Name: Tanmay Singhania
Class: TT-AIML
Roll No.: 51

Disadvantages of Cognitive Computing

Limitations

→ Large data sets
→ Limited interpretability
→ Lack of transparency
→ Limited generalization
→ Dependence on quality data

Challenges

→ Integration with legacy systems
→ Cost and resource constraints
→ Technical complexity
→ Maintaining models

Uncertainties

→ Unknown long-term effects
→ Incomplete knowledge
→ Limited control over outcomes
→ Unforeseen consequences

Ethical Concerns

→ Bias and discrimination
→ Privacy concerns
→ Security risks
→ Job displacement
→ Socioeconomic impacts

Regulatory Issues

→ Lack of regulation
→ Unclear legal liabilities
→ Intellectual property rights
→ Compliance challenges

Misuse

→ Misuse of data
→ Abuse of power
→ Potential for harm
→ Threats to democracy

How Cognitive Computing Works?

- **Input:** Cognitive computing starts with an input in the form of structured or unstructured data. This can come from various sources such as sensors, social media, or other data feeds.
- **Data Preprocessing:** The input data is preprocessed, which involves cleaning, filtering, and organizing the data to make it usable for analysis.
- **Natural Language Processing (NLP):** NLP is used to process unstructured data such as text, audio, or images. It involves tasks such as language translation, sentiment analysis, and speech recognition.
- **Machine Learning (ML):** ML is used to train models on the input data. This involves feeding the data into an algorithm that can identify patterns and make predictions.
- **Deep Learning (DL):** DL is a subset of ML that involves training deep neural networks. This can be used for more complex tasks such as image or speech recognition.
- **Reasoning and Inference:** Cognitive computing systems use reasoning and inference to draw conclusions based on the data and the models that have been trained.
- **Decision Making:** Cognitive computing systems can make decisions based on the output of the models and the reasoning and inference that has been performed.
- **Feedback:** Cognitive computing systems can provide feedback based on the decisions that have been made. This feedback can be used to improve the models and the overall performance of the system.
- **Human Interaction:** Cognitive computing systems can interact with humans through natural language interfaces, chatbots, or other forms of communication.
- **Learning and Adaptation:** Cognitive computing systems can learn and adapt over time based on the feedback they receive and the new data they encounter.

Different Attributes of Cognitive Computing

Adaptive

→ Systems must be flexible enough to learn as information changes and goals evolve.
→ Must adjust as data and environment change in real-time.

Interactive

→ Human-computer interaction is a critical component in cognitive systems.
→ Users must be able to interact with cognitive machines and define their needs.
→ The technologies must be able to interact with other processors, devices, and cloud platforms.

Iterative and Stateful

→ Cognitive computing technologies can ask questions and pull in additional data to identify or clarify a problem.
→ They must keep information about similar situations that have previously occurred.

Contextual

→ Understanding context is critical in thought processes.
→ Cognitive systems must understand, identify and mine contextual data.
→ Must draw on multiple sources of information, including structured and unstructured data and visual, auditory, and sensor data.
→ Identify syntax, time, location, domain, requirements, user's profile, tasks, and goals.

Limitations of Cognitive Computing

Technical Limitations
→ Limitations related to hardware, software, and data that can impact the performance of cognitive computing systems.
Hardware Limitations
→ The power and speed of the hardware can limit the performance of cognitive computing systems.
→ Hardware limitations can impact the accuracy and reliability of the results produced by cognitive systems.
Software Limitations
→ The accuracy and effectiveness of cognitive systems can be limited by the software that powers them.
→ Software limitations can impact the ability of cognitive systems to adapt and learn as new information becomes available.
Data Limitations
→ Cognitive systems rely on data to learn and make decisions.
→ Poor quality or limited data can limit the performance and effectiveness of cognitive systems.
Security
→ The use of cognitive systems to process sensitive data can raise concerns about security.
Human Factors
→ Limitations related to human factors, such as user experience, training, and acceptance, can impact the adoption and effectiveness of cognitive computing systems.
User Experience
→ The usability and accessibility of cognitive systems can impact their effectiveness.
Training
→ The complexity of cognitive systems can require specialized training for users, which can limit adoption.
Acceptance
→ Cultural and organizational factors can impact the adoption and acceptance of cognitive systems.

Role of NLP in Cognitive Computing

Understanding Human Language

→ NLP is used to help cognitive systems understand human language and meaning.

Sentiment Analysis

→ NLP can help cognitive systems analyze the sentiment of text or speech.
→ This can help identify the emotion behind communication and provide insights into how people feel about a particular topic or product.

Topic Modeling

→ NLP can help cognitive systems identify topics within text or speech.
→ This can help organize and categorize large volumes of data.

Named Entity Recognition

→ NLP can help cognitive systems identify and extract important information from text or speech.
→ This can include names of people, places, and organizations.

Natural Language Generation

→ NLP can be used to generate natural language responses to questions or prompts.

Speech Recognition

→ NLP can be used to help cognitive systems understand spoken language.

Explain Visualization Services

- Visualization services in cognitive computing are used to present and interact with large and complex data sets processed by cognitive computing systems.
- Cognitive computing systems simulate human thought processes, such as learning, reasoning, and decision-making, using technologies such as machine learning, natural language processing, and computer vision.
- Visualization services address the challenge of making the insights generated by cognitive computing systems more accessible and understandable by presenting them in a visual format, such as graphs, charts, and heatmaps.
- These services help users explore the data and gain a deeper understanding of the relationships between different variables.
- Visualization services can be used for various purposes, such as sentiment analysis, to understand the overall sentiment of a particular group of people towards a specific product or topic.
- Overall, visualization services play a critical role in cognitive computing by making the insights generated by these systems more actionable and understandable to a wider range of users.

What are Ontologies?

→ An ontology is a formal representation of knowledge or concepts within a domain.
→ In cognitive computing, ontologies are used to model the knowledge or concepts that a system needs to understand and reason about a particular domain.
→ Ontologies can help cognitive computing systems understand the relationships between different concepts within a domain and reason about them.
→ Ontologies can be created manually by subject matter experts or automatically through machine learning algorithms.
→ Ontologies can be used in various applications, such as natural language processing, knowledge representation, and decision-making systems.
→ Some challenges with ontologies in cognitive computing include maintaining and updating them as knowledge evolves and ensuring their accuracy and consistency.

What is Deep Learning?

- Deep learning is a subfield of machine learning that involves training neural networks with many layers to solve complex problems. It is used in a wide range of applications, such as computer vision, natural language processing, and robotics.

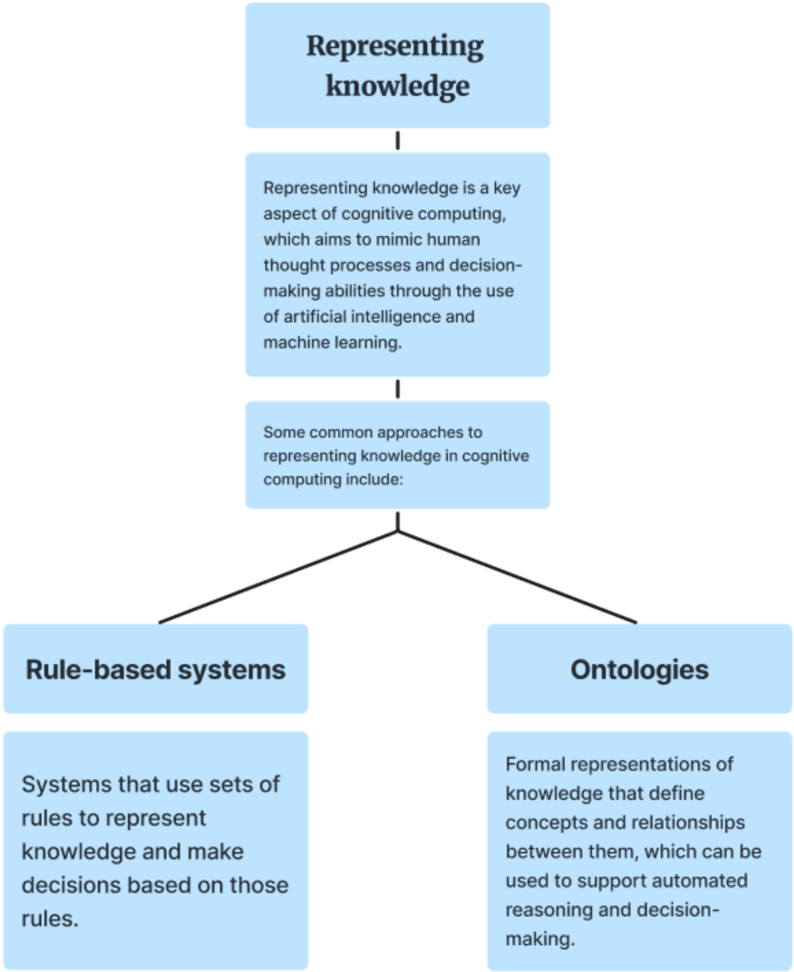
1. **Neural Networks:** Deep learning is based on neural networks, which are mathematical models that are inspired by the structure and function of the human brain. A neural network consists of many interconnected nodes or neurons, which process and transmit information.
2. **Layers:** A neural network consists of multiple layers, each of which processes input data in a different way. The first layer is the input layer, which receives the input data. The final layer is the output layer, which produces the output.
3. **Activation Functions:** Each neuron in a neural network applies an activation function to its input, which determines its output. Common activation functions include the sigmoid, tanh, and ReLU functions.
4. **Backpropagation:** Deep learning involves training a neural network by adjusting its weights and biases based on the error between the predicted output and the actual output. This is done using a technique called backpropagation, which involves propagating the error backwards through the network to update the weights.
5. **Gradient Descent:** The weights of a neural network are updated using a technique called gradient descent, which involves calculating the gradient of the error with respect to each weight and then adjusting the weight in the direction of the negative gradient.
6. **Overfitting:** Deep learning models can be prone to overfitting, which occurs when a model performs well on the training data but poorly on new data. To avoid overfitting, techniques such as regularization, dropout, and early stopping can be used.
7. **Deep Learning Frameworks:** There are many deep learning frameworks available, including TensorFlow, Keras, PyTorch, and Caffe. These frameworks provide high-level APIs for building and training neural networks, as well as low-level APIs for customizing and optimizing the network.
8. **Applications:** Deep learning has many applications in fields such as computer vision, natural language processing, speech recognition, and robotics. Some examples include image classification, object detection, machine translation, and autonomous driving.

Prabhat Shukla
TT AI ML 47

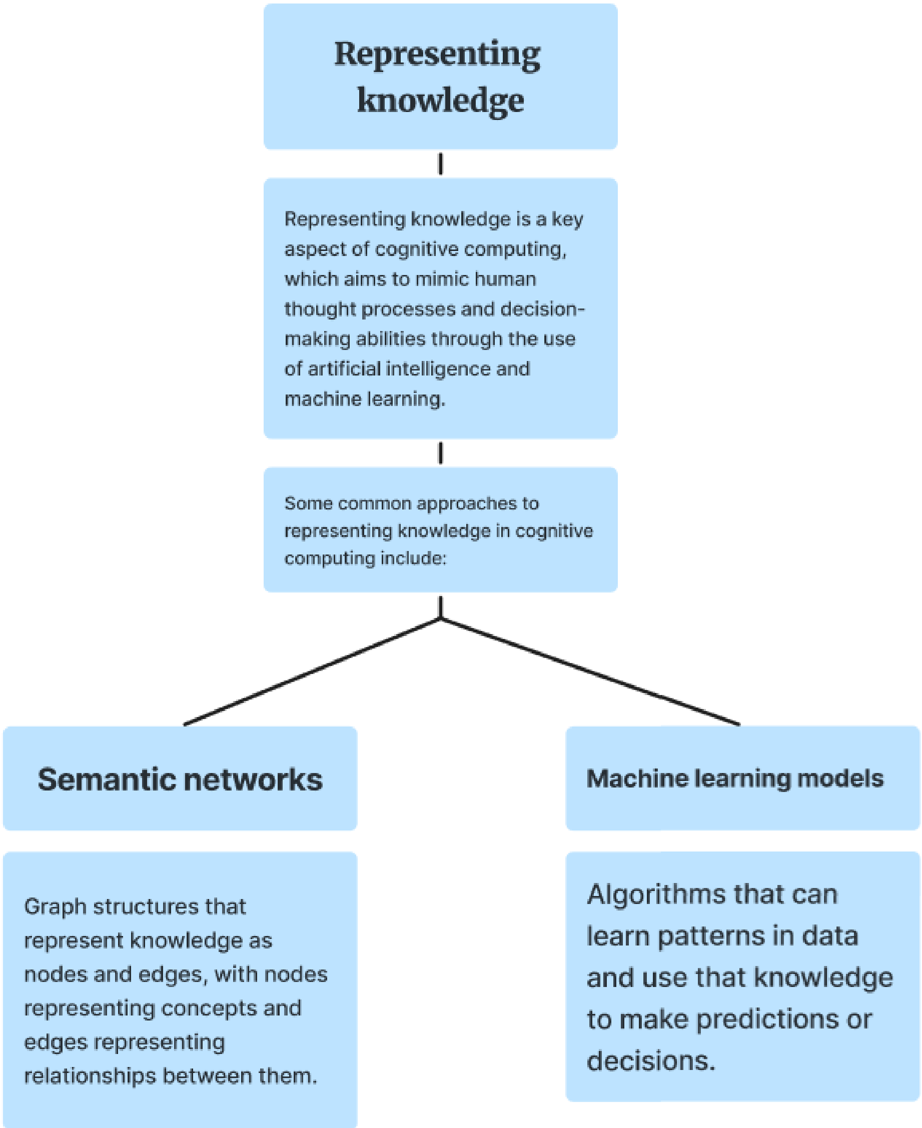
What is corpus in CC	**What is Machine Learning**
A corpus in cognitive computing refers to a collection of texts or data used for training and evaluating natural language processing (NLP) models. It includes diverse documents like books, articles, and websites, and is essential for NLP tasks such as language modeling, sentiment analysis, and entity recognition, providing the foundation for machine learning algorithms to understand and process human language.	Machine learning is a subset of artificial intelligence (AI) that involves the use of algorithms and statistical models to enable computers to learn from data and make predictions or decisions without being explicitly programmed. It involves training a model with data and allowing it to identify patterns and relationships within the data to make autonomous decisions or predictions.
Applications of ML	**Different algorithms in ML**
Applications of machine learning (ML) include image and speech recognition, recommendation systems, fraud detection, predictive maintenance, medical diagnosis, autonomous vehicles, financial forecasting, natural language processing, and personalized marketing. ML algorithms are used to analyze data and make predictions or decisions, enabling automation and optimization in various domains across industries.	Linear Regression, Decision Trees, Support Vector Machines (SVM), Random Forests, k-Nearest Neighbors (k-NN), Neural Networks, Clustering Algorithms (e.g., k-Means, DBSCAN, Hierarchical Clustering) are popular machine learning algorithms used for tasks such as prediction, classification, regression, anomaly detection, and data grouping. These algorithms leverage mathematical and statistical techniques to learn patterns and relationships from data, enabling automated decision-making and prediction capabilities in various domains.

Prabhat Shukla
TT AI ML 47

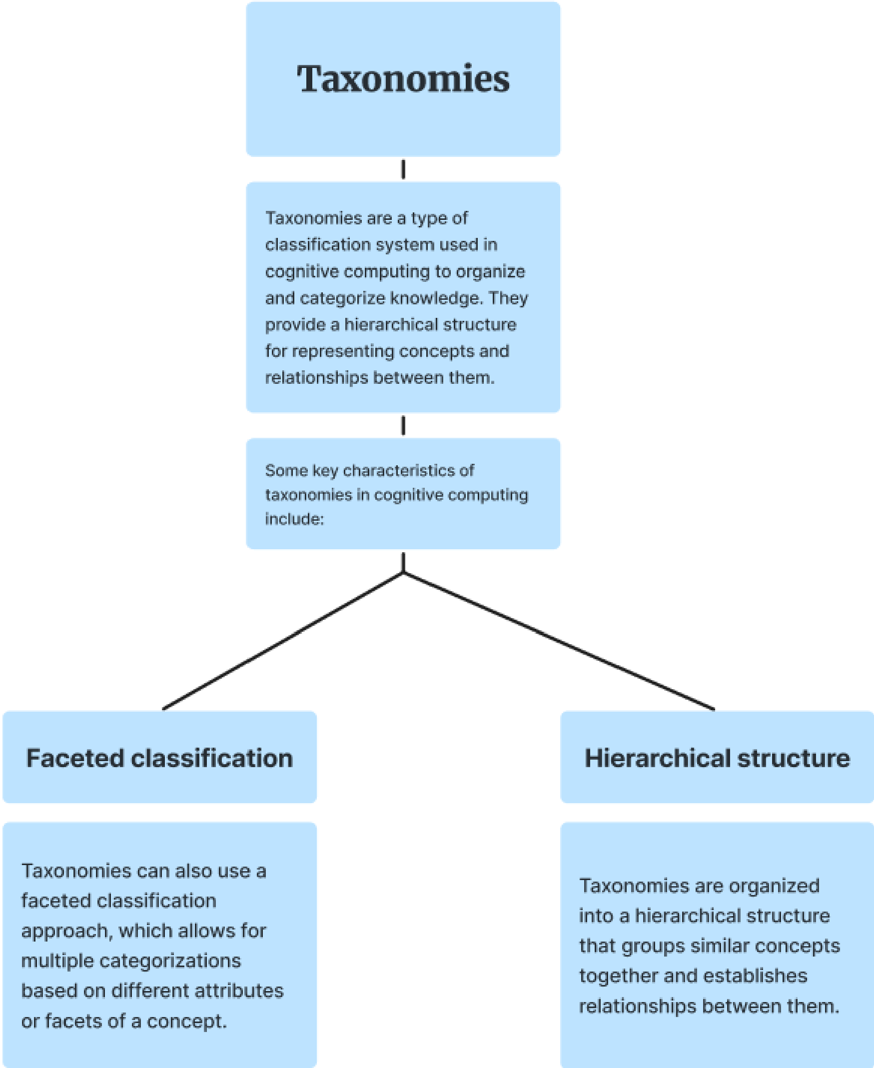
What is scoring in CC	**What is hypothesis generation**
Scoring in cognitive computing refers to the process of evaluating or assigning a score or measure to data or results generated by cognitive computing models. It can involve quantifying the performance, accuracy, or relevance of outputs from tasks such as natural language processing, image recognition, or recommendation systems. Scoring is crucial for assessing the effectiveness and quality of cognitive computing models and their outputs.	Hypothesis generation in cognitive computing refers to the process of proposing or generating potential explanations or predictions based on data analysis and pattern recognition. It involves formulating hypotheses or conjectures about the relationships or patterns within the data, which can then be further tested or validated using statistical methods or domain expertise. Hypothesis generation is an important step in the analytical process to generate insights and make informed decisions in cognitive computing applications.
What is visualization	**How AI is used in CC**
Visualization is the use of graphical representations, such as charts, graphs, or maps, to visually display data or information. It helps to convey complex data in a more understandable and accessible format, enabling users to interpret and derive insights from the visual representations of data.	AI is used in cognitive computing to enable machines to mimic human cognitive processes. Techniques like machine learning, natural language processing, and computer vision are used to process data, make predictions, generate insights, and automate decision-making in domains such as healthcare, finance, marketing, and more.

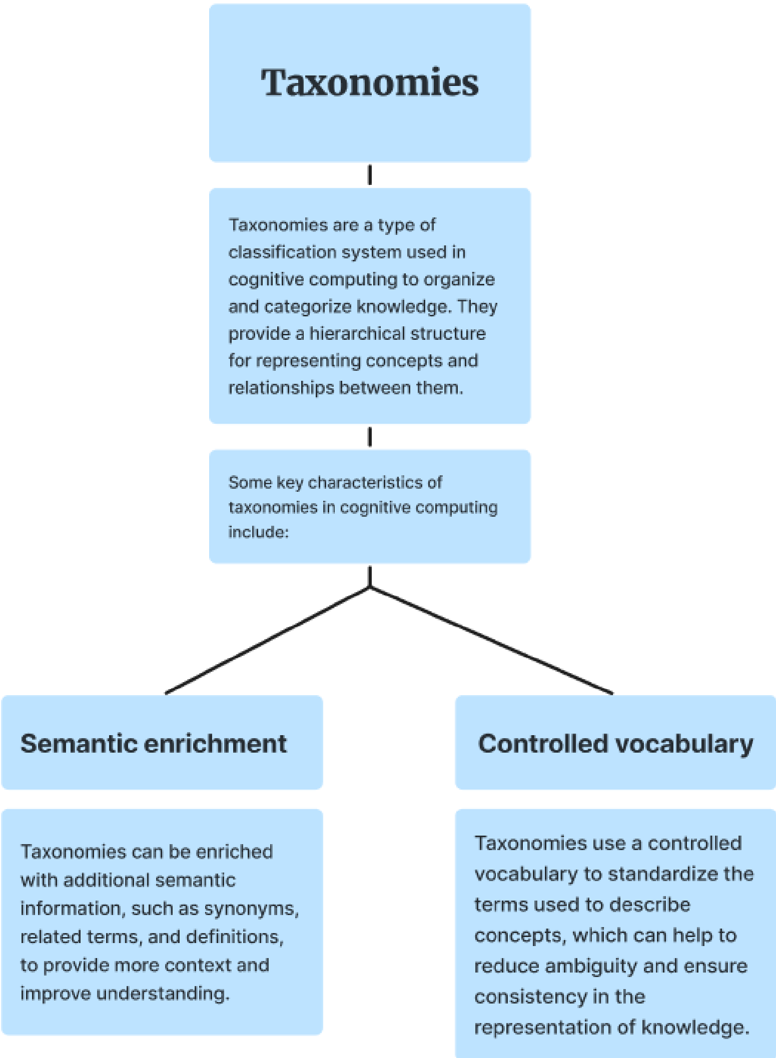


Representing knowledge
Representing knowledge is a key aspect of cognitive computing, which aims to mimic human thought processes and decision-making abilities through the use of artificial intelligence and machine learning.
Some common approaches to representing knowledge in cognitive computing include:
Rule-based systems
Systems that use sets of rules to represent knowledge and make decisions based on those rules.
Ontologies
Formal representations of knowledge that define concepts and relationships between them, which can be used to support automated reasoning and decision-making.



Representing knowledge
Representing knowledge is a key aspect of cognitive computing, which aims to mimic human thought processes and decision-making abilities through the use of artificial intelligence and machine learning.
Some common approaches to representing knowledge in cognitive computing include:
Semantic networks
Graph structures that represent knowledge as nodes and edges, with nodes representing concepts and edges representing relationships between them.
Machine learning models
Algorithms that can learn patterns in data and use that knowledge to make predictions or decisions.


Taxonomies
Taxonomies are a type of classification system used in cognitive computing to organize and categorize knowledge. They provide a hierarchical structure for representing concepts and relationships between them.
Some key characteristics of taxonomies in cognitive computing include:
Faceted classification
Taxonomies can also use a faceted classification approach, which allows for multiple categorizations based on different attributes or facets of a concept.
Hierarchical structure
Taxonomies are organized into a hierarchical structure that groups similar concepts together and establishes relationships between them.


Taxonomies
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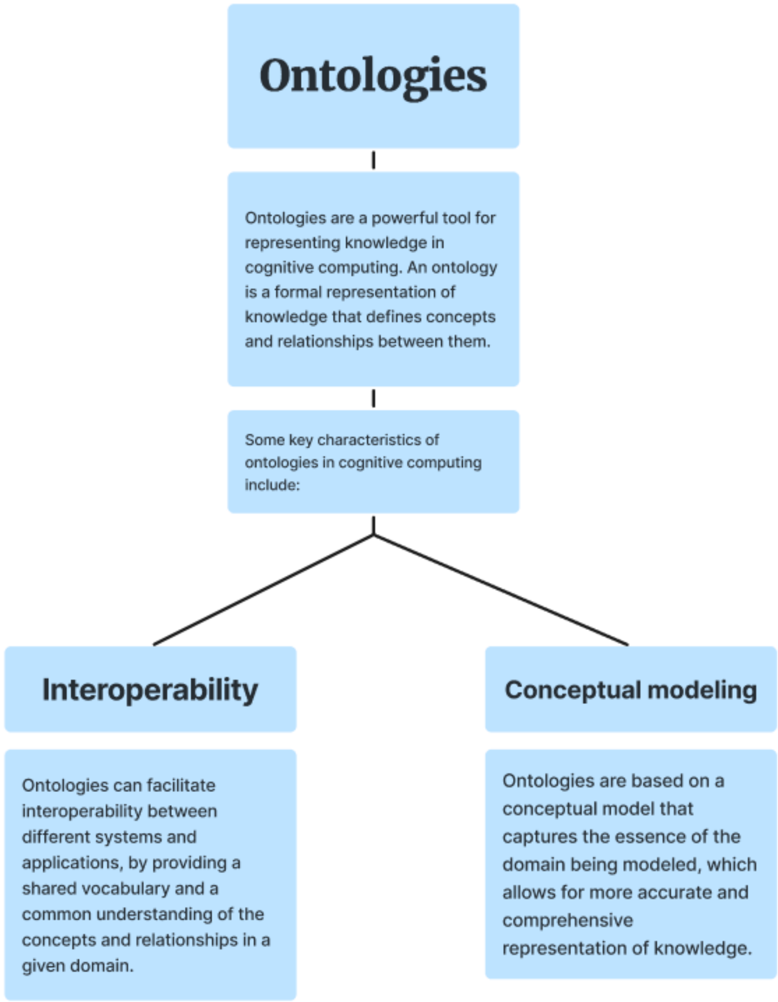
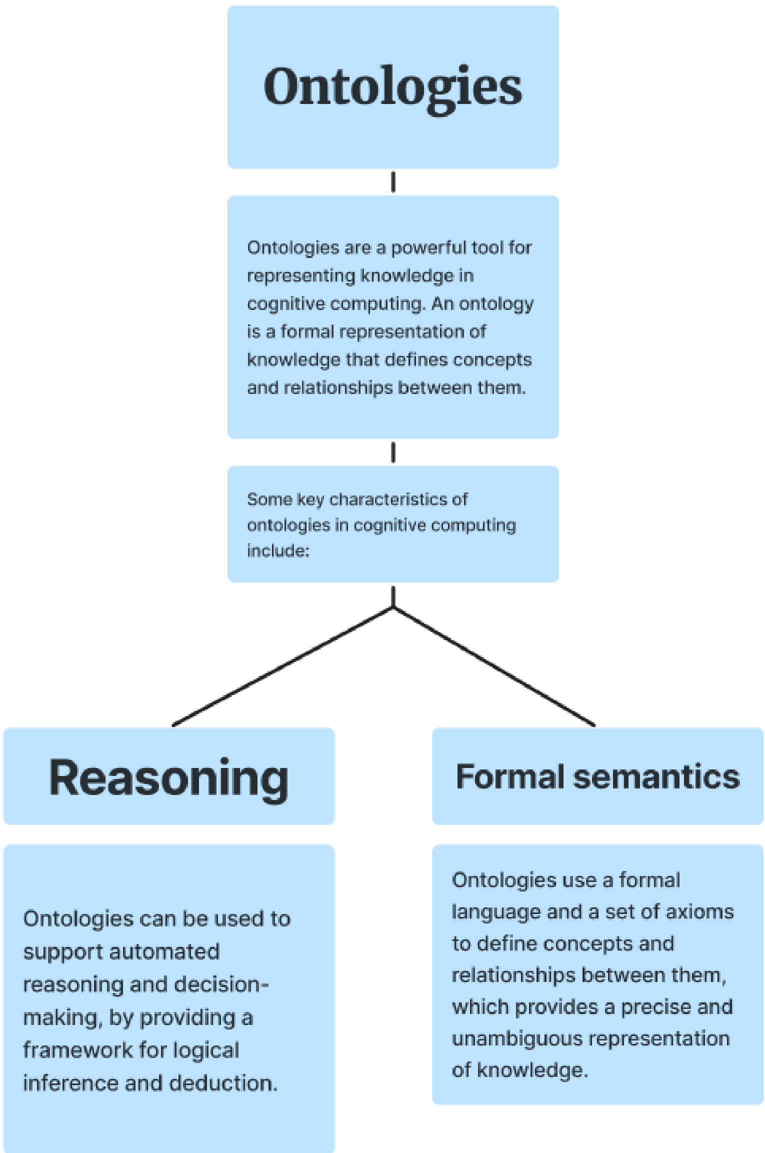
Semantic enrichment
Taxonomies can be enriched with additional semantic information, such as synonyms, related terms, and definitions, to provide more context and improve understanding.
Controlled vocabulary
Taxonomies use a controlled vocabulary to standardize the terms used to describe concepts, which can help to reduce ambiguity and ensure consistency in the representation of knowledge.


Ontologies
Ontologies are a powerful tool for representing knowledge in cognitive computing. An ontology is a formal representation of knowledge that defines concepts and relationships between them.
Some key characteristics of ontologies in cognitive computing include:
Interoperability
Ontologies can facilitate interoperability between different systems and applications, by providing a shared vocabulary and a common understanding of the concepts and relationships in a given domain.
Conceptual modeling
Ontologies are based on a conceptual model that captures the essence of the domain being modeled, which allows for more accurate and comprehensive representation of knowledge.


Ontologies
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Some key characteristics of ontologies in cognitive computing include:
Reasoning
Ontologies can be used to support automated reasoning and decision-making, by providing a framework for logical inference and deduction.
Formal semantics
Ontologies use a formal language and a set of axioms to define concepts and relationships between them, which provides a precise and unambiguous representation of knowledge.

Models for knowledge representation

Models for knowledge representation are an essential component of cognitive computing systems. Knowledge representation models are used to capture and organize complex information in a format that can be processed by computers.

There are several models for knowledge representation used in cognitive computing systems, including:

Frames

Frames are used to represent complex concepts and the relationships between them. A frame is composed of attributes that define the properties of a concept, and slots that define the relationships between the concept and other concepts.

Connectionist models

Connectionist models, such as neural networks, are used to represent knowledge by simulating the way the human brain processes information.

Models for knowledge representation

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Ontologies

An ontology is a formal representation of knowledge that defines concepts and relationships between them. Ontologies are used to provide a shared vocabulary and a common understanding of concepts in a particular domain.

Semantic networks

A semantic network is a type of knowledge representation model that represents relationships between concepts in a graphical format. The nodes in the graph represent concepts.

Name: Mehul Sarda
Branch: TT AIML
Roll No. 41

MARCH REMEDIAL

Data Catalogs

A data catalog is a centralized repository that provides a comprehensive inventory of all data assets within an organization. It acts as a directory for locating, managing, and sharing data assets across different teams and departments.

Data catalogs contain metadata about datasets, such as their names, descriptions, formats, owners, and access permissions. By using a data catalog, organizations can improve data governance, reduce data redundancy, enhance data discovery, and facilitate collaboration among teams.

Taxonomies

Taxonomies are hierarchical frameworks used to classify and organize information based on predefined categories. Taxonomies are used in various fields, such as biology, library science, and information management. In the context of data management, taxonomies are used to organize data assets based on their attributes, properties, or relationships.

Taxonomies can improve data discoverability, facilitate data retrieval, and enhance data quality. For example, a taxonomy can be used to categorize different types of products in an e-commerce website.

Multiple hypothesis generator

The multiple hypothesis generator (MHG) is a data analysis technique that generates multiple hypotheses about the underlying structure or patterns in a dataset. The MHG is used in exploratory data analysis to generate hypotheses that can be tested using statistical methods or machine learning algorithms.

The MHG works by iteratively applying statistical or machine learning algorithms to a dataset and generating multiple hypotheses based on the output of these algorithms. By generating multiple hypotheses, the MHG increases the chances of identifying significant patterns in the data.

Distributed data management

Distributed data management refers to the practice of managing data across multiple computing nodes or clusters. In distributed data management, data is stored and processed across multiple machines to improve scalability, performance, and fault tolerance.

Distributed data management is commonly used in big data applications, where the volume of data exceeds the capacity of a single machine. Distributed data management requires specialized tools and technologies, such as distributed databases, distributed file systems, and distributed computing frameworks, such as Apache Hadoop

Parallelism

Parallelism refers to the technique of breaking down a task into smaller sub-tasks that can be executed simultaneously across multiple computing resources. Parallelism is used to improve the performance and efficiency of computing systems, particularly in applications that require high computational power, such as scientific simulations, machine learning, and data analytics.

Parallelism can be achieved through various techniques, such as multi-threading, multi-processing, and distributed computing. Parallelism requires careful design and optimization to avoid issues such as race conditions, deadlocks, and resource contention.

Semi-Supervised learning

Semi-supervised learning is a machine learning technique that combines labeled and unlabeled data to improve the accuracy of a model. In semi-supervised learning, a small portion of the training data is labeled, while the rest is unlabeled. The labeled data is used to train a model, while the unlabeled data is used to improve the model's generalization ability.

Semi-supervised learning is used in situations where labeling data is expensive or time-consuming, or when the labeled data is insufficient for training a high-performing model. Semi-supervised learning has applications in various fields, such as natural language processing, computer vision, and speech recognition.

Name: Aryan Singh
Branch: TT AI&ML
Roll no: 49

MARCH REMEDIAL

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<td>RL in finance

In finance, RL can be used for a wide range of tasks, including algorithmic trading, portfolio optimization, risk management, fraud detection, and more.

One example of how RL can be used in finance is for algorithmic trading. An RL agent can be trained to learn from historical price data and make decisions on buying or selling stocks based on the current market conditions.

Another use case of RL in finance is for portfolio optimization. An RL agent can be trained to select the optimal mix of assets for a portfolio, based on historical data and other relevant factors such as risk tolerance and investment goals</td>
<td>Use cases for RL in finance

Algorithmic Trading:
RL can be used to train an agent to make buy or sell decisions based on market data. The agent learns from historical data, patterns and can take different actions and evaluate which action results in the highest reward.

Risk Management:
RL can be used for managing risk in financial institutions. An RL agent can be trained to monitor different risks such as market risk, credit risk, operational risk, and fraud.

Pricing:
RL can be used for dynamic pricing in financial markets. The agent can learn from historical data, market trends, and other relevant factors to determine the optimal price for financial products such as stocks, bonds, and options.</td>
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<td>Advantages of CC over AI

Scalability: Cloud computing provides the ability to scale up or down resources as needed, which can be beneficial for AI applications that require significant computing power.
Cost-Effective: Cloud computing can be more cost-effective than building and maintaining an in-house infrastructure for AI applications, as it allows organizations to pay only for the resources they use.
Accessibility: Cloud computing allows users to access AI applications from anywhere and at any time, as long as they have an internet connection.
Security: Cloud providers invest heavily in security measures and compliance standards, which can help protect sensitive data and reduce the risk of security breaches.</td>
<td>What is Data Modelling?

Data modeling is the process of creating a conceptual or logical representation of data and its relationships to other data elements. The goal of data modeling is to create a structured and organized view of data, which can be used to support various business processes and applications.

Types: conceptual and logical.

Conceptual data modeling is a high-level representation of data and its relationships, without taking into account the technical details of how the data will be implemented in a database or system.

Logical data modeling, on the other hand, is a more detailed representation of data and its relationships, taking into account the technical aspects of how the data will be stored and processed in a database or system. It often involves the use of a data modeling notation or language, such as the Entity-Relationship (ER) model or Unified Modeling Language (UML).</td>
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NLP in Business Problems

- NLP is a set of techniques that extract meaning from text.
- Determine the meaning of a word, phrase, sentence, or document by recognizing the grammatical rules—the predictable patterns within a language.
- NLP applies the same known rules and patterns to make inferences about meaning in a text document.

~ Nidhi Worah, AI&ML 60

Techniques to solve Business Practices in Cognitive Computing

Sentiment Analysis

Analyse customer feedback and reviews.

Chatbots

Understand and respond to customer queries

Text Classification

Classify text into predefined categories

~ Nidhi Worah, AI&ML 60

Sentiment Analysis

- Sentiment Analysis can be used to analyze customer feedback and reviews to understand their sentiment towards a product or service.
- These techniques are used to analyze and extract subjective information from text data, such as customer reviews, social media posts, news articles, comments, etc.
- This helps businesses to deduce insights from the reviews and identify areas of improvement
- Further, the respective teams form strategies to satisfy the customer needs and create a brand name.

~ Nidhi Worah, AI&ML 60

Chatbots

- Chatbots are AI programs that can simulate a human conversation.
- They can be integrated into cognitive computing systems to automate customer service and support, sales and marketing, and other business functions
- This helps businesses cater to the needs of the customers efficiently.
- Usually, chatbots are trained with a specific use in mind and the tasks they perform are pre-determined.

~ Nidhi Worah, AI&ML 60

Text Classification

- Text Classification is a NLP technique which is used to automatically classify text into different predefined categories.
- Ex : We can classify customer feedback into categories such as product quality, customer service, and shipping.
- This can help businesses to filter out unwanted messages and focus on important ones.
- Text classification when integrated with Sentiment Analysis helps a business understand the behaviour of the customers well , which inturn drive sales.

~ Nidhi Worah, AI&ML 60

Definition of Streaming Data: Streaming Data refers to data that is continuously generated and sent in real-time from various sources. such as sensors, social media, or other streaming data sources. Streaming data is often used in real-time analytics. machine learning, and other applications that require immediate processing.

Challenges of Streaming Data: Streaming data comes with its own set of challenges. including the high volume. variety, and velocity of data. as well as the need for real-time processing and analysis. These challenges require specialized tools and technologies. such as stream processing engines. to handle the data effectively

Definition of Data in Motion: Data in Motion refers to the continuous flow of data from one point to another in real-time, often over a network. and includes any data that is transmitted, streamed or communicated in real-time.

Types of Data in Motion: There are two types of Data in Motion. which are Push-based and Pull-based data streams. Push-based data streams include data that is automatically pushed from the source to the destination. while pull-based data streams include data that is requested by the destination from the source.

Use Cases for Data in Motion: Data in Motion is used in a variety of industries, including finance, healthcare, retail, and transportation, among others. Some common use cases include fraud detection, real-time inventory management, predictive maintenance, and personalized marketing.

Benefits of Data in Motion: Data in Motion allows businesses to make real-time decisions. improve operational efficiency. and enhance customer experiences. It also enables organizations to capture and analyze data that would be impossible to store and process with traditional methods.