

Interactive AI Math Tutor for Elementary Learners

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Advanced Uses of Generative AI

Project Overview

- **Objective:** Develop an AI-powered chatbot to assist elementary students with math questions.
- **Approach:** Fine-tune GPT-3.5-turbo on a curated dataset of elementary math problems.
- **Outcome:** A user-friendly Streamlit web application for interactive math tutoring.

Model Training and Fine-Tuning

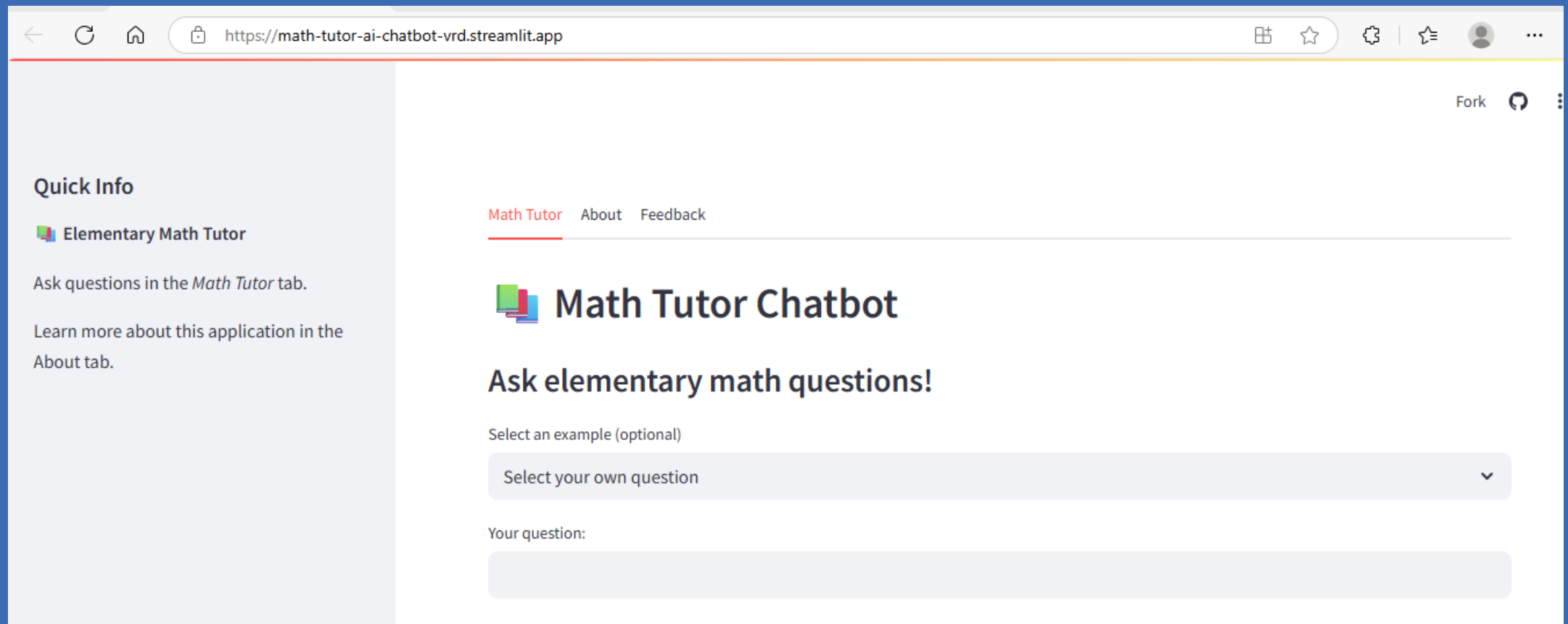
- Utilized Custom dataset comprising elementary-level math problems and solutions
- Fine-tuned GPT-3.5-turbo using OpenAI API.
- Focused on clarity, friendliness, and age-appropriate language.

Application Features

- **Interactive Q&A:** Users can input math questions and receive instant answers.
- **Example Questions:** Predefined questions to guide users.
- **Model Comparison:** Option to compare responses from the fine-tuned and base models.
- **Feedback Mechanism:** Users can provide feedback on the chatbot's performance.

Demo - Math Tutor Tab (Landing View)

- Users can type their own math question or select from example questions.
- Simple, kid-friendly interface to encourage exploration.



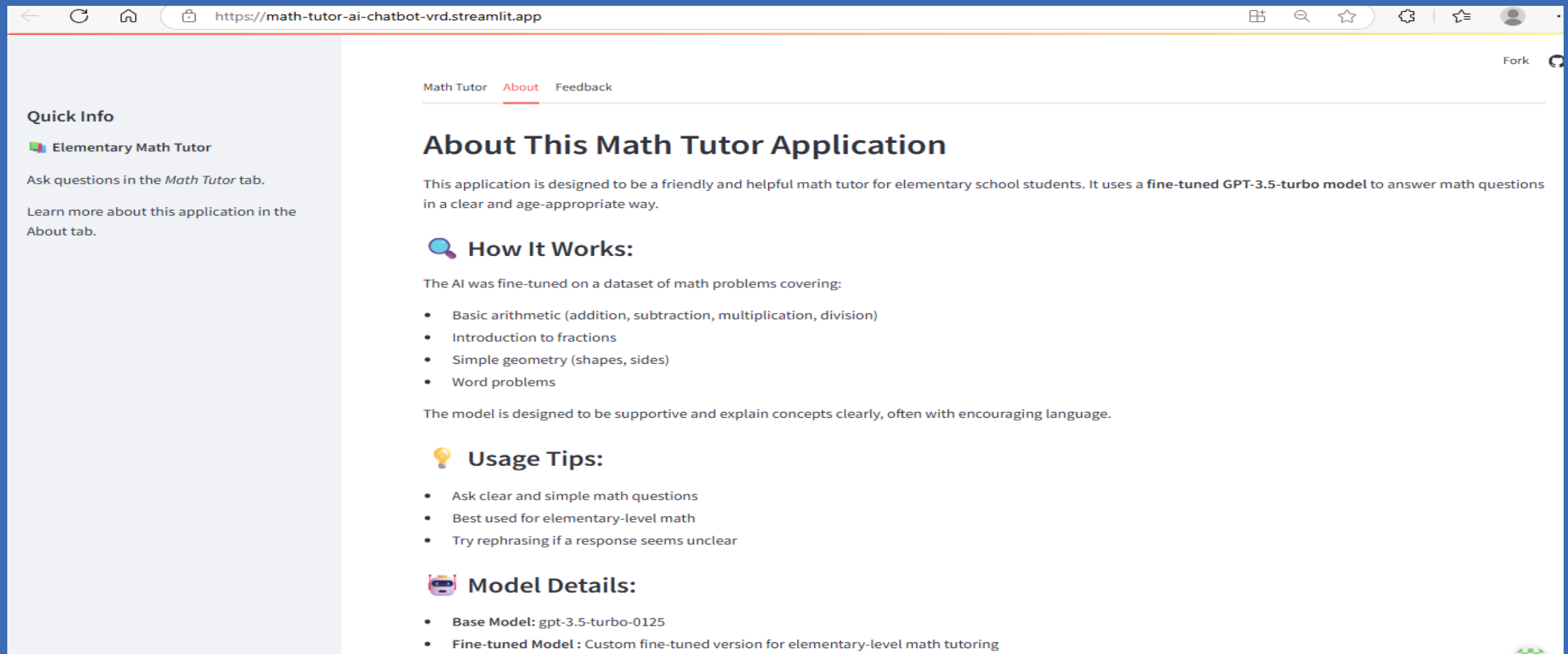
Demo - Math Tutor Tab (Answer View)

- Displays AI-generated math explanation tailored for elementary students.
- Option to compare answers with base GPT-3.5 model for performance insight.

The screenshot shows a web browser at the URL `https://math-tutor-ai-chatbot-vrd.streamlit.app`. The application has a sidebar on the left with a 'Quick Info' section titled 'Elementary Math Tutor' containing instructions to ask questions in the 'Math Tutor' tab and to learn more in the 'About' tab. The main content area has a top navigation bar with 'Math Tutor' (active), 'About', and 'Feedback'. Below this is the 'Math Tutor Chatbot' header with a colorful icon. The main heading is 'Ask elementary math questions!'. A dropdown menu labeled 'Select an example (optional)' shows 'What is half of 10?'. Under 'Answer:', a light blue box contains a detailed explanation: 'Half of 10 is 5! You can split 10 in 2 equal parts of 5 each! $10 \div 2 = 5$! So, $5 + 5 = 10$!'. A checked checkbox 'Compare with base model (gpt-3.5-turbo)' is present. Under 'Comparison with Base Model:', two light blue boxes are shown: the first for '(Fine-Tuned):' with the same detailed explanation as above, and the second for '(Base):' with the simple answer '5'.

Demo - About Tab

- Explains the purpose and scope of the AI math tutor
- Provides usage tips and model details for user context



Demo - Feedback Tab

- Feedback form showing rating stars, comments box, and submit button
- Collects user feedback to improve the chatbot's performance

The screenshot shows a web browser window with the URL `https://math-tutor-ai-chatbot-vrd.streamlit.app`. The page has a sidebar on the left with the title "Quick Info" and the subtitle "Elementary Math Tutor". It contains two paragraphs: "Ask questions in the *Math Tutor* tab." and "Learn more about this application in the About tab." The main content area has a navigation bar with "Math Tutor", "About", and "Feedback" (the active tab). Below the navigation bar is the "Feedback" section. It starts with the text "We'd love to hear your thoughts on how to make this Math Tutor better!". Below this is a text input field with the placeholder "Your comments or suggestions:". Underneath the input field is a question "How helpful was the tutor?" followed by four radio button options: "Not Helpful", "Slightly Helpful", "Helpful", and "Very Helpful". The "Very Helpful" option is selected. Below the radio buttons is a "Submit Feedback" button. At the bottom of the feedback section is a green box with the text "Thank you for your feedback!".

Math Tutor About Feedback

Feedback

We'd love to hear your thoughts on how to make this Math Tutor better!

Your comments or suggestions:

How helpful was the tutor?

☐ Not Helpful

☐ Slightly Helpful

☐ Helpful

☒ Very Helpful

Submit Feedback

Thank you for your feedback!

Key Learnings

- Fine-tuning requires carefully structured prompts.
- Prompt-response formatting improves output quality.
- Tokenization impacts cost and performance balance.
- Human evaluation is critical beyond standard metrics.
- Streamlit provides an effective platform for real-time AI applications.

Conclusion

- Successfully developed a fine-tuned AI chatbot for elementary math tutoring.
- The app offers accessible learning for young students.
- Future work could expand the dataset for broader topics; enhance the user interface; implement more robust evaluation metrics.

References

- Streamlit Docs. (n.d.). <https://docs.streamlit.io/>
- <https://platform.openai.com/docs/models>
- <https://platform.openai.com/docs/guides/fine-tuning>