

Project Proposal: Bhagavad Gita-Based Retrieval-Augmented Generation (RAG) Application

Project Participants

- **Team Members:**
 - Vasumathi Narayanan, Krishna Abhinav Atreyapurapu, Harshal Shinoy Thachapully
- **Roles:**
 - *Data Collection and Processing:* Harshal & Krish
 - *Model Development and Fine-Tuning:* Vasumathi, Krishna, and Harshal
 - *Frontend Development and Testing:* Vasumathi

1. Problem Statement

- **Objective:** This project aims to develop an interactive, RAG-based application to enable users to explore and understand the teachings of the Bhagavad Gita within the ISKCON (International Society for Krishna Consciousness) framework. Users will be able to ask questions related to ISKCON's interpretation of the Gita, receiving responses based on scripture and commentaries from Srila Prabhupada and other authoritative sources.
- **Significance:** With the increasing popularity of conversational AI in educational and religious contexts, this project offers a unique, interactive approach to studying spiritual texts. The project will facilitate a deeper connection to the Bhagavad Gita, allowing users to engage with the text in an accessible way that supports ISKCON's mission of spreading Krishna consciousness.
- **Impact:** The expected outcomes include enhanced engagement with ISKCON literature, providing devotees, students, and spiritual seekers with easy access to the Gita's wisdom. This RAG application could also be extended for other ISKCON texts in the future, creating a foundation for a more comprehensive ISKCON Knowledge AI.

2. Literature Review

- **Prior Work:**
 - Projects like *BibleGPT* and *QuranGPT* have shown the potential of applying LLMs to religious texts. They demonstrate how RAG models can bridge complex philosophical ideas with user-friendly interaction.
 - Studies on Retrieval-Augmented Generation (RAG) systems illustrate how using a retrieval step can enhance the accuracy and relevance of generated responses by drawing directly from a curated knowledge base rather than relying solely on model predictions.
- **Gaps and Innovation:**
 - While previous works focus primarily on Christian and Islamic texts, our project focuses on the Bhagavad Gita and ISKCON-specific interpretations, addressing the unique philosophies within Vaishnavism.
 - This application will incorporate ISKCON's perspective, offering users not just general answers but responses that are directly aligned with Prabhupada's teachings.

3. Methodology

- **System Architecture:**
 1. This project will employ a two-step RAG architecture combining a *retrieval mechanism* and a *generation mechanism*.
 2. **Retrieval Mechanism:**
 - Verses from the Bhagavad Gita and Prabhupada's commentaries will be embedded into a vector database using text embeddings, such as Sentence-BERT, enabling efficient search and retrieval based on user queries.
 3. **Generation Mechanism:**
 - Fine-tune an open-source LLM, such as *Llama* or *GPT-Neo*, to generate responses based on the context retrieved in the first step. This model will be trained to give responses that maintain theological consistency and context across conversation turns.
- **Process Flow:**
 1. **User Input:** The user asks a question related to the Bhagavad Gita or ISKCON teachings.

2. **Retrieval Step:** The question is transformed into an embedding and matched with relevant texts and verses from the indexed database.
3. **Generation Step:** The retrieved texts provide context for the LLM to generate a coherent, contextually accurate response.
4. **Response Delivery:** The model delivers the response to the user, providing an opportunity for follow-up questions.

4. Datasets

- **Primary Data:**
 - **Bhagavad Gita:** ISKCON's authorized translations and commentaries by Srila Prabhupada.
 - **Supporting Literature:** Lectures and talks from ISKCON archives, like *Vanipedia* and other ISKCON-affiliated sources, providing supplementary context.
- **Preprocessing:**
 - **Text Segmentation:** Each verse and commentary is segmented and tokenized for easy retrieval.
 - **Embedding Generation:** Text embeddings will be generated for each verse and commentary using *Sentence-BERT*, making them suitable for vector search.
 - **Indexing:** Using FAISS or Pinecone, embeddings will be indexed to support efficient search and retrieval

5. Libraries and Tools

- **Libraries:**
 - *Transformers* by Hugging Face for model fine-tuning.
 - *Sentence-BERT* for embedding generation.
 - *FAISS* or *Pinecone* for vector-based search indexing.
- **Tools:**
 - *Hugging Face Hub* or custom cloud infrastructure for model deployment.
 - *Streamlit* or *Gradio* for building an interactive frontend where users can type questions and receive answers.

6. Expected Results

- **Ideal Outcome:**
 - The application should respond accurately and consistently, providing users with answers that reflect ISKCON's teachings and interpretations of the Bhagavad Gita.
 - *Example User Scenario:* A user asks, "What does Krishna say about the nature of the soul?" The system should retrieve relevant verses on the soul's eternal nature and use Prabhupada's commentary to clarify Krishna's teachings.
- **Evaluation Metrics:**
 - **Quantitative:**
 - *Precision and Recall:* Measuring how well the system retrieves relevant verses.
 - *BLEU Score:* To assess the quality of generated responses.
 - **Qualitative:**
 - *Theological Accuracy:* Review responses with an ISKCON expert to ensure alignment with teachings.
 - *User Satisfaction:* Collect feedback on response clarity and depth.
- **Risk Assessment:**
 - **Potential Challenges:** Model might generate responses inconsistent with ISKCON philosophy, or retrieval accuracy may decrease with vague questions.
 - **Mitigation Plans:**
 - Continuous fine-tuning based on expert feedback.
 - Implement filters that alert users if answers cannot be generated with high confidence.

References

1. ISKCON Bhagavad Gita As It Is - A.C. Bhaktivedanta Swami Prabhupada: Primary source text.
2. Lewis, M. et al. (2020). "Retrieval-Augmented Generation for Knowledge-Intensive NLP Tasks." In *Proceedings of the Advances in Neural Information Processing Systems (NeurIPS)*.

3. Devlin, J., Chang, M.W., Lee, K., & Toutanova, K. (2018). "BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding." In *Proceedings of NAACL-HLT*.
4. *Vanipedia* - ISKCON's repository of Prabhupada's teachings and lecture transcriptions.