adapting effortlessly to the unique requirements and intricacies of each enterprise, subsequently enhancing customer satisfaction and streamlining operational efficiency.

In this paper, I embark on a comprehensive exploration of the challenges posed by the current usage of generalist LLMs in enterprise settings. I present a meticulous methodology for the integration of tailored data to facilitate fine-tuning. Furthermore, I delve into the broader implications of this approach for the future of enterprise AI, envisioning an era where AI not only transforms linguistic interactions but also profoundly reshapes the dynamics of business operations and customer engagement.

## **2. Challenges in Current LLM Implementations for Enterprise Applications**

### **2.1. Mismatch between Generalist AI Models and Specialized Business Needs**

A primary challenge inherent to the enterprise application of Large Language Models (LLMs) like GPT-3 lies in the profound incongruence between their expansive, generalist training and the intricately nuanced demands of diverse industries. These AI models, constructed upon a foundation of vast and diverse datasets, are undeniably exemplars of linguistic versatility. They possess the uncanny ability to engage in coherent conversations, translating diverse linguistic inputs into coherent and contextually relevant responses. However, it is within industries distinguished by unique terminologies, intricate regulatory frameworks, and multifaceted customer service dynamics that this linguistic versatility often reveals its limitations. Consider, for instance, the intricacies of the healthcare sector. In this domain, precision is paramount, and the stakes are exceptionally high. Medical terminology, patient data, and regulatory compliance are but a few facets that demand the utmost precision. LLMs, despite their remarkable linguistic capabilities, falter in grasping the intricacies of healthcare, where even the subtlest misinterpretation can have profound consequences. The same

applies to the legal and financial sectors, each boasting its own labyrinthine language and regulatory intricacies.

In these specialized domains, the AI's generic linguistic understanding proves inadequate, failing to meet the precision and contextual awareness demanded by the industries. It is within this incongruence that the challenge arises, prompting the need for a more tailored and specialized approach to AI. Some state-of-the-art products include Teneo (Artificial Solutions), Dialogflow (Google), LUIS (Microsoft), Watson Assistant (IBM) and Nuance (Nuance). The biggest challenge companies will have to face when implementing Conversational AI-platforms is the lack of knowledge on how to develop and work with bots [5].

As we navigate this chasm between generalism and specialization, the solution emerges—the fine-tuning of LLMs with industry-specific data. By empowering enterprises to infuse their own datasets, replete with industry jargon, regulatory documentation, and customer interaction logs, we enable the LLM to transcend its generalist origins. It becomes an adept conversational partner, not just in linguistic prowess, but also in domain-specific acumen.

The fine-tuning approach offers a bridge between the linguistic marvels of LLMs and the intricate demands of specialized industries. It transforms these models from linguistic chameleons into industry experts, capable of delivering responses that not only uphold linguistic correctness but also resonate with the precision, depth, and relevance demanded by enterprises. This transformation has the potential to revolutionize the way AI is applied in specialized fields, enhancing customer interactions, ensuring regulatory compliance, and ultimately elevating the user experience to unparalleled heights.

In the ensuing sections, we will delve further into the mechanics of this fine-tuning process, exploring its implementation challenges, ethical considerations, and the far-reaching implications for the future of conversational AI in specialized domains. By embracing the fine-tuning paradigm, we are poised to usher in an era where AI seamlessly aligns with the intricate requirements of industries, transforming itself from a linguistic powerhouse into a dynamic, domain-savvy partner.

## **2.2. Impersonal AI Interactions and Limited Personalization**

A significant limitation in current AI implementations is the impersonal nature of interactions with AI systems. AI-driven chatbots are often perceived as lacking empathy and personal touch, leading to resistance from consumers. This impersonality is particularly problematic in industries where building customer relationships and providing personalized experiences are crucial. Existing LLMs, despite their advanced capabilities, struggle to replicate the nuanced understanding and empathetic responses that define high-quality human customer service [6]. In service-oriented industries, where personalized engagement is key to customer satisfaction, this gap in AI capabilities is especially pronounced.

### 2.3. Complexities in Data Integration and Ethical Considerations

Integrating specific enterprise data into LLMs for effective fine-tuning introduces complex challenges. Beyond the technical aspects of integrating diverse data formats into AI models, significant concerns arise around data privacy and security. In sectors where data sensitivity is paramount, like healthcare and finance, the ethical implications of using customer and business data to train AI systems are a critical consideration. Navigating these ethical and privacy concerns while leveraging data for AI advancement requires a delicate balance, underscoring the need for robust data governance frameworks. Integrating specific enterprise data into Large Language Models (LLMs) for effective fine-tuning presents multifaceted challenges beyond the ethical considerations. One such challenge revolves around the disparate formats and structures of the datasets sourced from various enterprise systems. Enterprises often manage data across diverse platforms, including relational databases, document repositories, and proprietary software applications, each with its unique data schema and organization. Harmonizing these disparate data formats and structures into a cohesive dataset suitable for AI model training requires extensive preprocessing and data transformation efforts. Moreover, inconsistencies in data quality, such as missing values, duplicates, or inaccuracies, further complicate the integration process. Data engineers and AI practitioners must employ sophisticated data integration techniques, such as data mapping, schema alignment, and entity resolution, to reconcile these differences effectively. Additionally, ensuring the interoperability and compatibility of integrated datasets with the target AI model architecture is crucial to maintaining the integrity and effectiveness of the fine-tuning process. Consequently, navigating these technical intricacies demands a nuanced understanding of data management principles and advanced data engineering skills to facilitate seamless integration and maximize the utility of enterprise data for AI advancement.

### 2.4. Resource Intensity and Technological Limitations

Fine-tuning LLMs with enterprise-specific data is an intensive process, demanding significant computational resources, sophisticated data management systems, and specialized AI expertise. For smaller businesses or those with constrained IT resources, these requirements can be a substantial barrier, potentially exacerbating the digital divide within the business landscape. The high resource demand for customizing AI models places smaller enterprises at a disadvantage, limiting their ability to leverage advanced AI technologies for competitive advantage.

### 2.5. Navigating Cultural Sensitivities in Global Markets

For enterprises operating on a global scale, another challenge lies in ensuring that LLMs are sensitive to and capable of navigating cultural nuances across different markets. The potential for cultural misinterpretations or insensitivities in AI interactions is a significant risk. These missteps in AI communication can lead to customer dissatisfaction and damage to the brand's reputation interna-

tionally. Ensuring that LLMs are attuned to and respectful of diverse cultural contexts is crucial for global businesses aiming to leverage AI for customer engagement and support.

### **3. The Fine-Tuning Solution: Custom Data Integration**

#### **3.1. Enhancing LLMs for Industry-Specific Proficiency**

To tackle the limitations inherent in the generalist training of Large Language Models (LLMs), the proposed solution revolves around the fine-tuning of these models using customized, business-specific datasets. This approach essentially involves reprogramming the LLMs to understand and interpret the unique linguistic landscape of different industries. By incorporating datasets such as internal communications, industry-specific literature, regulatory documents, and detailed records of customer interactions, LLMs can be trained to grasp not just the language but also the contextual nuances of specific business domains. This specialized training enables LLMs to respond more accurately to industry-specific queries and engage in conversations that are more aligned with the business's unique needs and customer expectations.

#### **3.2. Personalization through Custom Data Integration**

The integration of custom datasets into LLMs significantly elevates the level of personalization in AI-driven interactions. By fine-tuning LLMs with data reflective of actual customer interactions and business-specific contexts, AI systems become capable of delivering responses that are not just accurate but also resonate more deeply with customers on a personal level [7]. This enhanced personalization makes AI interactions feel more human-like, fostering a greater sense of connection and engagement among users.

#### **3.3. Streamlining Data Integration in AI Systems**

To streamline the process of integrating custom data into AI systems, there is a need for developing AI platforms with advanced, user-friendly interfaces. These platforms should facilitate seamless data uploads and efficient management of diverse data formats, making the process accessible even to businesses with limited technical expertise. Key to this development is the creation of sophisticated algorithms capable of processing and assimilating vast and varied datasets. These algorithms must be designed to handle complex data structures, extract meaningful insights, and feed these into the LLMs in a manner that enhances their learning. Moreover, given the sensitive nature of business data, these platforms must be built with stringent data privacy and security measures, ensuring compliance with global standards and regulations. This aspect is crucial for maintaining trust and ensuring ethical use of data in AI applications.

#### **3.4. Ensuring Ethical and Compliant Data Utilization**

In the context of fine-tuning enterprise conversational AI, ethical considerations

surrounding data usage are paramount. Privacy protection stands as a fundamental principle, necessitating stringent measures such as data anonymization, consent management, and access control to safeguard sensitive user information. Concurrently, data security measures, including encryption, secure storage, and regular monitoring, are imperative to prevent unauthorized access or breaches. Compliance with relevant regulations, industry standards, and ethical guidelines ensures that AI development aligns with legal and ethical frameworks, fostering trust and accountability. Mitigation strategies such as robust data governance frameworks, privacy impact assessments, and ethical AI design further reinforce ethical practices, mitigating risks and promoting responsible AI deployment. By prioritizing these ethical considerations throughout the fine-tuning process, organizations can harness the benefits of AI technology while upholding privacy, security, and ethical standards.

### **3.5. Facilitating Continuous AI Evolution and Adaptation**

A vital component of this fine-tuning approach is its capacity for continuous evolution and adaptation. As businesses evolve and customer preferences change, the AI systems, fueled by ongoing data integration, must adapt accordingly. This dynamic approach to AI development ensures that the AI remains relevant, responsive, and effective over time, aligning with the changing landscapes of business and customer interactions.

## **4. Fine-Tuning Implementation: Steps, Tools, and Techniques**

### **4.1. Step 1: Data Collection and Preparation**

- 1) Identify Relevant Data Sources: Gather various datasets relevant to user's enterprise, including customer interaction logs, industry publications, internal reports, regulatory guidelines, etc.
- 2) Preprocess Data: Clean and preprocess the collected data to ensure consistency, remove noise, and format it appropriately for training.

### **4.2. Model Selection and Initialization**

- 3) Select a Base Model: Choose a base Large Language Model (LLM) such as GPT-3.5 that will serve as the foundation for fine-tuning.
- 4) Initialize the Model: Load the selected LLM and prepare it for fine-tuning with user's enterprise-specific data.

### **4.3. Fine-Tuning Process**

- 5) Fine-Tuning Configuration: Define the parameters for fine-tuning, including learning rate, batch size, number of epochs, etc.
- 6) Fine-Tuning with Custom Data: Train the initialized model using the prepared enterprise datasets, optimizing its performance to align with specific business requirements.

7) Validation and Evaluation: Validate the fine-tuned model using validation datasets and evaluate its performance metrics such as accuracy, precision, recall, etc.

#### **4.4. Model Deployment and Integration**

8) Deployment Infrastructure: Set up the necessary infrastructure for deploying the fine-tuned model, including servers, APIs, and other deployment environments.

9) Integration with Enterprise Systems: Integrate the fine-tuned model with existing enterprise systems such as customer service platforms, chatbots, or other AI applications.

10) Testing and Quality Assurance: Conduct thorough testing and quality assurance to ensure seamless integration and optimal performance in real-world scenarios.

#### **4.5. Tools and Technologies**

11) Deep Learning Frameworks: TensorFlow, PyTorch, Hugging Face Transformers.

12) Data Processing Tools: Pandas, NumPy, scikit-learn.

13) Deployment Platforms: AWS, Azure, Google Cloud Platform.

14) Monitoring and Logging Tools: Prometheus, Grafana, ELK Stack.

15) Version Control: Git, GitHub, GitLab.

#### **4.6. Techniques**

16) Transfer Learning: Leveraging pre-trained LLMs as a starting point and fine-tuning them with enterprise-specific data.

17) Data Augmentation: Generating synthetic data to increase the diversity and size of the training dataset.

18) Hyperparameter Tuning: Optimizing hyperparameters to enhance the performance of the fine-tuned model.

19) Continuous Integration/Continuous Deployment (CI/CD): Automating the deployment pipeline to ensure rapid and reliable deployment of model updates.

### **5. Benefits and Implementation of Fine-Tuned Conversational AI**

#### **5.1. Optimizing AI for Enhanced Efficiency and Relevance**

The implementation of fine-tuned Large Language Models (LLMs) in enterprise applications brings forth a significant enhancement in both the efficiency and relevance of AI responses. This fine-tuning process, tailored to the specificities of various industries, enables LLMs to deliver responses that are not only rapid but also highly accurate and contextually appropriate. In specialized sectors, such as finance, healthcare, or legal, where precision in language and understanding is vital, this targeted efficiency is crucial. As a result, enterprises can



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expect a notable improvement in customer satisfaction and engagement, stemming from the AI's ability to provide swift, accurate, and relevant solutions to complex queries.

## 5.2. Achieving Personalization at an Unprecedented Scale

One of the most transformative benefits of fine-tuning LLMs with enterprise-specific data is the ability to achieve personalization at scale. In today's competitive business landscape, where customer experience often serves as a critical differentiator, the ability to provide personalized interactions is invaluable. Fine-tuning LLMs enables businesses to maintain a high degree of personalization across all customer interactions, even as the business expands. This scalable personalization ensures that each customer interaction is tailored, fostering a deeper connection and a more satisfying customer experience.

## 5.3. Strategic Implementation of Fine-Tuned AI Systems

One Implementing fine-tuned LLMs in an enterprise setting requires a strategic approach, encompassing the development of a robust technological infrastructure and a continuous improvement mindset. This involves:

- 1) **Infrastructure Development:** Building a comprehensive infrastructure capable of handling the integration of diverse data sets, processing large volumes of information, and training AI models effectively. This infrastructure must be equipped with advanced computational resources, data storage solutions, and security measures to handle sensitive information.

- 2) **Advanced Training Algorithms:** Developing sophisticated machine learning algorithms that can efficiently process and learn from the integrated enterprise-specific data. These algorithms play a pivotal role in adapting the LLM to the unique linguistic and contextual nuances of the business.

- 3) **Continuous Learning and Adaptation:** Implementing mechanisms for ongoing learning and adaptation are crucial for the AI system's longevity and relevance. As businesses evolve, the AI system should be capable of integrating new data, learning from emerging trends, and adapting to changing customer needs. This continual adaptation ensures that the AI remains a dynamic, ever-improving asset to the enterprise.

- 4) **Expertise in AI and Machine Learning:** Harnessing the skills of AI and ML experts who can oversee the fine-tuning process, monitor the system's performance, and make necessary adjustments to optimize the AI's functionality.

- 5) **Ethical and Compliance Considerations:** Ensuring that the implementation of these AI systems adheres to ethical standards and complies with data privacy regulations is imperative. This includes establishing clear policies on data usage, consent, and security.

## 5.4. Reflections and Forward Outlook

The implementation of fine-tuned LLMs marks a significant advancement in the

realm of enterprise AI. By focusing on enhanced efficiency, unprecedented personalization, and strategic implementation, businesses can harness the full potential of AI to meet their specific needs. This approach not only elevates the level of customer interaction but also positions enterprises to stay ahead in the rapidly evolving landscape of AI technology.

## **6. Conclusions**

### **6.1. Advancing Enterprise Conversational AI through Custom Dataset Integration**

The journey of transforming conversational AI in enterprise environments is an ongoing and dynamic process. This research has delved into the critical need for a more nuanced approach—one that transcends the generalist capabilities of current Large Language Models (LLMs) like GPT-3. By integrating custom datasets for fine-tuning, enterprises can revolutionize the way conversational AI understands and interacts within specific business contexts. This tailored approach represents a significant leap from the prevailing one-size-fits-all AI solutions, offering a pathway to more accurate, efficient, and contextually relevant AI interactions.

### **6.2. Enhancing Accuracy and Speed in AI Responses**

The core benefit of this proposed methodology lies in its ability to enhance the accuracy and speed of AI responses. In the fast-paced business world where time and precision are of the essence, this improvement is not just a convenience but a necessity. Custom dataset fine-tuning allows conversational AI to become more than just a tool for generic responses; it becomes a specialized asset, deeply aligned with the specific operational, cultural, and linguistic nuances of the enterprise it serves.

### **6.3. Addressing the Challenges and Embracing Opportunities**

While the path to integrating custom datasets into LLMs is fraught with challenges—ranging from technical integration hurdles to data privacy concerns—the opportunities it unveils are immense. Businesses that navigate these challenges successfully open themselves to a world of AI-driven efficiency, where customer interactions are not just automated but are deeply insightful and personalized. This level of customization in AI could be a game-changer in sectors where customer experience is paramount, setting new standards in customer engagement and satisfaction.

### **6.4. Future Implications and Continuous Evolution**

Looking ahead, the implications of this research extend far beyond immediate operational enhancements. As AI continues to evolve, the integration of custom datasets sets the stage for continuous learning and adaptation. It paves the way for AI systems that not only grow with the business but also contribute proac-

tively to its strategic objectives. The fine-tuning process, therefore, is not a one-time task but a continuous journey towards excellence in AI capabilities.

### **6.5. A Call to Action for Enterprises and AI Developers**

This research serves as a call to action for both enterprises and AI developers. For enterprises, it's an invitation to rethink their approach to AI, viewing it as a customizable tool rather than a static solution. For AI developers and researchers, it presents an exciting challenge to innovate and develop solutions that facilitate easier integration of custom datasets, ensuring that AI technology is not just advanced but also accessible and relevant to all forms of enterprise.

### **6.6. Embracing the Future of Tailored Conversational AI**

In conclusion, the future of enterprise AI lies in customization and specificity. As businesses and AI developers embrace the potential of fine-tuning LLMs with custom datasets, we step closer to realizing an AI-driven future that is not only technologically advanced but also deeply aligned with the unique fabric of each enterprise. The journey towards this future is complex and requires a collaborative effort across various disciplines, but the destination promises a new era of AI—one that is faster, more accurate, and unmistakably personalized.

### **6.7. Future Directions and Recommendation**

As we look towards the future of fine-tuning enterprise conversational AI, several key recommendations emerge to better adapt to emerging technologies and changing needs. Firstly, continuous innovation in data collection methodologies is essential to ensure access to diverse and high-quality datasets. Exploring avenues such as federated learning or synthetic data generation can help address data scarcity issues while preserving privacy and security. Additionally, leveraging advancements in natural language processing (NLP) techniques, such as transformer-based models beyond GPT-3, could enhance the sophistication and contextual understanding of AI systems. Collaborative efforts between enterprises, AI developers, and regulatory bodies are crucial to establishing standardized protocols for ethical AI development and data governance. Furthermore, investing in research and development initiatives focused on interdisciplinary collaboration can drive breakthroughs in AI technology and address complex challenges in fine-tuning. By embracing these recommendations, organizations can stay at the forefront of AI innovation and effectively meet the evolving demands of the digital landscape.

### **Conflicts of Interest**

The author declares no conflicts of interest regarding the publication of this paper.

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