IBM HACKATHON PROJECT

AI-POWERED LATEX DIAGRAM GENERATOR FOR ACADEMIC RESEARCH

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OUTLINE

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PROBLEM STATEMENT

Researchers and academic writers often face significant challenges when creating diagrams in LaTeX, especially using the TikZ package. Writing TikZ code manually is time-consuming, requires technical expertise, and is prone to errors. This slows down the research documentation process and creates a steep learning curve for those unfamiliar with LaTeX graphics. There is a strong need for a user-friendly, intelligent tool that can simplify and automate this task.

Proposed Solution:

I propose an AI-powered intelligent agent that automatically converts natural language descriptions and sketches into professional TikZ code for LaTeX documents. This agent will support real-time feedback, accept refinement commands in plain English, and produce publication-ready diagrams, eliminating the need for manual coding and significantly enhancing productivity for academic researchers.



TECHNOLOGY USED

IBM cloud lite services

Natural Language Processing (NLP)

Retrieval Augmented Generation (RAG)

IBM Granite model



IBM CLOUD SERVICES USED

- IBM Cloud Watsonx Al Studio
- IBM Cloud Watsonx AI runtime
- IBM Cloud service
- IBM Granite (via watsonx.ai studio)
- IBM Cloud Object Storage IBM AI Tools



WOW FACTORS

Natural Language to TikZ: Generate LaTeX diagrams from plain English.

Sketch Recognition: Turn rough hand-drawn sketches into structured TikZ code.

Real-Time Refinement: Update diagrams instantly with plain English commands.

Publication-Ready: Produces clean, high-quality diagrams for academic papers.

No Coding Needed: No prior LaTeX or TikZ experience required.

Deploy Anywhere: Web, desktop, or Overleaf-integrated support.



END USERS

Academic Researchers

For thesis, paper, and journal diagram automation.

Professors & Educators

For creating lecture notes, slides, and visual explanations.

Students (UG/PG/PhD)

For simplifying LaTeX assignments and project reports.

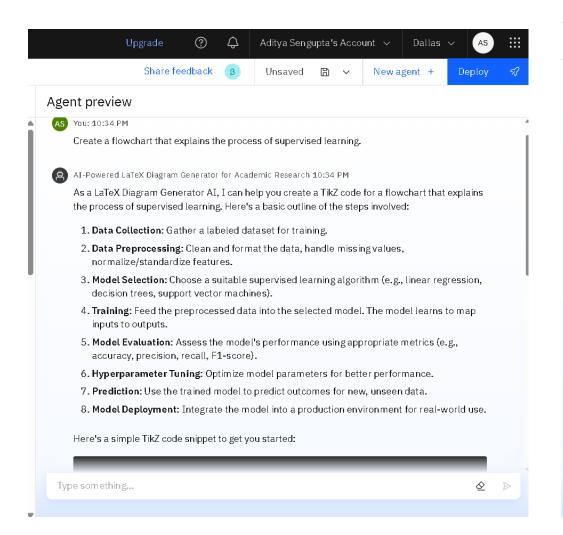
Research Institutions & Universities

For streamlining documentation and publication workflows.

Technical Writers & LaTeX Enthusiasts

For enhancing productivity and accuracy in LaTeX graphics.





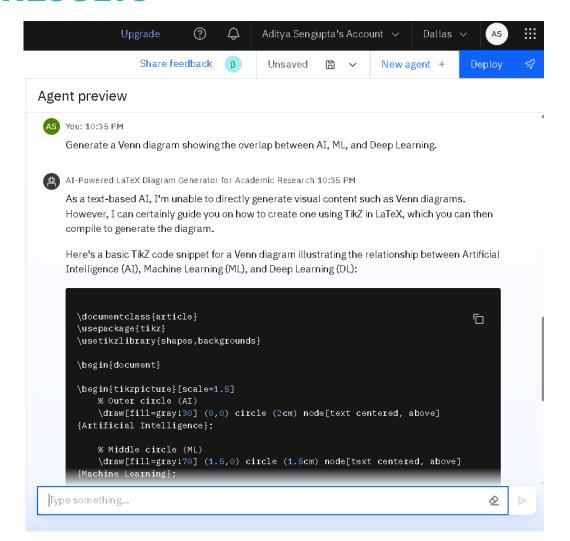
Agent preview Here's a simple TikZ code snippet to get you started: \documentclass{article} Ē \usepackage{tikz} \usetikzlibrary{shapes,arrows} \begin{document} \begin{tikzpicture}[node distance = 2cm, auto] \tikzstyle{block} = [rectangle, draw, fill=blue!20, text width=5em, text centered, rounded corners, minimum height=4em] \tikzstyle{line} = [draw, -latex'] \node [block] (data) {Data Collection}; \node [block, below of=data] (preprocess) {Data Preprocessing}; \node [block, below of=preprocess] (select) {Model Selection}; \node [block, below of=select] (train) {Training}; \node [block, below of=train] (evaluate) {Model Evaluation}; \node [block, below of=evaluate] (tune) {Hyperparameter Tuning}; \node [block, below of=tune] (predict) {Prediction}; \node [block, below of=predict] (deploy) {Model Deployment}; \path [line] (data) -- (preprocess); \path [line] (preprocess) -- (select);

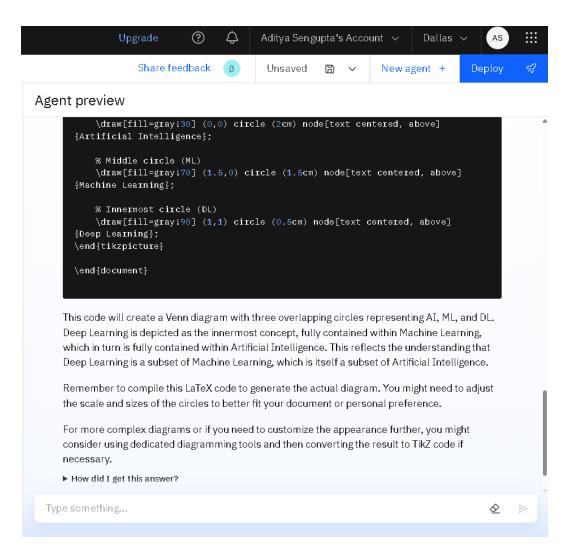
\path [line] (select) -- (train);
\path [line] (train) -- (evaluate);

\path [line] (evaluate) -- (tune);

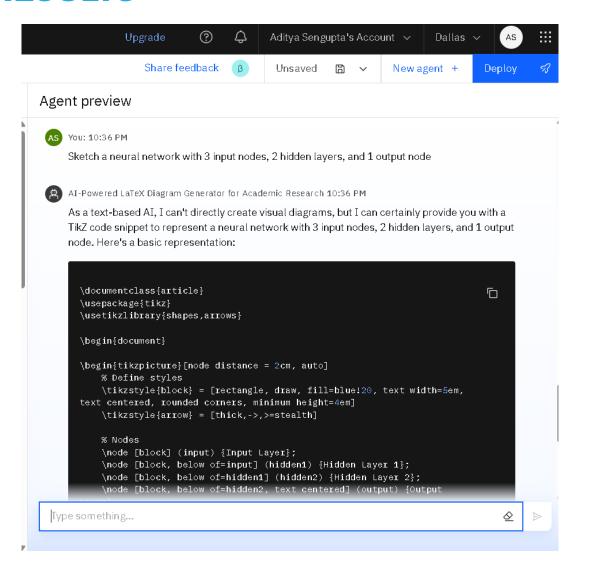
Type something...

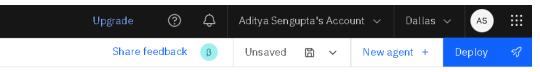




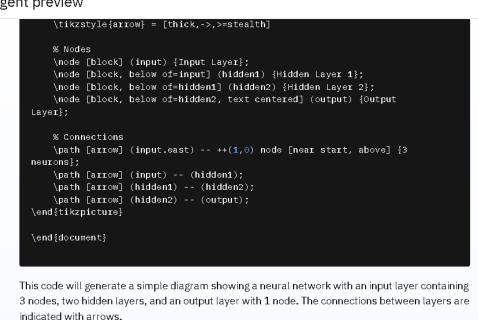








Agent preview



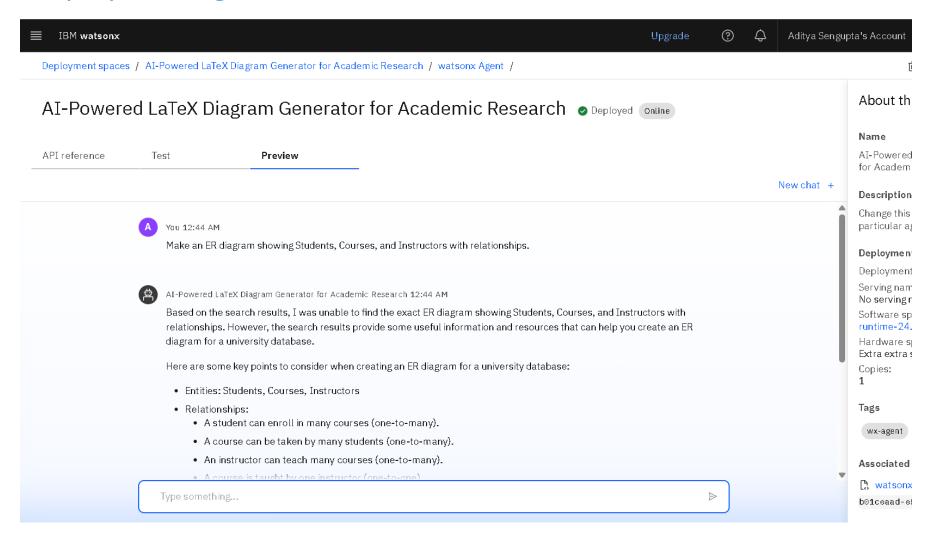
Remember to compile this LaTeX code to generate the actual diagram. You can adjust the sizes, colors, and text as needed to better fit your document's style. For more complex diagrams, consider using dedicated diagramming tools and converting the result to TikZ code if necessary.

► How did I get this answer?

Type something...



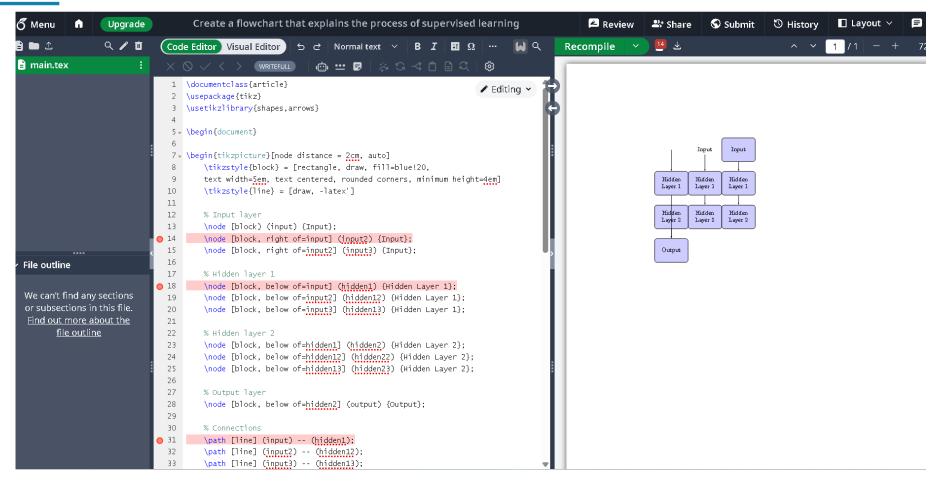
Deployed AI Agent





- Once the AI Agent generates the TikZ code, you can visualize the corresponding diagram by pasting the code into a LaTeX editor such as Overleaf, which renders the diagram from the TikZ instructions.

RESULTS





CONCLUSION

- **Simplifies Complex Tasks**: Eliminates the need to manually write TikZ code by converting natural language or sketches into LaTeX diagrams.
- Boosts Research Productivity: Saves time and effort for researchers, students, and educators by automating high-quality diagram generation.
- Enhances Accessibility: Makes professional diagram creation accessible to non-technical users with real-time feedback and plain English commands.



GITHUB LINK

https://github.com/Adityasen-cmd/Edunet-Hackathon-Project-.git



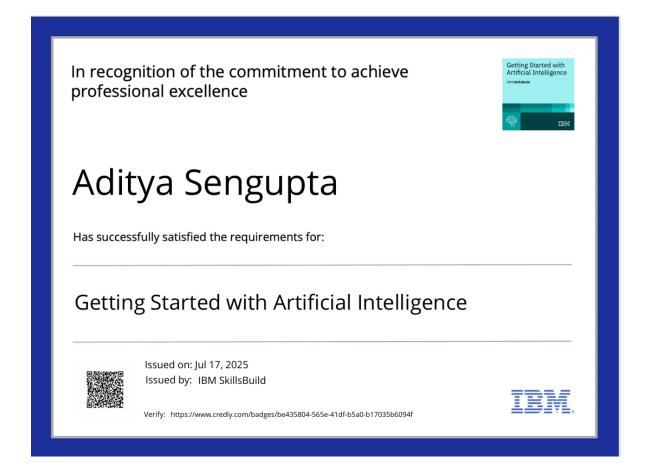
FUTURE SCOPE

- Voice-to-Diagram Generation
 - Enable hands-free diagram creation using speech-to-text for accessibility and faster interaction.
- Multilingual Support
 - Accept input and commands in multiple languages to support global researchers.
- Overleaf Integration
 - Direct integration with Overleaf for real-time diagram preview and editing within LaTeX environments.
- Auto-Diagram Suggestions
 - Automatically suggest diagrams based on surrounding LaTeX text or content analysis.
- Collaborative Editing
 - Allow multiple users to co-edit and refine diagrams in real time for group research projects.
- Al-Powered Diagram Optimization
 - Intelligent suggestions for better layout, aesthetics, and labeling of diagrams.
- Export to Multiple Formats
 - Support PNG, SVG, and PDF exports alongside TikZ for broader use in presentations and publications.



IBM CERTIFICATIONS

Certificate of Getting Started with Al





Certificate of RAG with LangChain

IBM SkillsBuild

Completion Certificate



This certificate is presented to

Aditya Sengupta

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 18 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU

