PEEKABOO: Hiding Parts of an Image for Unsupervised Object Localization

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We aim to localize unfamiliar and salient objects without the need for class specific training

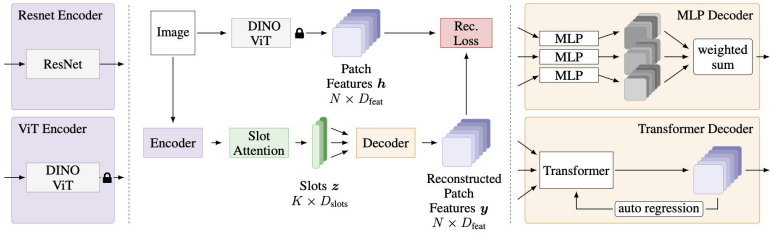
- Supervised learning is time-consuming and fails in cases of novel objects due to the finite nature of object classes.
- Unsupervised learning has challenges due to absence of visual information like appearance, type and number of objects

Image credit: Link

Existing unsupervised methods are complex and do not model visual context; fails when objects are small, reflective or under poor illumination

Model

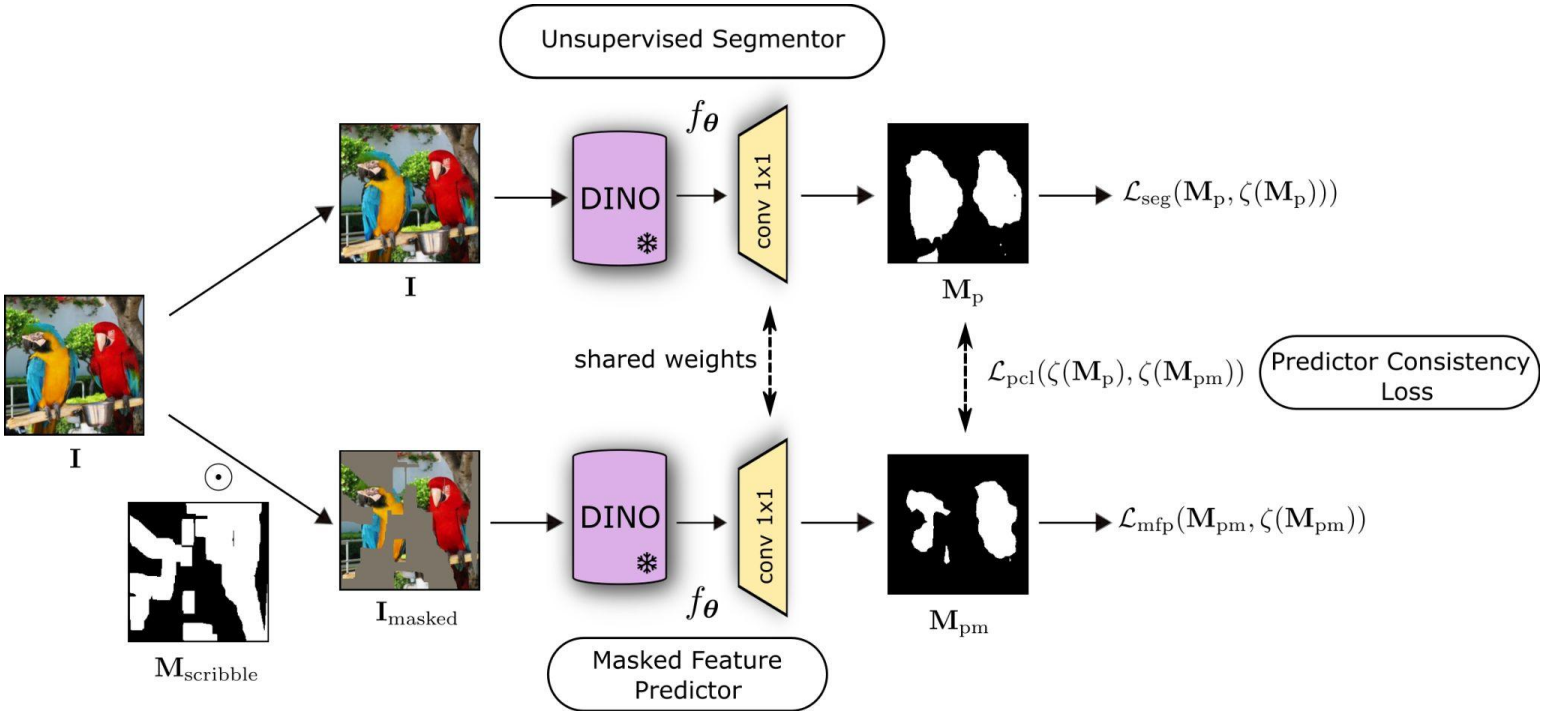
- Multiple stages of training
- Millions of learnable parameters
- Ensembles



Data:

- Uses both large-scale real world and synthetic data

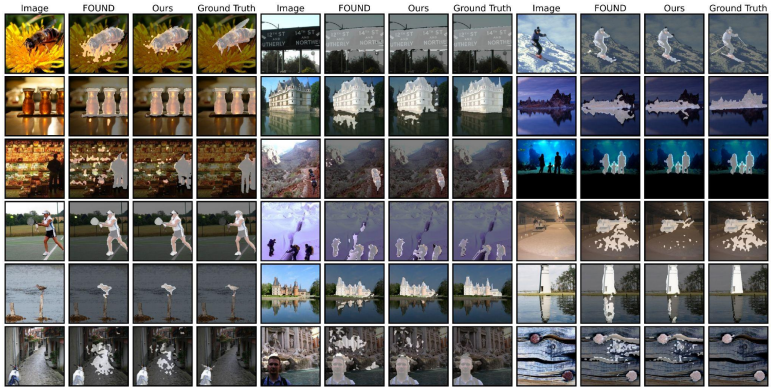
We introduce Peekaboo, a self-supervised single stage approach to localize novel and salient objects in an unsupervised manner



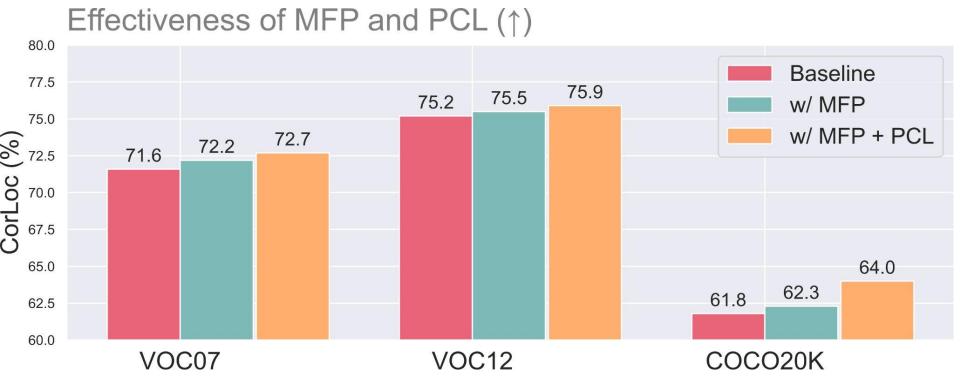
Peekaboo outperforms SOTA method on Single Object Discovery and Unsupervised Saliency Detection tasks

Method	Learning	DUT-OMRON			DUTS-TE			ECSSD		
		Acc	IoU	max F_β	Acc	IoU	max F_β	Acc	IoU	max F_β
HS [42]		84.3	43.3	56.1	82.6	36.9	50.4	84.7	50.8	67.3
wCtr [67]		83.8	41.6	54.1	83.5	39.2	52.2	86.2	51.7	68.4
WSC [18]		86.5	38.7	52.3	86.2	38.4	52.8	85.2	49.8	68.3
DeepUSPS [25]		77.9	30.5	41.4	77.3	30.5	42.5	79.5	44.0	58.4
BigBiGAN [37]		85.6	45.3	54.9	87.8	49.8	60.8	89.9	67.2	78.2
E-BigBiGAN[37]		86.0	46.4	56.3	88.2	51.1	62.4	90.6	68.4	79.7
Melas-Kyriazi et al. [23]		88.3	50.9	-	89.3	52.8	-	91.5	71.3	-
LOST [30]		79.7	41.0	47.3	87.1	51.8	61.1	89.5	65.4	75.8
DSM [22]		80.8	42.8	55.3	84.1	47.1	62.1	86.4	64.5	78.5
TokenCut [30]		88.0	53.3	60.0	90.3	57.6	67.2	91.8	71.2	80.3
SelfMask [29]	✓	90.1	**58.2**	-	92.3	62.6	-	94.4	78.1	-
FOUND† [30]	✓	90.7	57.1	79.9	93.5	63.7	85.2	**94.9**	**80.6**	95.1
DeepCut [0]	✓	-	-	-	-	59.5	-	-	74.6	-
WSCUOD [22]	✓	89.7	53.6	64.4	91.7	59.9	73.1	92.2	72.7	85.4
PEEKABOO (Ours)	✓	**91.5**	57.5	**80.4**	**93.9**	**64.3**	**86.0**	94.6	79.8	**95.3**
LOST + BS [30]	✓	81.8	48.9	57.8	88.7	57.2	69.7	91.6	72.3	83.7
DSM + CRF [22]	✓	87.1	56.7	64.4	83.8	51.4	56.7	89.1	73.3	80.5
WSCUOD + BS [22]	✓	90.9	58.5	68.3	92.5	63.0	76.4	92.8	74.2	89.6
TokenCut + BS [30]	✓	89.7	61.8	69.7	91.4	62.4	75.5	93.4	77.2	87.4
SelfMask + BS [29]	✓	91.9	**65.5**	-	93.3	66.0	-	**95.5**	**81.8**	-
FOUND + BS† [30]	✓	91.7	60.9	69.1	94.0	66.1	75.0	95.2	81.7	93.0
PEEKABOO + BS (Ours)	✓	**92.4**	61.2	**71.4**	**94.4**	**66.3**	**77.4**	94.9	80.6	**93.7**

Method	Learning	VOC07	VOC12	COCO20K
Zhang et al. [60]		46.2	50.5	34.8
DDT+ [51]		50.2	53.1	38.2
rOSD [55]		54.5	55.3	48.5
LOD [56]		53.6	55.1	48.5
DINO [0]		45.8	46.2	42.1
LOST [30] (ViT-S/16)		61.9	64.0	50.7
LOST + CAD [30]		65.7	70.4	57.5
DSM [22] (ViT-S/16)		62.7	66.4	52.2
TokenCut [30] (ViT-S/16)		68.8	72.1	58.8
TokenCut + CAD [30]		71.4	75.3	62.6
SelfMask [29]	✓	72.3	75.3	62.7
FOUND† [30]	✓	71.7	75.6	61.1
FreeSOLO [55]	✓	56.1	56.7	52.8
DeepCut [0]	✓	69.8	72.2	61.6
WSCUOD [22]	✓	70.6	72.1	63.5
DINOSAUR [22]	✓	-	70.4	**67.2**
PEEKABOO (ViT-S/8) (Ours)	✓	**72.7**	**75.9**	64.0



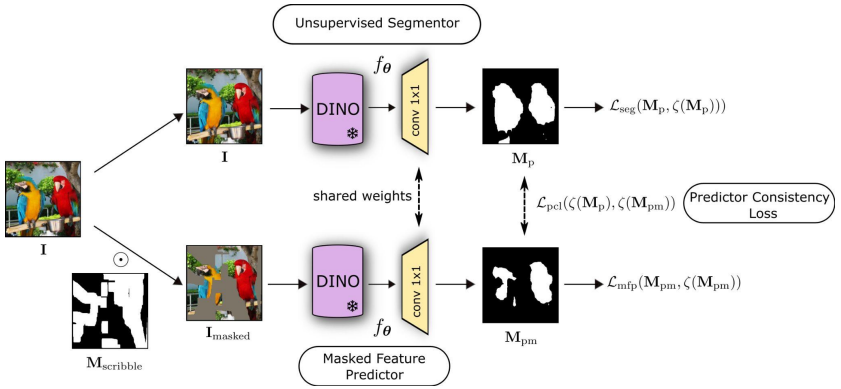
Peekaboo components complement each other; is better with high masking of images



Peekaboo can detect multiple unfamiliar objects of different shapes and scales; basically which are not background

Consider using Peekaboo in your research!

- A self-supervised segmentation model with zero-shot generalization to unfamiliar images and objects that are small, reflective or under poor illumination without the need for additional training.
- Compared to existing methods it does not require:
  - Multiple stages of training
  - Millions of learnable parameters
  - Combinations of multiple networks
  - Large scale real world and synthetic data



Project Page: https://hasibzunair.github.io/peekaboo/