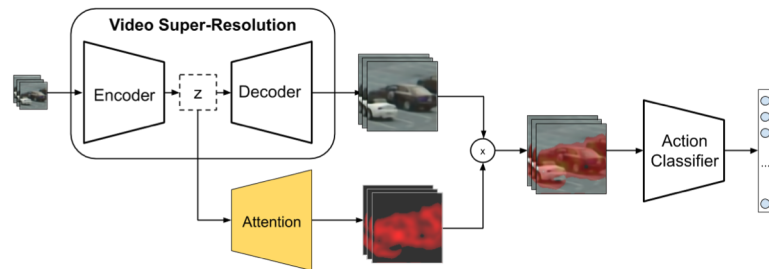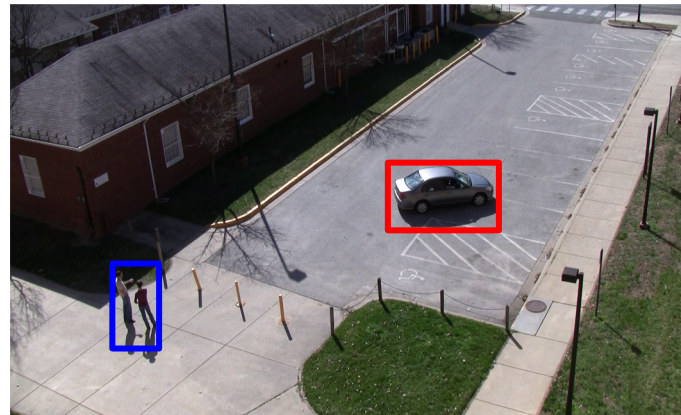# TinyVIRAT: Low-Resolution Video Action Recognition

Ugur Demir, Yogesh Rawat, Mubarak Shah

Introduction

- Action recognition in low resolution videos
  - Realistic low-resolution videos
  - **TinyVIRAT** benchmark

- Super-Resolution based enhancement
  - **Progressive** generative video SR
  - Weakly-supervised **foreground attention**
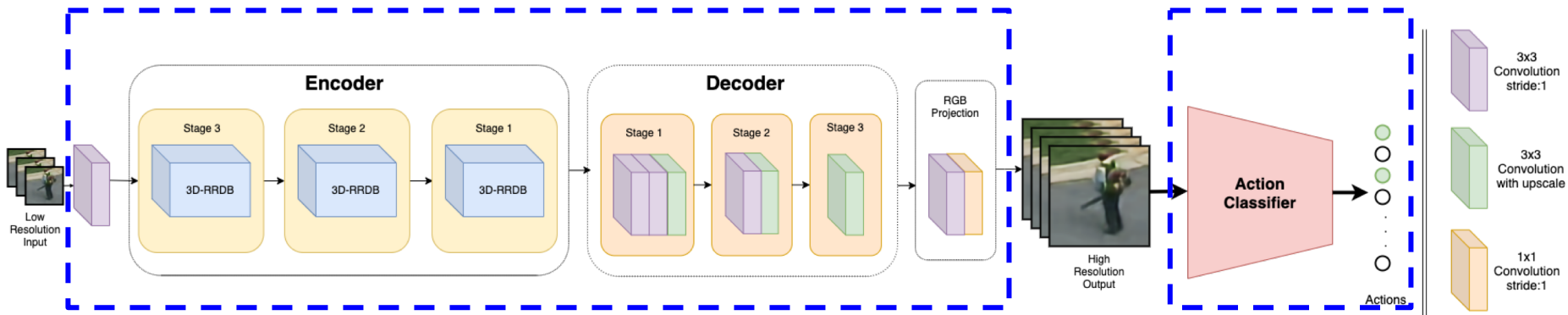
Motivation

JHMDB

AVA

UCF-101

VIRAT

- Most of the existing action recognition datasets contain high resolution actor centric videos

- Downsampling does not reflect real-world scenario

- **TinyVIRAT**: Realistic actor centric videos

TinyVIRAT Dataset

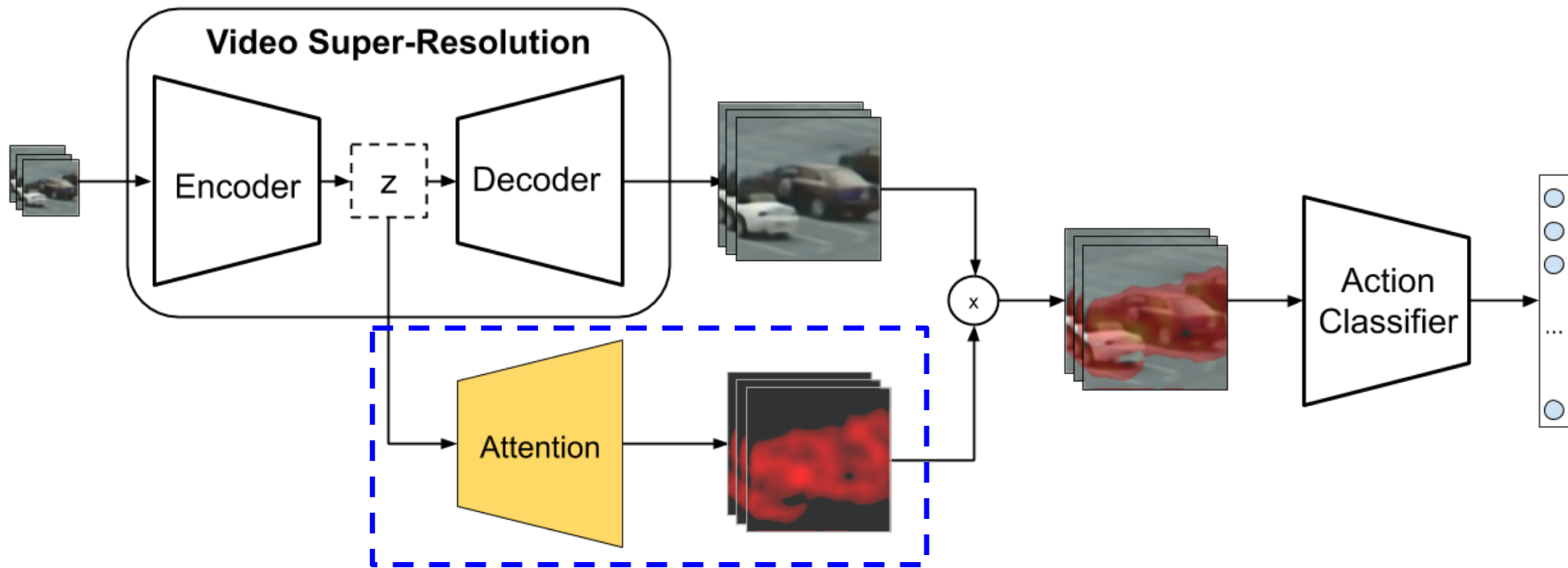| Size	Actions	Frames
20x20	standing	
76x76	vehicle moving	
28x28	carrying walking	
58x58	pull walking	

Method

Super Resolution

Action Classification

Method

Weakly-Supervised Attention Branch

Dataset

Dataset	Resolution	ANF	ML	NC	NV
UCF-101	320x240	186.50	No	101	13320
HMDB-51	320x240	94.49	No	51	7000
TinyVIRAT	10x10 - 128x128	93.93	Yes	26	12829

Quantitative Results on HMDB-51

Method	Input	Accuracy %
I3D	112x112	52.61
SoSR [12]	80x60	54.77
Bicubic - I3D	14x14	10.59
Privacy-Preserv [20]	12x16	28.68
F. Coupled [33]	12x16	39.15
DVSR	14x14	41.24
Prog. DVSR	**14x14**	**41.63**
Bicubic - I3D	28x28	46.97
Privacy-Preserv [20]	24x32	32.15
DVSR	28x28	53.66
Prog. DVSR	**28x28**	**55.95**

[12] H. Zhang, D. Liu, and Z. Xiong, "Two-stream action recognition-oriented video super-resolution," in ICCV, October 2019.
[20] M. S. Ryoo, B. Rothrock, C. Fleming, and H. J. Yang, "Privacy-preserving human activity recognition from extreme low resolution," in AAAI, 2017.
[33] J. Caballero, C. Ledig, A. P. Aitken, A. Acosta, J. Totz, Z. Wang, and W. Shi, "Real-time video super-resolution with spatio-temporal networks and motion compensation," 2017 CVPR, pp. 2848–2857, 2017.

Quantitative Results on UCF-101

Method	Input	Accuracy %
I3D	112x112	84.72
SoSR [12]	80x60	83.92
Bicubic - I3D	14x14	14.14
DVSR	14x14	68.17
Prog. DVSR	**14x14**	**70.55**
Bicubic - I3D	28x28	66.72
DVSR	28x28	82.37%
Prog. DVSR	**28x28**	**82.87**

Quantitative Results on TinyVIRAT

Method	F1-Score
I3D	28.73
I3D + Prog. DVSR	32.55
I3D + Prog. DVSR + Att.	34.49
ResNet-50	29.08
ResNet-50 + Prog. DVSR	29.81
ResNet-50 + Prog. DVSR + Att.	30.80
WideResNet	32.66
WideResNet + Prog. DVSR	34.05
WideResNet + Prog. DVSR + Attn.	35.07

Attention Visualization
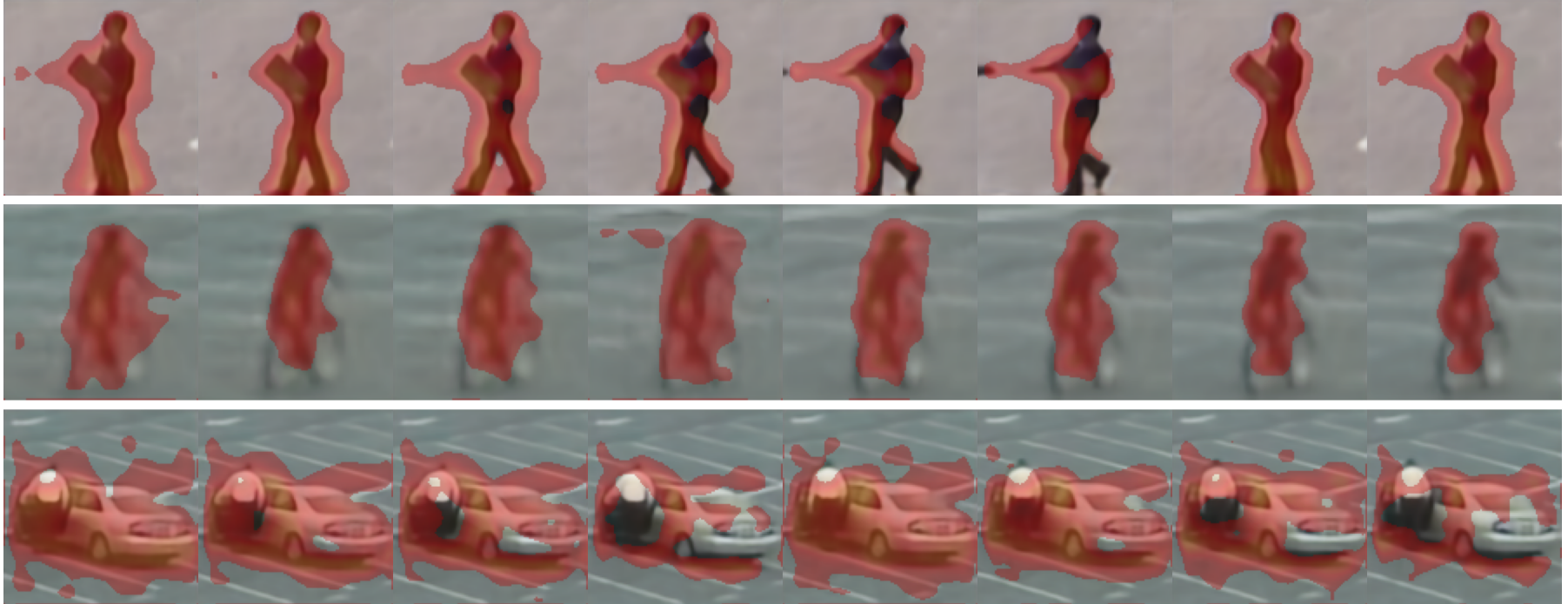
Ablation Study

Method	F1-Score
w/o DVSR	28.73
DVSR	30.45
Progressive DVSR	32.55
Progressive DVSR + Attention	34.49

Thank You

Project Page

https://tinyurl.com/yyafd7xa

TinyVIRAT Dataset

https://www.crcv.ucf.edu/datasets/ugur/TinyVIRAT.zip