SENSETIME 商 汤 科 技

Video Object Segmentation with Re-identification

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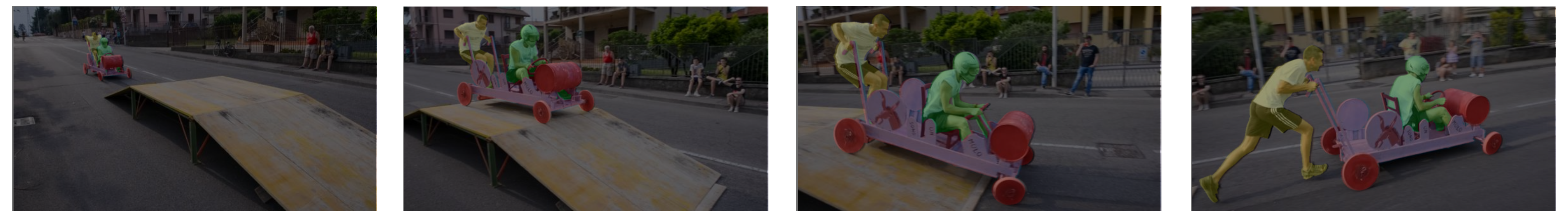
1. Introduction

- **Problem**
  - Semi-supervised video object segmentation
  - Input: video sequence and masks in the first frame

  - Output: masks in the rest of the frame



- **Challenges**
  - Small objects and fine structures
  - Scale & pose-variations
  - Frequent occlusions and fast motion

- **Our Idea**
  - Two modules:
    - Mask propagation module   Short term
    - Re-identification module   Long term
  - Alternating updating algorithm

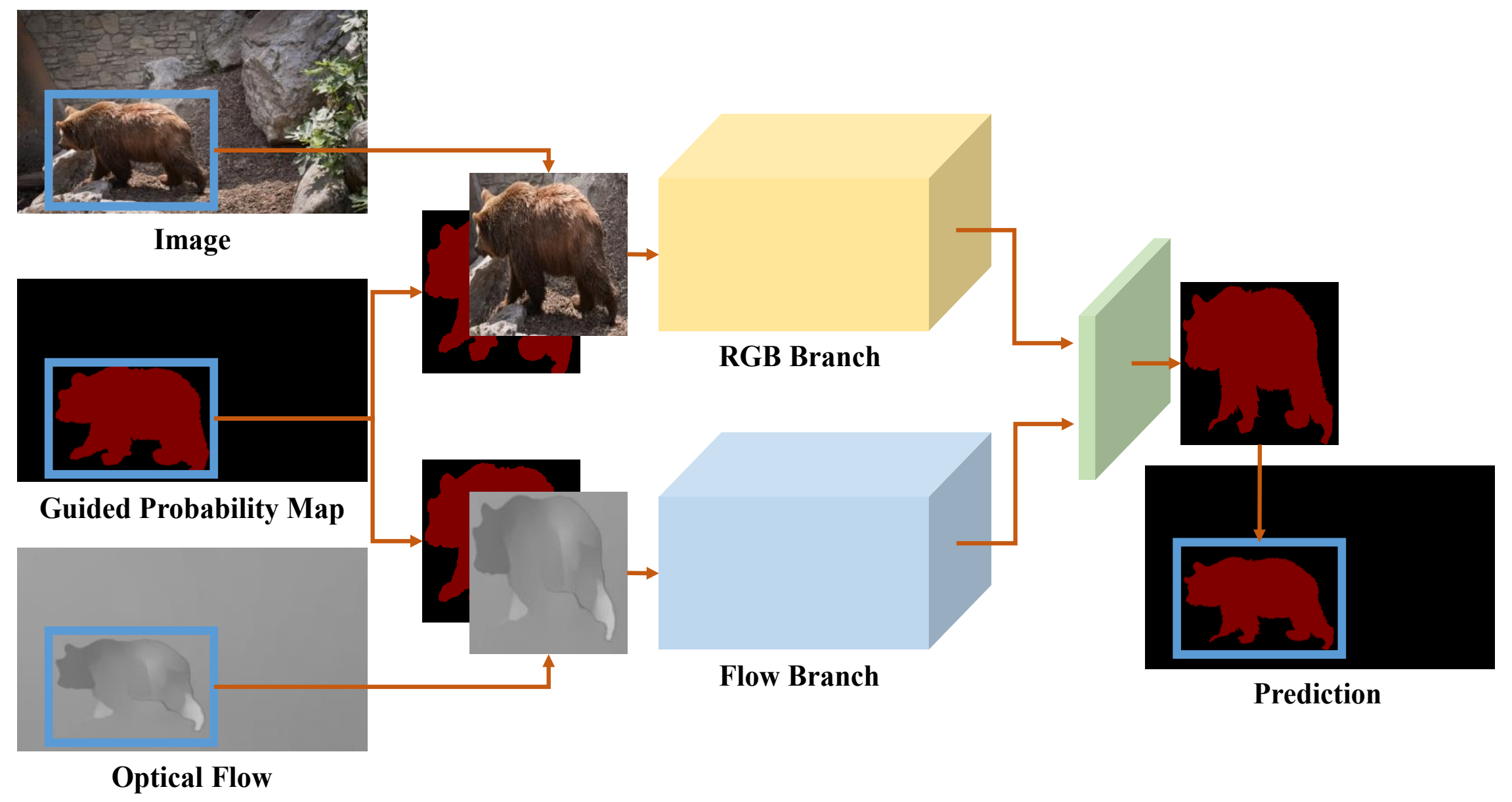
5. Overall Performance

Results on 2017 DAVIS Challenge test-challenge set.

Measure	Ours	Apata	Vanta	Haamo	Voigt	Lalal	Cjc	YXLKJ	Wasid	Froma	Zwrq0	Drbea	Anews	Ilanv	Koh	Make	Kozab	Xn881	Zpd	Griff	Nitin	Team5
Ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Global Mean ↑	69.9	67.8	63.8	61.5	57.7	56.9	56.9	55.8	54.8	53.9	53.6	51.9	50.9	49.7	49.1	48.0	47.8	47.6	47.1	42.0	25.6	11.2
J Mean ↑	67.9	65.1	61.5	59.8	54.8	54.8	53.6	53.8	51.6	50.7	50.5	50.5	49.0	46.0	45.9	46.3	43.9	47.8	44.9	40.6	24.9	11.8
J Recall ↑	74.6	72.5	68.6	71.0	60.8	60.7	59.5	60.1	56.3	54.9	54.9	56.4	55.1	49.3	50.2	50.0	45.8	56.3	48.0	42.1	12.3	7.3
J Decay ↓	22.5	27.7	17.1	21.9	31.0	34.4	25.3	37.7	26.8	32.5	28.0	34.1	21.3	33.1	36.1	40.2	33.0	16.7	31.8	37.4	13.1	14.0
F Mean ↑	71.9	70.6	66.2	63.2	60.5	59.1	60.2	57.8	57.9	57.1	56.7	53.3	52.8	53.3	52.3	49.7	51.6	47.3	49.3	43.3	26.3	10.6
F Recall ↑	79.1	79.8	79.0	74.6	67.2	66.7	67.9	62.1	64.8	63.2	63.5	57.9	58.3	58.4	57.1	52.8	56.0	53.0	54.4	43.2	9.1	3.0
F Decay ↓	24.1	30.2	17.6	23.7	34.7	36.1	27.6	42.9	28.8	33.7	30.4	39.5	23.7	36.4	39.2	44.8	36.3	21.6	36.2	40.2	13.0	12.6

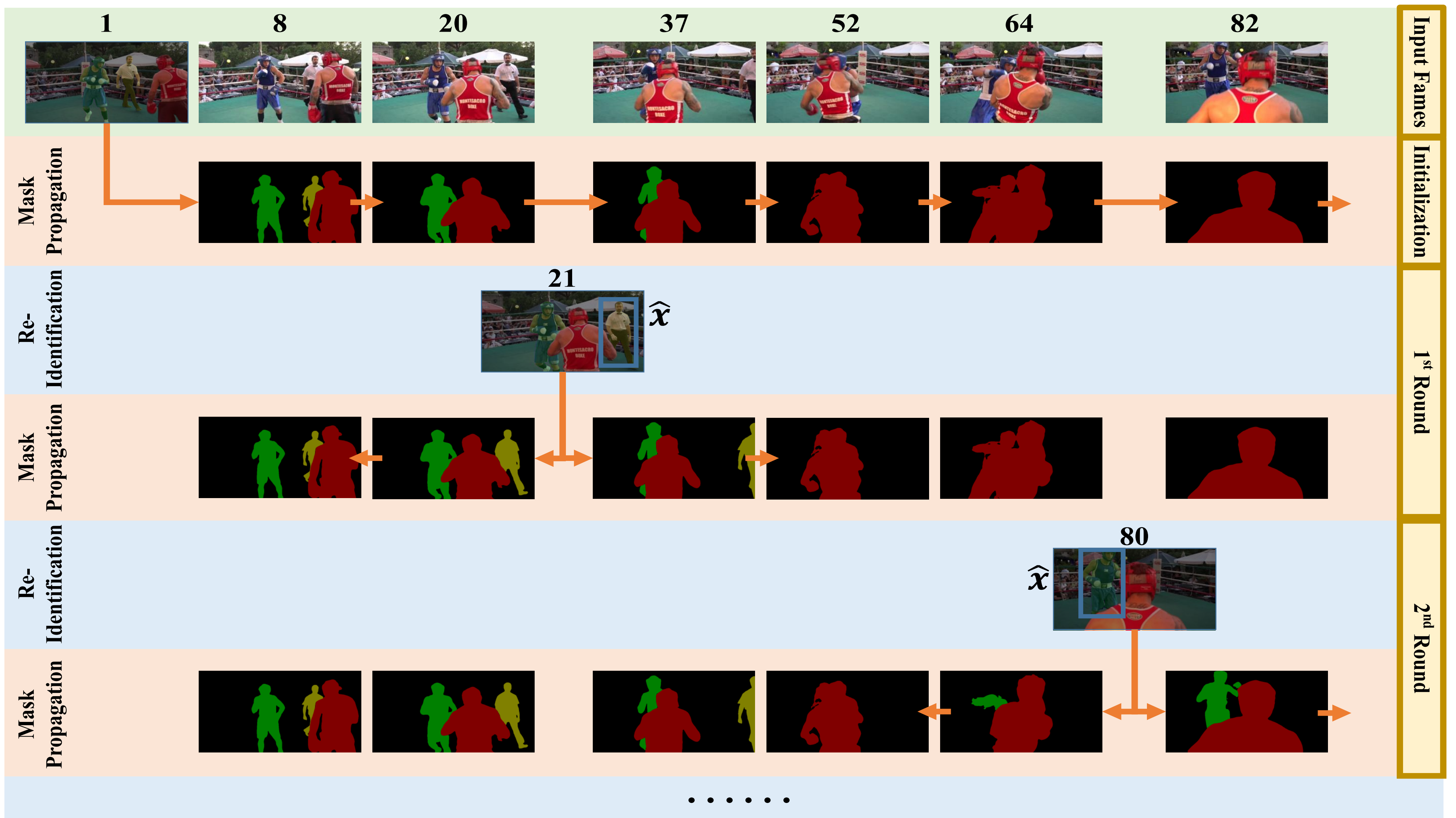
2. Approach

- **Mask Propagation Module**
  - Inspired by LucidTracker
  - Several important modifications
    - Deeper network (ResNet101)
    - Bounding box input (Handle scale-variations)
    - Two streams are jointly fine-tuned



- **Re-identification Module**
  - Detection and re-identification network (similar with person search)
  - Choose the instances in the first frame as the templates
  - Scan the whole video sequence and recover the most confident instance

- **Video Object Segmentation with Re-identification (VS-ReID)**

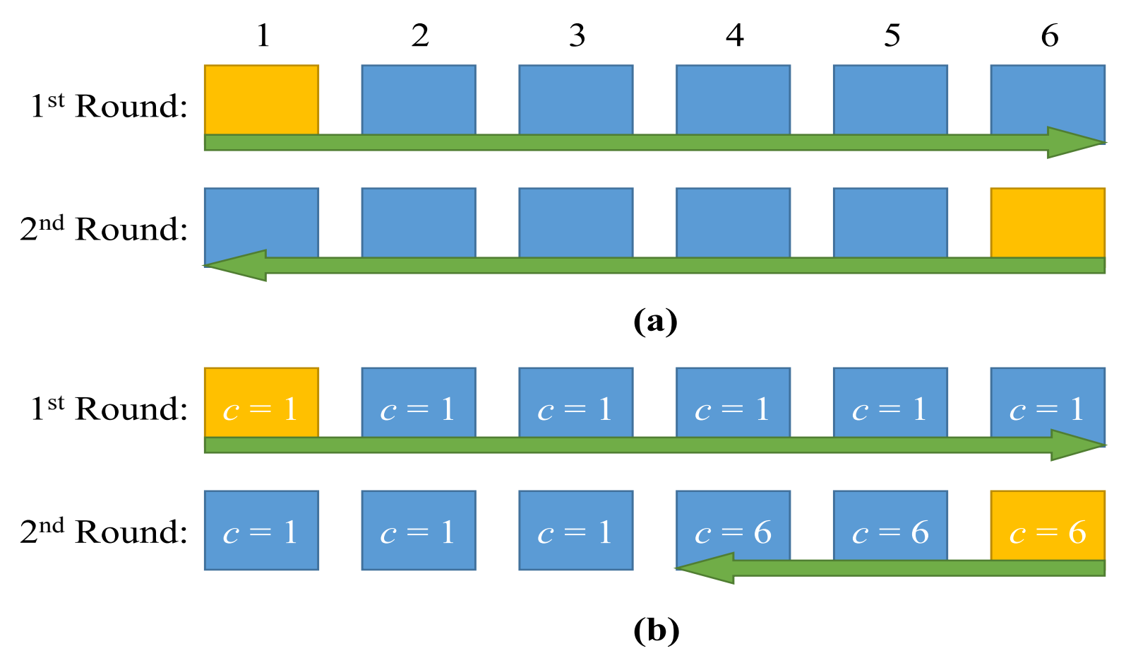


3. Implementation Details

- **Training Set**
  - Mask propagation module: COCO, PASCAL VOC, DAVIS
  - Re-identification Module: ImageNet, ImageNet-VID

- **Recover Mask from a Bounding Box**
  - Employ the mask in the first frame as the guided probability map
  - Execute the mask propagation module

- **Checkpoint Mechanism**

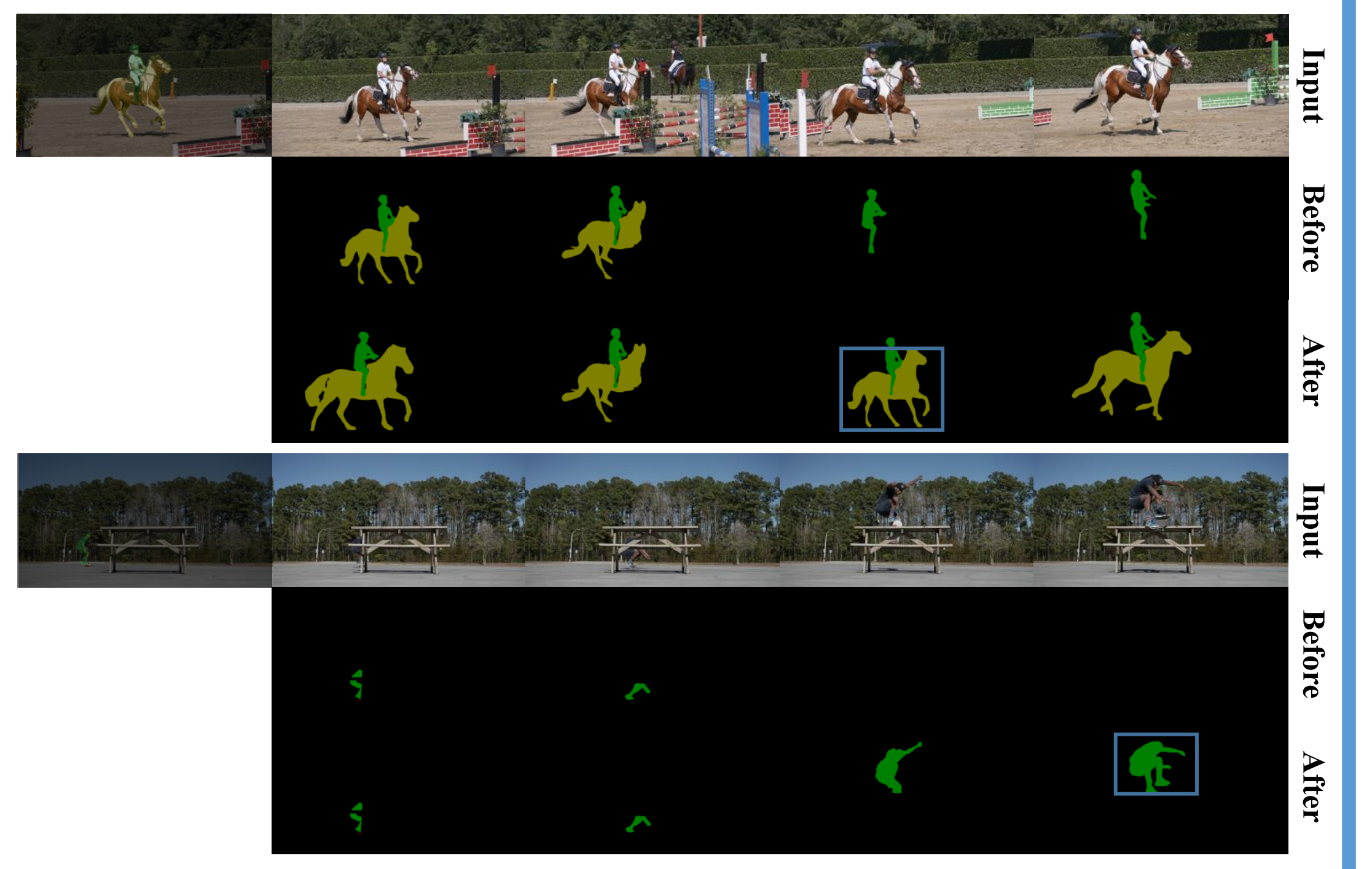


4. Experiments

- **Ablation Study of Each Module**

	J -mean	F -mean	global-mean	boost
baseline (MSK)	0.509	0.526	0.517	-
+ full-image to bbox	0.532	0.577	0.555	+ 0.038
+ f ow-stream	0.568	0.600	0.584	+ 0.007
+ re-id module	0.633	0.670	0.652	+ 0.068
+ multi-scale testing	0.644	0.678	0.661	+ 0.009

- **Missing Instances Are Retrieved**



- **Results**