DreamLLM  ICLR

Synergistic Multimodal Comprehension and Creation

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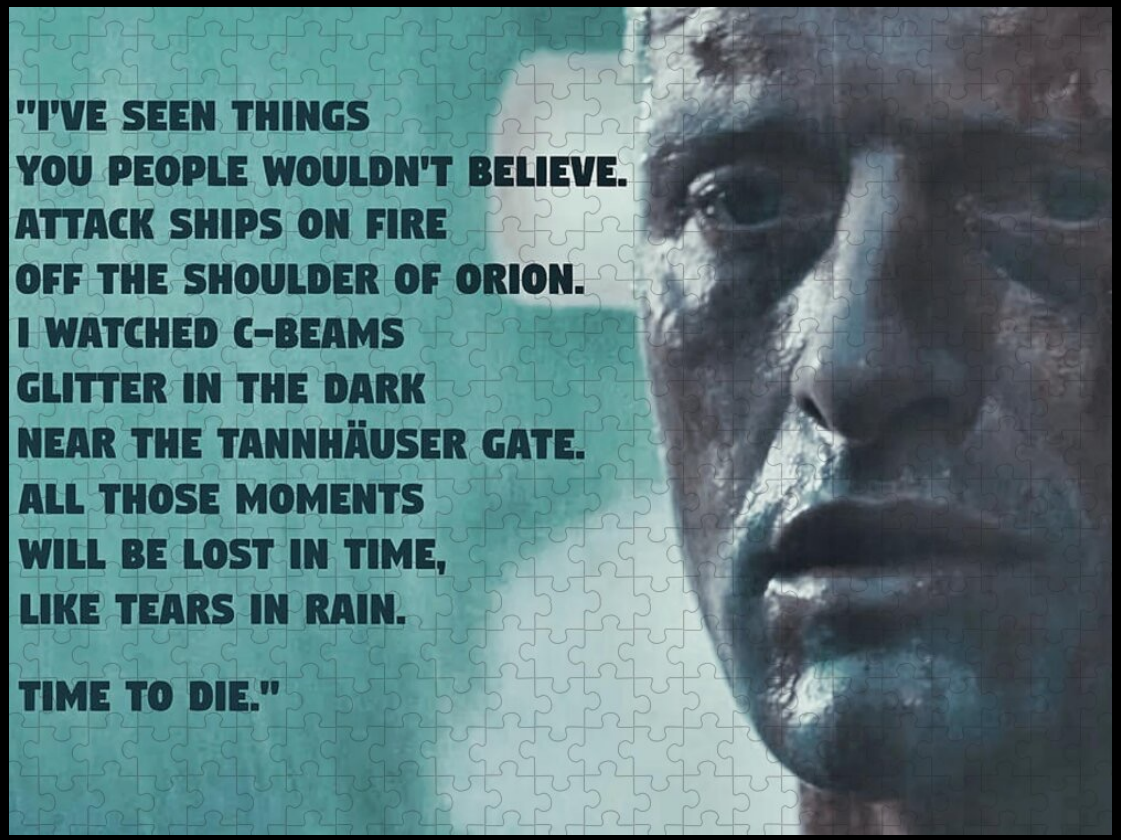
International Conference on Learning Representations (ICLR)
May 7th-11th 2024, Vienna Austria

Do Androids Dream of Electric Sheep?



Blade Runner, 1982

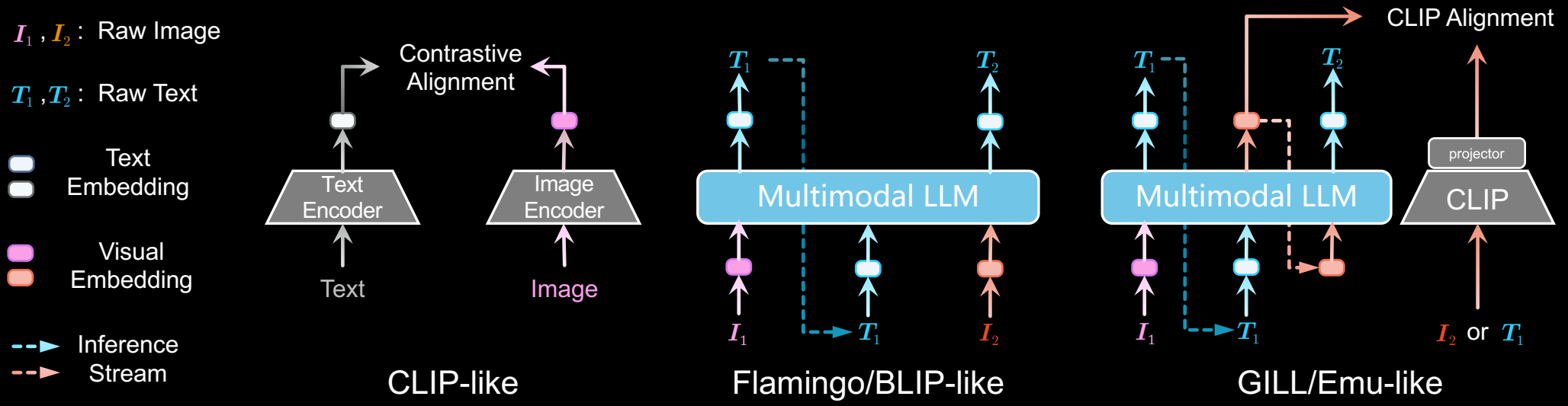
"What I cannot create, I do not understand"

Richard P. Feynman, 1988

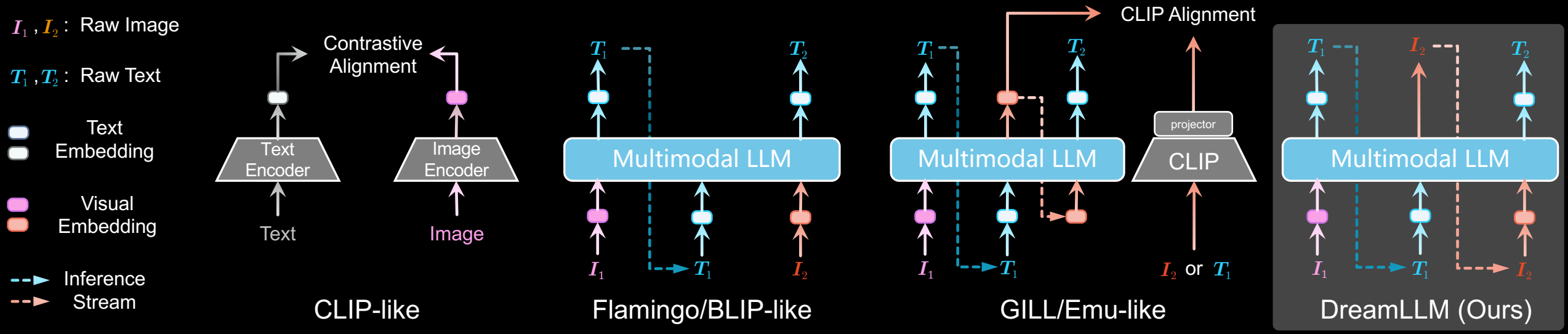
LLMs MIGHT DREAM, WHAT ABOUT MULTIMODAL LLMs?

Previous & Concurrent Works

BUT NO SYNERGY BETWEEN COMPREHENSION AND CREATION



Fully Autoregressive Multimodal Modeling



DreamLLM Key Points

- Fully Autoregressive Multimodal Modeling with raw data multimodal input & output
- First work for instruction-following Interleaved content creation
- Learning Synergy between multimodal comprehension & content creation

DreamLLM

Interleaved Documents

"I like my cute Siamese cat.",

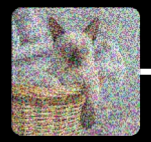
"She has beautiful blue eyes, and she likes to lie on her cozy nest.", ...

word embeddings

special <dream> token

Inference Stream

<s> I like my cute Siamese cat.



U-Net

Score Distillation

She has beautiful ... </s>

<dream>

Projection

Causal Multimodal Large Language Model (MLLM)

dream queries

Word Embedding

<s> I like my cute Siamese cat.

visual embeddings

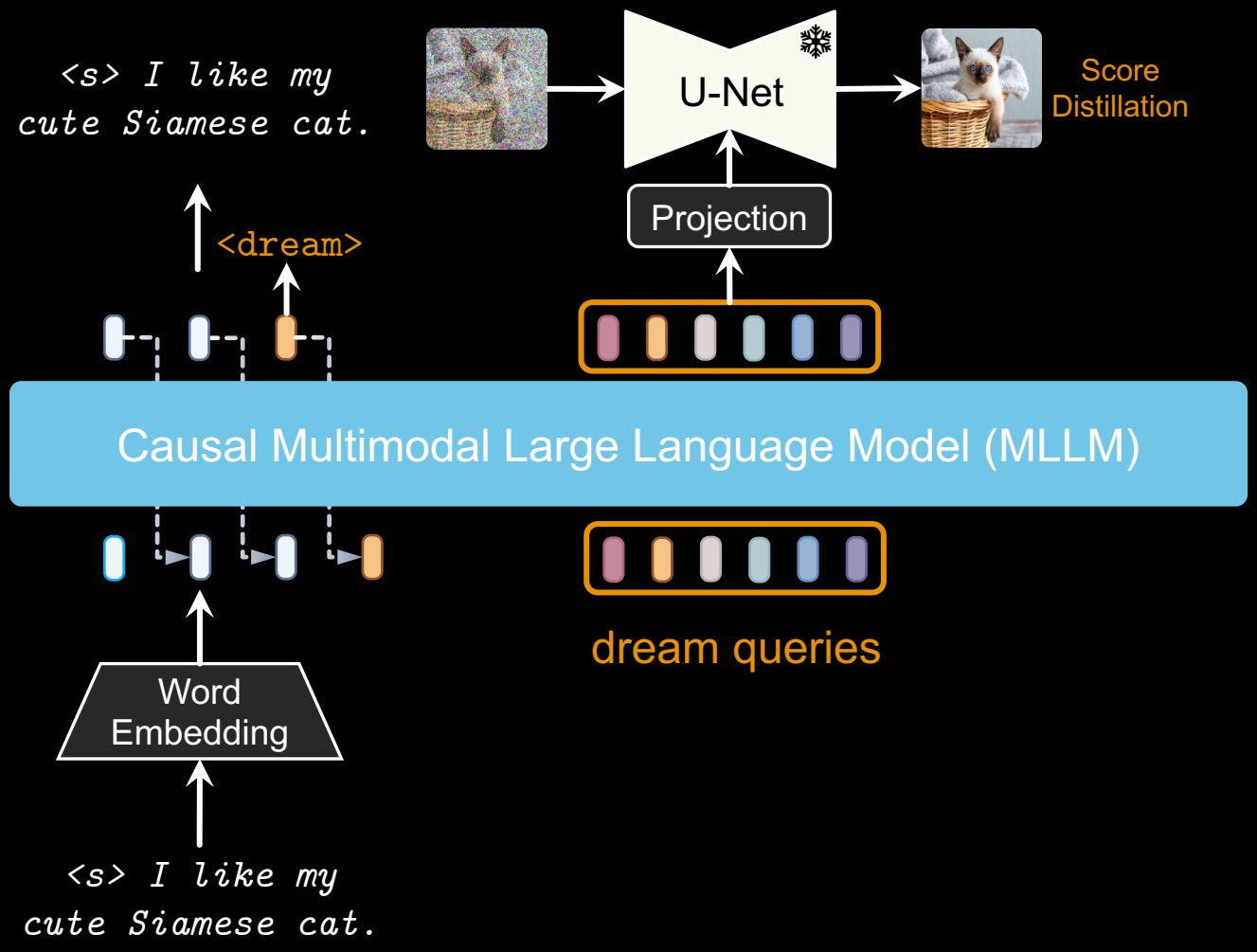
Projection

Visual Encoder

Word Embedding

She has beautiful ... </s>

DreamLLM



Learning Objective

Diffusion denoising instead of feature regression for direct distribution sampling in pixel space!

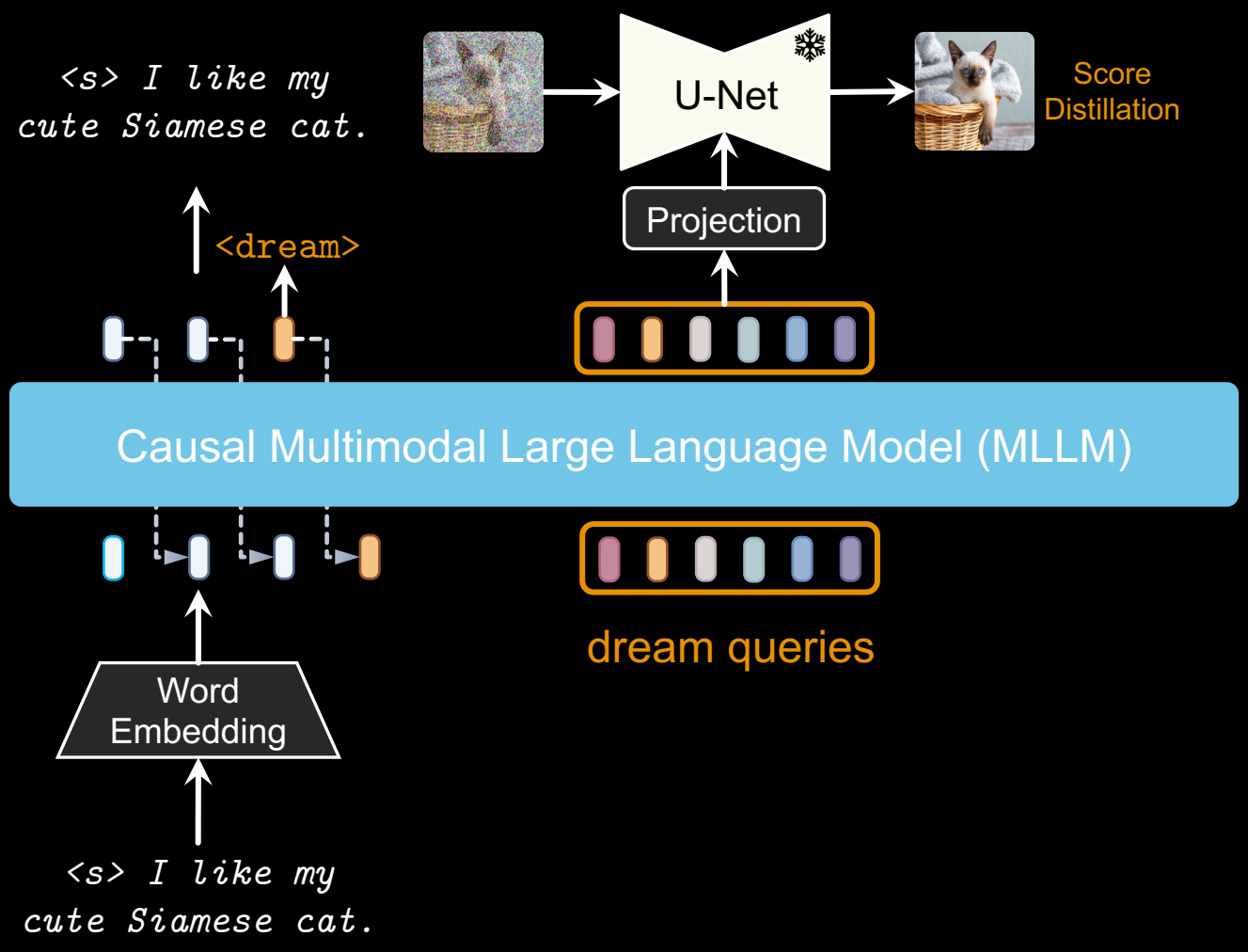
SCORE DISTILLATION FOR GENURE DISTRIBUTION LEARNING

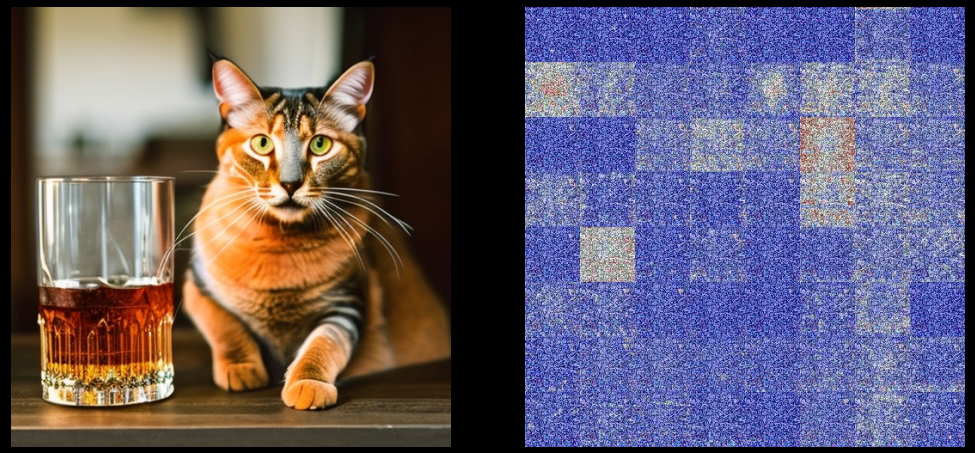
Conditional Embedding

Query LLMs using dream queries instead of forcing LLMs to output visual representations!

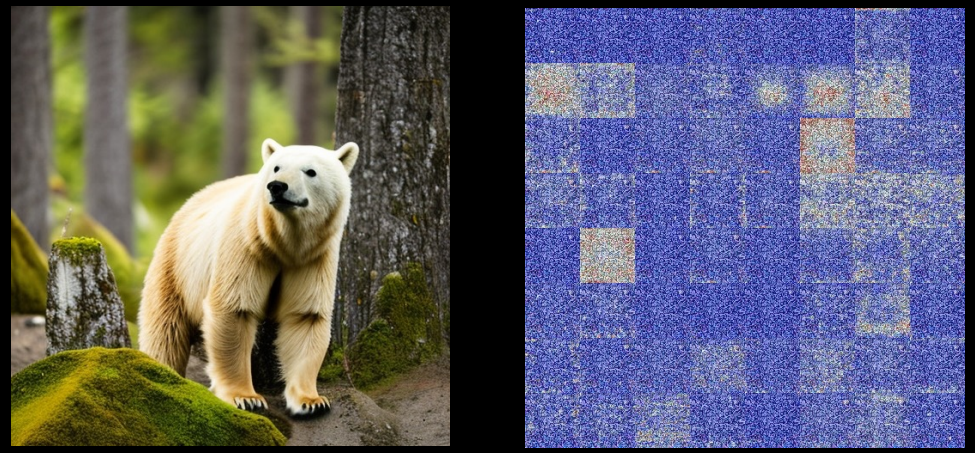
CONTRASTIVE MODELS ONLY LEARN MODALITY-SHARED BUT NOT MODALITY-SPECIFIC INFORMATION

DreamLLM



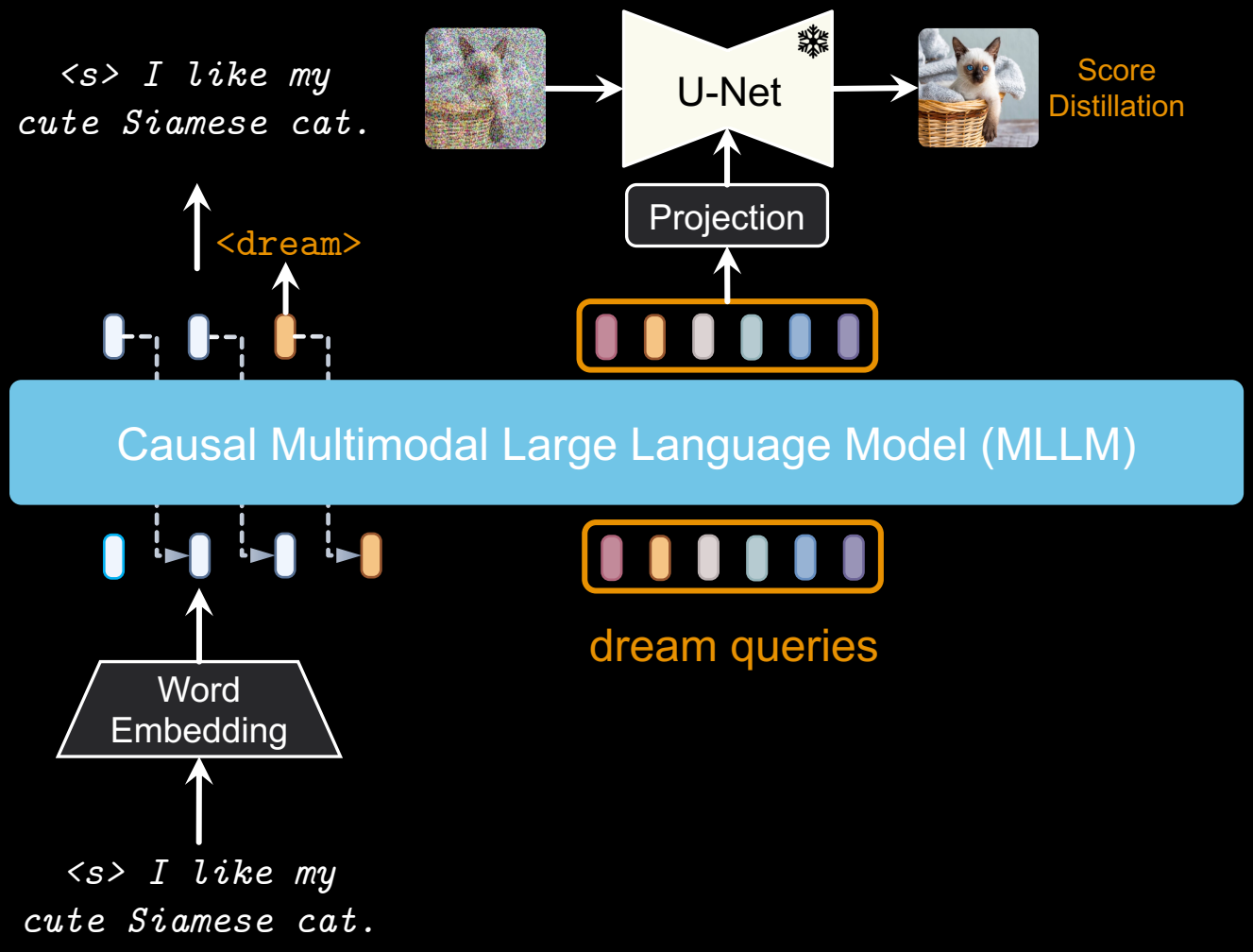


A cat and a whisky.



A polar bear in the forest.

DreamLLM



A cat and a whisky.

A polar bear in the forest.

Text-to-Image Generation

small bird with a pale yellow underside light brown crown and back gray tail and wing tips tip of tail feather bright yellow black eyes and black strip over eyes

panda mad scientist mixing sparkling chemicals, art station

an espresso machine that makes coffee X, art station, where X ∈ {"in a warm scene", "from human soul"}

an armchair in the shape of an avocado

a futuristic city X, where X ∈ {"in a synthwave style", "in vaporwave style", "made of water", "Beijing opera style"}

an astronaut riding a horse X, where X ∈ {"in a photorealistic style", "in the style of Pop Art", "as a charcoal sketch", "as a golden relief"}

robots meditating in a vipassana retreat

Multimodal Dialogue

Can you give a short introduction to this movie?

DreamLLM

The Godfather, also known as Il Padrino, is a classic American crime drama film directed by Francis Ford Coppola. It is the first installment in The Godfather trilogy, which also includes The Godfather Part II (1974) and The Godfather Part III (1990). The movie is widely regarded as a masterpiece and a milestone in the mafia genre, exploring the story of the Corleone family, a fictional Italian-American crime family in New York. It follows the transformation of Michael Corleone, the youngest son of the family's aging don, Vito Corleone, as he rises to power and eventually takes on the mantle of his father. The film features a strong cast, which includes Marlon Brando as Vito Corleone, Al Pacino as Michael Corleone, James Caan as Sonny Corleone, Robert Duvall as Tom Hagen, and Diane Keaton as Kay Corleone. The Godfather is known for its iconic scenes, memorable lines, and its impact on the Hollywood film industry.

Good. Show me an illustration of a panda wearing a suit and drinking the martini like the Godfather.

DreamLLM

An illustration of a panda wearing a suit and drinking a martini like the Godfather.

In-Context Dialogue

This is a Welsh Corgi.

This is a Koala.

This is

a woolly Mammoth.

What is the title of this painting? Answer: The Son of Man.

When was this masterpiece painted? Answer: 1818.

Who painted this? Answer:

Claude Monet.

Film name: Harry Potter and the Prisoner of Azkaban

Film name: Blade Runner 2049

Film name:

Joker

Input Prompt

Completion

Instruction-Following Interleaved Content Creation

Help me write the introduction and illustrations about Vienna city, show several high-quality photographs about the beautiful scenes and buildings such as Vienna International Opera House.

DreamLLM

The Austrian capital, Vienna, has long been known as the City of Dreams, and there is no better place to experience than this romantic city during the holiday season. The city's historic center is surrounded by a collection of beautiful buildings on a square mile. Stroll along the famous Ring Boulevard and admire the architecture. Some of the buildings date back to the 13th century. The Vienna State Opera House is one of the most beautiful buildings. Founded in 1869, the opera house is the home of the Vienna State Opera and the annual Vienna Opera Ball.

Cosmopolitan flair, an eclectic mix of architectural styles and a rich cultural heritage come together in Vienna. The city is home to a number of museums, palaces and churches. The Sacher Torte and the Wiener Schnitzel are local specialties. A visit to the romantic Christmas Market in Vienna is also a unique experience.

Multimodal In-context Image Generation

Multimodal Input

Delicious food. X.

DreamLLM

Teddy bear

In-context Image Edition

Multimodal Input

A black dog. *A dog* X.

DreamLLM

swims in water

on the beach

in the snow

lies on sofa

In-context Subject-Driven Generation

Multimodal Input

A bear.

A salmon. X.

A ship on the ocean. X.

DreamLLM

A grizzly bear catching a salmon in a crystal clear river surrounded by a forest

SD

A pod of dolphins leaping out of the water in an ocean, with a ship on the background.

In-context Compositional Generation

Image-to-Image Generation

Input Image

dog

swimming in the pool

Wearing sunglasses

wearing a top hat

in the jungle

Input Image

teapot

on the beach

in blue

as a lamp

in the jungle

Input Image

car

floating in the water

painted in green

runs on the mountain

in front of wheat field

DreamLLM ICLR

Synergistic Multimodal Comprehension and Creation

GitHub

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Thanks!

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