Innovation Challenge Proposal: AI-Powered BugFixGPT – Automatic Bug Localization & Fix Suggestion Tool

Purpose

Software debugging is time-consuming and often stalls developer productivity. While we explored AI in testing and code generation, automated bug fixing was not deeply covered. *BugFixGPT* is an AI tool that analyzes error logs, stack traces, and code diffs to automatically suggest fixes for bugs—saving developers time and effort in identifying and resolving defects.

Workflow

1. Input Collection:
    - Developer uploads error logs, stack traces, or source files.
    - Optionally connects to GitHub to access commit history and diff.
2. Bug Localization:
    - NLP model (e.g., fine-tuned BERT or GPT) parses logs and maps errors to relevant lines in the code.
    - Affected functions are prioritized using heuristics and frequency analysis.
3. Fix Suggestion Engine:
    - The model retrieves similar past bugs from a trained dataset (Stack Overflow, GitHub commits).
    - It generates patch suggestions using a transformer model fine-tuned on bug-fix pairs (like CodeT5 or GPT-4 code model).
4. User Interaction:
    - Suggestions are shown with explanation and confidence scores.

- Developers can apply the patch, refine it, or request alternative fixes.

Impact

- Efficiency Boost: Reduces mean time to resolve (MTTR) bugs by up to 50%.
- Knowledge Sharing: Helps junior developers understand and fix errors without relying heavily on senior engineers.
- Scalability: Integrates into CI/CD pipelines to run automatic fixes on minor bugs or warnings.
- Innovation: Goes beyond static code analysis by offering context-aware, AI-suggested resolutions, not just detection.

Tools/Technologies

- Backend: Python, FastAPI
- AI Models: GPT-4 or CodeT5, BERT for NLP, vector search for past bug cases
- Integration: GitHub/GitLab APIs, VS Code Extension

Conclusion

BugFixGPT has the potential to become a “co-pilot” for debugging, allowing developers to focus on features rather than firefighting bugs. It’s an innovative application of AI that fills a critical pain point in software engineering.