Vision-based Situation Awareness and Continual Learning for XR Environments

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Agenda

- Situational Awareness in AR/VR
  - Zero Shot Learning
  - Continual Learning
- Recent Work
  - Zero Shot Learning
  - Continual Learning

Situational Awareness in AR/VR

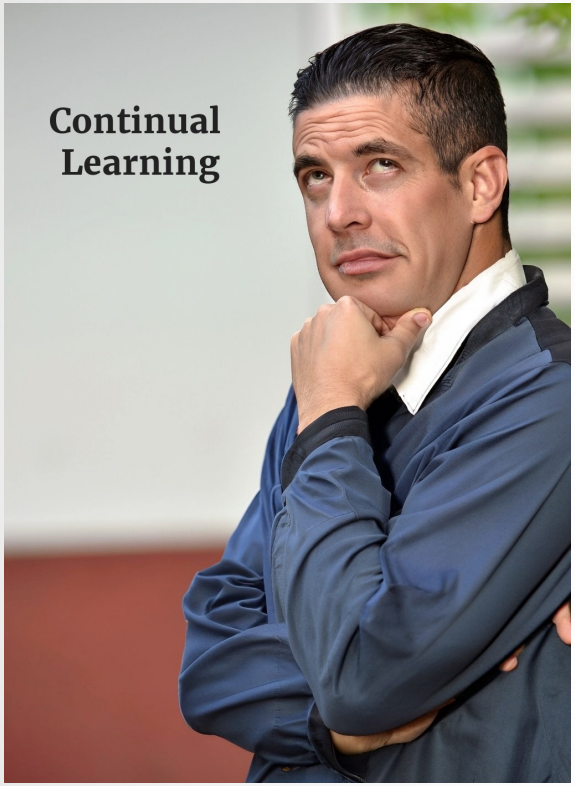
Understanding Situational Awareness

- Situational awareness is crucial for decision-making in dynamic environments.
- AR/VR offers immersive experiences that require real-time adaptability.
- AR glasses and VR environments provide users with contextual information.
- Real-time data integration enhances situational awareness in AR/VR.

Situational Awareness and Zero Shot Learning

Understanding Situational Awareness

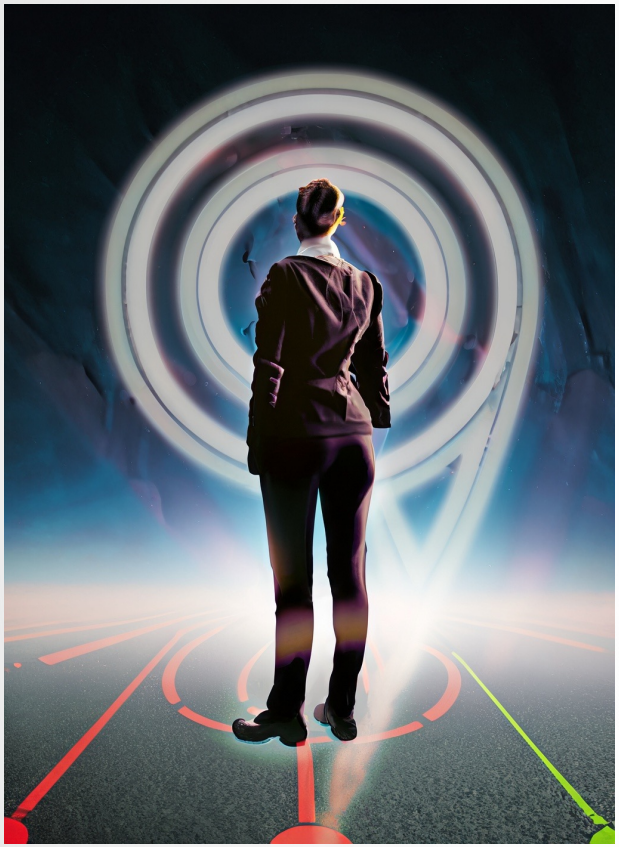
- Situational awareness is crucial for decision-making in dynamic environments.
- AR/VR offers immersive experiences that require real-time adaptability.
- Generalization



Situational Awareness and Continual Learning

Understanding Situational Awareness

- Adaptation to changing environments
- Long-Term Operations



Situational Awareness With Zero Shot and Continual Learning

Understanding Situational Awareness

- Adapting to Unknown Interactions
- Learning from Continuous User Interaction
- Enhanced Feedback Mechanisms

Zero-Shot Learning - Definition

Definition of Zero-Shot Learning

- Zero-shot learning enables models to predict or classify unseen data, offering flexibility beyond the training dataset.
- Zero-shot learning leverages semantic information to generalize knowledge and predict novel scenarios.
- It is particularly useful in AR/VR contexts with various objects and interactions.

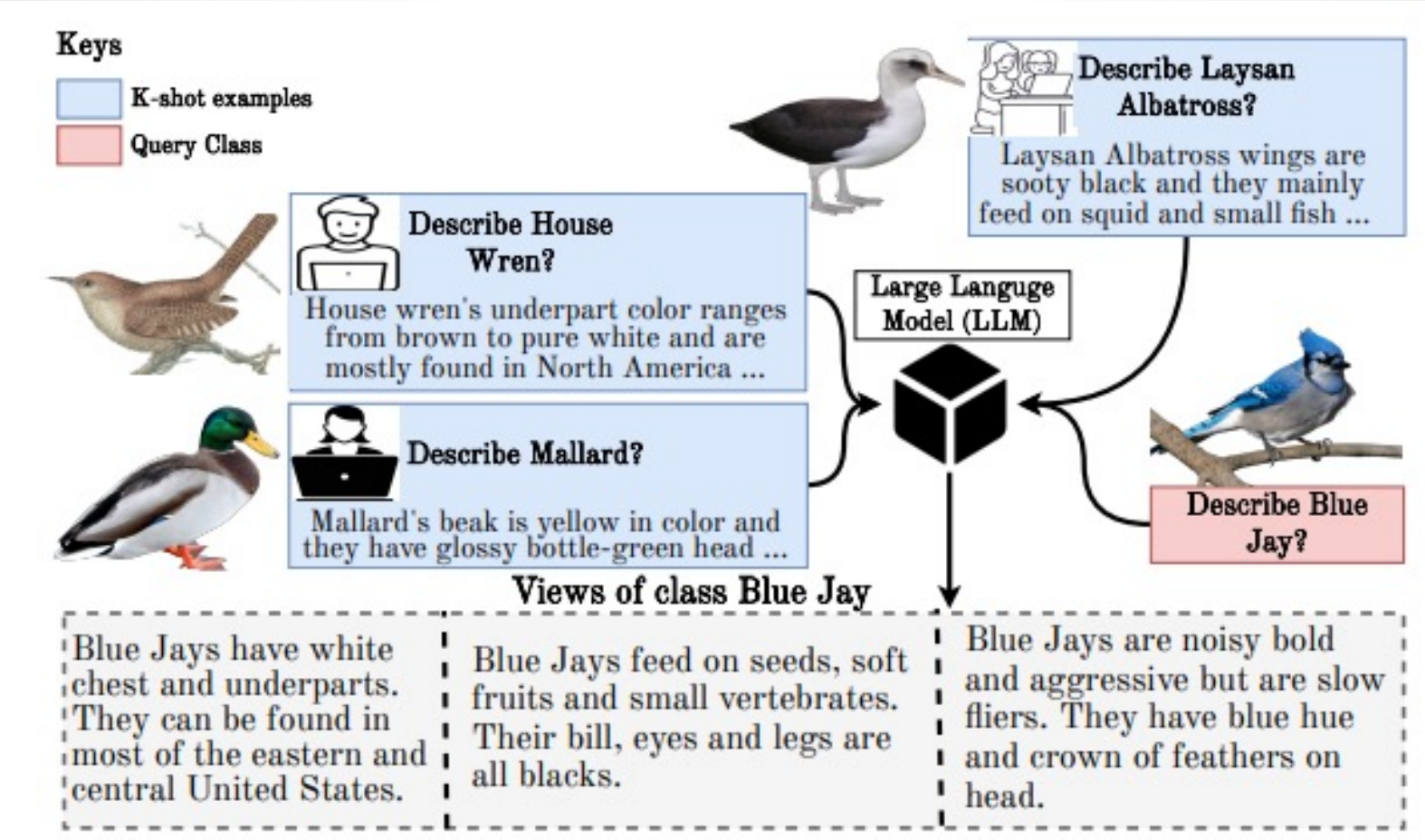
Zero-Shot in AR/VR - Dynamic Object Recognition

Dynamic Object Recognition

- AR/VR environments constantly evolve, and Zero-Shot Learning allows for the recognition of objects not seen during model training.
- It enables models to predict or classify unseen data, offering flexibility beyond the training dataset.
- AR overlays can identify unfamiliar objects by displaying a question mark and then labeling them.

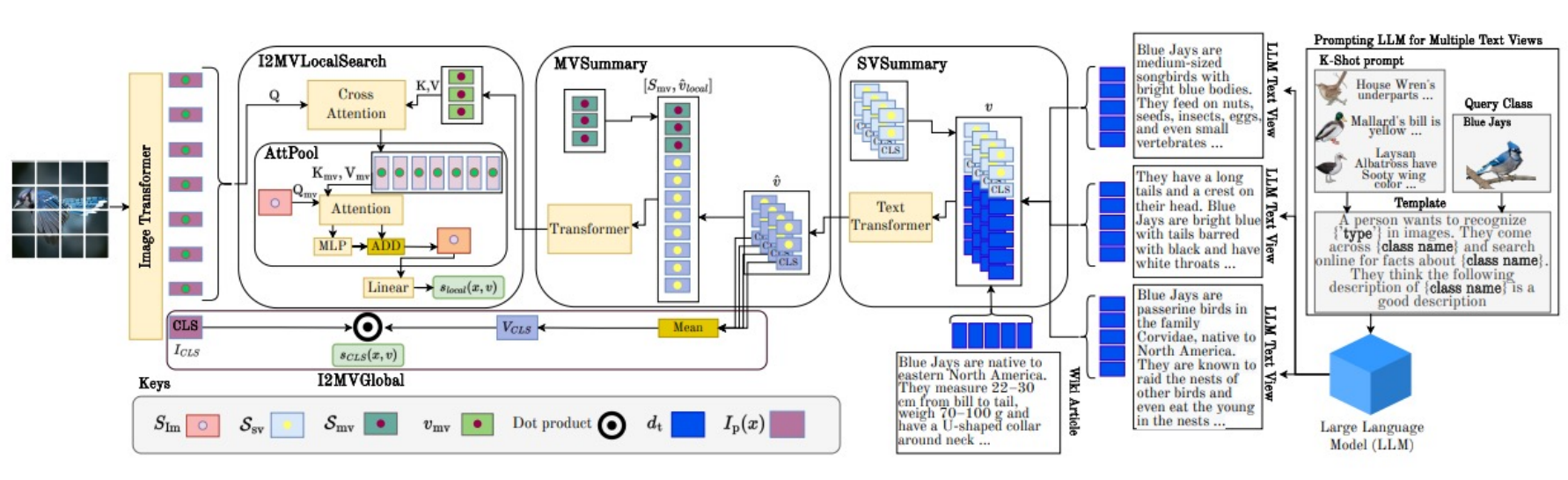
LLM Generated Multi-View Document Supervision for Zero-Shot Image Classification (CVPR 2023)

Prompting LLMs



LLM Generated Multi-View Document Supervision for Zero-Shot Image Classification

Unsupervised embeddings
Multiview Summary
Local Search
Global Alignment



Zero-Shot in AR/VR - Contextual Assistance

Contextual Assistance

- Zero-Shot learning enables AR/VR systems to provide guidance and support in unfamiliar scenarios.
- Users can receive real-time assistance that bridges the gap between known and unknown contexts.
- AR/VR interfaces can offer contextual information and relevant suggestions to enhance user experiences.
- Contextual assistance can improve user engagement and reduce errors in AR/VR interactions.

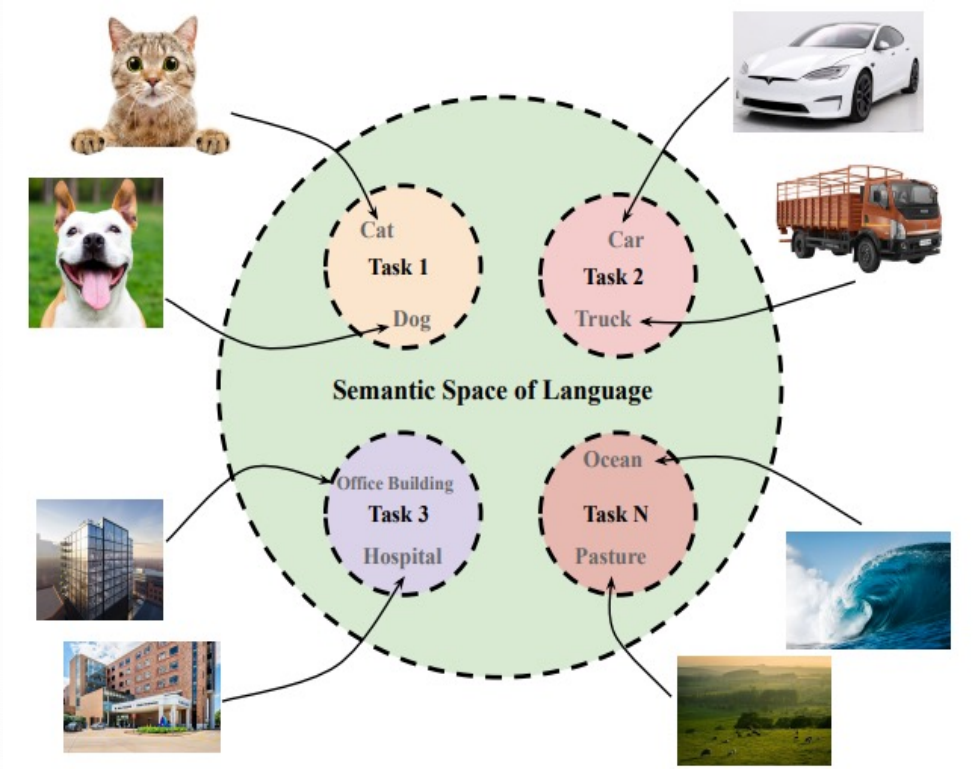
Continual Learning - Definition

Definition of Continual Learning

- Continual Learning ensures AI models evolve over time, adapting to new data without forgetting past experiences.
- It allows for the integration of new knowledge while retaining previously learned information.
- This adaptive learning approach enables AR/VR systems to provide more tailored and intuitive experiences.

Continual Learning (Class Incremental)

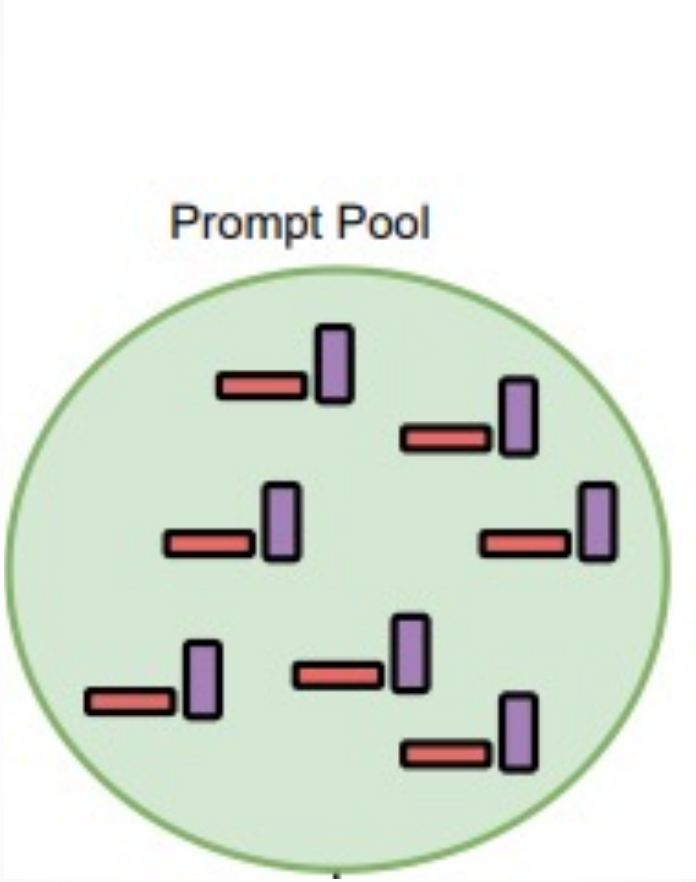
- Classes
- Tasks
  - 1..n Classes
  - Disjoint Set
- Hypothesis
  - Classes of same Tasks can be mapped to the semantic space of LLMs
- Benefit
  - Mitigation of catastrophic forgetting



Language Guidance in Prompt-based Continual Learning

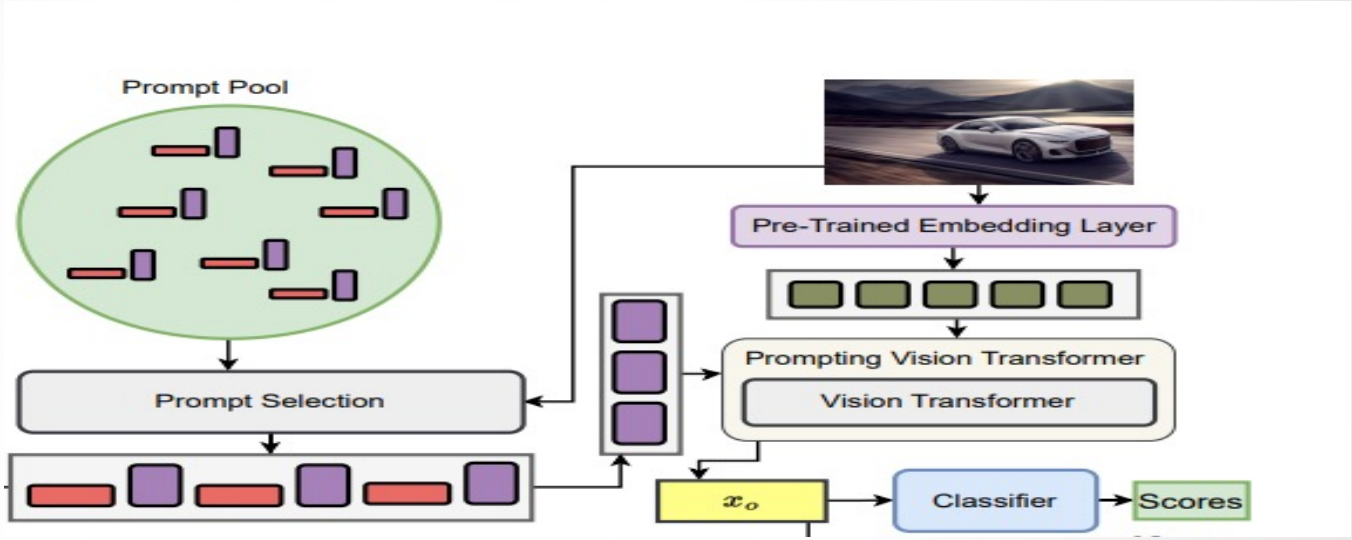
Prompt pool

- Prompt
- Keys

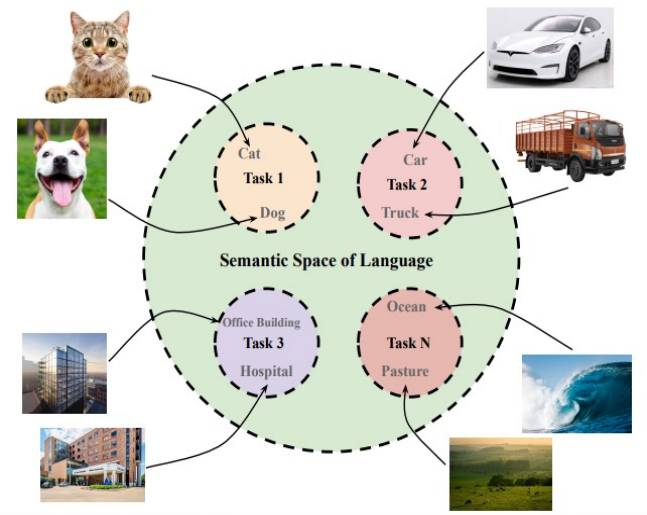


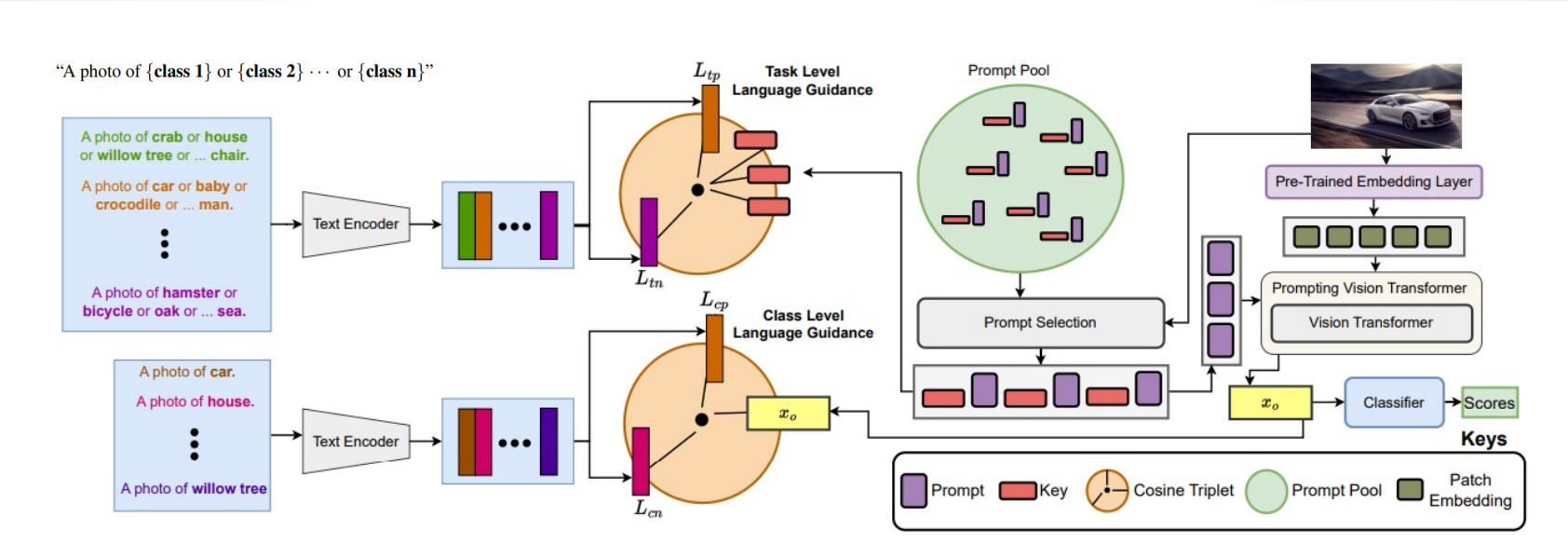
Language Guidance in Prompt-based Continual Learning

- Prompt pool
  - Prompt
  - Keys
- Image input
  - Pretrained Embedding



Language Guidance in Prompt-based Continual Learning

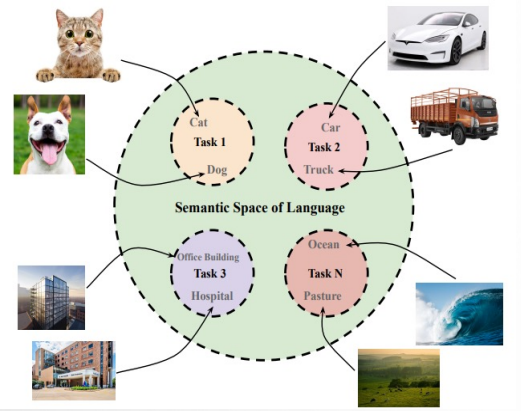


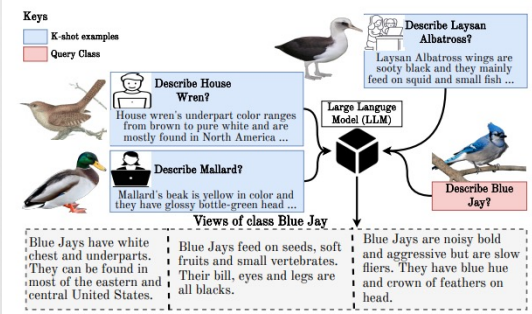


What is Next

Online Continual Learning

- The offline
- Difference
- Why it is important





Conclusion

Understanding Situational Awareness is important in AR VR

- Situational awareness is crucial for decision-making in dynamic environments.
- AR/VR offers immersive experiences that require real-time adaptability.
- User Safety and Comfort
- Adapting to unknown
  - Objects
  - Environments
  - Interactions
- Online Continual Learning

Thank you for your attention!

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