



مجموعة جامعة
الجميع الذكية
للتعليم القابضة

MIDOCEAN
UNIVERSITY
BY EVERYONE'S SMART UNIVERSITY

HCIA-AI Huawei

Lecture 12

Cutting Edge AI Applications

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Lecture

12

Content:

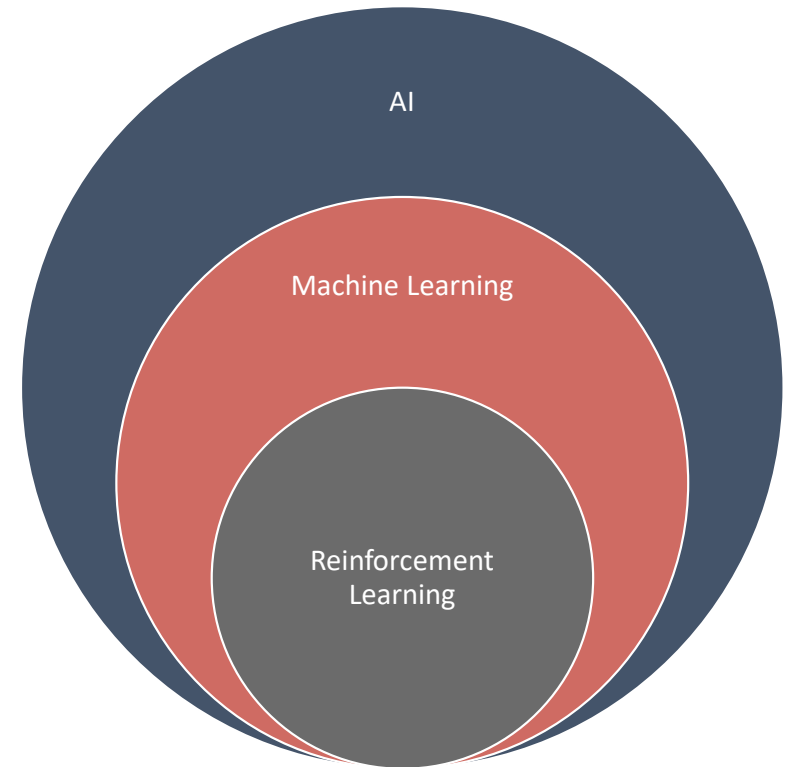
1. Reinforcement Learning
2. GAN
3. Knowledge Graph
4. Intelligent Driving
5. Transformers

The background of the slide is a dark blue gradient. On the right side, there is a network of white dots connected by thin white lines, resembling a molecular structure or a neural network. On the left side, there is a large, light blue oval with a white border. Inside the oval, the text "Reinforcement Learning" is written in a bold, black, sans-serif font.

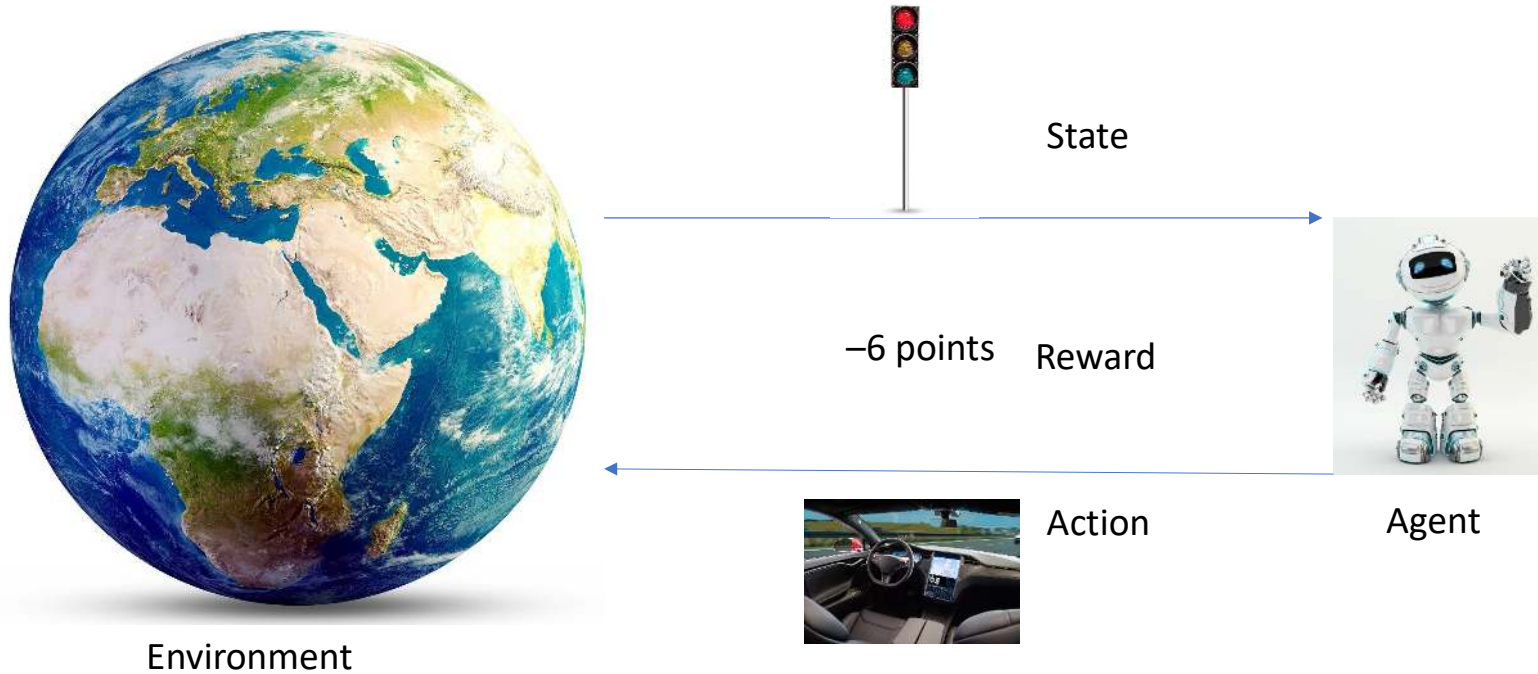
Reinforcement Learning

Reinforcement Learning

- Reinforcement learning (RL) is a branch of machine learning that emphasizes how to act based on the environment in order to maximize the expected benefits.

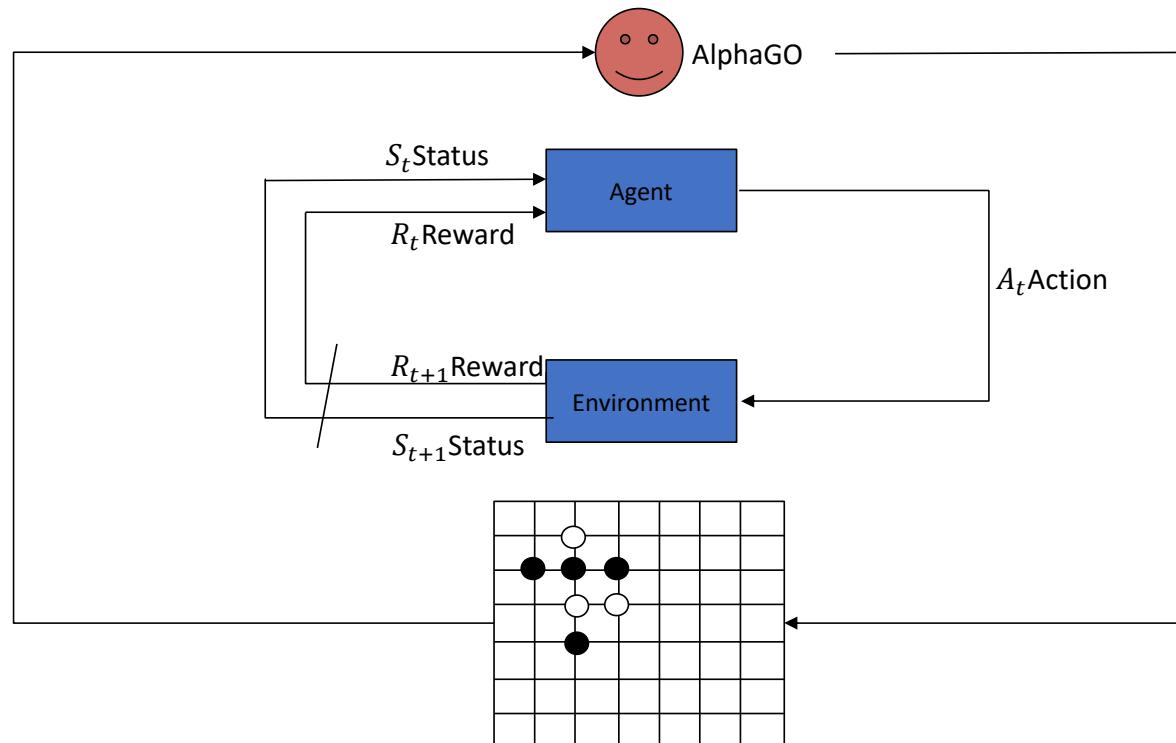


Environment Sensing



Reinforcement Learning Model - Go

What is the situation?
Who is winning?



Where to place the go?

Basic Concepts in Reinforcement Learning

- Two objects:
 - Agent
 - Environment
- Main elements:
 - Action: performed at the current moment based on the status.
 - Policy: makes decisions based on the status and controls the agent to perform actions.
 - Reward: provided by the environment based on the current action.
 - Return: sum of rewards at all moments.

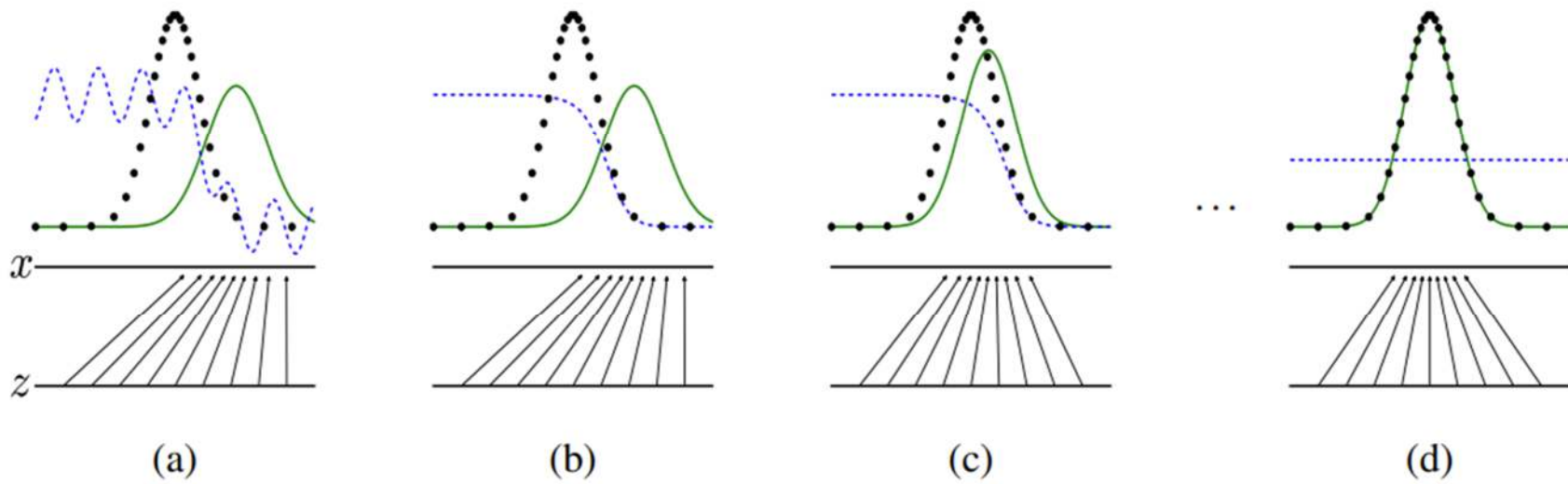


GAN

Generative Adversarial Network (GAN)

- A GAN is a class of frameworks that trains generator G and discriminator D to compete in a game. The game between the two makes the discriminator D unable to distinguish whether the sample is a fake sample or a real sample.
 - The generator G generates "fake" images that look like the images for training.
 - The discriminator D determines whether the images output by the generator are real images or fake images.
- GANs are used in scenarios such as image generation, text generation, speech enhancement, and image super-resolution.

GAN Training Process

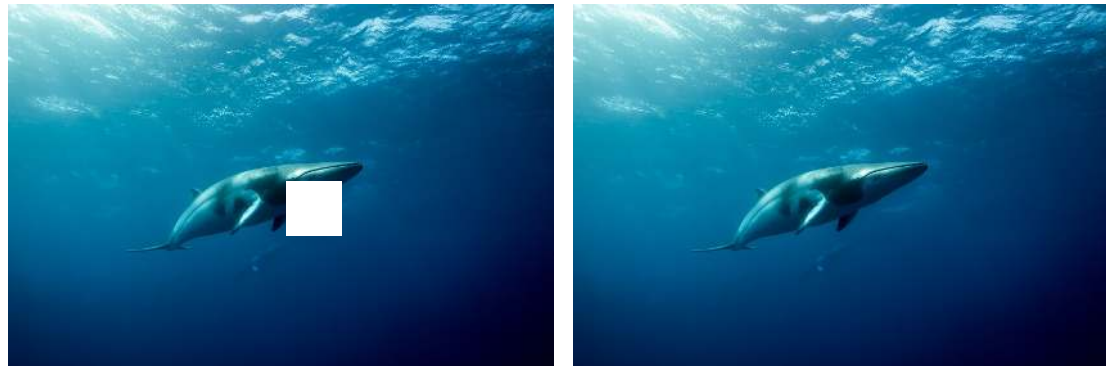


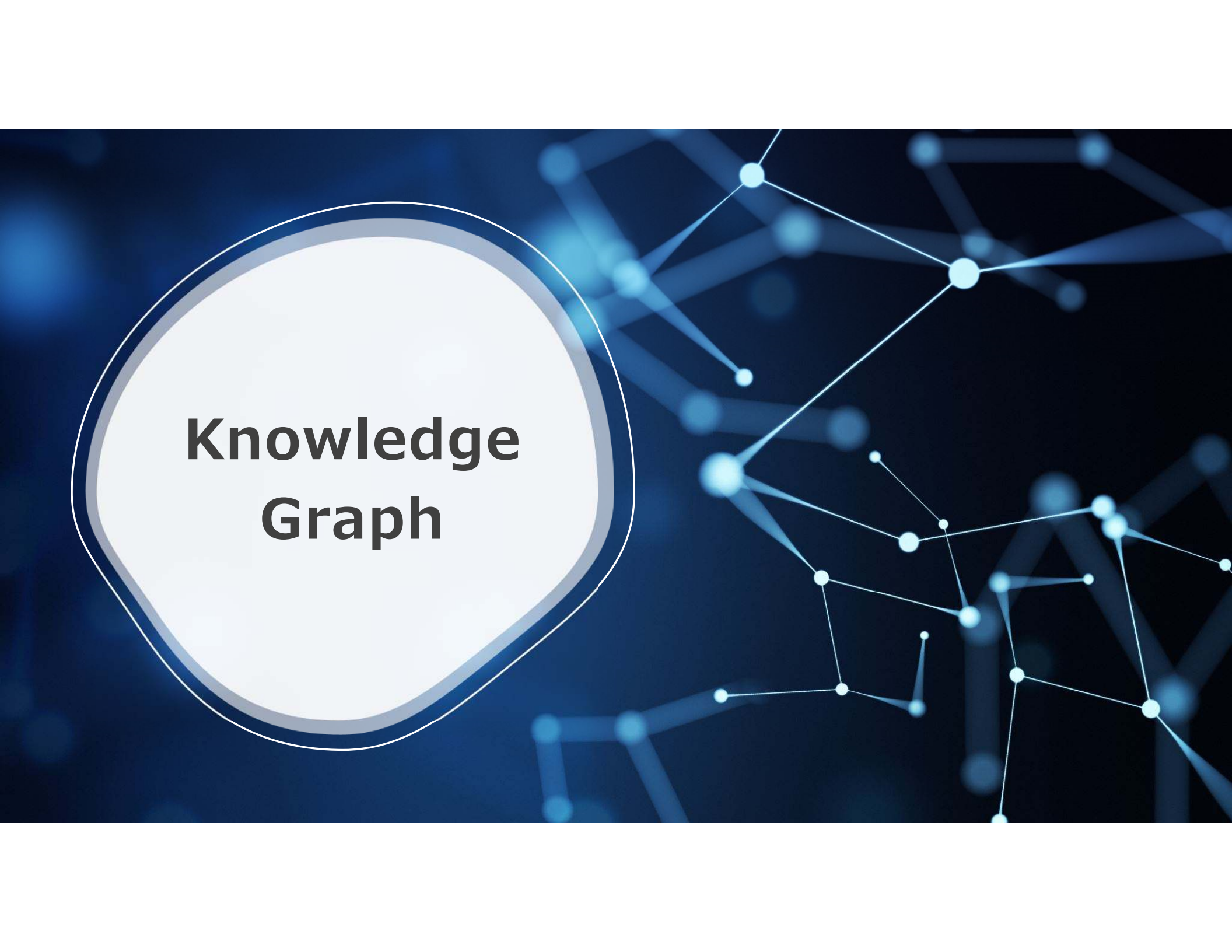
GAN Application

- Image dataset generation
- Image-to-image conversion
- Resolution enhancement, making photos clearer
- Text-to-image conversion

GAN - Photo Repair

- If an area in a photo is faulty (for example, colored or erased), GAN can repair the area and restore it to its original state.



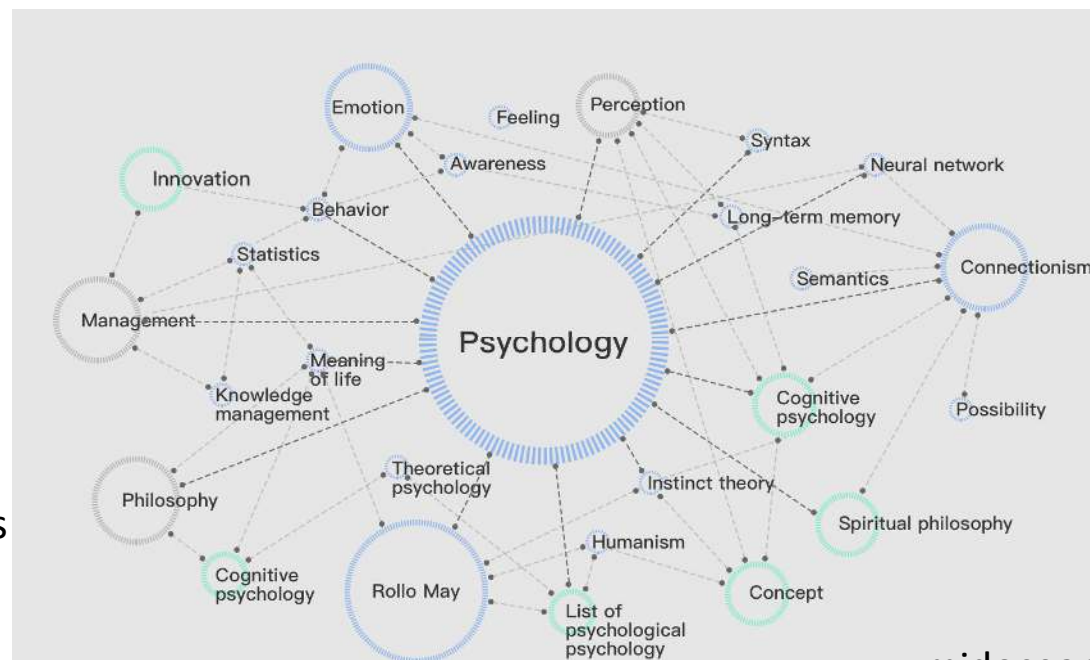
The background of the slide features a dark blue field with a network of glowing white nodes and connecting lines, representing a knowledge graph. A large, light blue circle with a double border is positioned on the left side, containing the title text.

Knowledge Graph

Basic Concepts

- Knowledge graph is essentially a knowledge base of the semantic network. It describes various concepts, entities, and relationships in the real world in a structured manner to form a huge semantic network. Nodes in the network are entities, and each edge represents a property of entities or the relationship between entities.

- Entity**: an object that exists in the real world and can be distinguished from other objects.
- Property**: The nature and relationship of a specific object are called the properties of the object.
- Concept**: a set of entities with the same features.
- Ontology**: a set of abstract concepts used to describe the common features of all the things in a domain and the relationships between them.

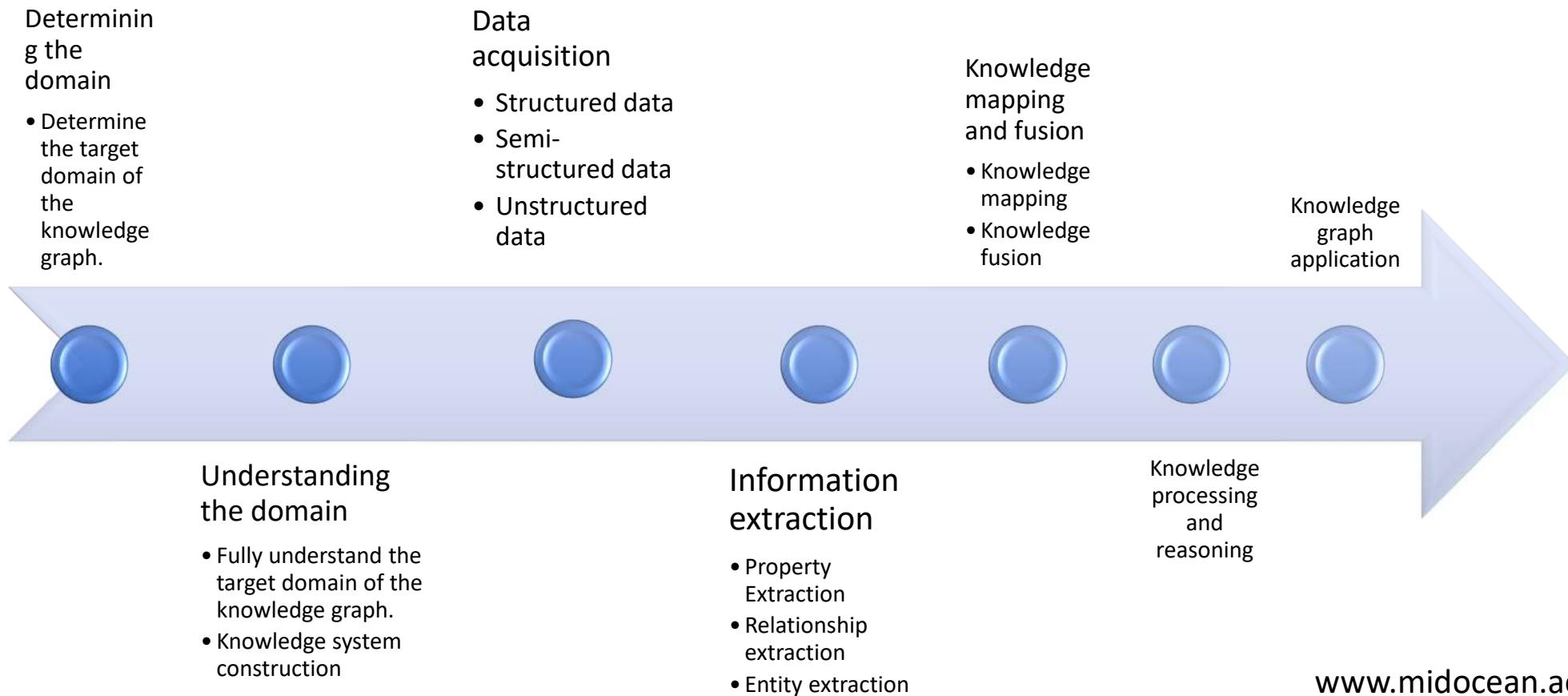


History of Knowledge Graph

- Knowledge graph is a relatively mature application "fruit" of knowledge engineering in the current stage of AI development.
- Five phases of knowledge engineering:
 - Pre-knowledge engineering period (1950s–1970s)
 - Expert system period (1970s–1990s)
 - World Wide Web 1.0 period (1990s–early 21st century)
 - Swarm intelligence period (2000–2006)
 - Knowledge graph period (2006–present)
- In the knowledge graph period, the vigorous development of large-scale structured encyclopedia websites and the continuous progress of text information technology provide conditions for obtaining large-scale knowledge.
- Google took the lead in applying knowledge graphs to search engines in 2012, successfully improving users' search quality and experience.

Process for Constructing a Knowledge Graph

- The general knowledge graph construction process is as follows:



Knowledge Graph Application Scenario (1)

The common application scenarios are as follows:

Precise
recommendation



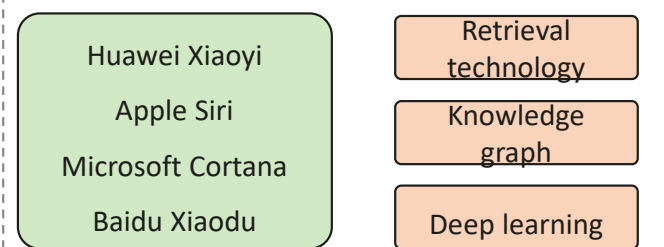
Music apps accurately recommend songs that you like to listen to.

Semantic search



Exact keyword matching by the Petal search engine

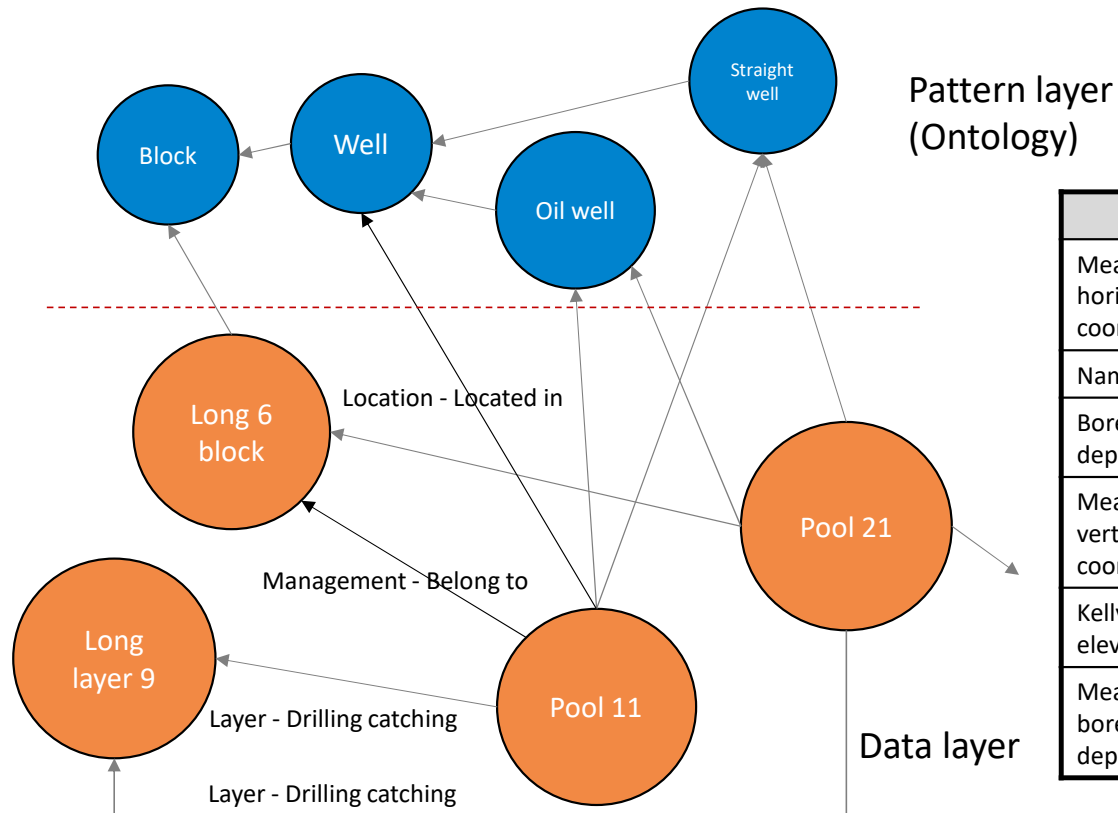
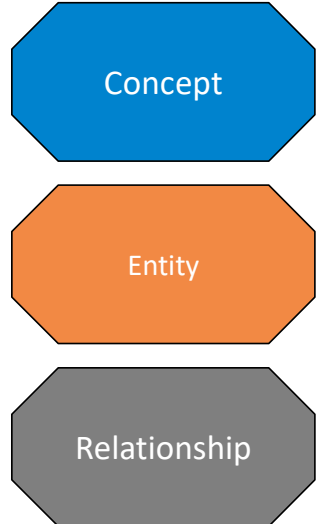
Intelligent Q&A



The graph technology applies to the intelligent Q&A robots of major vendors.

Knowledge Graph Application Scenario (2)

Oil and Gas Knowledge Computing



Item	Value
Measured horizontal coordinate	3.81980698645996E7
Name	Pool 155
Borehole depth	2710.0
Measured vertical coordinate	5883120.49477415
Kelly bushing elevation	1571.779
Measured borehole depth	2710.0



Intelligent Driving

Intelligent Driving Will Lift Society to New Heights

Third living space

- "Mobile third space": Intelligent vehicles automate driving, to give drivers and passengers a multi-functional space for new entertainment, social networking, and retail scenarios.
- With an emphasis on passenger experience, consumer demand will concern industries such as media, entertainment, retail, and health. Its reported 63% of people use the time traveling to socialize, and nearly 25% want to spend the time on fitness.

Huge reductions in
road accidents

- About 1.2 million people die from traffic accidents every year.
- In 2019, more than 60,000 people died from traffic accidents in China.
- 90% of traffic accidents are caused by human error.

Convenient and
efficient travel

- Intelligent driving enables special groups to drive on roads.
- China - 75% of roads in major cities suffer from traffic jams during peak hours, with an average traffic delay of one hour.
- Vehicle-road collaboration using an intelligent transportation system (ITS) can greatly improve traffic efficiency.
- University of Michigan estimates one shared autonomous vehicle can replace 9.34 conventional vehicles.



Intelligent driving

Manual Driving vs. Intelligent Driving

Where am I?

Sensing, positioning, and mapping



Sensing & positioning



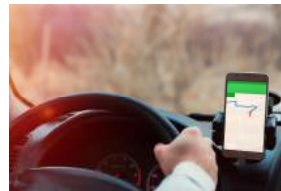
Decision-making & planning



Control

Where am I going?

Navigation and map



Eyes & ears



Brain



Hands & feet

How do I get there?

Sensing, positioning, map, and planning
and control (PnC)



Cameras & radars

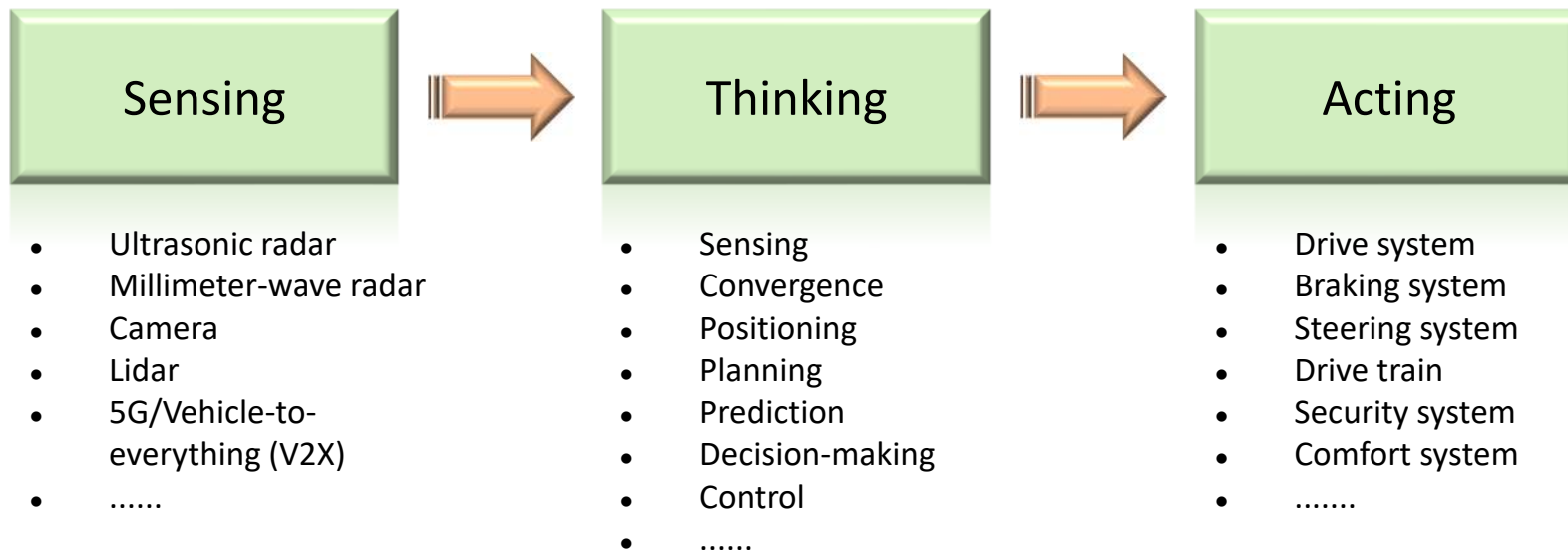


Central control unit



Steering wheel & pedals

Three Subsystems of Intelligent Driving

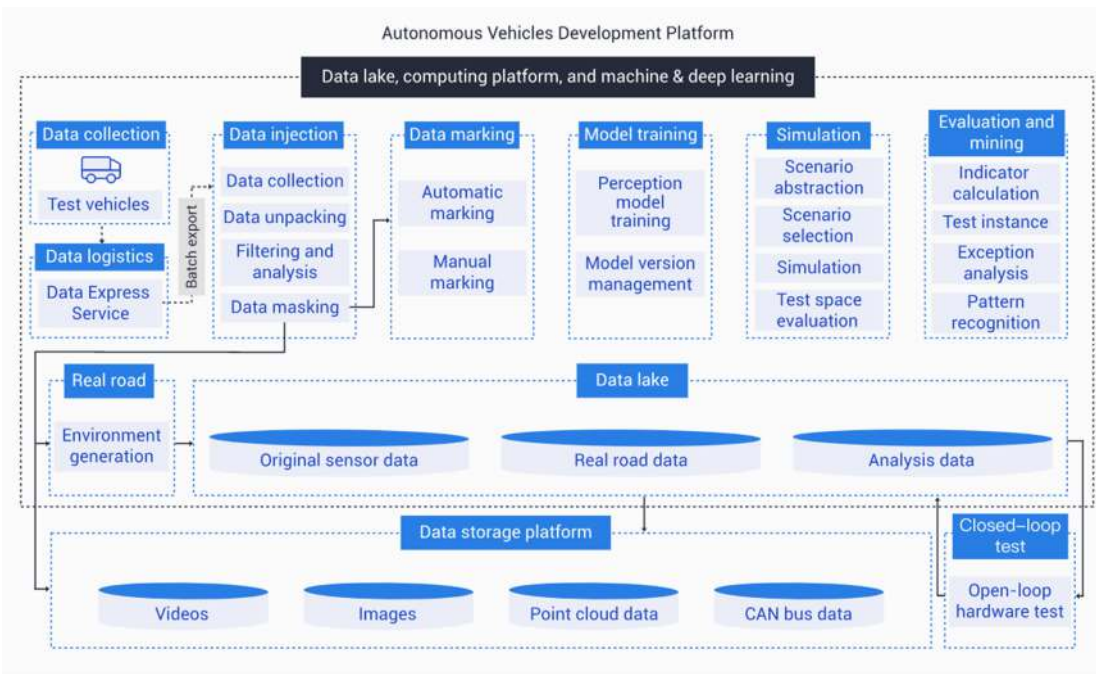


Huawei MDC: Leading Intelligent Driving Computing Platform



Lecture 12

Autonomous Driving Cloud Service: One-Stop Development Platform for Autonomous Vehicles



- **Data services:**

- Data storage management, processing pipeline, overview, and playback, as well as an annotation platform

- **Training services:**

- Training tasks, algorithm and model management, algorithm iteration, and model evaluation

- **Simulation services:**

- Simulated scenarios, online simulations, task management, and simulation algorithms

- **Competitive advantages:**

- **Annotation platform**
- **Model training**
- **Parallel simulation**



Transformers

Transformer Model :

transformer model is a neural network that learns context and thus meaning by tracking relationships in sequential data like the words in this sentence.

Transformer models apply an evolving set of mathematical techniques, called attention or self-attention, to detect subtle ways even distant data elements in a series influence and depend on each other.

They're called "transformers" because they transform one piece of information into another.

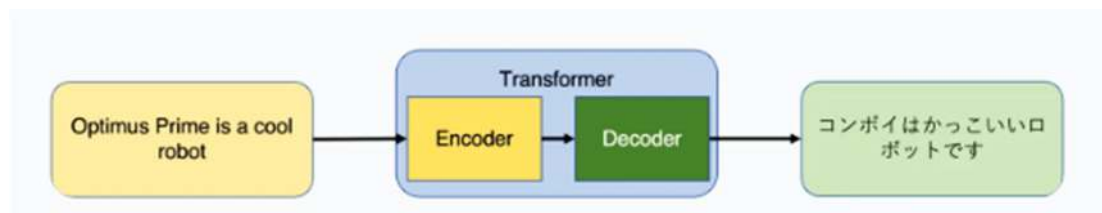


Transformer Model :

Simply translating word by word in the order of appearance may result in an output that a human Japanese speaker would consider ungrammatical. For instance, in Japanese the verbs are placed at the end of the utterance, whereas this never happens in English. One of the main questions in sequence transduction is the learning of representations for both the input and output sequences in a robust manner, so that no distortions are introduced. You do not want to mistranslate an important message.

The magic of machine translation works thanks to two components in the architecture: the encoder and decoder. The former is the element that receives each component of the input sequence, encoding (hence the name) it into a vector carrying the context information about the whole sequence. This is sent to the decoder whose job is to understand the context and resolve the output meaningfully.

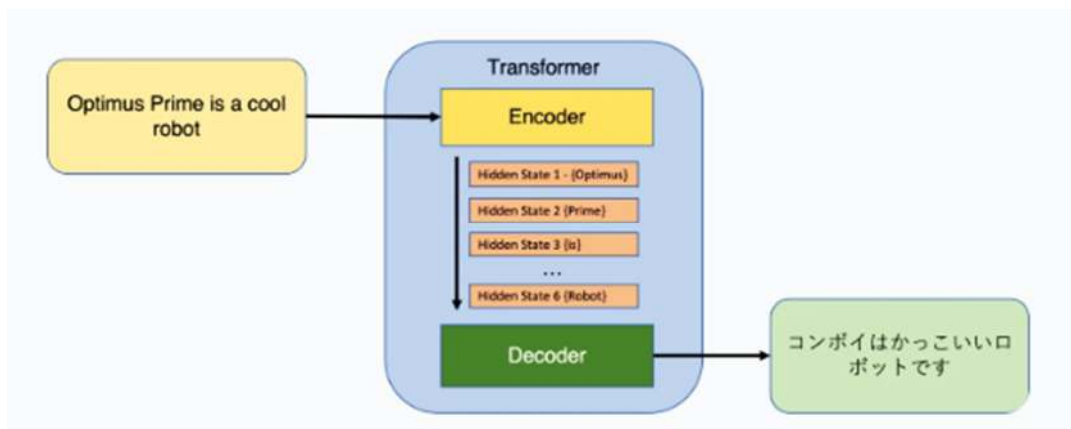
Transformer Model :



As we can see, "memory" alone in the model (such as in an LSTM) may not be enough. We need "attention" to help further improve tasks such as machine translation. Let us take a look at what attention does.

In a sequence-to-sequence model the encoder passes only the last hidden state as the context to the decoder. When attention is used, the encoder passes not only the last hidden state, but actually all of them. This means that the decoder may have a bit more work to do than before. This extra processing is needed as now every hidden state received is associated with a given part of the input sequence. In our sample sentence "Optimus Prime is a cool robot" the first hidden state is related to the word "Optimus", the second to the word "Prime", the third one to "is" and so on. In this way, the decoder gets to do more, but also receives much more information.

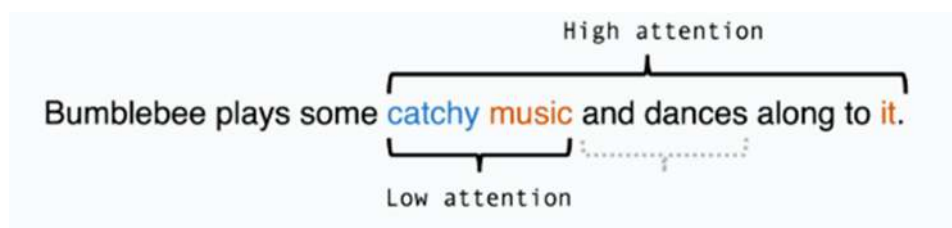
Transformer Model :



The job of the decoder is now to calculate the weight for each hidden state received by the encoder. This is done with the decoder's own hidden state, in other words, the output of the previous time step in the model. The aim is to provide greater importance to hidden states with higher weight values, and this is our new context vector. We can then use this context as input to the decoder's feed forward neural net to obtain the output sequence we are after. In turn the output sequence is used as the hidden state of the decoder that is used in the calculation of weights in the next time step.

Transformer Model :

Attention is Key: At the heart of transformers is something called "attention." Imagine you're reading a sentence, and you want to understand it. Your brain doesn't treat each word equally; it pays more attention to important words. Transformers do the same thing with data.



Self-Attention: Transformers use "self-attention" to decide which parts of the input data are most important. For example, in a sentence like "The cat chased the mouse," self-attention helps the model focus on "cat" when trying to understand the word "chased."

Transformer Model :

No Recurrence: Unlike traditional recurrent neural networks (RNNs) that process data in order, transformers can process all parts of the data at the same time. This makes them very fast and good at understanding long-range relationships in data.

Layers and Stacking: Transformers have many layers, each with its own attention mechanism. These layers work together, with each layer adding more understanding and context to the data. It's like solving a puzzle piece by piece.

Applications: Transformers have been used in many applications, from language translation (like Google Translate) to chatbots, image recognition, and more. They're especially great at handling sequences, like sentences in natural language.



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Thank You

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