SIG788

Engineering AI solutions

Pass Task 7

Arunkumar Balaraman

S223919051

Contents

Meeting Notes Michelle Sandford

The training was about exploring **AI technologies**, especially the ones provided by **Microsoft Open AI**. Explored about how **ChatGPT**, an **AI model**, can be used to build **AI support apps**. Also discussed the role of **embeddings** in **machine learning** and how different types of data can be used in **AI development**.

Highlighted the advantages of using **Azure Open AI services** for creating **secure** and **scalable** AI solutions. The meeting stressed on the importance of **ethical practices in AI development**.

Lastly, aimed to **motivate** and **guide** to pursue careers in tech by providing resources for learning about AI technology.

Summary:

Azure OpenAI Service

➢ **Enterprise Account**: Highlighted the need for enterprise accounts to access full features & Azure Student subscription would have limitation and Microsoft is prioritizing the enterprise subscription due to demand.

➢ **Initial Configuration:** Guided through the setup process, emphasizing on configuration for optimal use of the service**.**

➢ **Enhancement:** Discussed the integration of Azure OpenAI tools into the our curriculum to provide practical AI experiences.

➢ **Careers in Azure AI:** Pointed out the long-term benefits of learning advanced AI tools to prepare students for tech-oriented careers.

Fundamentals of Language Models in Azure OpenAI

➢ **Tokenization and Neural Network Processing**: Explained how text is converted into tokens for neural network processing to generate responses.

➢ Model Mechanics: Detailed the probabilistic nature and mechanics of language models.

Applications in Real-World Scenarios:

➢ **Automating Customer Interactions**: Provided examples of AI in customer service to enhance efficiency.

➢ **Content Creation Capabilities**: Showcased AI's role in diverse content creation, demonstrated its practical benefits.

Prompt Engineering

➢ **Effective Prompt Construction**: Discussed crafting precise prompts to guide AI to desired outputs.

- ➤ **Influence on AI Responses**: Highlighted how well-designed prompts improve AI's accuracy and relevance.

- ➤ **Zero-shot, Few-shot, and Meta Prompting**: detailed about different prompting techniques, explained their uses and advantages.

- ➤ **Real-World Example**: Offered real world examples where these techniques been effectively utilized.

Azure OpenAI Capabilities

- ➤ **Tutorials on Code and Image Generation**: Provided Step-by-Step Guides & mentioned availability of tutorials through youtube sessions for practical learning.

- ➤ **Showcased AI Capabilities**: Demonstrated Azure OpenAI's ability to generate code and images.

Responsible AI Practices

- ➤ **Ethical Guidelines and Safety Protocols**: Detailed the guidelines for ethical AI development to prevent harmful content creation.

- ➤ **Technical and Behavioural Safeguards**: Explained about setting up technical and behavioral guardrails for AI integrity.

- ➤ **Strategies for Bias Mitigation**: Discussed approaches to reduce AI biases, ensuring fairness.

- ➤ **Considering Societal Impacts**: Explored the broader implications of AI on society, emphasizing responsible development.

Evaluating and Enhancing AI

- ➤ **Key Performance Metrics**: Described metrics like grounded ness, relevance, and coherence to evaluate AI models.

- ➤ **Importance of Comprehensive Evaluation**: Stressed thorough evaluation to ensure practical benefits of AI outputs.

- ➤ **Access to Learning Resources**: Listed resources available for enhanced learning, such as forums and workshops.

- ➤ **Community Collaboration and Support**: Encouraged active participation in the Azure AI community for enriched learning experiences.

Advancements with Retrieval Augmented Generation (RAG)

- ➤ **Functionality of RAG**: Explained how RAG integrates external data into AI responses for enhanced accuracy.

> ➢ **Academic Application and Benefits**: Discussed the educational benefits of using RAG to provide interactive learning experiences.

> ➢ **Preparation for Technological Careers**: Emphasized the role of Azure OpenAI in preparing students for future careers in technology.

Reference:

> ➢ Michelle Sandford. (14th April 2024). **Training on AI Technologies & Microsoft Open AI**. Available at: https://olympus.mygreatlearning.com/mentorship_recordings/2328800

Part1 - Recommendation System

What Is Azure OpenAI?

Azure OpenAI is a cloud-based service provided by **Microsoft** that integrates **OpenAI's advanced natural language processing** (NLP) models into the **Azure cloud platform**. This integration allows developers, data scientists, and businesses to utilize cutting-edge **AI models**, such as the Generative Pre-trained Transformer (GPT) series, including the latest iterations like GPT-3 and GPT-4, within a secure, scalable, and managed Azure environment.

Key features of Azure OpenAI:

> ➢ **AI Models**: Provides access to powerful AI models for tasks like text generation and language understanding.
> ➢ **Scalability**: As part of Azure, it can scale resources according to demand.
> ➢ **Security**: Offers enterprise-grade security and compliance, protecting sensitive data.
> ➢ **Customization**: Allows fine-tuning of models and integration of custom data for specific needs.
> ➢ **Managed Service**: Simplifies AI model management, letting users focus on application development.
> ➢ **Applications**: Can be used in various domains like customer support automation, personalized communication, content generation, and data analysis.

Reference:

> ➢ Microsoft Learn (no.date.) "**What is Azure OpenAI Service?**"Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/overview

What is Tokenizer?

Tokenizer is a fundamental component used in **natural language processing (NLP)** systems, particularly in tasks involving text analysis and model training. Its primary function is to break down or segment text into smaller, manageable parts called **tokens**, which are the building blocks for further processing and analysis.

Tokenizer Functions:

Tokenization: Splits text into tokens, which can be words, phrases, symbols, etc. The token definition depends on the application and language complexity.

Standardization: Performs preprocessing tasks like converting text to lowercase, removing punctuation, or eliminating "stop words".

Special Cases Handling: Deals with special cases like contractions, dates, numbers, or specialized terminology.

Tokenization Types:

- **Word Tokenization**: Breaks the text into individual words.
- **Sentence Tokenization**: Segments text into sentences.
- **Subword Tokenization**: Breaks words into smaller meaningful units (subwords) using techniques like Byte Pair Encoding (BPE) or WordPiece.

Applications in Machine Learning and NLP:

- **Text Classification**: Uses tokenization to understand and classify text.
- **Machine Translation**: Breaks down sentences into tokens for accurate translation.
- **Sentiment Analysis**: Examines tokens that denote sentiment.
- **Information Retrieval**: Uses tokenization for indexing content in search engines.

Reference:

- Microsoft AI Tour (no.date.) "**Tokenization**" Available at: https://microsoft.github.io/Workshop-Interact-with-OpenAI-models/tokenization/

What is few-shot and Zero-shot Learning and their advantages on LLMs and prompting?

Few-Shot Learning (FSL): FSL is a method where a model is trained or fine-tuned on a small amount of task-specific data. It provides the model with a few examples to adapt to a specific task.

Advantages:

- **Increased Accuracy**: FSL often improves performance on specific tasks by providing the model with context.
- **Quick Adaptation**: It enables the model to adapt quickly to new tasks with just a few examples, making it useful when large datasets are hard to obtain.
- **Versatile**: It supports a wide range of tasks with minimal examples, reducing the effort of preparing a full dataset but still customizing the model to specific needs.

Zero-Shot Learning (ZSL): ZSL is a machine learning technique where a model can perform tasks it has not seen during training. It uses the knowledge gained from a diverse training dataset to make predictions about unseen tasks.

Advantages:

- **Broad Application**: Models can handle a wide range of tasks without needing task-specific data.
- **Cost-Efficient**: It reduces the need for task-specific data collection and annotation, saving time and resources.
- **Flexible**: It allows quick deployment across various domains and tasks without the need for retraining.

Application in Large Language Models (LLMs) and Prompting

➢ **Effective Prompting:** Large Language Models (LLMs) like GPT-3 or GPT-4 can use few-shot and zero-shot learning effectively with specific prompts. For zero-shot learning, the task is described in the prompt. For few-shot learning, the prompt includes a few examples of the task.

➢ **Versatile Task Management:** These models can handle various Natural Language Processing (NLP) tasks dynamically with the same base model. This reduces the need for multiple specialized models.

➢ **Enhanced Understanding:** Few-shot learning helps LLMs understand the task better by providing context through example prompts. This leads to more accurate and contextually relevant responses.

Reference:

➢ Geeksforgeeks (08th Jan 2024) "**Few shot and Zero Learning**" Available at: https://www.geeksforgeeks.org/few-shot-learning-in-machine-learning/

➢ Akshita (18th Feb 2024) "**Implement Adaptability and Performance of Large Language Models (LLMs): Why Zero, One, and Few-Shot Learning?**" Available at: https://medium.com/@ak_12/implement-adaptability-and-performance-of-large-language-models-llms-why-zero-one-and-few-shot-0d4e12db3332

What is the difference between System Prompt and meta prompt? Provide an example.

System prompt: A **System Prompt*** is a predefined sets of instruction given to a language model to perform a specific task. Also a defines the AI's role capabilities, limitations and expected responses.

Example

➢ A language model to translate **English text to French**, the **system prompt** would be "**Translate the following English text to French**: 'Hello, how are you?'". The model then uses this prompt to generate the appropriate output.
➢ **Customer service assistant:** responses should always be polite and focused on helping users understand and use our products. Avoid discussing topics not related to our products

Meta prompt: A **Meta Prompt** is an advanced prompting technique that focuses on the structural and syntactical aspects of problems, prioritizing the general format and pattern over specific content details. It provides a platform that outlines the general approach to a problem, enabling Large Language Models (LLMs) to fill in specific details as needed.

Example:

➢ **A meta prompt for a translation task**: Translate the following {language1} text to {language2}: '{text}'". Here, {language1}, {language2}, and {text} are placeholders that can be filled with specific details for each new task.

> ➢ When asked about **account details**, first verify the user's identity by asking for their last order number and email address. Only provide account details if the information matches our records.

Reference:

> ➢ Tanujareddy Maligireddy (12th Oct 2023) "**Prompt Generation for Meta Prompting: A Deep Dive**" Available at: https://medium.com/@tanujareddy.maligireddy/prompt-generation-for-meta-prompting-a-deep-dive-15ecbcd20138

> ➢ Michelle Sandford. (14th April 2024). **Training on AI Technologies & Microsoft Open AI**. Available at: https://olympus.mygreatlearning.com/mentorship_recordings/2328800

Explain generate the code with Azure OpenAI service? What's the advantage of using this service?

Azure OpenAI Service is a fully managed service that allows developers to easily integrate OpenAI models into their applications. One of the **key features** of this service is the **ability to generate code**.

To generate code with Azure OpenAI Service uses natural language prompts to instruct the AI model. That is we can provide a prompt like "Write a Python function to calculate the factorial of a number", and the model will generate the corresponding Python code. This can be particularly useful for tasks such as building unit tests, understanding complex code, and generating comments and documentation for existing code.

Advantages of using Azure OpenAI Service:

Simplified Integration: The service provides a simple and easy-to-use API with various endpoints for different tasks, such as text generation, summarization, sentiment analysis, language translation, and more.

Pre-trained Models: The service includes pre-trained models that have been fine-tuned on vast amounts of data, making it easier for developers to leverage the power of AI without having to train their own models from scratch[1].

Customization: Developers can fine-tune the included pre-trained models with their own data with minimal coding, providing an opportunity to create more personalized and specialized AI applications.

Scalability and Reliability: Hosted on Microsoft Azure, the service provides robust scalability and reliability that developers can leverage to deploy their AI applications with confidence, without having to worry about managing the underlying infrastructure.

Responsible AI: Azure OpenAI Service promotes responsible AI by adhering to ethical principles, providing explainability tools, governance features, diversity and inclusion support, and collaboration opportunities.

Community Support: With an active community willing to help and share their experiences via forums and support channels, developers can ask questions, seek guidance, and learn from others.

Reference:

> ➢ Microsoft Learn (no.date.) "What is Azure OpenAI Service?" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/overview

> ➢ Microsoft Learn (no.date.) "Generate code with Azure OpenAI Service" Available at: https://learn.microsoft.com/en-us/training/modules/generate-code-azure-openai/

What is DALL-E? explain it in the context of Azure OpenAI services?

DALL-E is an AI system developed by OpenAI that can **generate realistic images** and **art** from a description in natural language. It's a 12-billion parameter version of **GPT-3** trained to generate images from text descriptions, using a dataset of text–image pairs. DALL-E can create original, realistic images and art from a text description, combine concepts, attributes, and styles, and make realistic edits to existing images from a natural language caption.

Azure OpenAI services Context:

DALL-E is available as a **fully managed service** that developers can use to generate images based on user-provided text prompts. This service is part of the Azure OpenAI Service, which provides a simple and easy-to-use API with various endpoints for different tasks.

Advantages of using DALL-E in Azure OpenAI services:

> ➢ **Simplified Integration**: The service provides a simple API for generating images with DALL-E.
> ➢ **Scalability and Reliability**: Being hosted on Microsoft Azure, the service provides robust scalability and reliability.
> ➢ **Customization:** Developers can fine-tune the included pre-trained models with their own data.
> ➢ **Responsible AI**: Azure OpenAI Service promotes responsible AI by adhering to ethical principles, providing explainability tools, governance features, diversity and inclusion support, and collaboration opportunities.
> ➢ **Community Support**: With an active community willing to help and share their experiences via forums and support channels, developers can ask questions, seek guidance, and learn from others.

Reference:

> ➢ Microsoft Learn (no.date.) "**Quickstart: Generate images with Azure OpenAI Service**" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/dall-e-quickstart?tabs=dalle3%2Ccommand-line&pivots=programming-language-studio

> ➢ Microsoft Learn (no.date.) "**Learn how to work with the DALL-E models**" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/how-to/dall-e?tabs=dalle3

> ➢ OpenAI (no.date) "**DALL·E 2**" Available at: https://openai.com/dall-e-2

What is RAG? Summarize your understanding of your understanding from the Lecture.
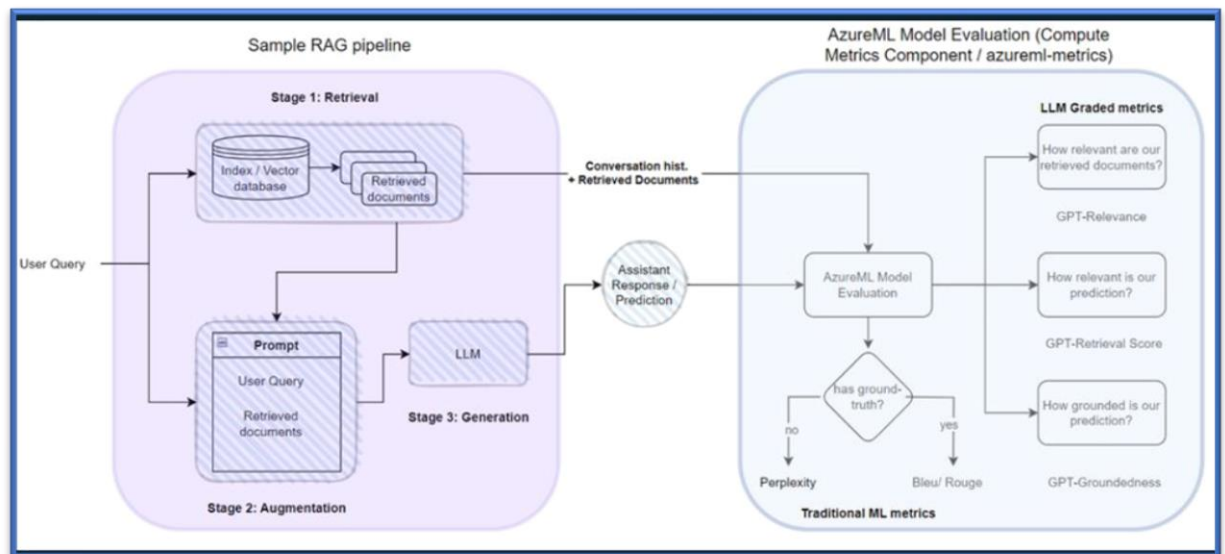
Retrieval-Augmented Generation (RAG) is an AI method that combines retrieval and generative capabilities of language models. It aims to improve the AI's responses by grounding them in relevant data.

Components:

- ➢ **Retrieval**: Searches a database to find information related to the provided query or prompt.
- ➢ **Generation**: Uses the retrieved information to generate a coherent and contextually relevant response.

Process:

- ➢ **Input**: Receives a query or prompt from the user.
- ➢ **Retrieval**: Searches a dataset to find relevant content.
- ➢ **Generation**: Produces a final output that combines the retrieved information and the AI's generative capabilities.

Advantages:

- ➢ **Accuracy**: Provides more accurate responses by using real-world data.
- ➢ **Reduced Hallucination**: Mitigates the generation of plausible but incorrect responses by grounding responses in retrieved data.
- ➢ **Flexibility**: Adapts to new information or changes in data without needing to retrain the generative model.

Applications

- ➢ **Question Answering**: Provides verified responses in applications where factual accuracy is critical.
- ➢ **Content Creation**: Assists writers by providing background information or data-driven insights.
- ➢ **Interactive Applications**: Improves user satisfaction and engagement by providing contextually grounded responses in interactive AI systems.

Reference:

- ➢ Michelle Sandford. (14th April 2024). **Training on AI Technologies & Microsoft Open AI**. Available at: https://olympus.mygreatlearning.com/mentorship_recordings/2328800
- ➢ Microsoft Learn (no.date.) "**Retrieval Augmented Generation (RAG) in Azure AI Search**" Available at: https://learn.microsoft.com/en-us/azure/search/retrieval-augmented-generation-overview

What is the Azure AI Search Hybrid Retrieval? Explain Vector Embedding.

Azure AI Search Hybrid Retrieval is a feature of Azure AI Search that allows you to formulate hybrid queries that execute in parallel. It enables vector fields containing embeddings to live alongside textual and numerical fields. This means you can take advantage of existing functionality like **filtering, faceting, sorting, scoring profiles, and semantic ranking** in a single search request.

A hybrid query combines full text search and vector search. The search engine runs full text and vector queries in parallel. All matches are evaluated for relevance using Reciprocal Rank Fusion (RRF) and a single result set is returned in the response.

Vector Embedding is a way of **representing data as points** in **n-dimensional space** so that similar data points cluster together. Vector embeddings are numerical representations of data that capture semantic relationships and similarities. This makes it possible to perform mathematical operations and comparisons on the data for various tasks like text analysis and recommendation systems.

A vector embedding has ability to represent a piece of data as a mathematical equation. This representation makes it possible to translate semantic similarity as perceived by humans to proximity in a vector space. In other words, when we represent real-world objects and concepts such as images, audio recordings, news articles, user profiles, weather patterns, and political views as vector embeddings, the semantic similarity of these objects and concepts can be quantified by how close they are to each other as points in vector spaces.

Reference:

➢ Nathan Crone (22nd Aug 2023) "**Vector Embedding 101: The New Building Blocks for Generative AI**" Available at: https://medium.com/kx-systems/vector-embedding-101-the-new-building-blocks-for-generative-ai-a5f598a806ba

➢ Alec Berntson (18th Jul 2023) "**Azure AI Search: Outperforming vector search with hybrid retrieval and ranking capabilities**" Available at: https://techcommunity.microsoft.com/t5/ai-azure-ai-services-blog/azure-ai-search-outperforming-vector-search-with-hybrid/ba-p/3929167

Explain the fundamentals of Responsible GenAI?

Responsible Generative AI (GenAI) is implementing generative AI solutions in a way that minimizes the risk of harmful content generation. It involves developing an overall process for responsible generative AI solution development.

Fundamentals of Responsible GenAI include:

➢ **Identifying and Prioritizing Potential Harms**: This involves understanding the potential risks and harms that could arise from the use of a generative AI solution.

➢ **Measuring the Presence of Harms**: It's important to have mechanisms in place to measure the presence of harms in a generative AI solution.

> ➢ **Mitigating Harms**: Once potential harms are identified, steps should be taken to mitigate these harms.
> ➢ **Deploy and Operate a Generative AI Solution Responsibly**: Includes considering the ethical implications of deploying the AI solution and ensuring that it is used responsibly.

Reference:

> ➢ Microsoft AI Certification (29th Feb 2024) "**AI 900 Certification**" Certification Available at: https://learn.microsoft.com/api/credentials/share/en-us/ArunkumarBalaraman-8966/F5A3D0C0E5C8E3A6?sharingId=775FA5C9DD7AF454

> ➢ Microsoft Learn (no.date.) "**Fundamentals of Responsible Generative AI**" Available at: https://learn.microsoft.com/en-us/training/modules/responsible-generative-ai/

Part II - Advanced Intelligent Systems

Find an advanced intelligent system and provide a comprehensive overview of the system. You need the to discuss the problem and why do we need to use the system to solve the proposed problem (500 words)

Advanced Intelligent system:

Advanced intelligent systems are comprehensive solutions that amalgamate various facets of artificial intelligence (AI). This includes machine learning, natural language processing, robotics, and data analytics. Their primary function is to automate and enrich decision-making processes. These systems are proficient in handling and examining extensive data from a multitude of sources, proving to be crucial in intricate scenarios where traditional techniques might not suffice. Azure AI services often encompass features for perception, comprehension, action, and learning. This allows them to continually enhance their performance without the necessity for human intervention.

Problem

Healthcare supply chains are difficult to manage. They have many different items, each with its own rules for handling, storage, and use. Old systems often use manual processes that take a lot of time and can make mistakes. These mistakes can cause problems like delays in medical procedures, higher costs, and even harm to patient care because of missing or mismanaged supplies.

Solution: Multimodal AI System

To solve these problems, the advanced intelligent system could fit in to solve the problem that uses chat, voice, and image search. This system uses different types of inputs to make inventory management easier, improve interactions with users, and make better decisions.

Chat Interface:

The chat interface lets staff talk to the system using text. They can ask about inventory levels, ask for supplies, and get updates about stock or problems. This gives staff a fast and easy way to manage and watch inventory without interrupting their work. It can work with existing hospital communication platforms to make sure users have a smooth experience.

Voice Recognition:

The voice recognition feature lets users talk to the system without using their hands. This is very useful in places where staff can't touch a device (like during surgeries or when handling clean equipment). This makes the system easier to use and more convenient, letting staff give verbal commands to quickly check stock levels, find items, or update inventory records. This is very important in urgent situations where time is very important.

Image Search:

The image search feature uses computer vision to identify items from pictures. Staff can take pictures of items to check if they are in stock or to find similar items when substitutes are needed. This reduces mistakes in choosing items, especially for items that look different or when barcodes are damaged or missing. It also helps in checking the condition of items when they are used.

AI Techniques and System Integration:

The system uses several AI techniques to process and analyse the data collected from chat, voice, and image inputs. Natural Language Processing (NLP) is used in both chat and voice interfaces to understand and process user questions and commands. Machine Learning (ML) looks at usage patterns and inventory levels to predict stock needs, automate reordering, and suggest ways to optimize inventory. Computer Vision uses image recognition algorithms to accurately identify and categorize items based on visual data.

These AI services are combined into a system that manages data flow and decision-making processes. Inputs from chat, voice, and images are collected and turned into structured data. The AI analyses the data to understand context, pull out relevant information, and make decisions. The system updates inventory records, sends notifications, and provides analytics, all accessible through a central dashboard.

By using a **multimodal AI system** in the healthcare supply chain, facilities can greatly improve the efficiency and accuracy of their inventory management. This not only lowers operational costs but also makes sure that medical professionals have the right supplies at the right time, leading to better patient care. This would be a big step forward in operational efficiency and service delivery in the **healthcare sector**.
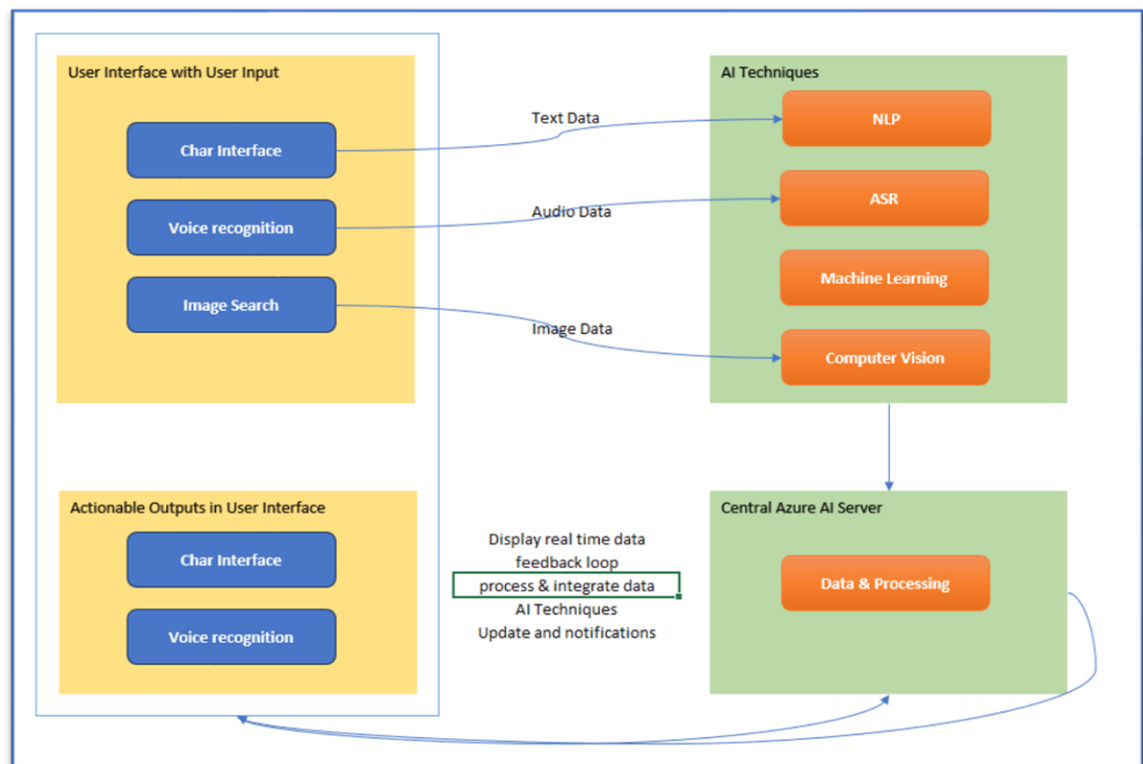
You need to explain the details of the system (the diagram or flowchart) and discuss how the system is working, the input data, the AI techniques, how AI services are working together as a system.

Advanced intelligent system flow diagram created for healthcare supply chain management.

Data Inputs:

- **Chat Interface:** Staff can type messages to check stock, order supplies, and get updates.
- **Voice Recognition:** Staff can speak commands to the system, useful when they can't use their hands.
- **Image Search:** Staff can use pictures to identify and check the availability of items.

AI Processing:

- ➢ **Natural Language Processing (NLP):** Helps the system understand and respond to text and voice inputs.
- ➢ **Machine Learning (ML):** Predicts what supplies will be needed and suggests inventory changes.
- ➢ **Computer Vision:** Recognizes and categorizes items from images.

Actionable Outputs:

- ➢ **Inventory Updates:** The system keeps track of stock levels and orders new supplies as needed.
- ➢ **Alerts & Notifications:** Staff are informed about stock issues or updates.

User Interface Dashboard:

A user interface screen where staff can see all the information and controls for managing supplies.

This system uses AI to automate and improve decisions in managing healthcare supplies. It handles tons of data from different sources, making it very useful in complex situations where old methods aren't enough. The system gets better over time, learning from the data it processes, which helps ensure that healthcare professionals have the right supplies when they need them, improving patient care and saving money. This is a big improvement in how healthcare facilities operate.

References:

- ✦ Microsoft AI Certification (29th Feb 2024) "AI 900 Certification" Certification Available at: https://learn.microsoft.com/api/credentials/share/en-us/ArunkumarBalaraman-8966/F5A3D0C0E5C8E3A6?sharingId=775FA5C9DD7AF454

- Microsoft Learn (no.date.) "Fundamentals of Responsible Generative AI" Available at: https://learn.microsoft.com/en-us/training/modules/responsible-generative-ai/

- Nathan Crone (22nd Aug 2023) "Vector Embedding 101: The New Building Blocks for Generative AI" Available at: https://medium.com/kx-systems/vector-embedding-101-the-new-building-blocks-for-generative-ai-a5f598a806ba

- Alec Berntson (18th Jul 2023) "Azure AI Search: Outperforming vector search with hybrid retrieval and ranking capabilities" Available at: https://techcommunity.microsoft.com/t5/ai-azure-ai-services-blog/azure-ai-search-outperforming-vector-search-with-hybrid/ba-p/3929167

- Michelle Sandford. (14th April 2024). Training on AI Technologies & Microsoft Open AI. Available at: https://olympus.mygreatlearning.com/mentorship_recordings/2328800

- Microsoft Learn (no.date.) "Retrieval Augmented Generation (RAG) in Azure AI Search" Available at: https://learn.microsoft.com/en-us/azure/search/retrieval-augmented-generation-overview

- Microsoft Learn (no.date.) "Quickstart: Generate images with Azure OpenAI Service" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/dall-e-quickstart?tabs=dalle3%2Ccommand-line&pivots=programming-language-studio

- Microsoft Learn (no.date.) "Learn how to work with the DALL-E models" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/how-to/dall-e?tabs=dalle3

- OpenAI (no.date) "DALL·E 2" Available at: https://openai.com/dall-e-2

- Microsoft Learn (no.date.) "What is Azure OpenAI Service?" Available at: https://learn.microsoft.com/en-us/azure/ai-services/openai/overview

- Microsoft Learn (no.date.) "Generate code with Azure OpenAI Service" Available at: https://learn.microsoft.com/en-us/training/modules/generate-code-azure-openai/

- Tanujareddy Maligireddy (12th Oct 2023) "Prompt Generation for Meta Prompting: A Deep Dive" Available at: https://medium.com/@tanujareddy.maligireddy/prompt-generation-for-meta-prompting-a-deep-dive-15ecbcd20138

- Geeksforgeeks (08th Jan 2024) "Few shot and Zero Learning" Available at: https://www.geeksforgeeks.org/few-shot-learning-in-machine-learning/

- Great learning (2024) "**Week 7 - Advanced intelligent systems**" Available at: https://olympus.mygreatlearning.com/courses/109553

- Akshita (18th Feb 2024) "Implement Adaptability and Performance of Large Language Models (LLMs): Why Zero, One, and Few-Shot Learning?" Available at: https://medium.com/@ak_12/implement-adaptability-and-performance-of-large-language-models-llms-why-zero-one-and-few-shot-0d4e12db3332

- Microsoft AI Tour (no.date.) "Tokenization" Available at: https://microsoft.github.io/Workshop-Interact-with-OpenAI-models/tokenization/