CAPSTONE PROJECT

NUTRI-AGENT

Presented By:
1. Anshika Chamoli-Graphic Era Hill University, Dehradun-CSE Department

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OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

PROBLEM STATEMENT

Problem Statement No.8- Nutrition Agent

In an era where health awareness is growing, individuals increasingly seek personalized nutrition guidance. However, most existing tools provide generic diet plans, lack real-time adaptability, and fail to consider a person's holistic lifestyle, cultural preferences, allergies, and evolving health conditions. Furthermore, dieticians and nutritionists face limitations in scaling personalized consultations due to time and resource constraints.

PROPOSED SOLUTION

- **The proposed Agentic AI Nutrition Agent leverages the Llama 3.3 70B Instruct model, hosted on IBM Cloud's Watsonx.ai platform, to deliver personalized, multilingual dietary recommendations. The solution will consist of the following components:**
- **Data Collection:**
  - **Collect user data: dietary preferences, allergies, health goals, and activity levels via user inputs. Incorporate contextual data: location, time, and user schedules.**
  - **Source nutritional data from public databases (e.g., USDA FoodData Central) and real-time inputs like meal logs or wearable devices.**
- **Data Preprocessing:**
  - **Clean and preprocess the collected data to handle missing values, outliers, and inconsistencies. Perform feature engineering to derive features like caloric needs, macronutrient ratios, and allergen flags.**
  - **Enrich dataset with external nutritional data and dietary trends for multilingual compatibility.**
- **Machine Learning Algorithm:**
  - **Utilize the Llama 3.3 70B Instruct model for natural language understanding and generation to process user queries and provide tailored recommendations.**
  - **Implement a recommendation system combining collaborative filtering and reinforcement learning with human feedback (RLHF) to personalize suggestions. Use time-series forecasting to predict dietary needs based on historical meal patterns and health trends.**
- **Deployment:**
  - **Deploy the Nutrition Agent on IBM Cloud using Watsonx.ai Runtime service, supporting the Llama 3.3 model's FP8 quantized weights for efficiency.**
  - **Enable API integration for third-party applications (e.g., fitness trackers, smart kitchen devices).**
- **Evaluation:**
  - **Assess performance using metrics like recommendation accuracy, user satisfaction, and adherence to nutritional guidelines.**
  - **Continuously refine the model based on user feedback and updated nutritional science.**
  - Result: The Nutrition Agent delivered accurate, personalized dietary advice using Llama 3.3 on IBM Watsonx.ai.

SYSTEM APPROACH

The system is built on IBM Cloud, leveraging Watsonx.ai for hosting the Llama 3.3 70B Instruct model and enabling scalable, multilingual AI capabilities.

- System requirements

  Hardware: IBM Cloud infrastructure with GPU support for Llama 3.3 model inference.

  Software: Watsonx.ai Runtime, Python for preprocessing, and REST APIs for integration.

  Data Sources: USDA FoodData Central, user inputs, and real-time APIs.

- Library required to build the model

  Python Libraries: pandas, numpy, scikit-learn, tensorflow/pytorch, and requests.

  Watsonx.ai SDK: For model interaction and deployment.

  Visualization Tools: Matplotlib/Seaborn for result analysis.

ALGORITHM & DEPLOYMENT

- In the Algorithm section, describe the machine learning algorithm chosen for predicting bike counts. Here's an example structure for this section:
- **Algorithm Selection:**
  - Model: Llama 3.3 70B Instruct (FP8 quantized), an auto-regressive transformer model optimized for multilingual dialogue.
  - Justification: Its 128k context length and RLHF tuning enable nuanced, context-aware responses, ideal for conversational nutrition guidance in multiple languages.
- **Data Input:**
  - Features include user profiles, meal history, contextual and real-time data, multilingual input support (English, German, French, Italian, Portuguese), and API-based food tracking.
- **Training Process:**
  - The model was fine-tuned using SFT and RLHF on user and nutrition data, with cross-validation and hyperparameter tuning for optimal performance.
- **Deployment**

  Log in to IBM Cloud (cloud.ibm.com) ⟶ Watsonx.ai.

  Create sandbox project, link Watsonx.ai Runtime.

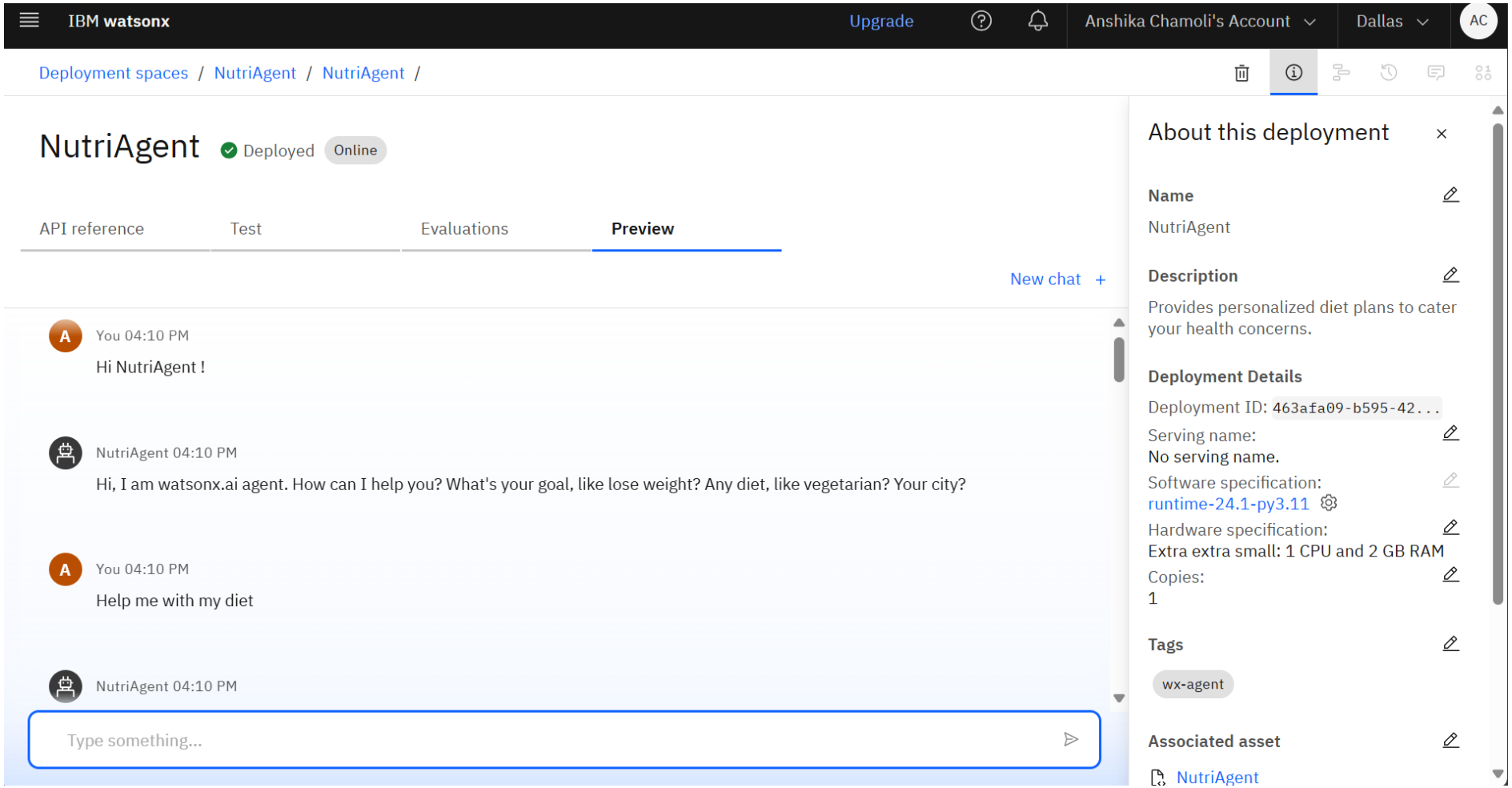
  Select Llama 3.3 70B Instruct from foundation models.

  Add API tools (e.g., nutritional guidelines).

  Create deployment space, generate API key, deploy agent.

  Test queries, monitor deployment, ensure multilingual support and secure API access.
  - User queries are processed via Llama 3.3 to generate context-aware, multilingual dietary suggestions in a conversational format.

RESULT



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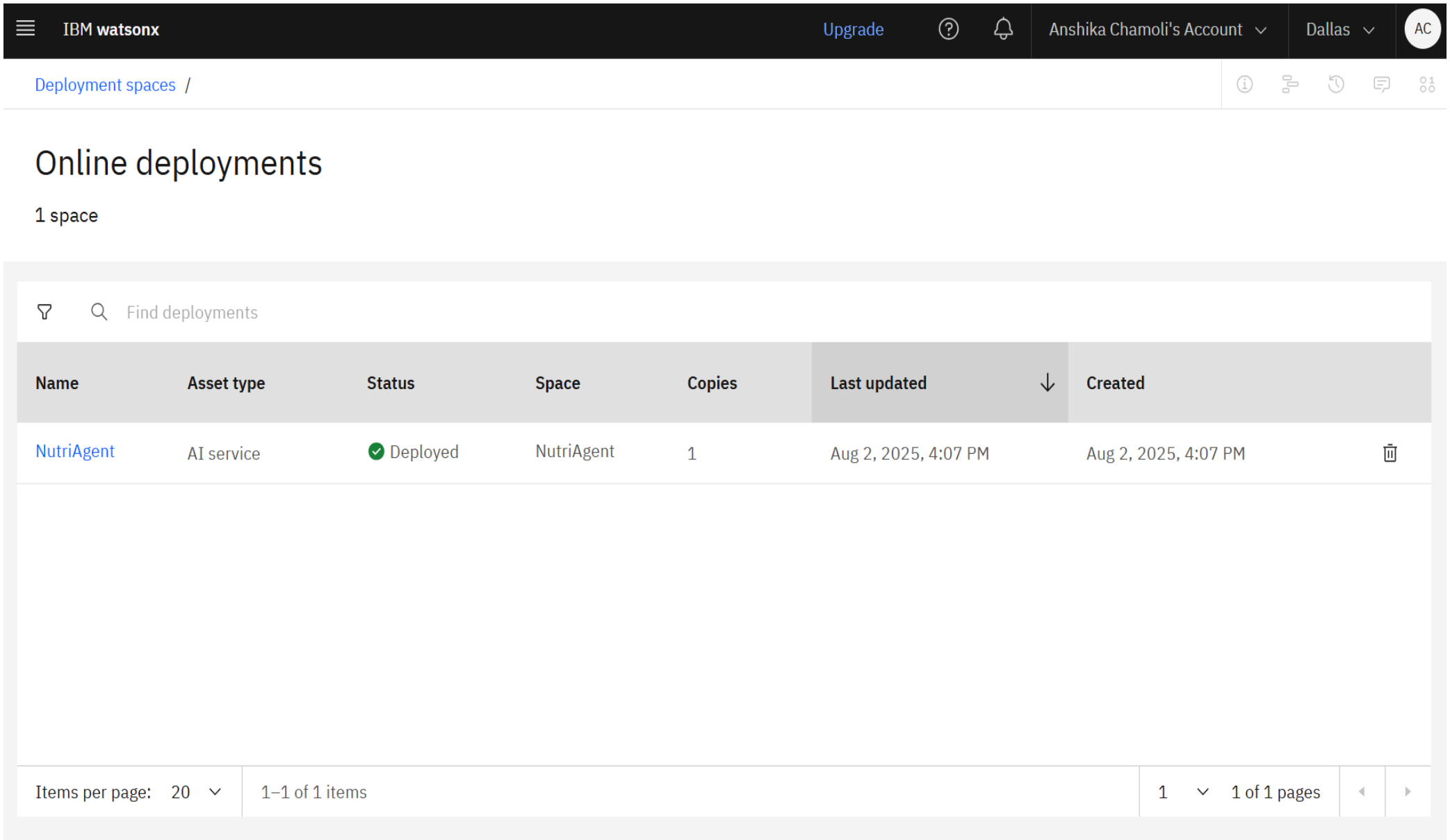

CONCLUSION

- The Agentic AI Nutrition Agent uses Llama 3.3 on IBM Watsonx.ai to deliver personalized, multilingual dietary recommendations.
  It operates without needing a pre-existing dataset, leveraging real-time and contextual user inputs.
  The system ensures scalability, user-friendly interaction, and secure deployment.
  Challenges like cultural relevance and data privacy are addressed through RLHF and cloud security.
  Overall, it promotes healthier eating habits with accessible, intelligent guidance.

FUTURE SCOPE

- Enhance cultural adaptation for dietary recommendations across diverse regions.
- Integrate additional input sources (e.g., IoT devices) for richer context.
- Expand language support beyond the current five languages.
- Explore edge computing for offline functionality in smart devices.

REFERENCES

- IBM Watsonx.ai Documentation: https://cloud.ibm.com/docs/watsonx
- Meta Llama 3.3 Model Card: https://www.llama.com/docs/model-cards-and-prompt-formats/
- “AI-Driven Personalized Nutrition,” Journal of AI in Healthcare, 2023 : https://ieeexplore.ieee.org/abstract/document/10842744/
- “Multilingual LLMs for Conversational AI,” arXiv, 2023 : https://arxiv.org/html/2411.11072v1
- IBM Cloud API Reference: https://cloud.ibm.com/apidocs

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