Segment Everything Everywhere All at Once

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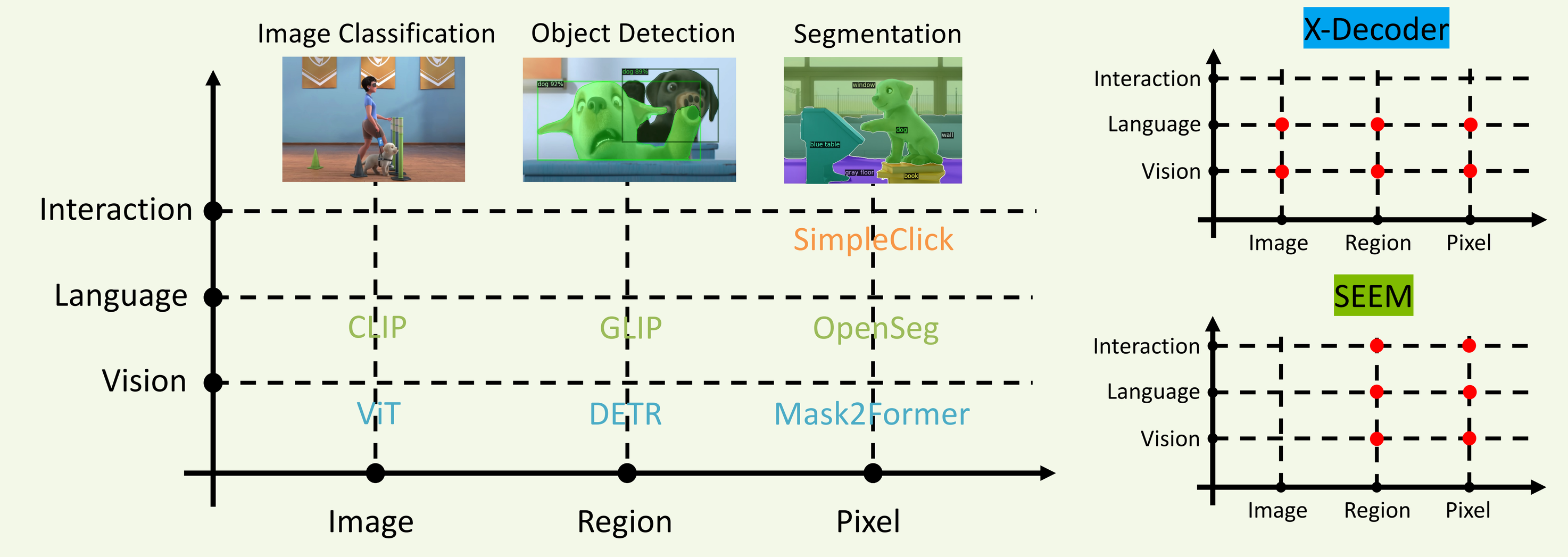
X-Decoder SEEM FIND

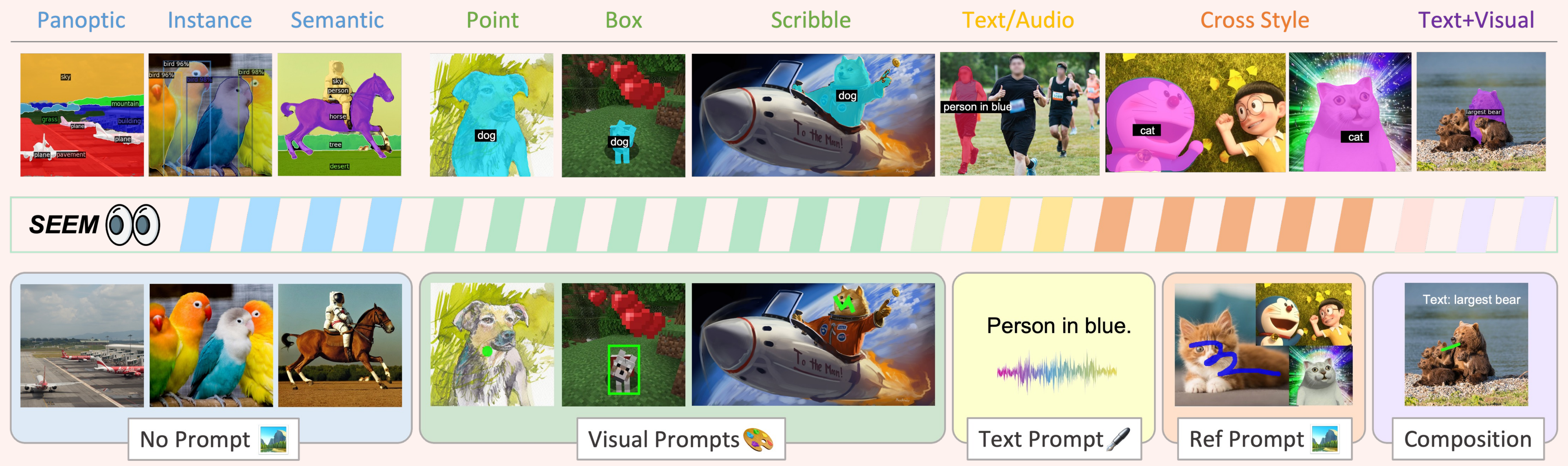
NEURAL INFORMATION PROCESSING SYSTEMS

Goal: A Single Generalist Approach for multimodal visual understanding with the same modal and a single set of weights



Foundation Model
+ Interactive
+ Interleave

Xueyan Zou*, Ziyi Dou*, Jianwei Yang*▲, Zhe Gan, Linjie Li, Chunyuan Li, Xiyang Dai, Harkirat Behl, Lu Yuan, Nanyun Peng, Lijuan Wang, Yong Jae Lee§, Jianfeng Gao§. ***"Generalized Decoding for Pixel, Image, and Language."*** CVPR, 2023.



Xueyan Zou*, Jianwei Yang*▲, Hao Zhang*, Feng Li*, Linjie Li, Jianfeng Wang, Lijuan wang, Jianfeng Gao§, Yong Jae Lee§. ***"SEEM: Segment Everything Everywhere All at Once."*** **NeurIPS, 2023.**

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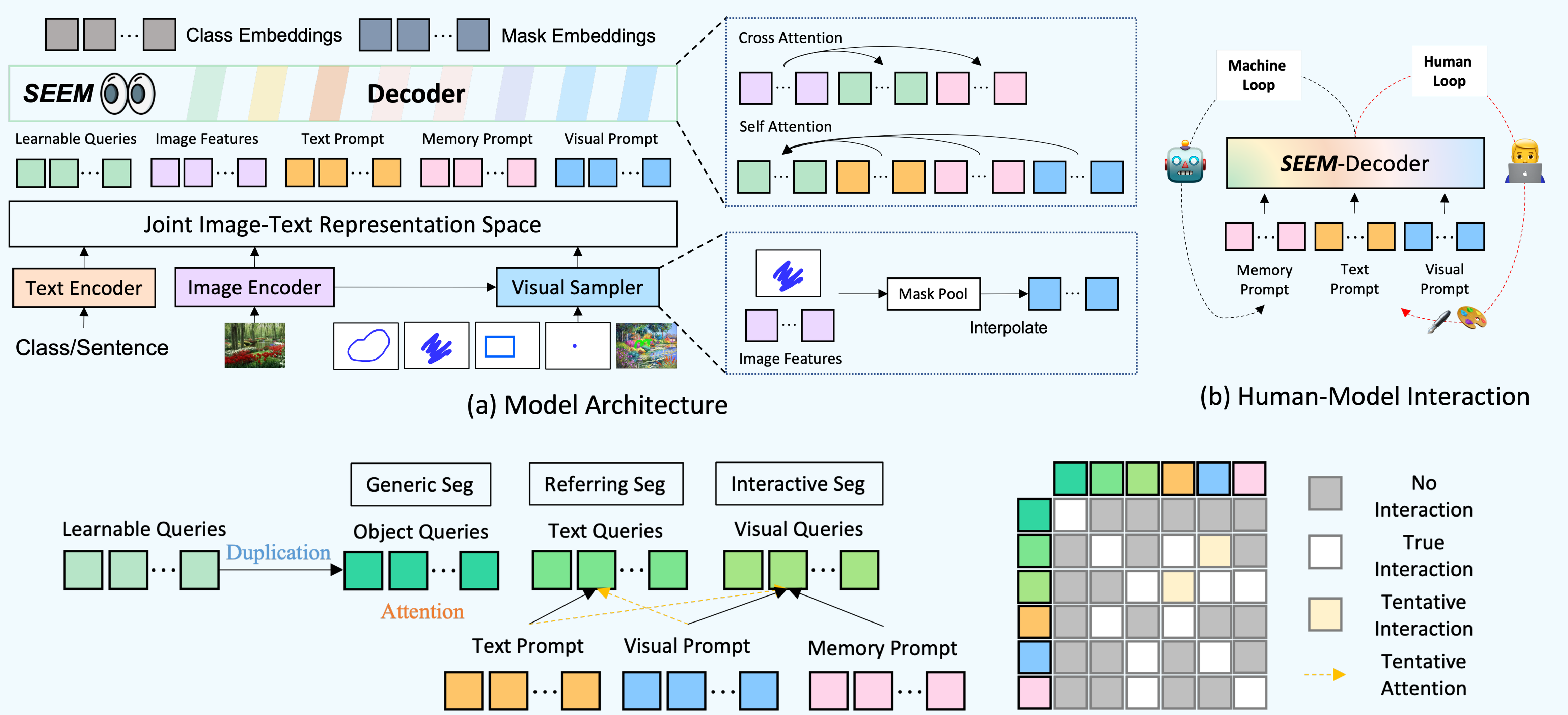
SEEM Architecture:



(a) Model Architecture

(b) Human-Model Interaction

(c) Queries and Prompt Interaction

(d) Self-Attention Mask

Quantitative Results:

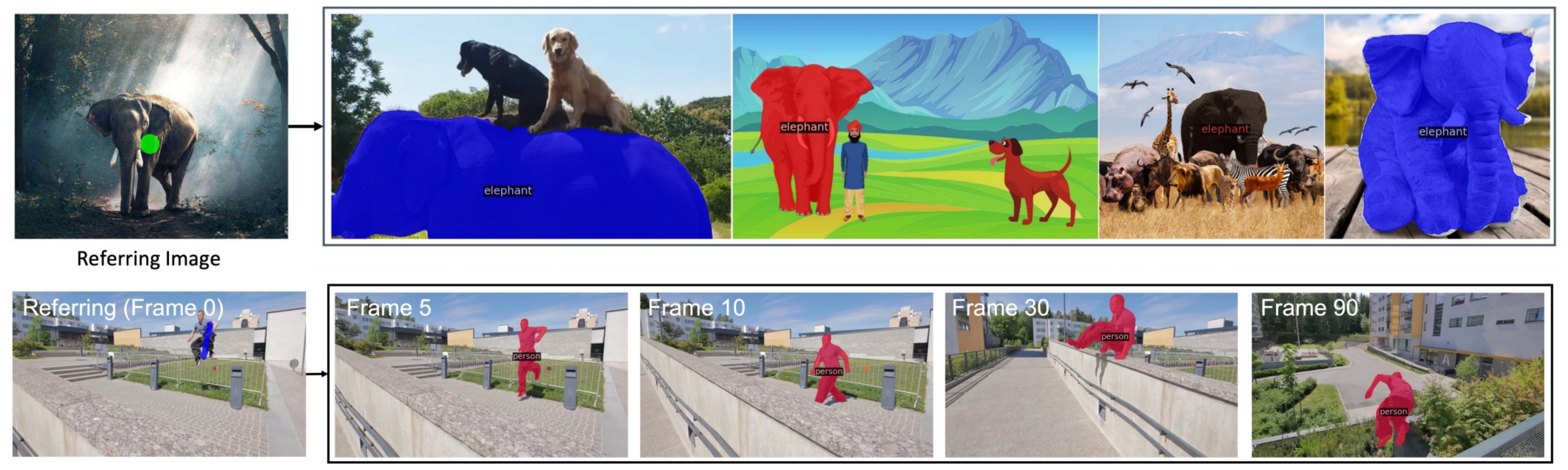
Table 1: **One model** for segmentation on a wide range of segmentation tasks. *SEEM* is the first model to simultaneously support generic segmentation, referring segmentation, and interactive segmentation, as well as prompt compositionality. (#Concurrent work. - indicates the model does not have capability for the task, * indicates do not have reported number.)

Method	Segmentation Data	Type	Generic Segmentation COCO			Referring Segmentation RefCOCOg			Interactive Segmentation PascalVOC					
			PQ	mAP	mIoU	cIoU	mIoU	AP50	5-NoC85	10-NoC85	20-NoC85	5-NoC90	10-NoC90	20-NoC90
Mask2Former (T) [6]	COCO (0.12M)	Segmentation	53.2	43.3	63.2	-	-	-	-	-	-	-	-	-
Mask2Former (B) [6]	COCO (0.12M)		56.4	46.3	67.1	-	-	-	-	-	-	-	-	-
Mask2Former (L) [6]	COCO (0.12M)		57.8	48.6	67.4	-	-	-	-	-	-	-	-	-
Pano/SegFormer (B) [45]	COCO (0.12M)		55.4	*	*	-	-	-	-	-	-	-	-	-
LAVT (B) [53]	Ref-COCO (0.03M)		-	-	-	61.2	*	*	-	-	-	-	-	-
PolyFormer (B) [17]	Ref-COCO+VG+... (0.16M)		-	-	-	69.3	*	*	-	-	-	-	-	-
PolyFormer (L) [17]	Ref-COCO+VG+... (0.16M)		-	-	-	71.1	*	*	-	-	-	-	-	-
RITM (<T) [18]	COCO+LVIS (0.12M)	Interactive	-	-	-	-	-	-	*	*	2.19	*	*	2.57
PseudoClick (<T) [54]	COCO (0.12M)		-	-	-	-	-	-	*	*	1.94	*	*	2.25
FocalClick (T) [21]	COCO (0.12M)		-	-	-	-	-	-	*	*	2.97	*	*	3.52
FocalClick (B) [21]	COCO (0.12M)		-	-	-	-	-	-	*	*	2.46	*	*	2.88
SimpleClick (B) [20]	COCO+LVIS (0.12M)		-	-	-	-	-	-	1.75	1.93	2.06	1.94	2.19	2.38
SimpleClick (L) [20]	COCO+LVIS (0.12M)		-	-	-	-	-	-	1.52	1.64	1.72	1.67	1.84	1.96
SimpleClick (H) [20]	COCO+LVIS (0.12M)		-	-	-	-	-	-	1.51	1.64	1.76	1.64	1.83	1.98
UViM (L) [55]	COCO (0.12M)	Generalist	45.8	*	*	-	-	-	-	-	-	-	-	-
Pix2Seq v2 (B) [56]	COCO (0.12M)		-	38.2	-	-	-	-	-	-	-	-	-	-
X-Decoder (T) [11]	COCO (0.12M)		52.6	41.3	62.4	59.8	*	*	-	-	-	-	-	-
X-Decoder (B) [11]	COCO (0.12M)		56.2	45.8	66.0	64.5	*	*	-	-	-	-	-	-
X-Decoder (L) [11]	COCO (0.12M)		56.9	46.7	67.5	64.6	*	*	-	-	-	-	-	-
UNINEXT (T) [48]	Image+Video (3M)		-	44.9	-	70.0	*	*	-	-	-	-	-	-
UNINEXT (L) [48]	Image+Video (3M)		-	49.6	-	73.4	*	*	-	-	-	-	-	-
Painter (L) [57]	COCO+ADE+NYUv2 (0.16M)		43.4	*	*	-	-	-	-	-	-	-	-	-
#SegGPT (L) [50]	COCO+ADE+NYUv2 (0.16M)		34.4	*	*	-	-	-	-	-	-	-	-	-
#SAM (B) [36]	SAM (11M)		-	-	-	-	-	-	2.47	2.65	3.28	2.23	3.13	4.12
#SAM (L) [36]	SAM (11M)		-	-	-	-	-	-	1.85	2.15	2.60	2.01	2.46	3.12
#SAM (H) [36]	SAM (11M)		-	-	-	-	-	-	1.82	2.13	2.55	1.98	2.43	3.11
SEEM (T)	COCO+LVIS (0.12M)		50.8	39.7	62.2	60.9	65.7	74.8	1.72	2.30	3.37	1.97	2.83	4.41
SEEM (B)	COCO+LVIS (0.12M)		56.1	46.4	66.3	65.0	69.6	78.2	1.56	2.04	2.93	1.77	2.47	3.79
SEEM (L)	COCO+LVIS (0.12M)		57.5	47.7	67.6	65.6	70.3	78.9	1.51	1.95	2.77	1.71	2.36	3.61
SEEM (T)	COCO+LVIS (0.12M)	Composition	-	-	-	70.4	71.7	82.1	1.72	2.28	3.32	1.97	2.82	4.37
SEEM (B)	COCO+LVIS (0.12M)		-	-	-	76.2	77.8	87.8	1.56	2.03	2.91	1.77	2.46	3.76
SEEM (L)	COCO+LVIS (0.12M)		-	-	-	75.1	76.9	86.8	1.52	1.97	2.81	1.72	2.38	3.64

Table 2: **One model** for all kinds of mask interactions. *SEEM* has strong generalization capability on different input mask types.

Method	COCO					Open Image					ADE				
	Point 1-IoU	Stroke 1-IoU	Scribble 1-IoU	Polygon 1-IoU	Box 1-IoU	Point 1-IoU	Stroke 1-IoU	Scribble 1-IoU	Polygon 1-IoU	BoX 1-IoU	Point 1-IoU	Stroke 1-IoU	Scribble 1-IoU	Polygon 1-IoU	BoX 1-IoU
SimpleClick (B)	49.0	33.1	65.1	48.6	42.5	48.6	29.5	54.2	49.5	42.7	47.0	19.0	52.1	48.3	37.2
SimpleClick (L)	38.9	33.9	68.8	39.2	34.7	37.5	29.1	59.8	35.2	31.2	36.8	16.4	56.4	41.7	29.5
SimpleClick (H)	59.0	37.3	71.5	45.3	52.4	54.1	32.6	64.7	39.9	49.3	52.8	18.4	58.3	46.8	41.8
SAM (B)	58.6	22.8	34.2	44.5	50.7	62.3	28.4	39.2	45.8	53.6	51.0	21.9	31.1	31.0	**58.8**
SAM (L)	64.7	44.4	57.1	60.7	50.9	65.3	45.9	55.7	57.8	52.4	57.4	45.8	53.1	45.8	58.7
SAM (H)	65.0	27.7	30.6	37.8	50.4	67.7	26.5	29.9	41.9	52.1	58.4	20.4	22.2	28.3	58.5
SEEM (T)	78.9	81.0	81.2	72.2	73.7	67.1	**69.4**	**69.5**	63.1	**60.9**	65.4	67.3	67.3	59.0	53.4
SEEM (B)	81.7	82.8	83.5	76.0	75.7	**67.6**	69.0	68.7	**64.2**	60.3	**66.4**	**68.6**	**67.7**	**60.5**	53.6
SEEM (L)	**83.4**	**84.6**	**84.1**	**76.5**	**76.9**	66.8	67.8	67.6	62.4	60.1	65.5	66.6	66.3	58.1	54.1

Zero Shot In-Context Prompting



Interactive Segmentation

Positive Negative