A Multi-modal Global Instance Tracking Benchmark (MGIT): Better Locating Target in Complex Spatio-temporal and Causal Relationship

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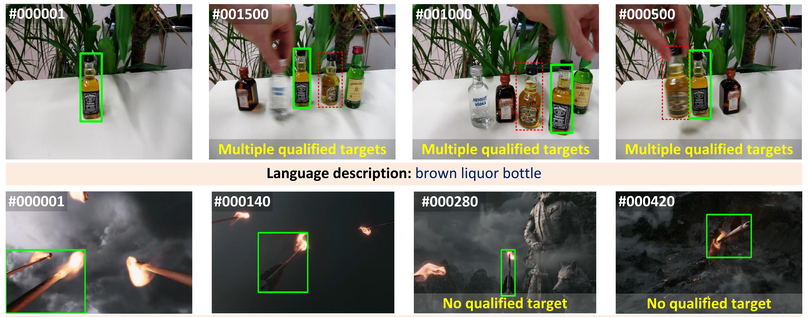
Platform for more information

Motivation

Limitations in existing visual-language tracking benchmarks

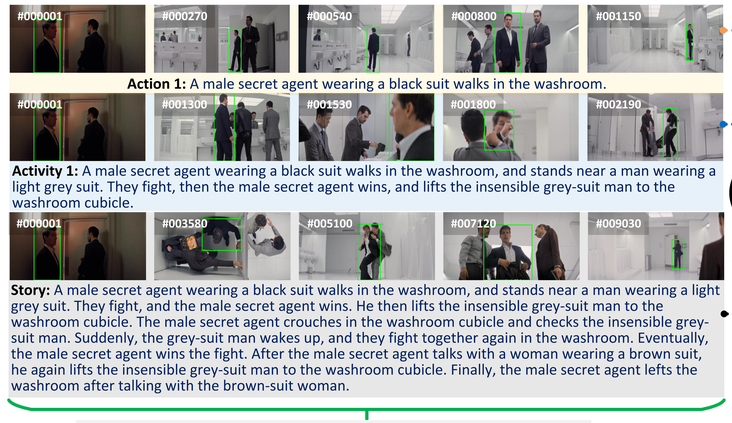


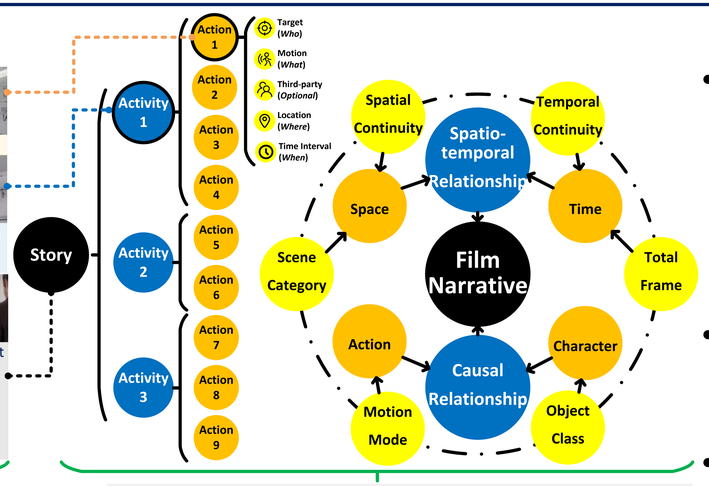
Video Short sequences with uncomplicated spatio-temporal and causal relationships

Lang-uage Simple semantic descriptions (multiple qualified targets, no qualified target)

Existing trackers always perform poorly in complex environments (e.g., longer videos with more complicated narrative content)

Method





Video Long sequences with complex spatial-temporal variation and casual relationship

Language Multi-granular annotation strategy based on the hierarchical structure of human cognitive

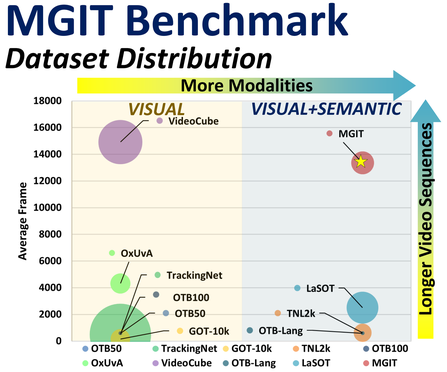
Coupling human causal reasoning ability into multi-modal information → Helping algorithms understand video content from a multi-modal perspective

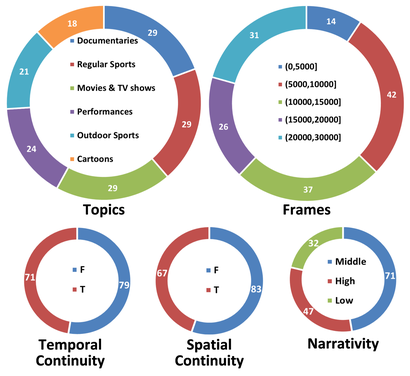
Contributions

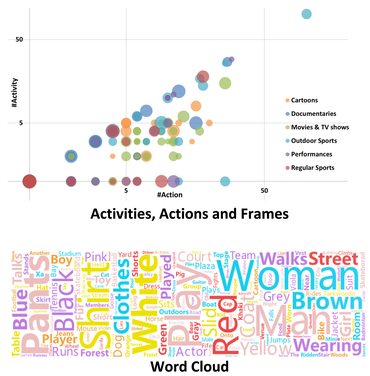
- We propose a new multi-modal benchmark named MGIT. It consists of 150 long videos with a total of 2.03 million frames, and the average length of a single sequence is 5-22 times longer than existing multi-modal benchmarks.
- We design a multi-granular annotation strategy for providing scientific semantic information.
- We execute comparative experiments on other benchmarks, and conduct detailed experimental analyses on MGIT.

MGIT Benchmark

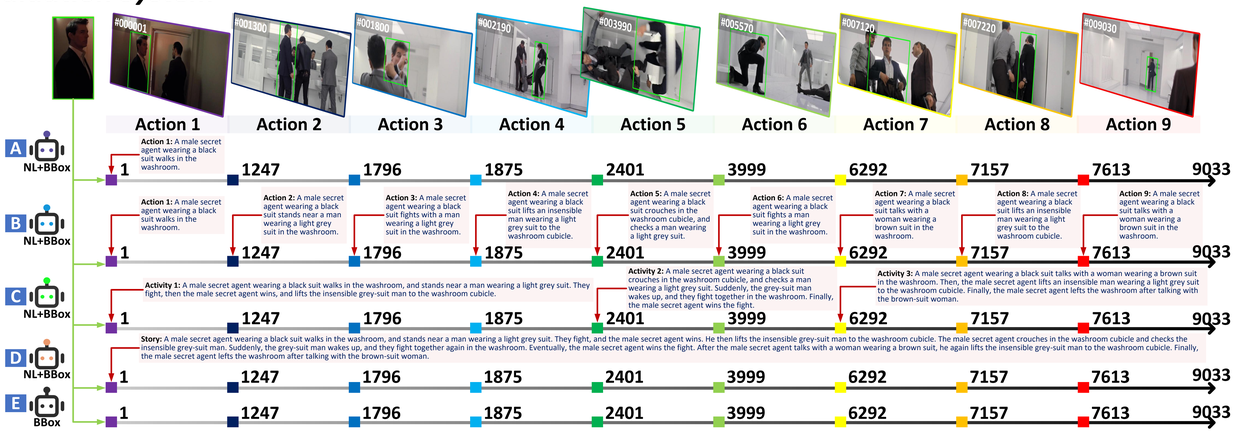
Dataset Distribution







Evaluation System

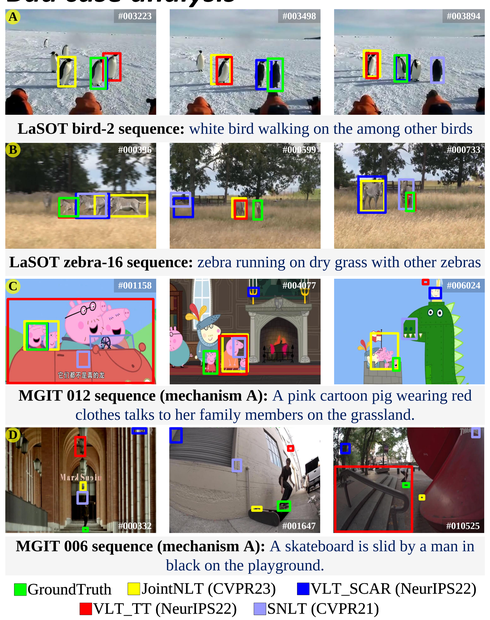


Experiments

Results on different multi-modal benchmarks (mechanism A)

Tracker	OTB-Lang [1]		TNL2k [3]		LaSOT [2]		LaSOT$_{Ext}$ [17]		LaSOT$_{Sub}$		LaSOT$_{NLC}$		MGIT	
	PRE	SR	PRE	SR	PRE	SR	PRE	SR	PRE	SR	PRE	SR	PRE	SR
SNLT [46]	0.848	0.666	0.081	0.100	0.475	0.459	0.306	0.262	0.527	0.495	0.513	0.483	0.004	0.036
VLT_SCAR [42]	0.898	0.739	0.556	0.497	0.677	0.630	0.503	0.428	0.670	0.633	0.659	0.633	0.124	0.177
VLT_TT [42]	0.931	0.764	0.583	0.539	0.714	0.670	0.549	0.465	0.707	0.660	0.721	0.662	0.324	0.474
JointNLT [18]	0.856	0.653	0.598	0.552	0.640	0.607	0.457	0.398	0.624	0.583	0.707	0.651	0.433	0.603

Bad case analysis



Results of different trackers on MGIT (mechanism B-E)

Tracker	Architecture	Initialize	Mechanism	PRE	N-PRE	SR
SiamCAR [11]	SNN	BBox	E	0.116	0.378	0.183
SiamRCNN [10]	SNN	BBox		0.512	0.707	0.591
PrDiMP [12]	SNN+CF	BBox		0.296	0.602	0.453
KeepTrack [13]	SNN+CF	BBox		0.373	0.695	0.519
TransT [39]	Transformer	BBox		0.447	0.670	0.539
MixFormer [14]	Transformer	BBox		0.526	0.775	0.629
OSTrack [15]	Transformer	BBox		0.476	0.706	0.583
GRM [16]	Transformer	BBox		0.500	0.718	0.597
SNLT [46]	SNN	NL&BBox	Action (B)	0.004	0.226	0.036
			Activity (C)	0.004	0.234	0.038
			Story (D)	0.005	0.230	0.040
VLT_SCAR [42]	SNN	NL&BBox	Action (B)	0.116	0.354	0.167
			Activity (C)	0.124	0.382	0.180
			Story (D)	0.127	0.403	0.184
VLT_TT [42]	Transformer	NL&BBox	Action (B)	0.318	0.602	0.468
			Activity (C)	0.325	0.627	0.485
			Story (D)	0.322	0.616	0.480
JointNLT [18]	Transformer	NL&BBox	Action (B)	0.445	0.786	0.610
			Activity (C)	0.441	0.780	0.605
			Story (D)	0.433	0.773	0.600

Conclusions

- MGIT is a complex environment, the annotation strategy is a feasible solution for coupling human understanding into semantic labels.
- Existing trackers should improve the capability for processing long text and aligning multi-modal information.