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FLAR: A Unified Prototype Framework for Few-sample Lifelong Active Recognition

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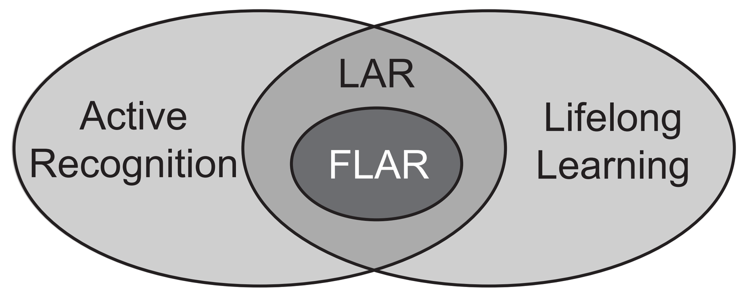
Motivation

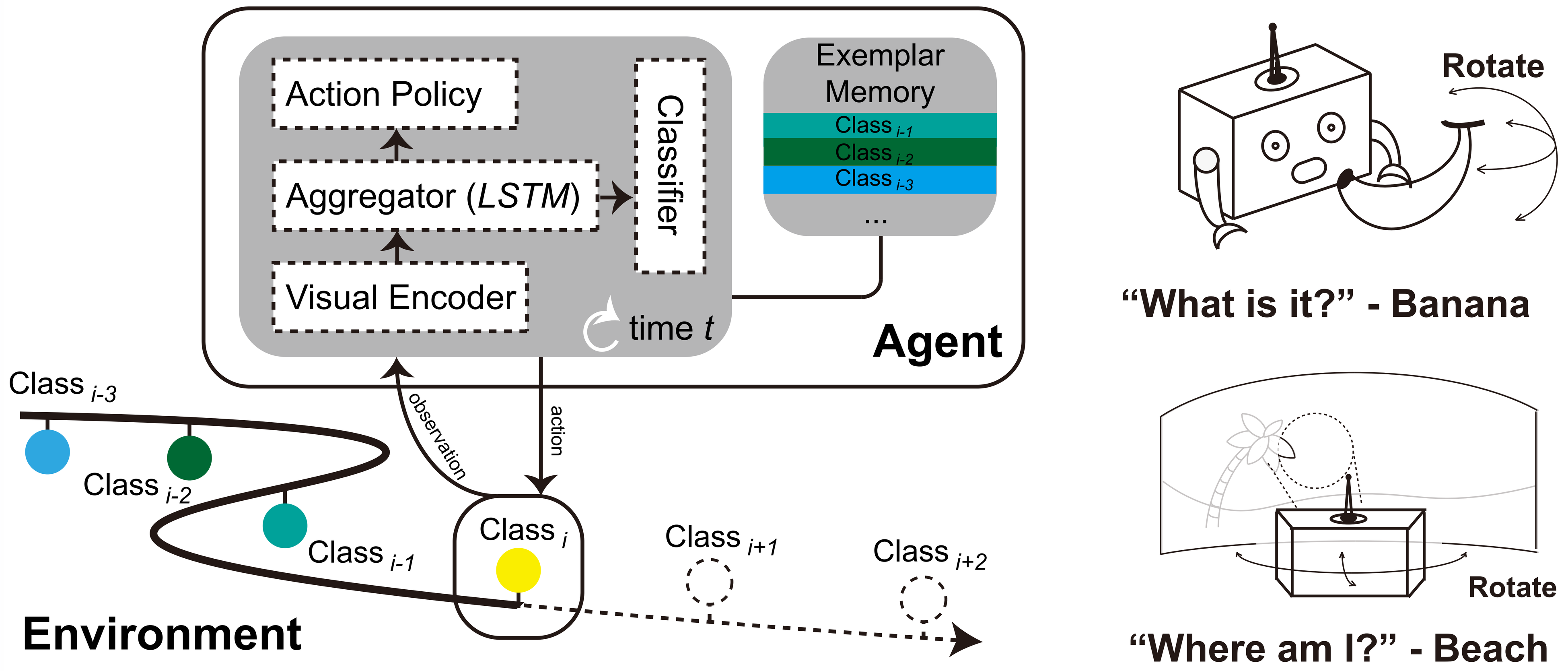
1. The **agent exploration** in a real-world environment is **inherently incremental**.
2. The ability to actively recognize novel classes that could not be known in advance is **demanded to be incorporated by the agent continuously**.



Venn diagram

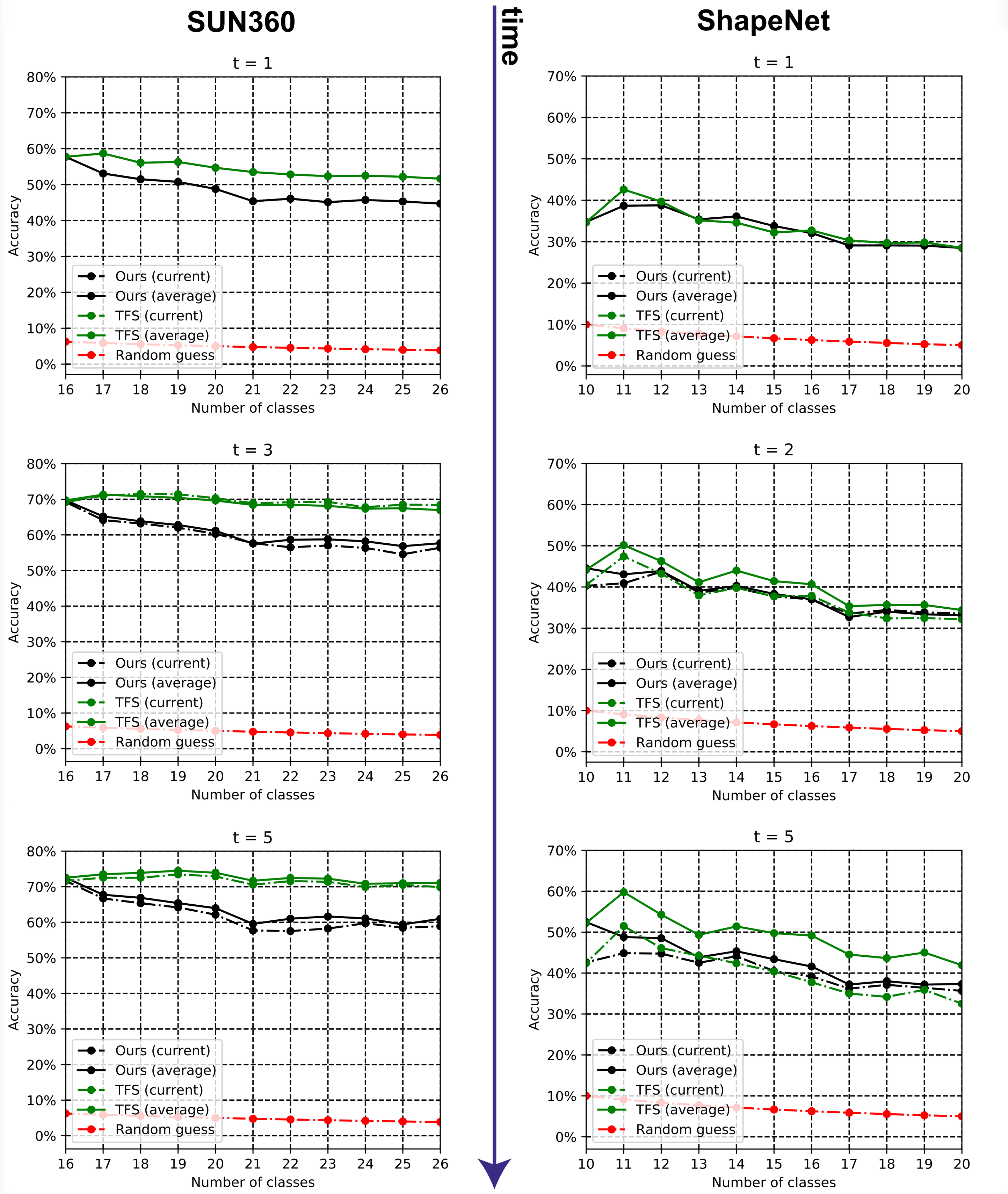
- **AR - Active Recognition**
- **LAR - Lifelong Active Recognition**
- **FLAR - Few-sample Lifelong Active recognition**

Main Idea



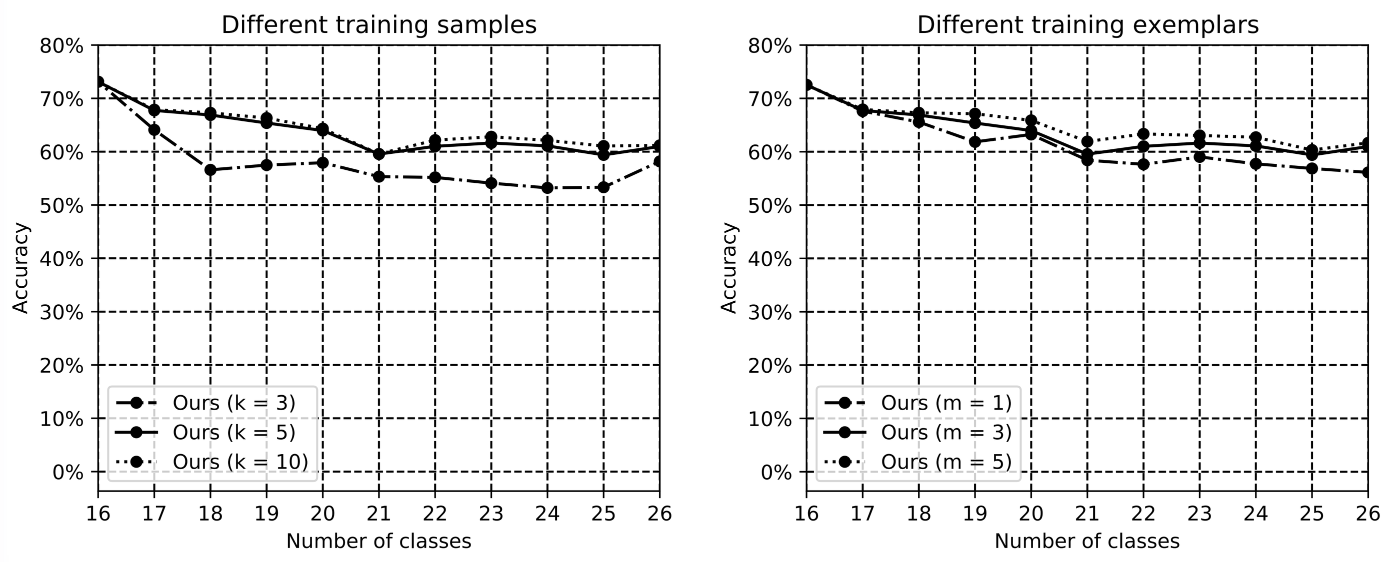
- The agent could **interact with the environment by obtaining observations and making movements**, which benefits recognition.
- As the agent exploring in the environment, the proposed method **expands its recognition ability to new classes**.

Quantitative Results



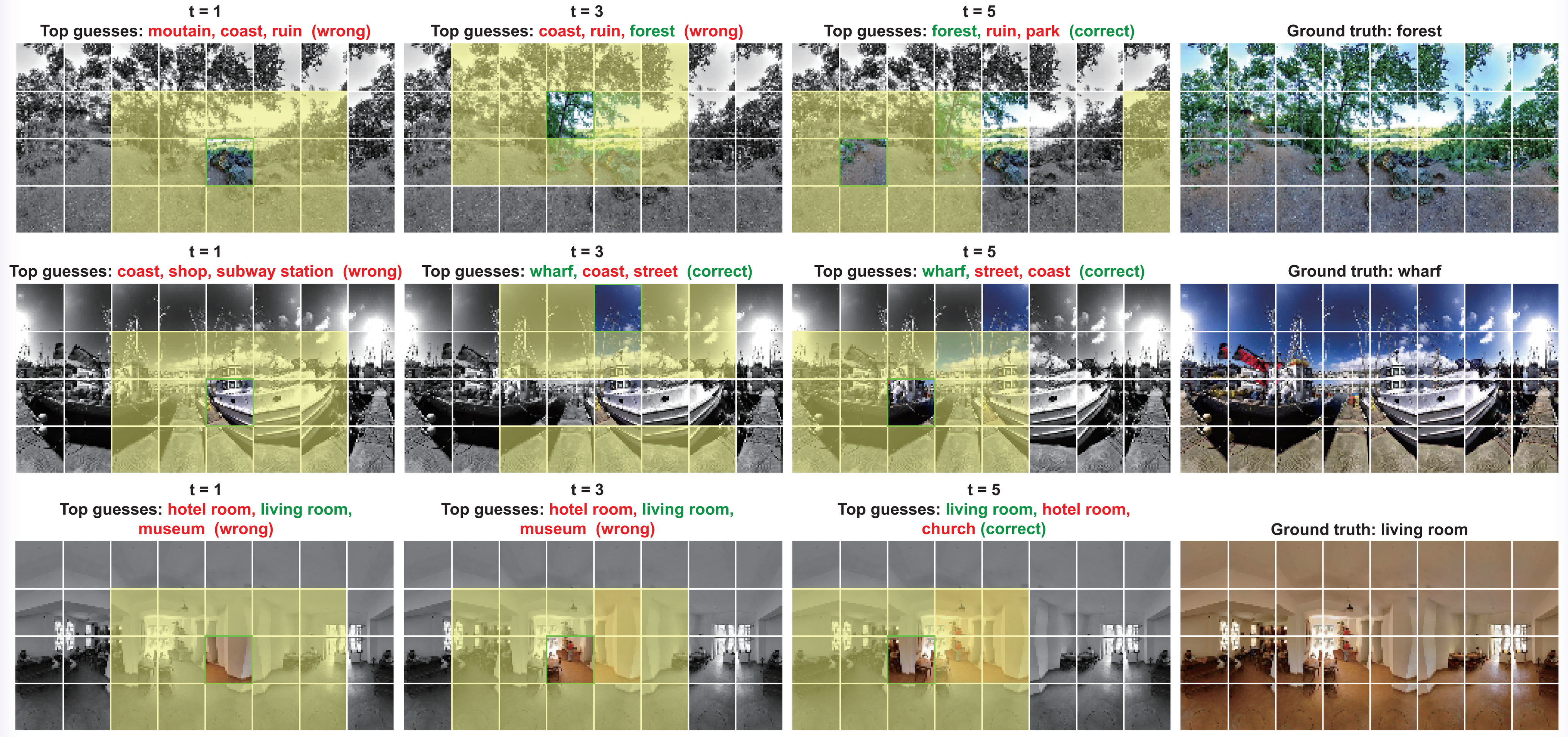
The comparison on recognition accuracy for both datasets.

Ablation studies

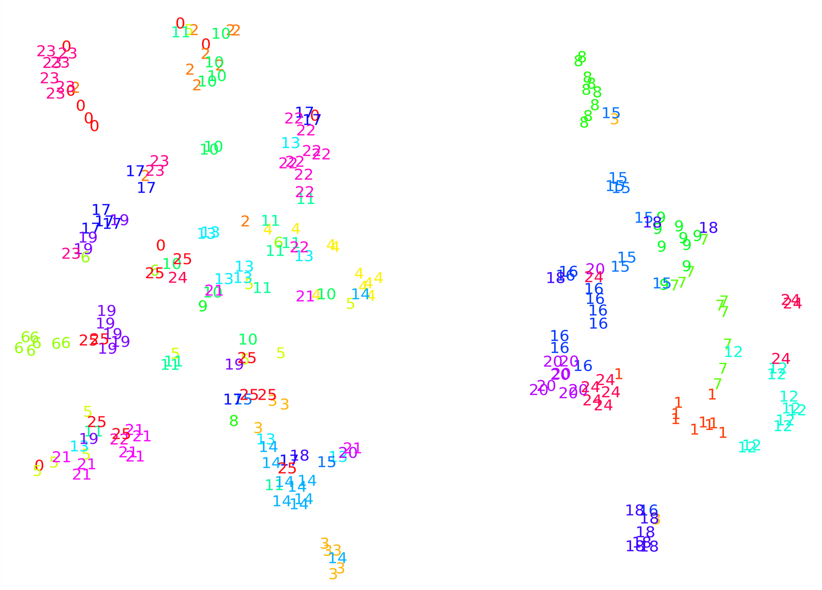


(a) Training sample sizes (b) Exemplar sizes

Qualitative Results



The active scene recognition process of the proposed approach.



t-SNE Visualization

- **The t-SNE demonstration of learned features by our approach.**
- The features from **the same category** are **located close to each other**.
- It demonstrates **the effectiveness of the proposed method in learning**

Summary

- We derive **the prototype** as the representation for each category, which is **robust in handling limited training samples**.
- The novel designed reward **motivates the agent to achieve more discriminative features** by measuring distances in the embedding space.
- To alleviate catastrophic forgetting, **the knowledge distillation with exemplars** stored in the agent memory is applied during the policy training.