

PROJECT PROPOSAL

Date of proposal: 15 Sep 2023
Project Title: Intelligent Agent - Quiz and Survey Generation
Group ID (As Enrolled in Canvas Class Groups): Practice Project Group 1
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Background/Aims/Objectives: <p>Many companies require their employees to receive training and to have knowledge on various topics such as sales techniques, marketing promotions, product information, or technical skills. And this is a perpetual requirement, month after month, year after year.</p> <p>Yet, whose job is it to create such training?</p> <p>Larger companies may have a department, for example, the Learning and Development Department (L&D) dedicated to creating training content for the entire organization, but many don't. Even then, the L&D team typically finds themselves overwhelmed by the demand.</p> <p>As a result, many teams spend time and resources creating training content instead of focusing on their primary role (or end up not providing training). This situation is worse for smaller companies.</p> <p>In addition, unless expressly provided for, most if not all companies do not wish their data to be sent out of their networks.</p> <p>In this project, the objective is to create an Intelligent Agent (IA) that:</p> <p>when given:</p> <ul style="list-style-type: none"> • Custom Text Content • Text Content Sourced from Internet • User text input <p>Generates:</p> <ul style="list-style-type: none"> • Lesson plan

- One or more quizzes to support the lesson plan (and answers)
- Supplementary learning content e.g., fact sheets, flow charts etc.
- Does not include harmful content.

If the IA generates training content that is of high enough quality and at a tiny fraction of the time the human user would take to create similar content, this already provides great value to the user as it removes most of the mundane toil and will be greatly appreciated as most users' primary job role is not creating training quizzes.

On another note, surveys are in many ways similar to quizzes. The key difference being that a quiz usually comes with answers, surveys do not. Hence, this IA can also be used for AI generated survey questions for non-commercial or commercial purposes.

Project Descriptions:

Programming Language

- Python 3.9

User Interface

- Streamlit

LLM

- Either T5, Llama 2, Falcon

LLM Framework

- LangChain

Vector Storage

- Either Faiss or Chroma

Machine Learning Platform

AWS SageMaker

LLM Deployment Framework

BentoML

Container Image

- Docker

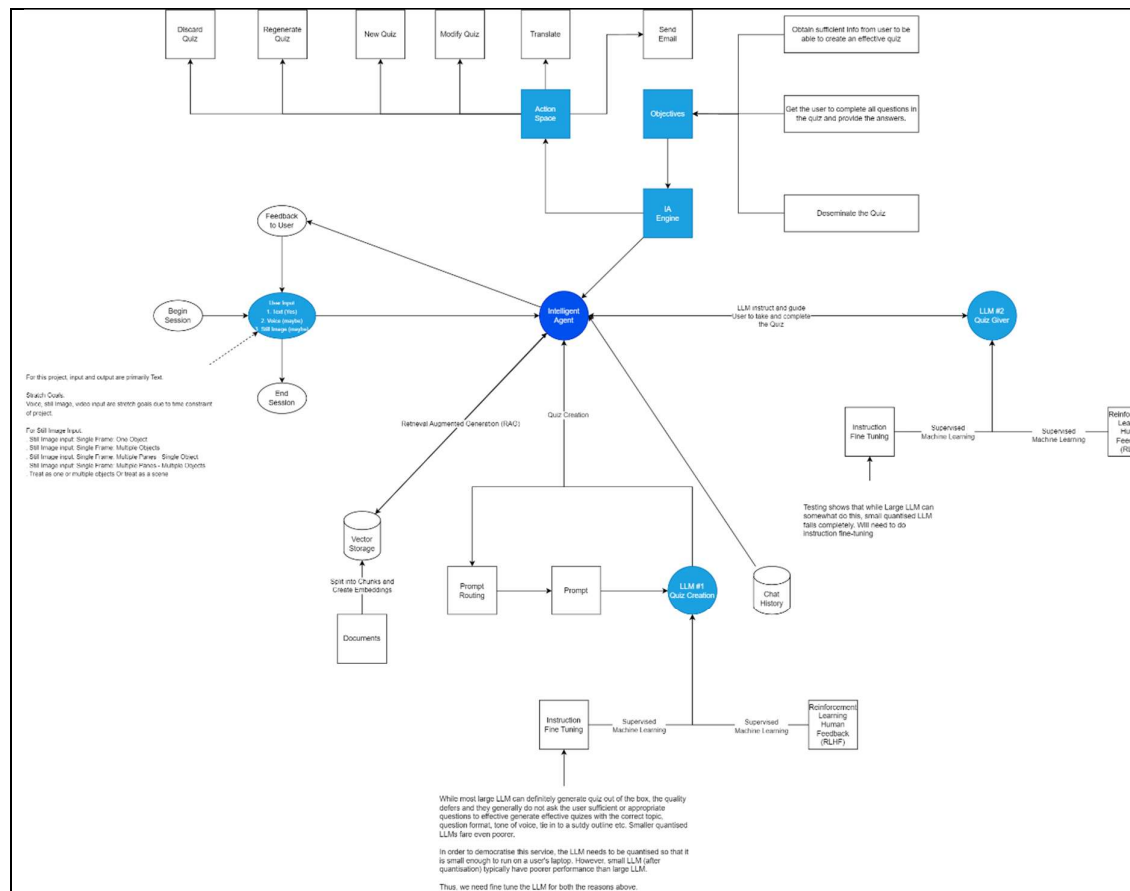
LLM Inferencing Endpoint

- AWS

Some of the Python Packages used (as-of-now)

- faiss-cpu==1.7.4
- gpt4all==1.0.8
- huggingface-hub==0.16.4
- Jinja2==3.1.2
- langchain==0.0.240

- langsmith==0.0.14
- nltk==3.8.1
- numpy==1.25.1
- openai==0.27.8
- openapi-schema-pydantic==1.2.4
- pandas==2.0.3
- Pillow==9.5.0
- pyarrow==12.0.1
- pydantic==1.10.11
- pypdf==3.14.0
- pywin32==306
- PyYAML==6.0.1
- requests==2.31.0
- scikit-learn==1.3.0
- scipy==1.11.1
- sentence-transformers==2.2.2
- SQLAlchemy==2.0.19
- streamlit==1.25.0
- tokenizers==0.13.3
- torchvision==0.15.2
- tornado==6.3.2
- tqdm==4.65.0
- transformers==4.31.0
- urllib3==2.0.4
- websocket-client==1.6.1
- bentoml==1.1.6



Task Flow

After the User logs in and initiates the conversation, the Intelligent Agent (IA) guides the user in creating an effective quiz. The reference content used for the quiz could be the user deciding on a topic and letting the LLM use data that it has already been pre-trained on, or the user can upload custom reference content for the IA to use.

The IA guides the user in a conversational manner to obtain inputs that are necessary to create an effective quiz and the required output format.

After the quiz is generated, the user can opt to interact with the IA to modify the quiz. The primary input and output are text. Should there be sufficient time, voice and image input and output may be considered.

Once the user is happy with the created quiz, the IA will offer the user the option of taking the quiz as it may be helpful to test the quiz. If the user is satisfied, he can then request for the quiz to be translated and/or emailed to another party. If not, he has the option to discard the quiz, regenerate or modify the quiz.

Machine Learning Components

In this project, there will be two Large Language Models, one for Quiz Creation and the other for Quiz Taking. Both models will undergo the following:

- Instruction Fine Tuning (Supervised Machine Learning)

- A form of transfer learning to update the weights of the foundation LLM will be done to help the LLM guide the user in creating effective quizzes instead of being passive.
 - For Quiz Taking, many LLM are better in answering rather than asking questions.
 - The quality varies (especially for quantized models)
 - As the hope is to create quantized LLM so that this quiz intelligent agent can be used on laptops (even though there will be a hosted non-quantized version), it is likely that prompt engineering alone is insufficient.
- Reinforcement Learning Human Feedback (Supervised Machine Learning)
 - The reward model is trained using annotated prompt pairs after which reinforcement learning (PPO) is used to update the LLM's weights to improve the performance.
 - In the prompt pair, the "completion" acts as the label which a human initially annotates and subsequently the trained reward model takes over and human annotation is no longer required.
 - To do the above, a quality prompt-pair dataset would need to be sourced or created synthetically.