

# Leveraging Large Language Models for Improving Agricultural Extension in Nigeria

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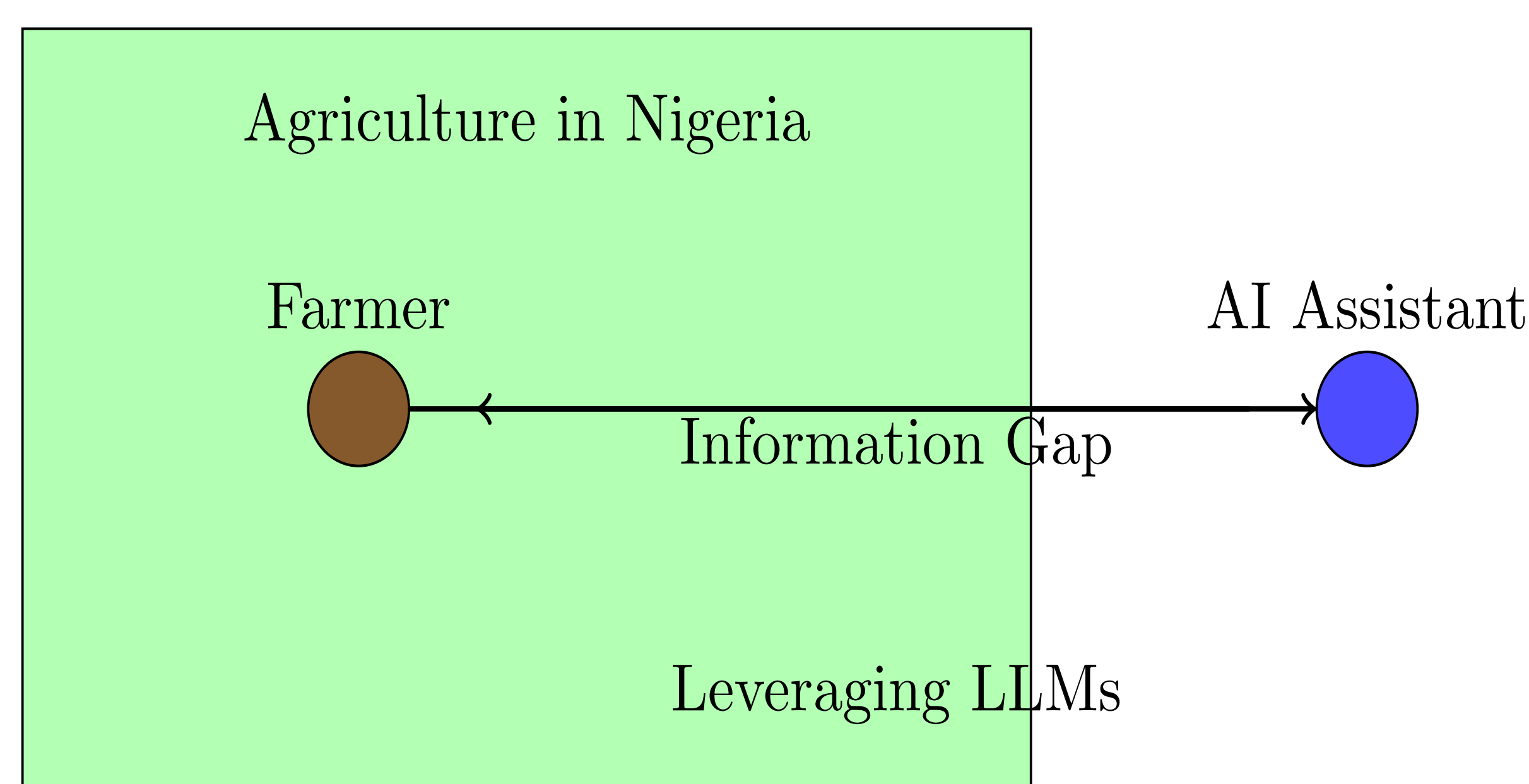
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## Abstract

Access to accurate and timely agricultural information and agriculture extension experts is essential for farmers to make informed decisions and improve their agricultural practices. However, farmers in Nigeria, especially those in rural areas, face significant challenges in accessing such information and expertise. This research addresses the information gap by leveraging the power of large language models (LLMs) to develop an AI-driven platform that serves as agricultural extension services in Nigeria. Specifically, we incorporated a retrieval-based approach and instruction-tuned OpenAI's GPT-3.5 model, an advanced LLM, utilizing its API, to develop a virtual agricultural extension agent that can provide Nigeria's agriculture context-specific information to farmers.

## Introduction

- Agriculture is vital for economic development, but Nigerian farmers, especially in rural areas, face limited access to timely agricultural information [2, 3].
- Recent advancements in NLP have introduced large language models (LLMs) [1], like OpenAI GPT-3.5 [4], which excel in understanding language nuances [5, 6, 7].
- Leveraging LLMs can bridge information gaps for farmers, creating AI-driven systems to provide context-specific agricultural information.
- This research focuses on using OpenAI GPT-3.5 to develop an AI-driven application for Nigerian agricultural extension services.
- The goal is to empower farmers with accurate agricultural knowledge and improve decision-making and productivity.
- The study showcases the transformative potential of LLMs in knowledge dissemination and sustainable agricultural practices in Nigeria.



## Methodology

- Methodology involves a retrieval-based approach utilizing agricultural datasets specific to Nigeria, covering diverse topics, and instruction-tuned OpenAI's GPT-3.5 model via API.
- Develops an API as an interface for farmers to interact with the AI assistant, allowing natural language queries and receiving context-specific responses.
- Integrates a database to store conversational data for analysis and research purposes, tracking API endpoint usage.
- Utilizes Amazon Web Services (AWS) for reliable and scalable infrastructure, ensuring data durability and high performance.
- The approach will facilitate effective knowledge dissemination, to empower farmers and contributes to natural language processing and agricultural extension fields.

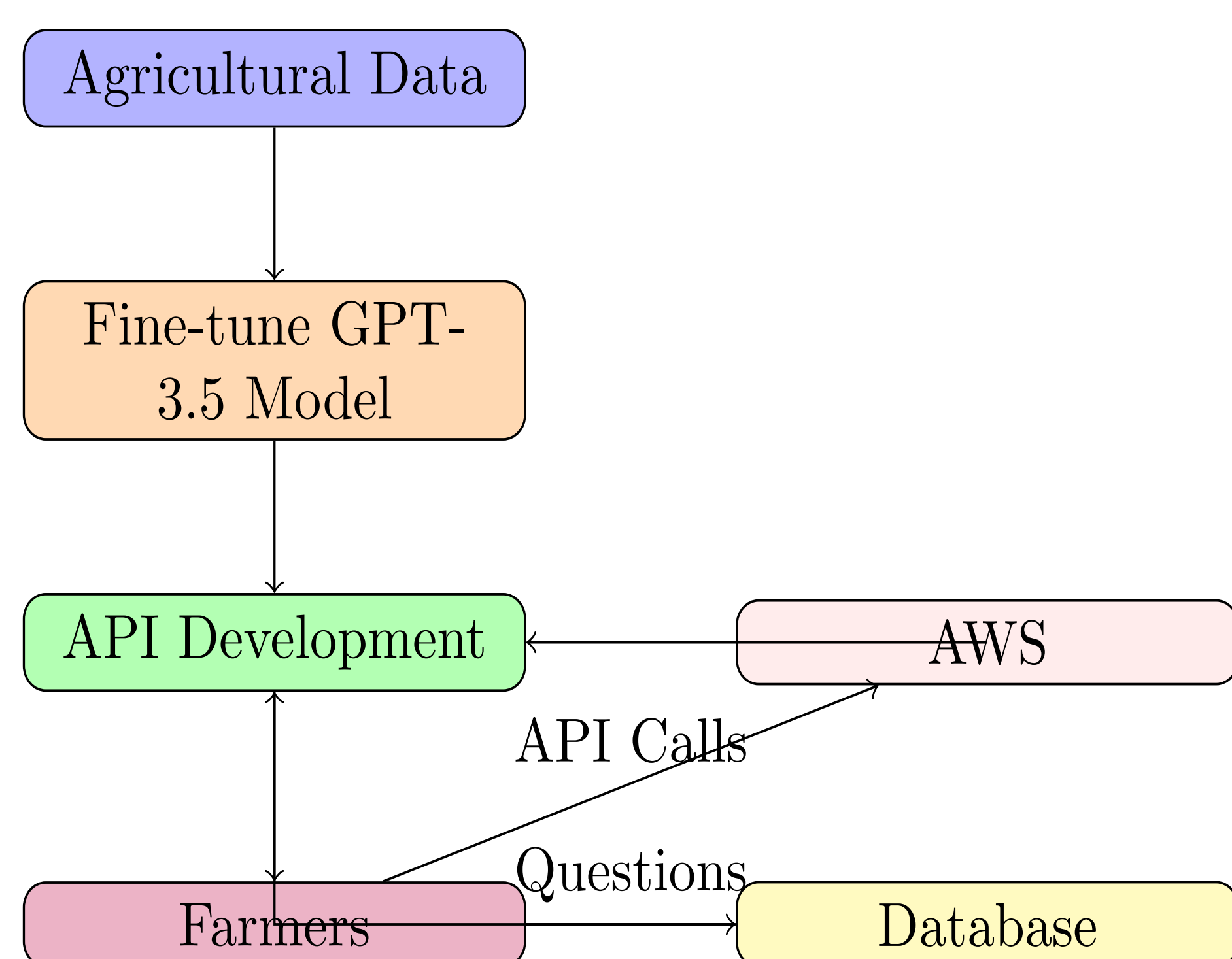


Figure 1: Methodology Illustration

## Ethical Consideration

Preventing the dissemination of hallucinated or inaccurate information to farmers through the AI agricultural extension system, we have:

- Integrate a feedback loop into the system that allows farmers to provide feedback on the accuracy and usefulness of the information they receive.
- Implement a mechanism for human oversight and review of the responses generated by the AI system
- Clearly define the scope of the AI's expertise and knowledge. Avoid providing information beyond the system's domain. For complex or critical matters, direct farmers to consult with local agricultural experts who have direct experience in the specific context.

## Findings

- The findings of this research demonstrate the effectiveness of leveraging large language models for agricultural extension in Nigeria.
- The AI-powered application if successful, will provide farmers with accurate responses to their queries, covering a wide range of agricultural topics.
- By analyzing the conversation data, patterns and trends in farmers' information needs can be identified, enabling the customization and improvement of agricultural extension services.
- The implementation of the database into the system, will allow for the storage of conversational data, facilitating further analysis and research in the agricultural domain.



## Conclusion

- This research highlights the immense potential of large language models in enhancing agricultural extension services in Nigeria.
- The AI-powered application will serve as a reliable and accessible source of information for farmers, and the integration of conversational data and a robust database infrastructure will enhance its learning capabilities.
- Continuous data collection and model response refinement are necessary to ensure optimal performance.
- Theoretical and practical implications emphasize the importance of leveraging advanced AI technologies to address agricultural challenges and facilitate knowledge dissemination.
- To ensure inclusivity and cater to linguistic diversity, future research will focus on making the AI-powered application available in major local languages like Yoruba, Igbo, and Hausa. This expansion will enhance accessibility and enable farmers to benefit from the technology in their native languages.
- The study's implications extend beyond agricultural extension, demonstrating the transformative power of AI in driving sustainable agricultural development.
- Moving forward, further exploration and refinement of the application hold great promise for revolutionizing agricultural practices and fostering the prosperity of Nigeria's farming community.
- We are committed to investing in further research that focuses on making the application available in local languages, enabling a broader range of farmers to fully leverage its benefits.

## References

- [1] L. Fan, L. Li, Z. Ma, S. Lee, H. Yu, and L. Hemphill. A bibliometric review of large language models research from 2017 to 2023. *ArXiv. /abs/2304.02020*, 2023.
- [2] E. Loizou, C. Karelakis, K. Galanopoulos, and K. Mattas. The role of agriculture as a development tool for a regional economy. *Agricultural Systems*, 173:482–490, 2019.
- [3] Nnenna A. Obidike. Rural farmers' problems accessing agricultural information: A case study of nsukka. *Library Philosophy and Practice (e-journal)*, 660, 2011.
- [4] OpenAI. Openai model index for researchers. <https://platform.openai.com/docs/model-index-for-researchers>, 2023.
- [5] T. Zhang, F. Ladhak, E. Durmus, P. Liang, K. McKeown, and T. B. Hashimoto. Benchmarking large language models for news summarization. *ArXiv. /abs/2301.13848*, 2023.
- [6] W. Zhang, Y. Deng, B. Liu, S. J. Pan, and L. Bing. Sentiment analysis in the era of large language models: A reality check. *ArXiv. /abs/2305.15005*, 2023.
- [7] W. Zhu, H. Liu, Q. Dong, J. Xu, S. Huang, L. Kong, J. Chen, and L. Li. Multilingual machine translation with large language models: Empirical results and analysis. *ArXiv. /abs/2304.04675*, 2023.