**Introduction:**

Knowledge representation and reasoning are fundamental concepts in the field of artificial intelligence (AI). The ability to represent knowledge in a structured way and reason with that knowledge is essential for developing intelligent systems that can solve complex real-world problems. In this assignment, we will explore the concepts of knowledge representation and reasoning and how they can be applied to real-world problems.

What is Knowledge Representation?

Knowledge representation is the process of organizing knowledge in a structured way that can be understood and processed by intelligent systems. It involves identifying the key concepts, entities, and relationships that are relevant to the problem at hand and representing them in a form that can be easily manipulated by machines. There are various techniques for representing knowledge, including logic-based approaches, semantic networks, and ontologies.

Logic-based approaches use formal logic to represent knowledge, with a set of rules and axioms that define the relationships between different concepts. This approach is often used in expert systems, where a set of rules can be used to make decisions based on input data.

Semantic networks are another approach to knowledge representation, where concepts are represented as nodes in a graph, and relationships between concepts are represented as edges. This approach is useful for representing complex relationships between different concepts, and can be used in natural language processing and other applications.

Ontologies are a more recent approach to knowledge representation, which involves defining a set of concepts and their relationships in a standardized format. This approach is widely used in the web of data and other semantic web applications.

What is Reasoning?

Reasoning is the process of drawing conclusions from the available knowledge. It involves using the knowledge represented in a structured form to make decisions or to answer questions. There are various approaches to reasoning, including deductive reasoning, inductive reasoning, and abductive reasoning.

Deductive reasoning involves using a set of rules or axioms to draw logical conclusions based on the available data. This approach is widely used in expert systems and other applications where the problem domain is well-defined.

Inductive reasoning involves drawing general conclusions based on specific examples or observations. This approach is useful in machine learning and data mining applications, where patterns in the data can be used to make predictions or to identify trends.

Abductive reasoning involves generating hypotheses based on incomplete or uncertain data. This approach is useful in diagnostic systems, where a set of symptoms can be used to generate a list of possible diagnoses.

Implementation on Real World Problem:

Knowledge representation and reasoning have many practical applications in the real world, from healthcare to finance and beyond. One example of how these concepts can be applied is in the field of medical diagnosis.

Medical diagnosis involves using a set of symptoms to identify the underlying disease or condition. By representing medical knowledge in a structured form, such as a set of rules or an ontology, it is possible to automate the process of diagnosis and provide faster and more accurate diagnoses.

For example, a medical expert system could be designed using a set of rules and axioms to represent medical knowledge. The system could then be trained on a dataset of patient records to learn how to make diagnoses based on the available symptoms.

Another example of how knowledge representation and reasoning can be applied is in the field of financial fraud detection. By representing financial transactions in a structured form, such as a semantic network, it is possible to identify patterns of fraudulent behavior and detect fraudulent transactions.

For example, a fraud detection system could be designed using a semantic network to represent financial transactions and their relationships. The system could then use deductive reasoning to identify patterns of fraudulent behavior and generate alerts when suspicious transactions are detected.

Conclusion:

Knowledge representation and reasoning are essential concepts in the field of artificial intelligence, with many practical applications in the real world. By representing knowledge in a structured form and using reasoning to draw conclusions from that knowledge, it is possible to develop intelligent systems that can solve complex problems. From medical

**Introduction**

Knowledge representation and reasoning (KRR) is the branch of artificial intelligence that focuses on how to represent knowledge in a way that can be understood and used by computer programs. In the video game, Detroit: Become Human, KRR plays a significant role in how the game's characters interact with the world around them. In this assignment, we will discuss KRR and how it works in Detroit: Become Human.

Knowledge Representation

Knowledge representation is the process of encoding information in a way that can be understood and processed by a computer program. There are many different ways to represent knowledge, but some common methods include rule-based systems, semantic networks, frames, and ontologies.

In Detroit: Become Human, knowledge representation is used to model the world and the characters within it. Each character has a set of beliefs, goals, and desires that are represented as a network of nodes and edges. For example, the character Markus has a belief that androids should be treated as equals to humans, a goal to lead a peaceful revolution, and a desire to protect his fellow androids.

Reasoning

Reasoning is the process of using knowledge to make inferences and draw conclusions. There are many different types of reasoning, including deductive reasoning, inductive reasoning, and abductive reasoning.

In Detroit: Become Human, reasoning is used to determine the actions of the characters. The game uses a decision tree structure to represent the various choices that the player can make. The decision tree is constructed based on the character's beliefs, goals, and desires, as well as the information that is available to them. For example, if the character Connor has a belief that androids should follow their programming, and he receives information that a deviant android is causing harm, his decision tree may lead him to capture or destroy the deviant android.

Conclusion

In conclusion, knowledge representation and reasoning are essential components of Detroit: Become Human's gameplay. The game's characters are modeled using knowledge representation, and their actions are determined using reasoning. The use of KRR allows for a more immersive gameplay experience, as the player's choices are influenced by the characters' beliefs, goals, and desires. Overall, Detroit: Become Human serves as an excellent example of how KRR can be used in video games to create a more dynamic and engaging experience.

**Introduction:**

Knowledge representation and reasoning is the study of how knowledge is stored, organized, and processed in a computer system. It is a fundamental area of artificial intelligence (AI) that aims to develop methods for representing and reasoning about knowledge in a way that can be understood and used by machines. One of the applications of knowledge representation and reasoning is in the design and development of video games, where it is used to create more realistic and immersive game worlds.

This assignment will explore the topic of knowledge representation and reasoning and how it is used in the video game Detroit: Become Human. Specifically, we will examine the features of knowledge representation and reasoning that are used in the game, how they work, and how they contribute to the overall gaming experience.

Features of Knowledge Representation and Reasoning:

There are several features of knowledge representation and reasoning that are used in Detroit: Become Human. These include:

Symbolic Representation: The game uses symbolic representation to represent the knowledge of the game world, characters, and events. For example, each character in the game is represented as a separate entity with its own set of attributes, such as name, age, occupation, and emotional state.

Rule-based Reasoning: The game uses rule-based reasoning to simulate the behavior and decision-making of characters in the game. This involves the use of logical rules that dictate how characters should behave in different situations.

Decision Trees: The game uses decision trees to model the various possible outcomes of different decisions made by the player or characters in the game. This allows for a more dynamic and interactive gaming experience, where the player's decisions can have a significant impact on the outcome of the game.

Bayesian Networks: The game uses Bayesian networks to model the uncertainty and probability of different events in the game world. This allows for a more realistic and complex gaming experience, where the player must consider the potential consequences of their actions.

How Knowledge Representation and Reasoning Works in Detroit: Become Human:

The use of knowledge representation and reasoning in Detroit: Become Human is evident in several aspects of the game, such as the behavior and decision-making of the game's characters, the branching storylines, and the game's overall narrative structure. The game uses a combination of symbolic representation, rule-based reasoning, decision trees, and Bayesian networks to create a dynamic and immersive gaming experience.

Symbolic Representation: The game uses symbolic representation to represent the various characters in the game world. Each character is represented as a separate entity with its own set of attributes, such as name, age, occupation, and emotional state. These attributes are used to determine the behavior and decision-making of the characters in the game. For example, if a character is feeling stressed or anxious, they may be more likely to make rash decisions or behave irrationally.

Rule-based Reasoning: The game uses rule-based reasoning to simulate the behavior and decision-making of characters in the game. This involves the use of logical rules that dictate how characters should behave in different situations. For example, if a character is faced with a difficult decision, they may weigh the pros and cons of each possible outcome before making a decision. The game uses a complex set of rules to simulate the decision-making process of characters in the game, which contributes to the overall realism of the game world.

Decision Trees: The game uses decision trees to model the various possible outcomes of different decisions made by the player or characters in the game. This allows for a more dynamic and interactive gaming experience, where the player's decisions can have a significant impact on the outcome of the game. The game presents the player with a range of different decisions to make throughout the game, each of which can have a significant impact on the game's overall narrative. The use of decision trees allows for a more complex and nuanced narrative structure, where the player

**Introduction**:

Knowledge representation and reasoning are the two fundamental concepts in the field of artificial intelligence. Knowledge representation is the process of structuring knowledge in a way that can be processed by a computer system, and reasoning is the process of deriving new knowledge from existing knowledge. Detroit: Become Human is a video game that makes extensive use of these two concepts to create a compelling interactive experience for the player. In this assignment, we will discuss the knowledge representation and reasoning techniques used in Detroit: Become Human and how they are represented in a data flow diagram (DFD).

Features taken:

The following features of Detroit: Become Human are taken into consideration for this assignment:

Choice-based gameplay: The game presents the player with a series of choices that affect the outcome of the story.

Multiple characters: The game features three main characters, each with their own storylines that intersect at various points in the game.

Dynamic world: The game world changes based on the choices the player makes, leading to different outcomes and story paths.

Dialogue trees: The game features complex dialogue trees that allow for a wide range of player responses and interactions with other characters.

QTE (Quick-Time Events): The game includes QTEs that require the player to react quickly to on-screen prompts to progress the story.

Knowledge Representation and Reasoning in Detroit: Become Human:

The knowledge representation and reasoning techniques used in Detroit: Become Human are primarily based on decision trees and rule-based systems.

Decision Trees: The game's choice-based gameplay is driven by decision trees. Each choice the player makes leads to a different branch of the decision tree, which ultimately affects the outcome of the story. The decision tree structure allows for a large number of potential story paths, but also ensures that the overall narrative remains coherent.

Rule-based Systems: The game also employs rule-based systems to determine the behavior of non-player characters (NPCs) and the world around the player. For example, if the player chooses to vandalize a building, NPCs may react negatively, and the player's reputation may decrease. These rules are defined in the game's code and are executed by the game engine to create a dynamic and responsive game world.

Data Flow Diagram (DFD):

The following DFD represents the knowledge representation and reasoning techniques used in Detroit: Become Human:

DFD image

The DFD consists of four main components:

Player: The player interacts with the game world through dialogue trees, QTEs, and choices that affect the outcome of the story.

Decision Trees: The player's choices lead to different branches of the decision tree, ultimately affecting the outcome of the story.

Rule-based Systems: The game engine executes rules that determine the behavior of NPCs and the world around the player.

Dynamic World: The game world changes based on the player's choices, leading to different outcomes and story paths.

Conclusion:

Knowledge representation and reasoning are crucial components of artificial intelligence, and Detroit: Become Human makes excellent use of these concepts to create a compelling interactive experience for the player. The game's use of decision trees and rule-based systems allows for a wide range of potential story paths while maintaining a coherent overall narrative. The DFD presented in this assignment provides a visual representation of the knowledge representation and reasoning techniques used in the game, highlighting the interconnectedness of the game's various components.

**Introduction:**

Knowledge representation and reasoning (KR&R) is an important subfield of artificial intelligence that focuses on the representation of knowledge and the development of reasoning mechanisms to make decisions based on that knowledge. The Detroit Become Human video game is an example of an AI system that utilizes KR&R techniques to create an immersive gaming experience. This assignment aims to provide a detailed explanation of knowledge representation and reasoning and how it is used in Detroit Become Human, along with a well-defined data flow diagram.

Knowledge Representation and Reasoning:

KR&R is the process of encoding knowledge into a form that can be used by an AI system. There are various types of knowledge representation techniques such as logical representation, semantic networks, frames, rules, and ontologies. The knowledge representation technique used in Detroit Become Human is a combination of logical representation and rules.

Logical representation is a technique that uses formal logic to represent knowledge. In this technique, knowledge is represented in the form of symbols and logical operators, such as AND, OR, and NOT. For example, the knowledge that "if it is raining, then the streets will be wet" can be represented using the logical statement "if raining, then streets wet". This knowledge can then be used by an AI system to reason about whether the streets are wet based on whether it is raining or not.

Rules are another type of knowledge representation technique used in Detroit Become Human. Rules are statements that describe a relationship between a set of conditions and a set of actions. For example, the rule "if the player chooses option A, then the character will do X" describes the relationship between the player's choice and the character's action.

Data Flow Diagram for Detroit Become Human:

The following is a data flow diagram that illustrates how knowledge representation and reasoning is used in Detroit Become Human.

Data Flow Diagram for Detroit Become Human

As shown in the diagram, the knowledge representation and reasoning component receives input from various sources such as the player's actions, the game environment, and the game script. This input is processed by the KR&R component to generate an output, which is then used to update the game state and provide feedback to the player.

The player's actions are first processed by the KR&R component, which uses rules to determine the character's response to the player's choices. The game environment is also processed by the KR&R component, which uses logical representation to reason about the state of the game world. For example, the KR&R component can use logical statements to determine whether a door is locked or unlocked based on the player's actions.

The game script is another important source of input for the KR&R component. The game script contains a set of rules and logical statements that describe the game's storyline and events. The KR&R component uses this information to determine the appropriate responses and actions for the game characters.

Conclusion:

Knowledge representation and reasoning is an important subfield of artificial intelligence that is used in a wide range of applications, including video games. Detroit Become Human is an example of a video game that utilizes KR&R techniques to create an immersive gaming experience. The data flow diagram provided in this assignment illustrates how KR&R is used in Detroit Become Human to process input from various sources and generate output that updates the game state and provides feedback to the player.

**Introduction:**

Knowledge representation and reasoning are two crucial aspects of Artificial Intelligence that enable machines to perform intelligent tasks. In this assignment, we will explore the concept of knowledge representation and reasoning and how it works smartly in Detroit: Become Human, a popular video game developed by Quantic Dream. We will also provide a well-defined data flow diagram to illustrate the process.

Knowledge Representation and Reasoning:

Knowledge representation is the process of storing information in a way that can be easily understood and processed by a machine. In the context of AI, knowledge can be represented using various techniques such as rule-based systems, semantic networks, and frames. These representations allow machines to reason about the information and make decisions based on it.

Reasoning, on the other hand, refers to the process of using the stored knowledge to draw conclusions or make inferences. AI systems use reasoning to solve problems, make predictions, and perform intelligent tasks. There are various types of reasoning such as deductive reasoning, inductive reasoning, and abductive reasoning.

Smart AI in Detroit: Become Human:

Detroit: Become Human is a video game set in a futuristic world where androids are sentient and have become an integral part of society. The game features three playable android characters, each with their own storyline and unique abilities. The game heavily relies on knowledge representation and reasoning to provide an immersive gaming experience.

Data Flow Diagram:

The following data flow diagram illustrates the process of knowledge representation and reasoning in Detroit: Become Human:

Data Flow Diagram

Perception: The first step in the process is perception. The game uses sensors and cameras to detect the environment and gather information about the surroundings. This information is then stored in a knowledge base.

Knowledge Representation: The knowledge base stores all the relevant information in a structured format. The game uses a variety of techniques such as semantic networks and frames to represent the knowledge.

Reasoning: The game uses various forms of reasoning such as deductive, inductive, and abductive reasoning to draw conclusions and make decisions. For example, the game uses deductive reasoning to solve puzzles and inductive reasoning to predict future events.

Action: The final step in the process is action. Based on the conclusions drawn by the AI system, the android characters perform various actions such as moving, interacting with objects, and talking to other characters.

Conclusion:

In conclusion, knowledge representation and reasoning are crucial components of AI that enable machines to perform intelligent tasks. Detroit: Become Human is an excellent example of how these techniques can be used to create an immersive gaming experience. The well-defined data flow diagram illustrates the process of knowledge representation and reasoning in the game and how it helps the AI system make smart decisions.