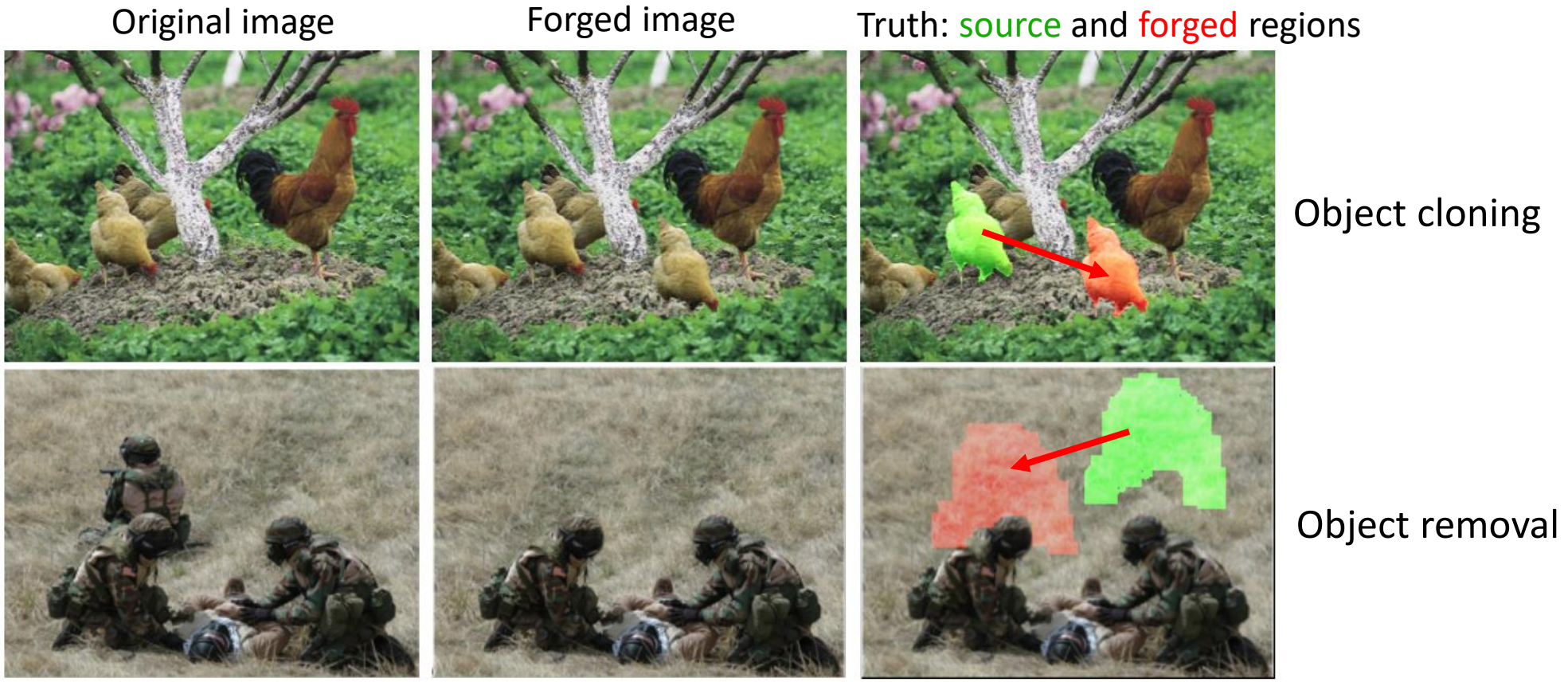
DOA-GAN: Dual-Order Attentive GAN for Image Copy-Move Forgery Detection and Localization

Ashraful Islam, Chengjiang Long*, Arslan Basharat, Anthony Hoogs
Rensselaer Polytechnic Institute, Troy, NY
Kitware Inc., Clifton Park, NY
islama6@rpi.edu, cjfykx@gmail.com, arslan.basharat@kitware,com, anthony.hoogs@kitware.com

⁎This work was supervised by Chengjiang Long when Ashraful Islam was a summer intern at Kitware Inc.

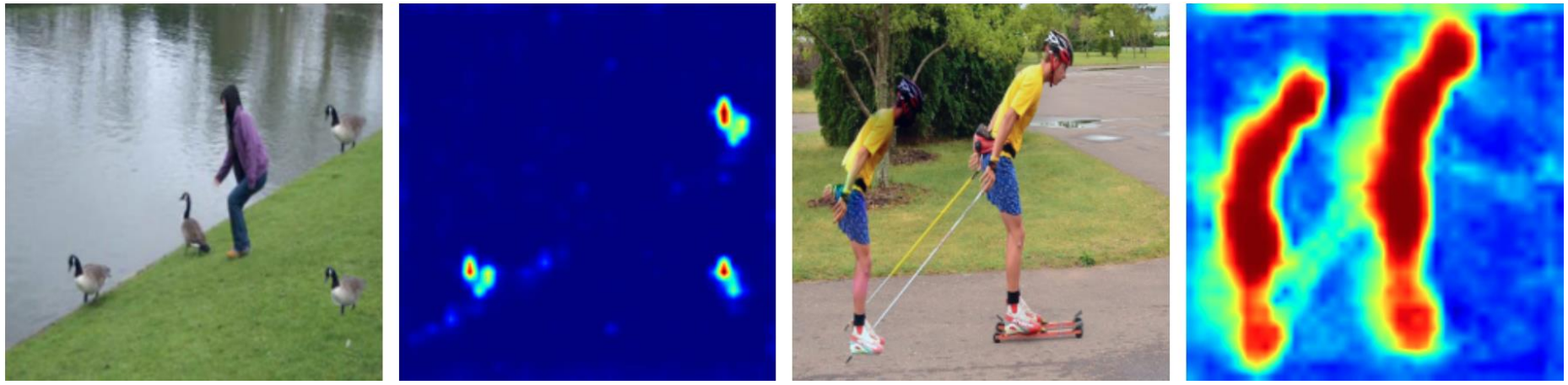
Problem and Objective



- Very challenging to distinguish copy-move from the frequent, incidental similarities
- **<u>Goal</u>:** Automatically detect and localize the source (green) and the forged (red) regions in forged images

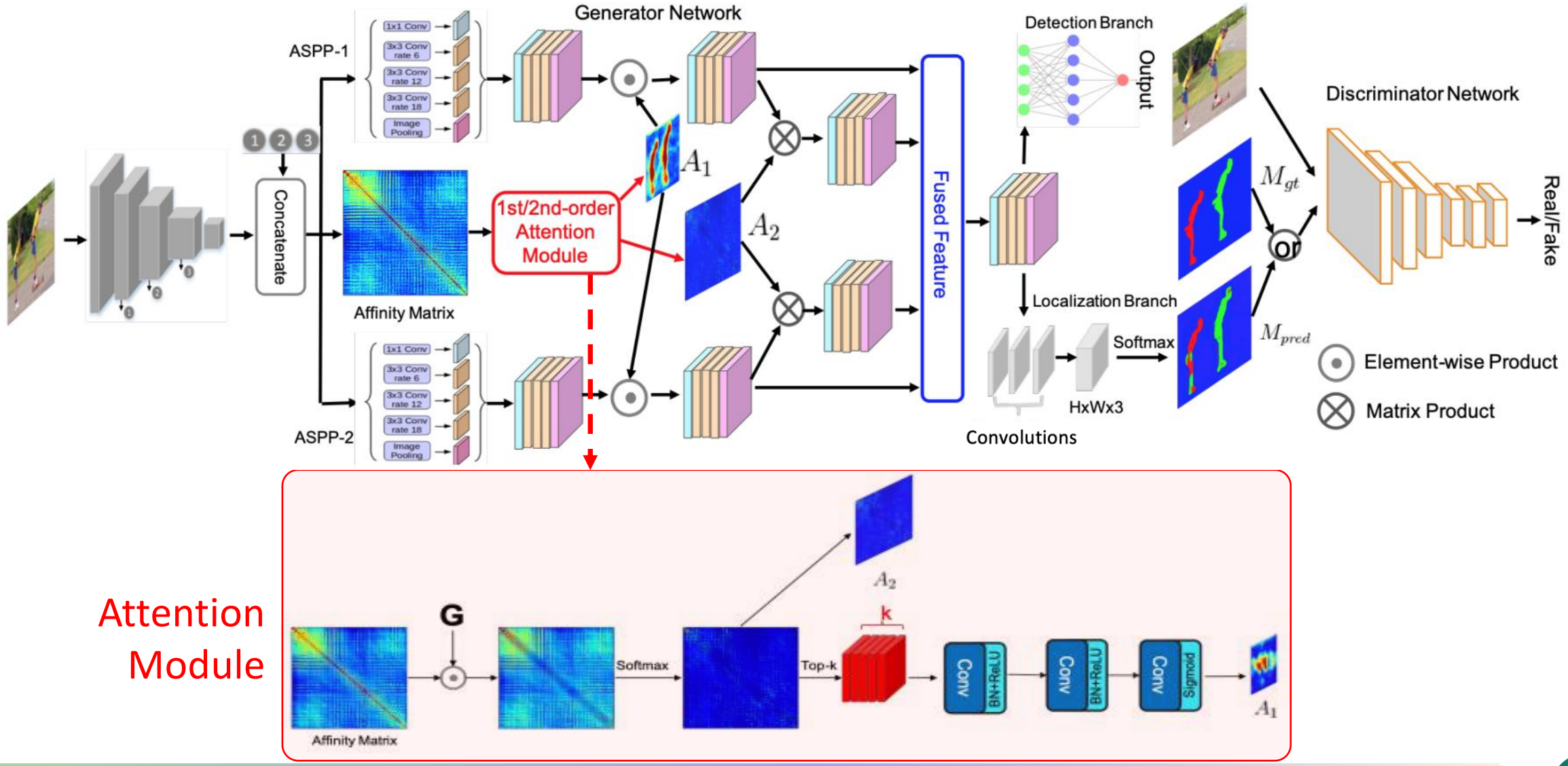
Contributions

- We propose a dual-order attentive Generative Adversarial Network for image copy-move forgery detection and localization.
- The 1st-order attention module extracts copy-move location aware attention map and the 2nd-order attention module explores patch-to-patch inter-dependence.
- Extensive experiments strongly demonstrate that the proposed DOA-GAN clearly outperforms state-of-the-art (BusterNet, DenseField, 3D PatchMatch, and others).



Visualization of the 1st-order attention on two copy-move forgery images.

DOA-GAN Framework



Attention Module

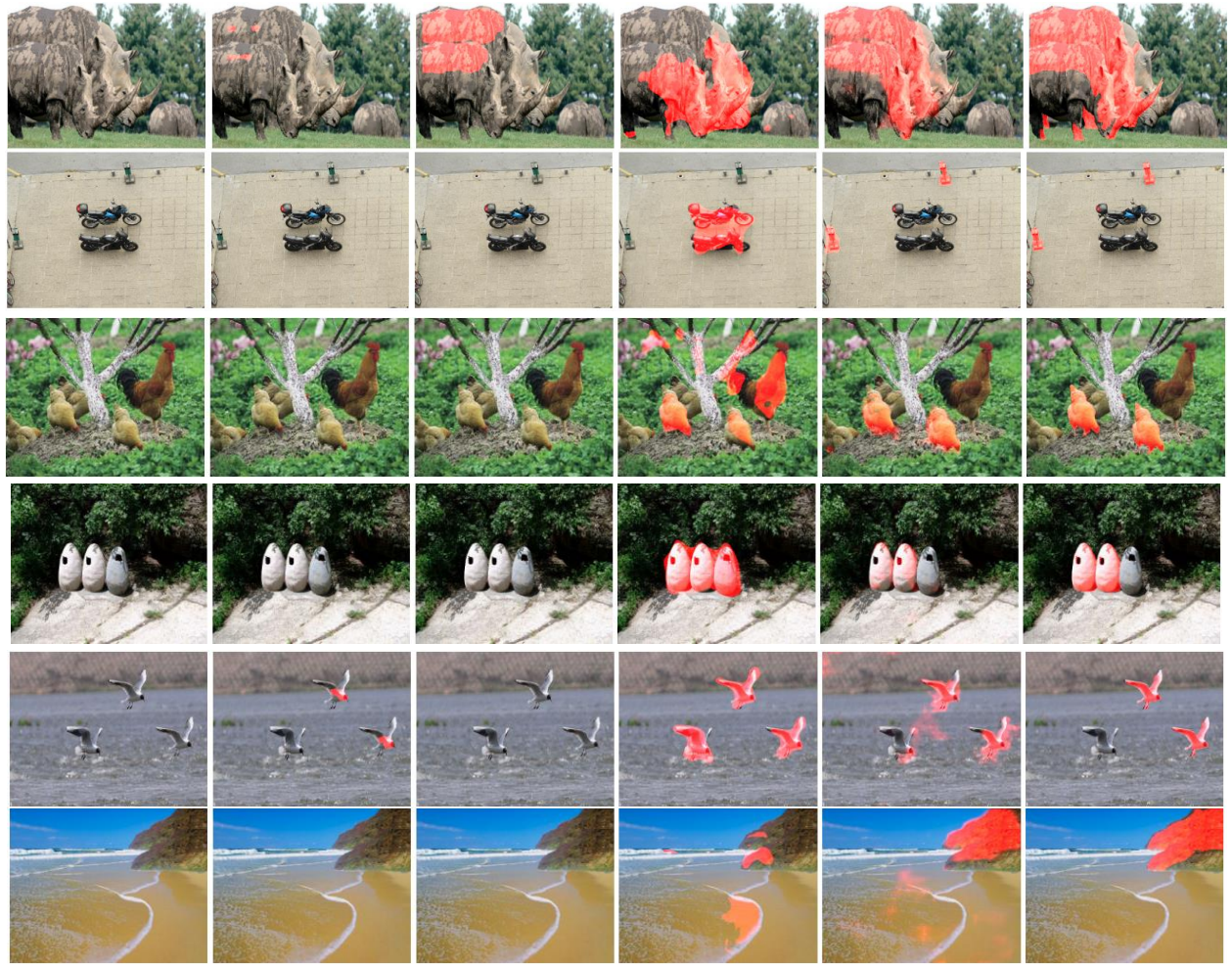
Quantitative and Qualitative Result

CASIA

	Methods	Year	Precision	Recall	F1
Det	Block-ZM	2010	68.97	53.69	60.38
	DCT-Match	2012	63.74	46.31	53.46
	Adaptive-Seg	2015	93.07	25.59	40.14
	DenseFiled	2015	**99.51**	30.61	46.82
	BusterNet	2018	48.34	75.12	58.82
	DOA-GAN	2020	63.39	**77.00**	**69.53**
Loc	Block-ZM	2010	10.09	3.01	3.30
	DCT-Match	2012	8.80	1.90	2.40
	Adaptive-Seg	2015	23.17	5.14	7.42
	DenseField	2015	20.55	20.91	20.36
	BusterNet	2018	42.15	30.54	33.72
	DOA-GAN	2020	**54.70**	**39.67**	**41.44**

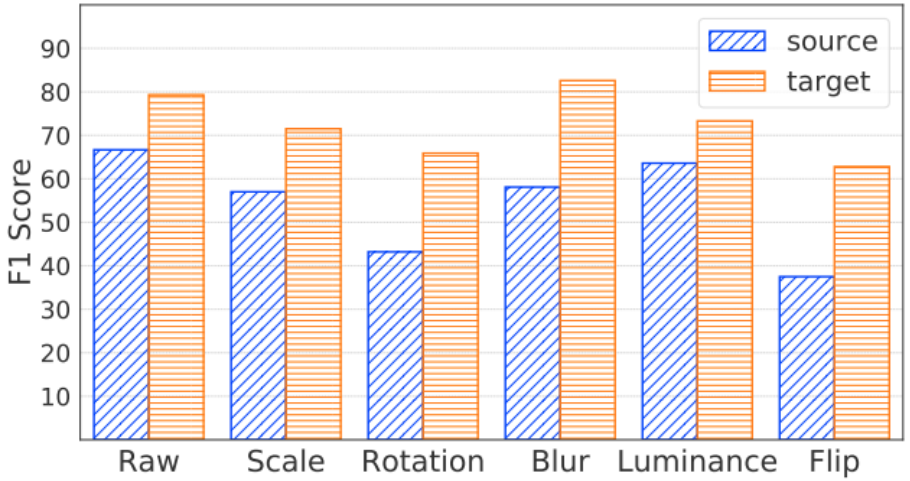
CoMoFoD

	Methods	Year	Precision	Recall	F1
Det	Block-ZM	2010	51.72	20.87	29.74
	DCT-Match	2012	50.48	29.77	37.46
	Adaptive-Seg	2015	65.66	43.37	52.24
	DenseField	2015	**80.34**	20.10	32.15
	BusterNet	2018	53.20	57.41	55.22
	DOA-GAN	2020	60.38	**65.98**	**63.05**
Loc	Block-ZM	2010	2.90	2.50	1.73
	DCT-Match	2012	3.53	3.41	2.03
	Adaptive-Seg	2015	23.02	13.27	13.46
	DenseField	2015	22.23	23.63	22.60
	BusterNet	2018	**51.25**	28.20	35.34
	DOA-GAN	2020	48.42	**37.84**	**36.92**

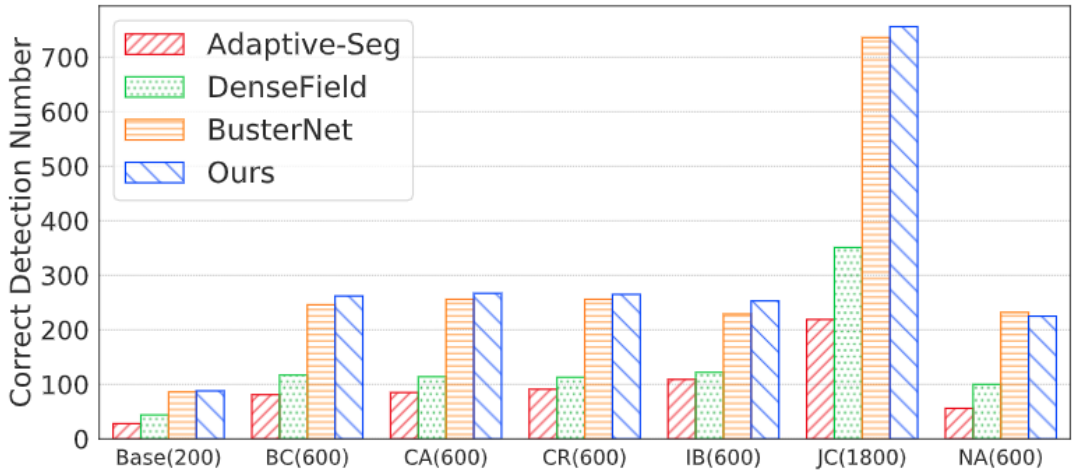


Input image | Adaptive-Seg | DenseField | BusterNet | DOA-GAN | Truth

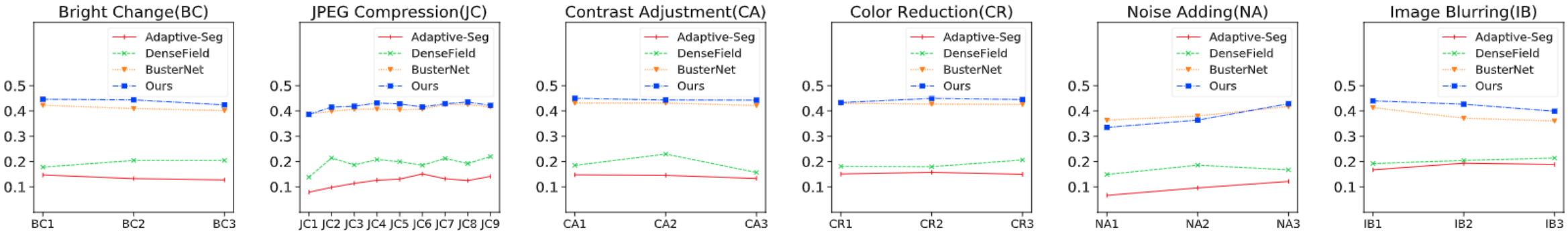
Robustness Analysis



Invariance Analysis on our self-collected dataset



Number of correctly detected images on CoMoFoD



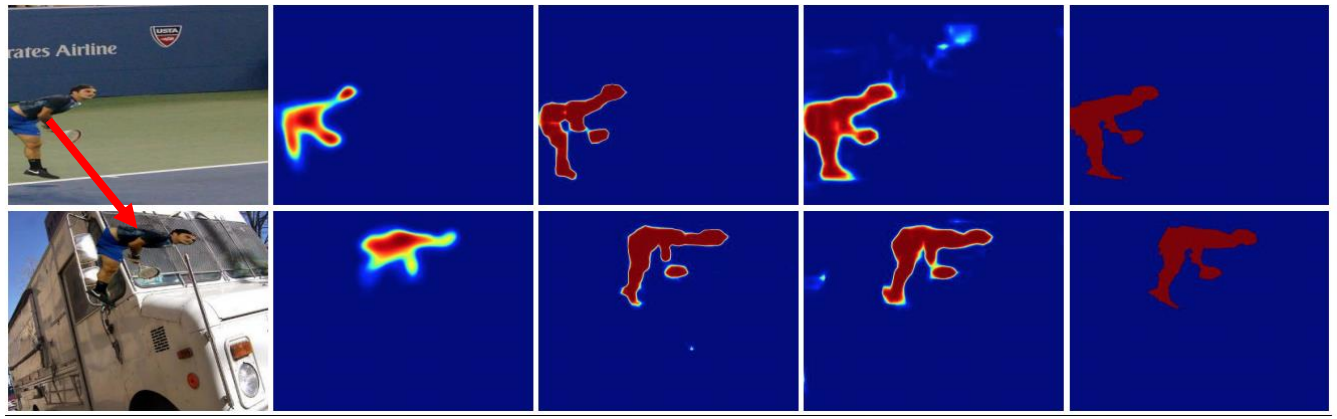
F1 scores on CoMoFoD under attacks

Extension to Other Manipulations

CVPR SEATTLE WASHINGTON JUNE 16-18 2020

Image Splicing Localization

Method	Source			Target		
	IoU	F1	MCC	IoU	F1	MCC
DMVN	37.2	48.4	32.3	42.0	53.5	36.7
DMAC	76.5	81.2	76.7	85.6	90.0	85.2
DOA-GAN	**86.4**	**91.0**	**86.2**	**92.4**	**95.4**	**91.8**



Input images DMVN DMAC DOA-GAN Truth

Video Copy-move Localization

Method	F1 Score			IoU		
	S	T	A	S	T	A
PatchMatch [11]	-	-	11.7	-	-	9.8
DMVN	27.2	33.8	37.2	20.5	25.76	27.3
DMAC	39.5	39.0	45.2	31.1	30.5	35.3
DOA-GAN	**62.9**	**62.3**	**65.0**	**50.7**	**49.6**	**53.3**

Input Video DOA-GAN Truth

Paper QR Code:
http://www.chengjianglong.com/publications/DOAGAN_CVPR.pdf

Thank you!

This research was developed with funding from the Defense Advanced Research Projects Agency (DARPA). The views, opinions and/or findings expressed are those of the author and should not be interpreted as representing the official views or policies of the Department of Defense or the U.S. Government.