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Enhancing modern telephony systems with large language models: applications, benefits, and challenges

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Abstract. In recent years, telephony systems have moved beyond rigid menu-based interaction toward more intelligent and responsive communication. Large Language Models (LLMs) play an important role in this transition because they can understand natural language, preserve conversational context, and generate relevant answers in real time. This article examines the main applications of LLMs in modern telephony, including intelligent call routing, automated customer support, multilingual communication, and post-call summarization. It also highlights the practical benefits of these systems, such as improved service quality, reduced operator workload, and better customer experience. At the same time, the study outlines major implementation challenges, including latency, privacy risks, and response reliability. The article concludes that LLMs can significantly enhance telephony systems when they are integrated responsibly with speech technologies and human oversight.

Keywords: large language models, telephony systems, artificial intelligence, customer support, voice assistants, natural language processing, automation

Introduction

Modern telephony remains a core channel of communication for banks, hospitals, service providers, and commercial organizations. Traditional interactive voice response systems are useful for basic navigation, but they often frustrate users because they rely on fixed scripts and limited answer paths. As user expectations grow, organizations need telephony systems that can understand requests more naturally and respond with greater flexibility.

Applications and Benefits of LLMs in Telephony

LLMs provide this new level of intelligence. When combined with automatic speech recognition and text-to-speech technologies, they allow callers to speak in ordinary language instead of following a strict menu. The system can identify intent, keep track of context, answer routine questions, and direct the caller to the proper department. This approach improves both accessibility and efficiency, especially in high-volume support environments. One of the most valuable applications of LLMs in telephony is automated customer support. A system can explain service conditions, answer frequently asked questions, or help users complete simple requests without waiting for a human operator. LLMs are also useful for intelligent IVR, where the caller describes the issue freely and the system chooses the next action. Another important function is call summarization: after the conversation, the model can produce a short record of the discussion, key problems, and required follow-up actions. In multilingual settings, LLM-based systems can further support communication across different languages and improve service consistency.

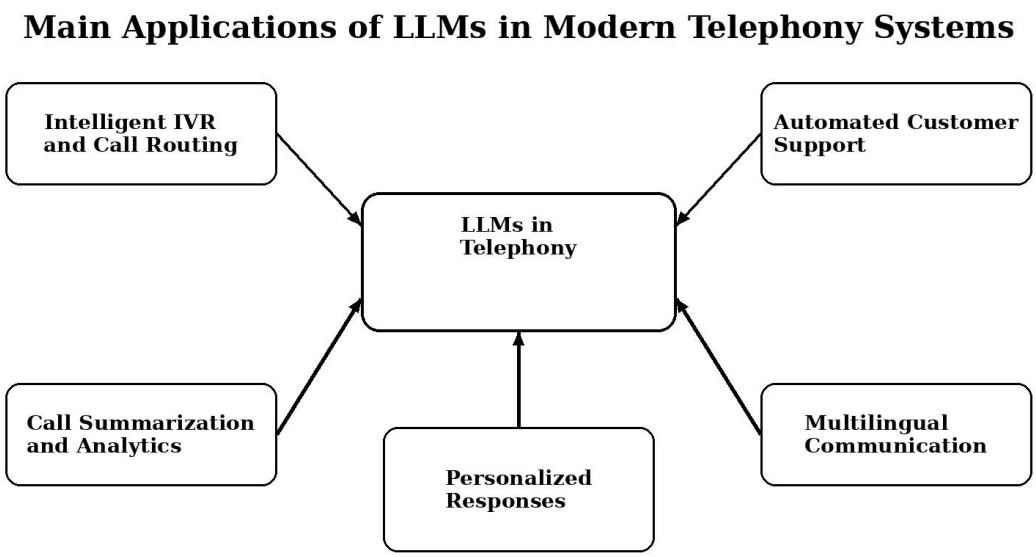


Figure 1. Main applications of LLMs in modern telephony systems.
Source: prepared by the author.

Challenges and Limitations

Despite these advantages, several challenges remain. Telephony requires fast responses, so model latency must be carefully controlled. Accuracy is equally important because incorrect or misleading answers may harm customer trust. In addition, call data often contains sensitive information, which makes privacy, security, and regulatory compliance essential. For this reason, LLM solutions should usually include monitoring and an easy transfer to a human operator when the request is complex or high-risk.

Conclusion

Large Language Models are reshaping modern telephony by making voice interaction more natural, adaptive, and informative. Their use in customer support, call routing, and conversational analytics demonstrates strong practical value for organizations that rely on telephone communication. However, their success depends not only on model capability, but also on careful integration, data protection, and human supervision. Overall, LLMs offer a promising foundation for the next generation of intelligent telephony systems.

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