NEURAL INFORMATION PROCESSING SYSTEMS

Agency for Science, Technology and Research SINGAPORE

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Adaptive Visual Scene Understanding: Incremental Scene Graph Generation

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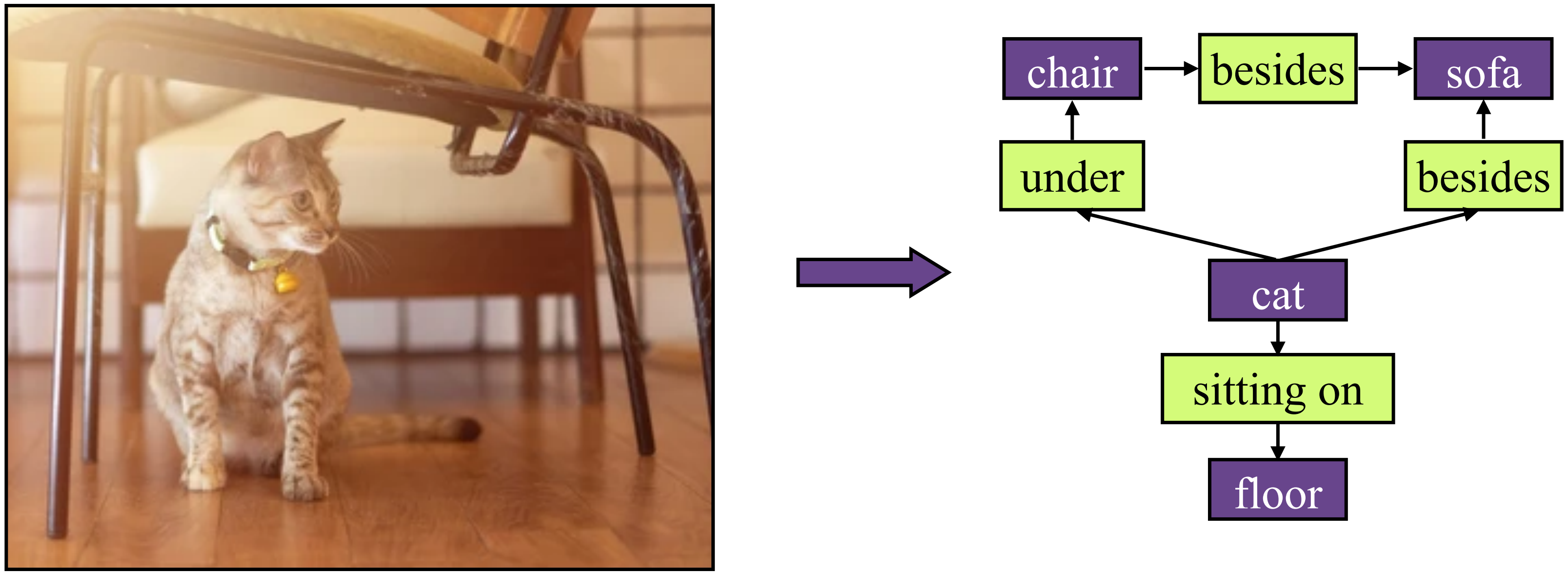
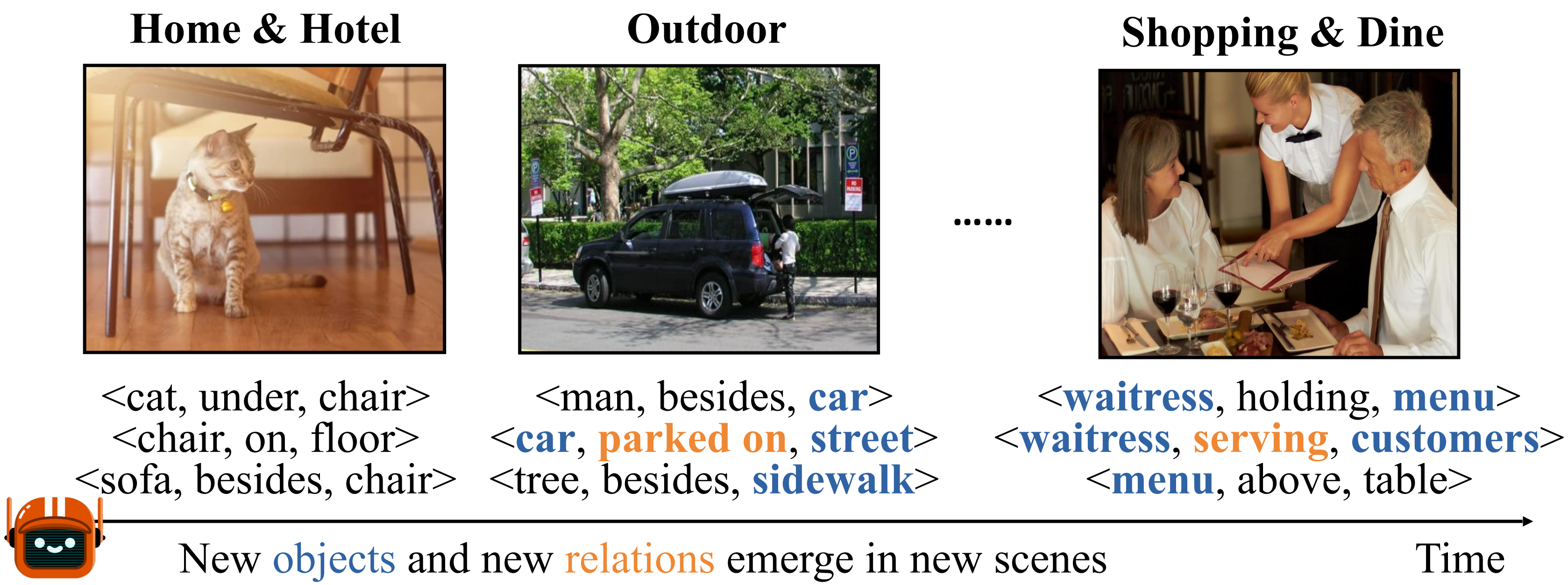
arxiv github

Introduction



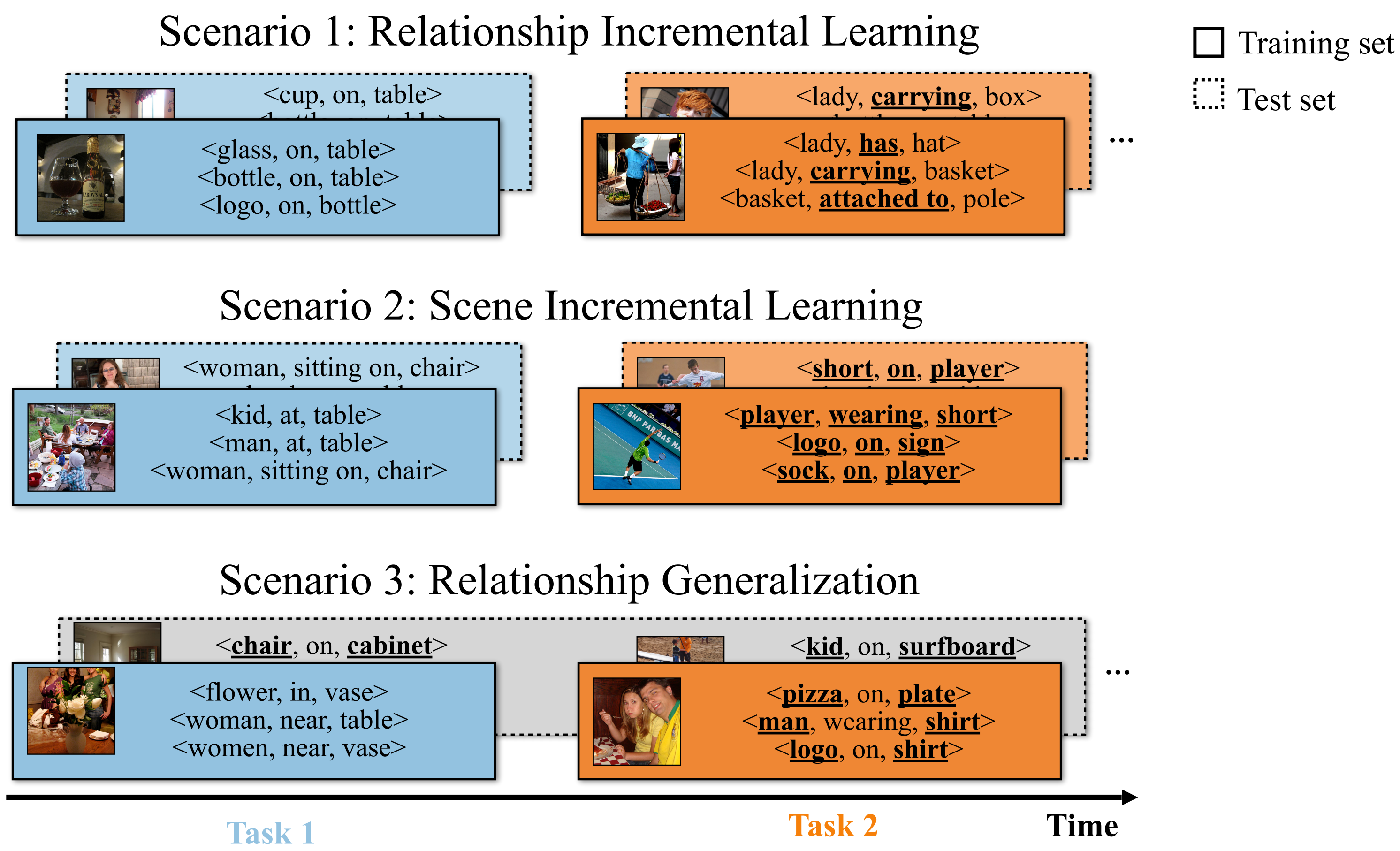
Scene **G**raph **G**eneration (**SGG**)

Introduction

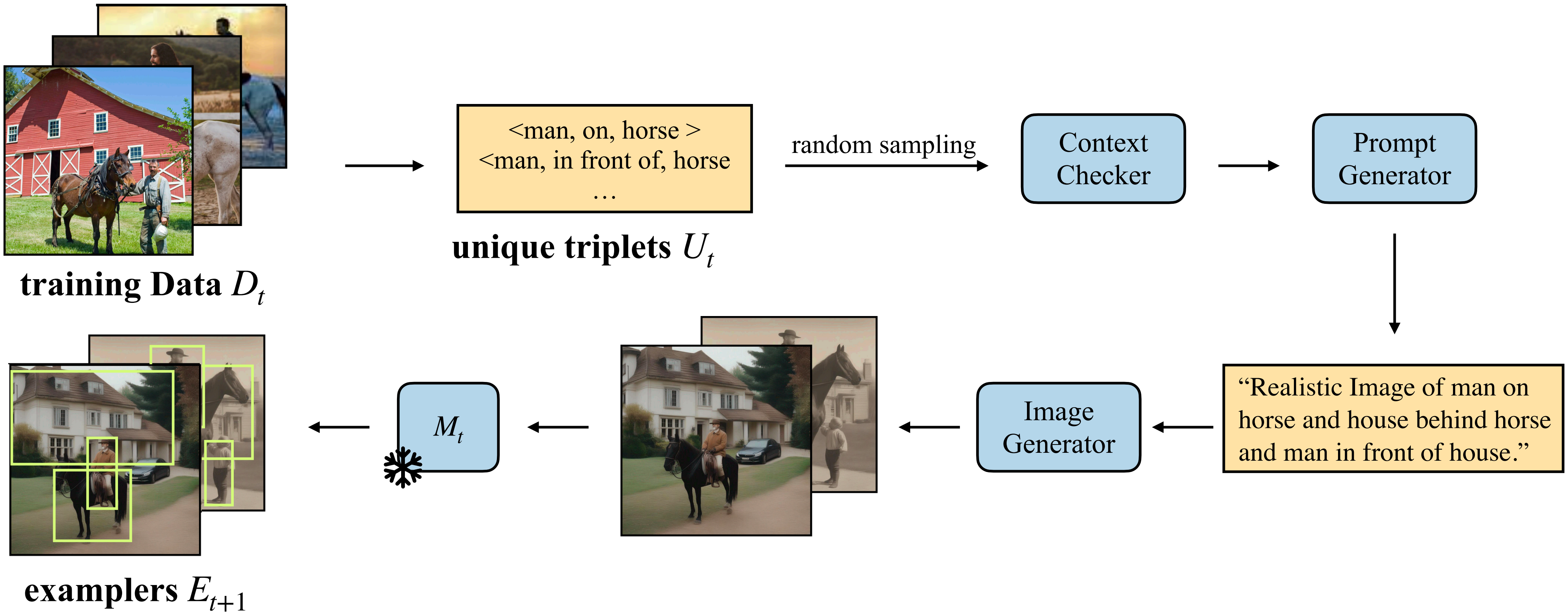


Continual **S**cene **G**raph **G**eneration (**CSEGG**)

CSEGG Benchmark



Replays via Analysis by Synthesis (RAS)



Main Results

SGTR[32]

Methods	Learning Scenario 1 (S1)						Learning Scenario 2 (S2)					
	Avg.R ↑	F↑	mR↑	mF↑	FWT↑	BWT↑	Avg.R↑	F↑	mR↑	mF↑	FWT↑	BWT↑
Joint	20.15	0	4.6	0	-	-	12.64	0	9.84	0	-	-
Replay@100%	16.17	-12.24	3.32	-1.34	-1.77	-11.72	4.56	-4.13	4.56	-5.61	-1.045	-30.25
Naive	1.33	-28.7	0.86	-1.74	-2.03	-60.67	0.51	-23.22	0.05	-11.31	-3.77	-62.34
EWC[24]	1.89	-28.4	0.96	-1.72	-1.17	-52.45	0	-23.22	0	-11.31	-2.65	-50.12
RAS_GT	5.78	-26.51	1.43	-1.54	-1.2	-44.27	0.98	-23.11	0.76	-10.86	-1.6	-43.25
PackNet[44]	7.19	-25.67	1.35	-1.64	-1.03	-42.35	1.67	-22.77	0.9	-10.33	-1.4	-42.45
Replay@10%	8.55	-22.21	4.33	-1.44	**4.29**	-38.35	1.81	-20.72	1.15	-9.64	-0.9	-40.67
Replay@20%	9.25	-20.35	4.78	-1.42	3.21	-31.98	2.57	-17.17	1.56	-8.07	-0.67	-38.27
Ours*	**10.78**	**-18.92**	**5.6**	**-1.39**	2.3	**-25.56**	**3.45**	**-10.23**	**2.75**	**-6.57**	**-0.54**	**-35.67**

TCNN[72]

Methods	Learning Scenario 1 (S1)						Learning Scenario 2 (S2)					
	Avg.R↑	F↑	mR↑	mF↑	FWT↑	BWT↑	Avg.R↑	F↑	mR↑	mF↑	FWT↑	BWT↑
Joint	19.53	0	3.9	0	-	-	4.3	0	3.7	0	-	-
Replay@100%	13.45	-8.83	3.6	-0.35	-1.5	-10.45	12.45	-4.13	3.2	-0.56	-2.1	-20.34
Naive	0.98	-21.2	0.74	-1.35	-3.45	-43.87	0	-18.22	0.45	-2.67	-4.12	-53.12
EWC[24]	2.36	-21.05	0.67	-1.34	-2.34	-39.89	0	-18.22	0.03	0	-3.77	-51.67
PackNet[44]	3.2	-19.7	1.1	-1.13	-1.3	-32.45	1.1	-17.82	0.84	-1.97	-2.84	-40.34
Replay@10%	5.67	-18.9	3.21	-1.05	**1.45**	-28.34	1.81	-16.72	1.03	-1.74	-1.4	-43.56
Replay@20%	6.23	-17.45	3.5	-1.01	1.01	-24.32	2.37	-15.17	1.45	-1.53	-1.1	-38.56
Ours*	**7.8**	**-15.67**	**3.9**	**-0.95**	0.5	**-19.83**	**4.67**	**-11.31**	**2.2**	**-0.89**	**-0.97**	**-29.65**

RAS outperforms all CSEGG baselines in S1 and S2

Main Results

Methods	SGTR[32] Learning Scenario 1 (S1)						Learning Scenario 2 (S2)					
	Avg.R ↑	F↑	mR↑	mF↑	FWT↑	BWT↑	Avg.R↑	F↑	mR↑	mF↑	FWT↑	BWT↑
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Decomposing scene graphs into smaller, diverse components with clear prompts is more effective than directly storing and using ground truth scene graphs for image generation

Main Results

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RAS outperforms Replay@20% (~2 Gb) while requiring less storage (~1.2 Gb)

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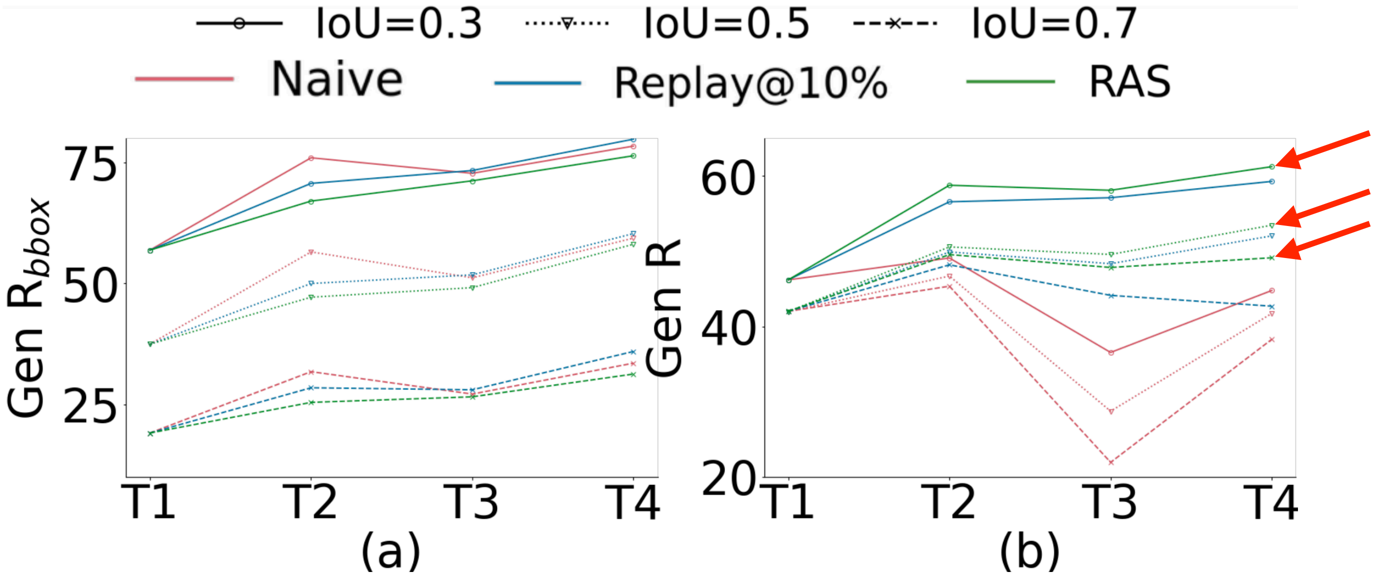
CSEGG models still find it challenging to learn new scenes incrementally

Main Results



RAS is more proficient in generalizing to classify relationships among unknown objects

Future Work

- ➢ Explore CSEGG on video-based datasets.
- ➢ Develop a synthetic CSEGG dataset to analyze continual learning under controlled conditions.
- ➢ Integrate a generative model with fine-grained control signals

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