Multi-Patch Aggregation Models For Resampling Detection

Computational Imaging Lab
Indian Institute of Technology Madras
Mohit Lamba and *Kaushik Mitra*

Science Fiction

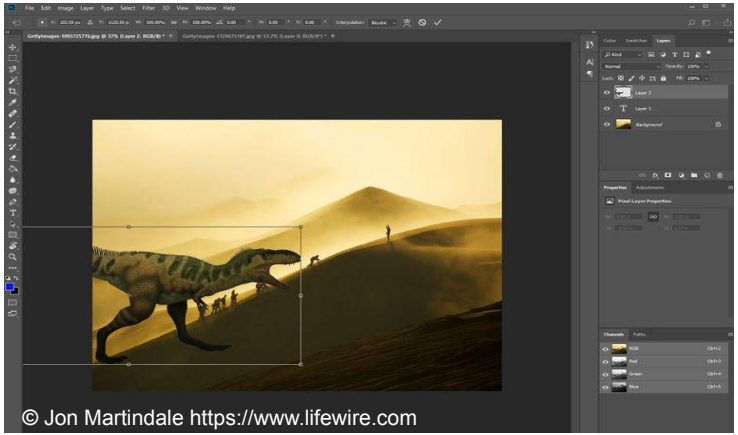

Photo Albums

a

b

c

Science Fiction

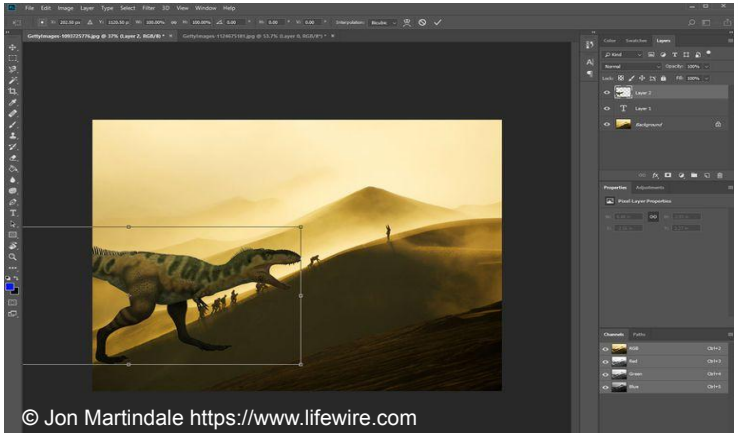

Photo Albums

Malicious Intents !!!

Related Works

- Popescu, A. C., & Farid, H., TSP(2005).

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Suitable for UNCOMPRESSED Images

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- Bianchi, T., & Piva, A., WIFS(2012).
- Bayar, B., & Stamm, M. C., TIFS(2018)
- Sahu, S., & Okade, M., WIFS(2018)

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JPEG + Resampling + JPEG

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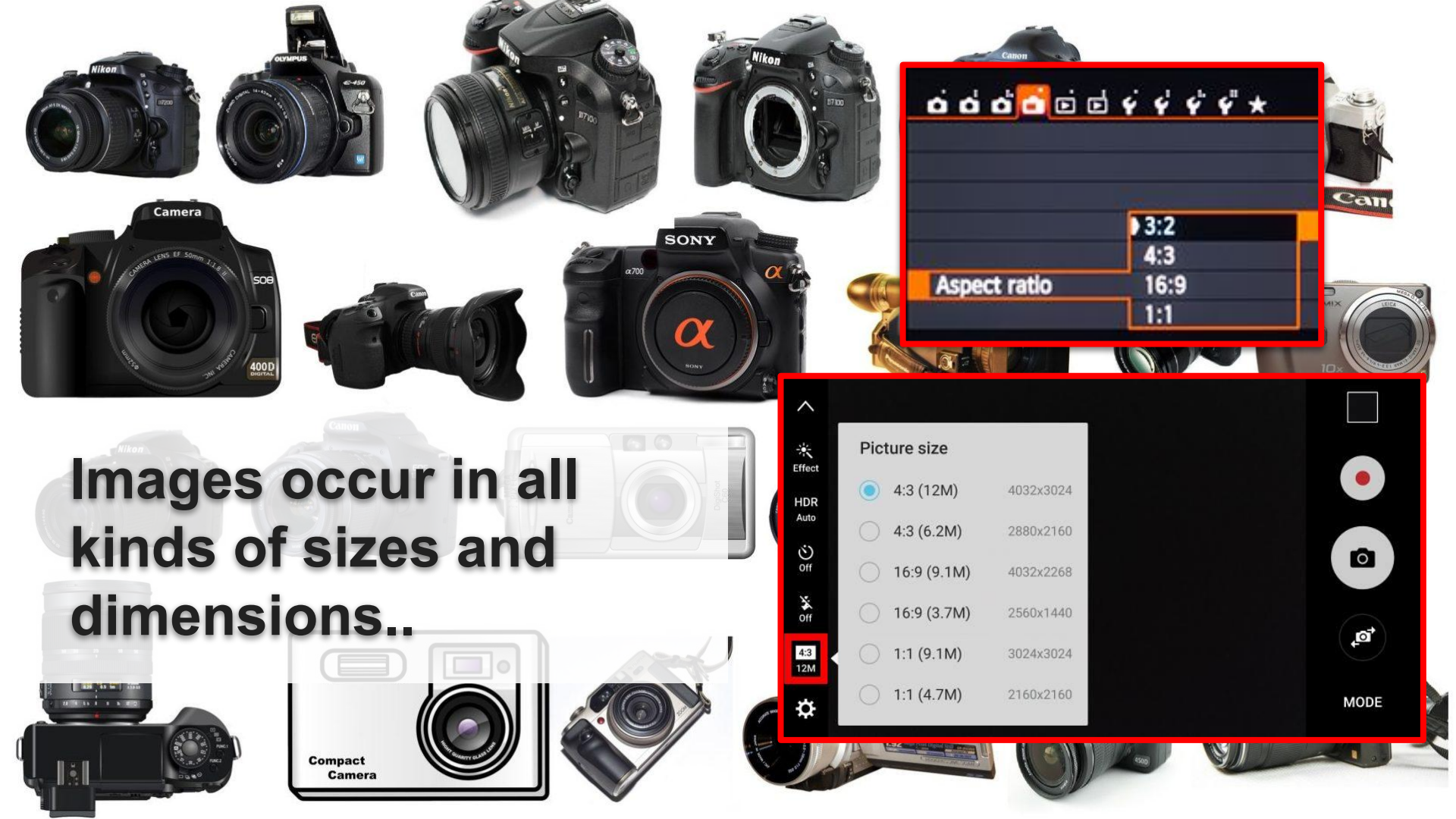
JPEG + Resampling + JPEG

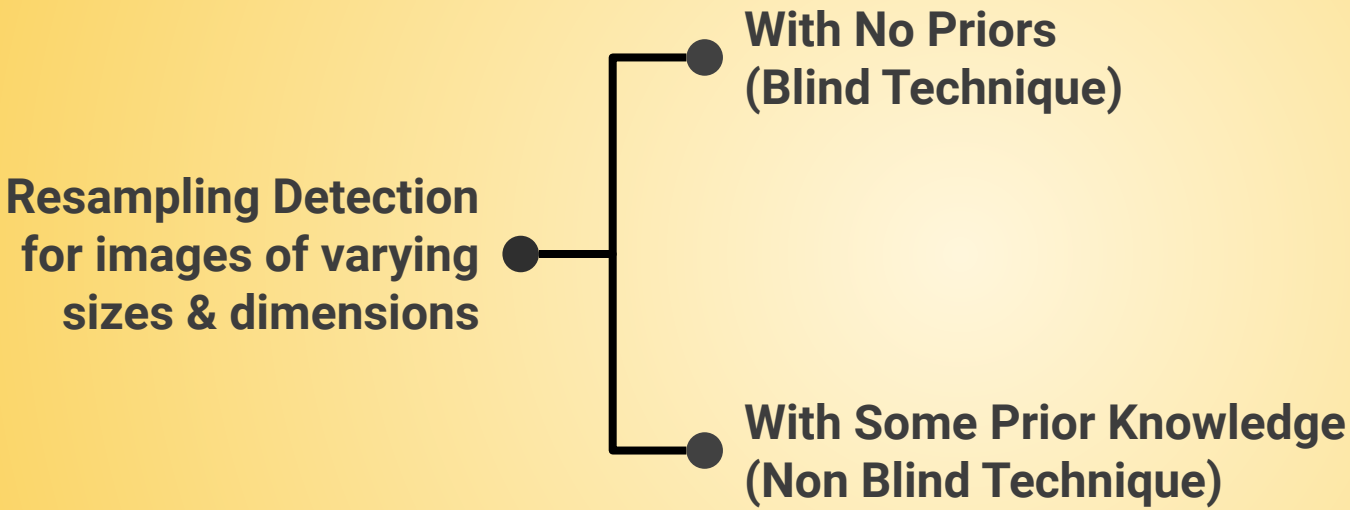
(Image Acquisition) (Forgery) (Re-Save)

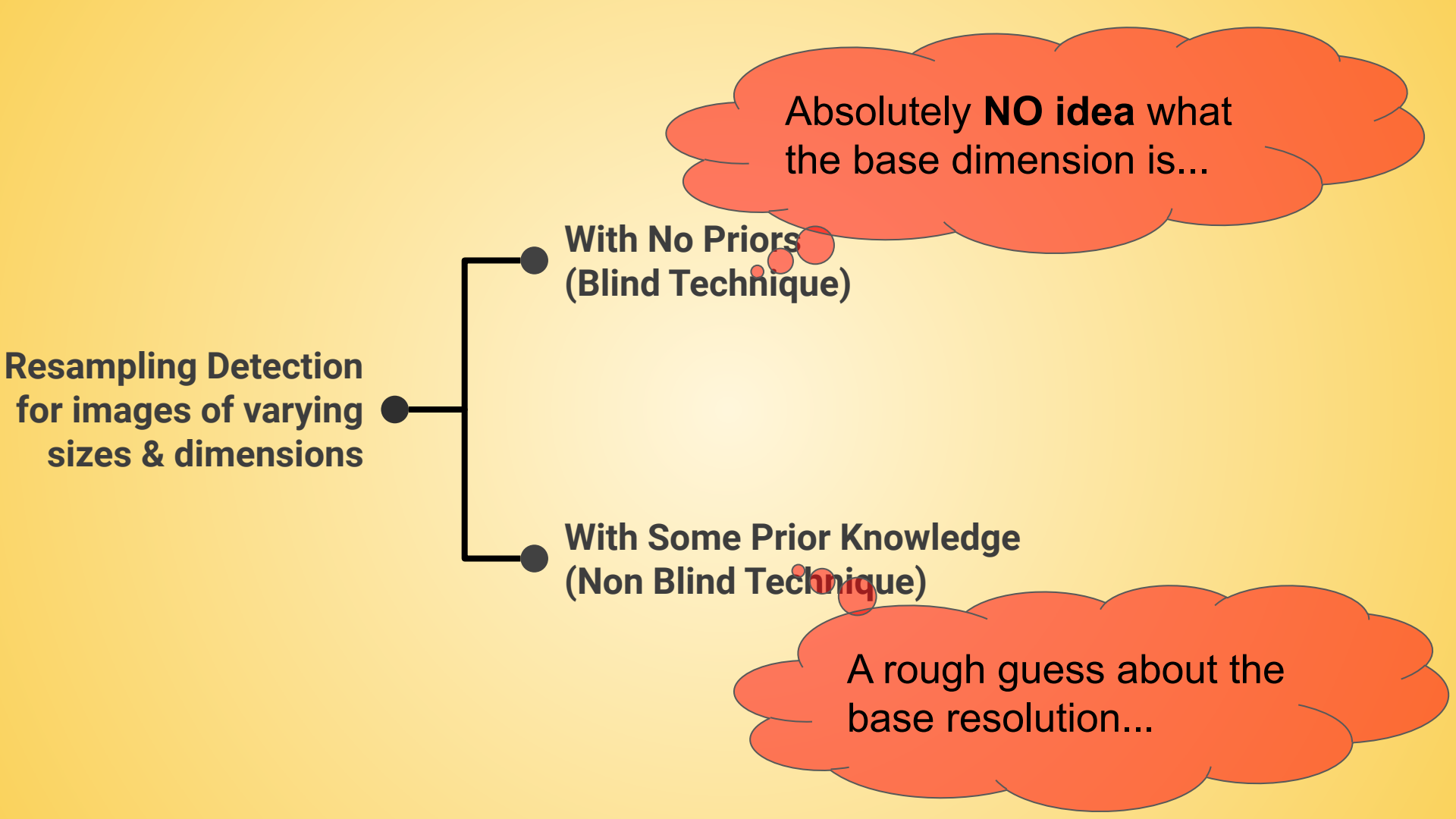
Work	Image Size	Patch Size
Sahu *et al.*, WIFS(2018)	1024×1024	512×512
MISLnet (Bayar *et al.*, TIFS 2018)	256×256	256×256
Li *et al.*, TCSVT(2018)	512×512	512×512
Verma *et al.*, Elsevier(2018)	512×384	128×128
Kirchner *et al.*, WIFS(2009)	1024×1024	512×512
Bianchi *et al.*, WIFS(2012)	1024×1024	512×512
Quan *et al.*, TIFS(2018)	$<1024 \times 1024$	233×233

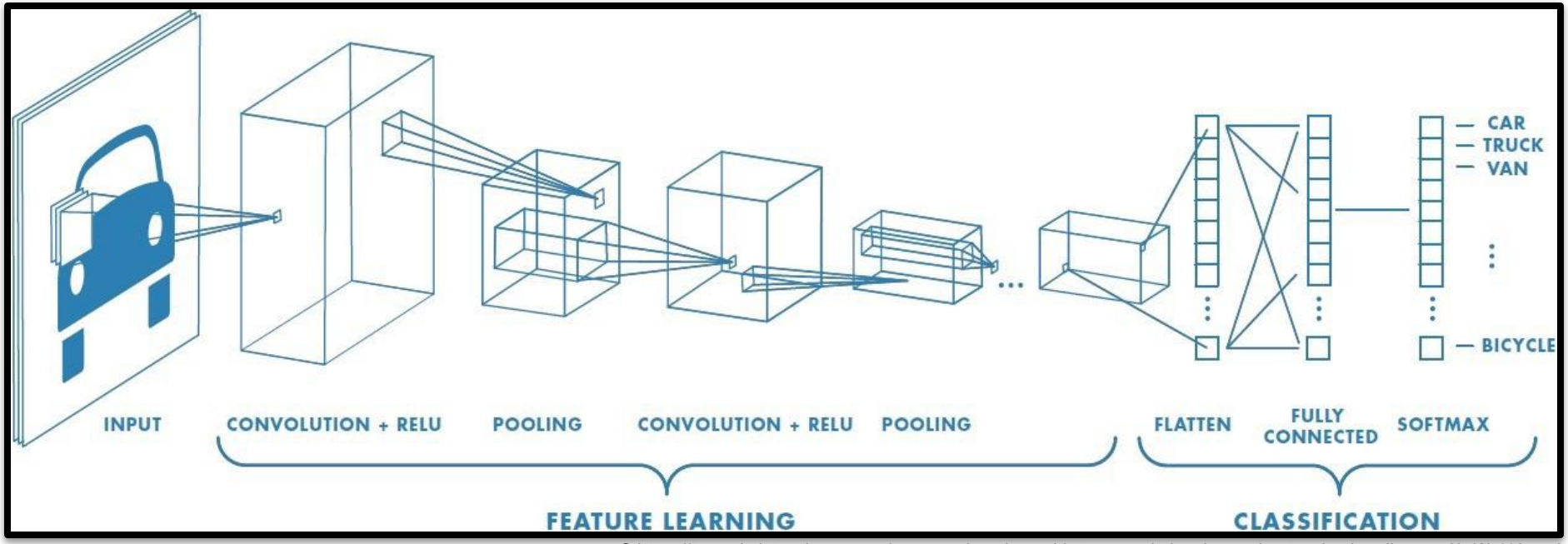

Nikon
OLYMPUS
Nikon
Nikon
Canon
Camera
400D
SONY
α
Aspect ratio
3:2
4:3
16:9
1:1
Images occur in all kinds of sizes and dimensions..
Effect
HDR
Auto
Off
Off
4:3
12M
Picture size
4:3 (12M) 4032x3024
4:3 (6.2M) 2880x2160
16:9 (9.1M) 4032x2268
16:9 (3.7M) 2560x1440
1:1 (9.1M) 3024x3024
1:1 (4.7M) 2160x2160
MODE
Compact
Camera

Experiments on MISLnet (Bayar *et al.*, TIFS 2018)

Patch size / Img Resolution	Resampling Factors					
	0.6	**0.8**	**1**	**1.2**	**1.4**	**Avg Acc %**
$256 \times 256/1024 \times 1024$	99.3	98.8	99.1	99.4	99.0	**99.0**
$256 \times 256/Variable$	89.0	73.5	97.5	96.6	93.4	**89.90**

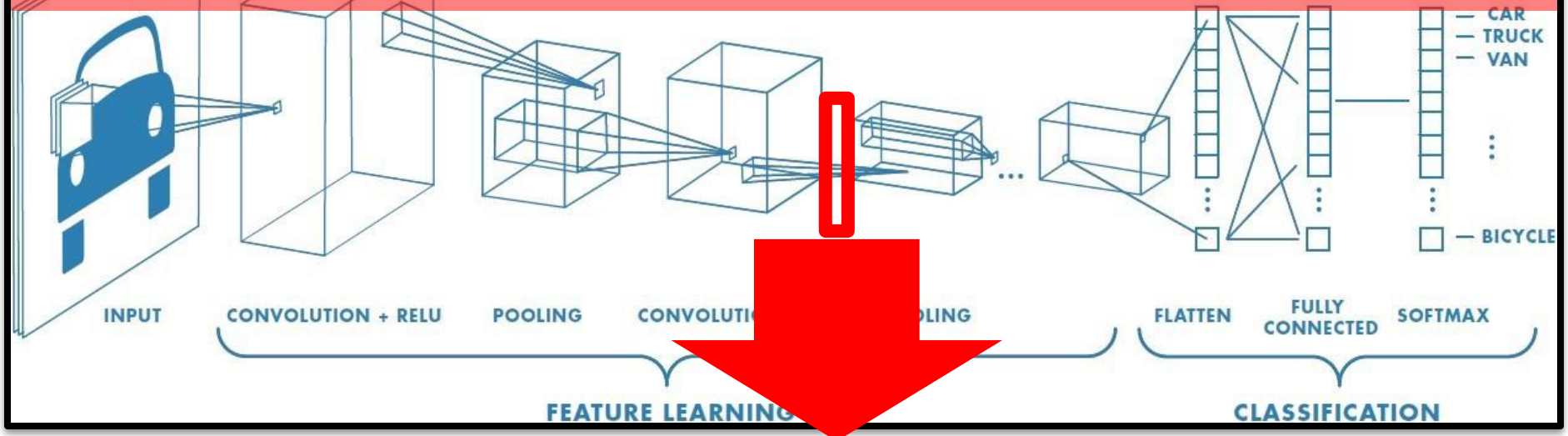

Resampling Detection for images of varying sizes & dimensions
With No Priors (Blind Technique)
With Some Prior Knowledge (Non Blind Technique)

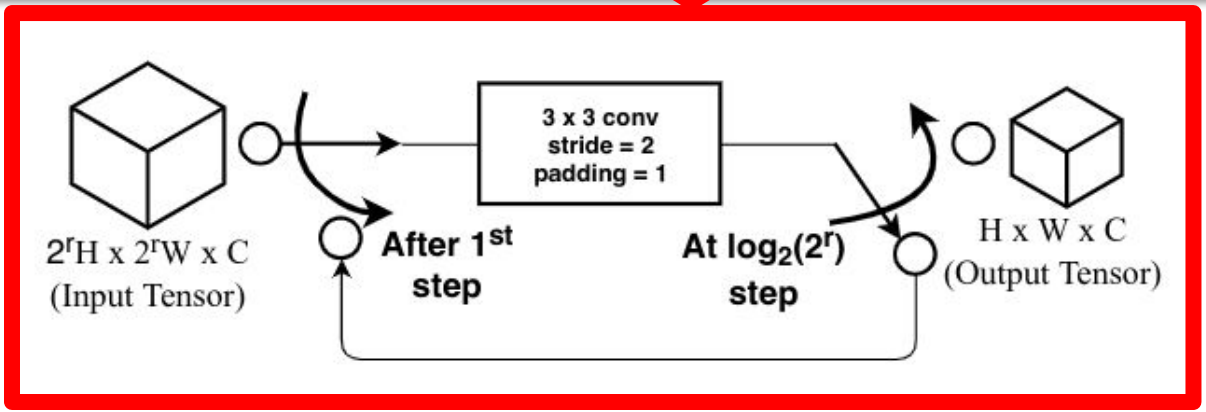

Resampling Detection for images of varying sizes & dimensions
With No Priors (Blind Technique)
With Some Prior Knowledge (Non Blind Technique)
Absolutely NO idea what the base dimension is...
A rough guess about the base resolution...



© https://towardsdatascience.com/a-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53

Iterative Pooling Strategy - A Blind Technique w/o priors





Iterative Pooling Strategy - A Blind Technique w/o priors

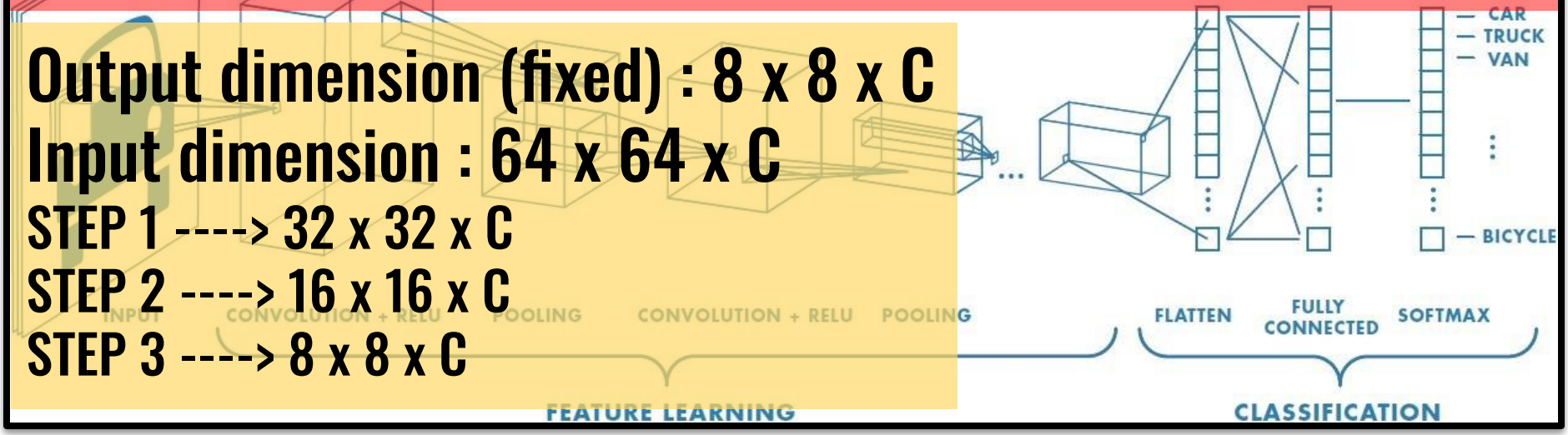
Output dimension (fixed) : 8 x 8 x C

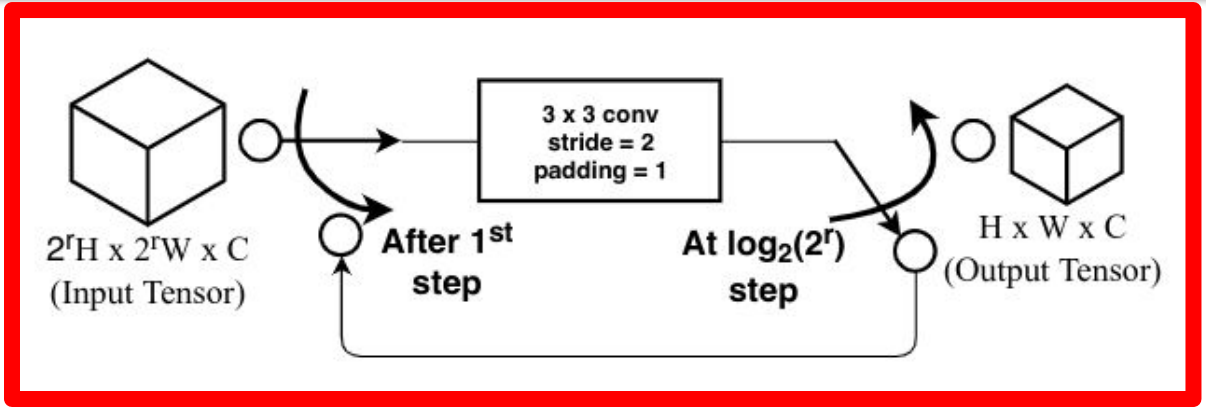
Input dimension : 64 x 64 x C

STEP 1 ----> 32 x 32 x C

STEP 2 ----> 16 x 16 x C

STEP 3 ----> 8 x 8 x C



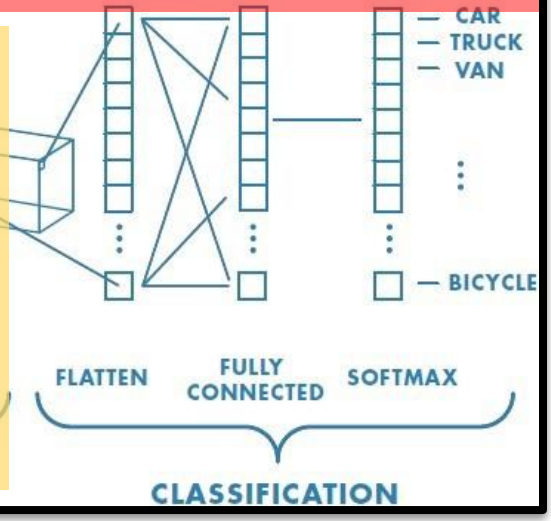


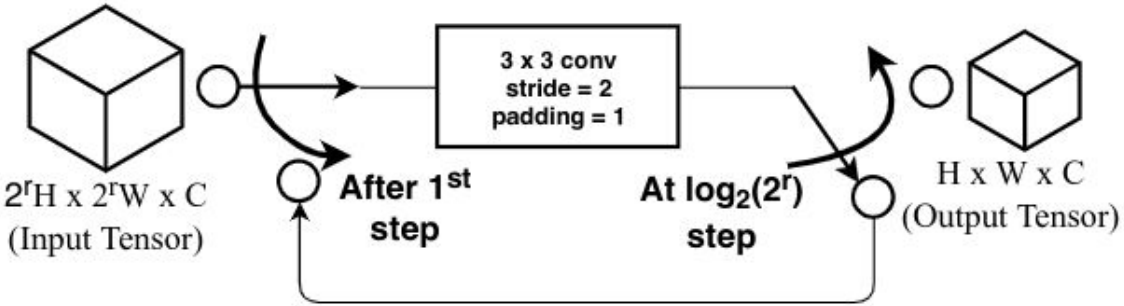
Iterative Pooling Strategy - A Blind Technique w/o priors

Output dimension (fixed) : 8 x 8 x C

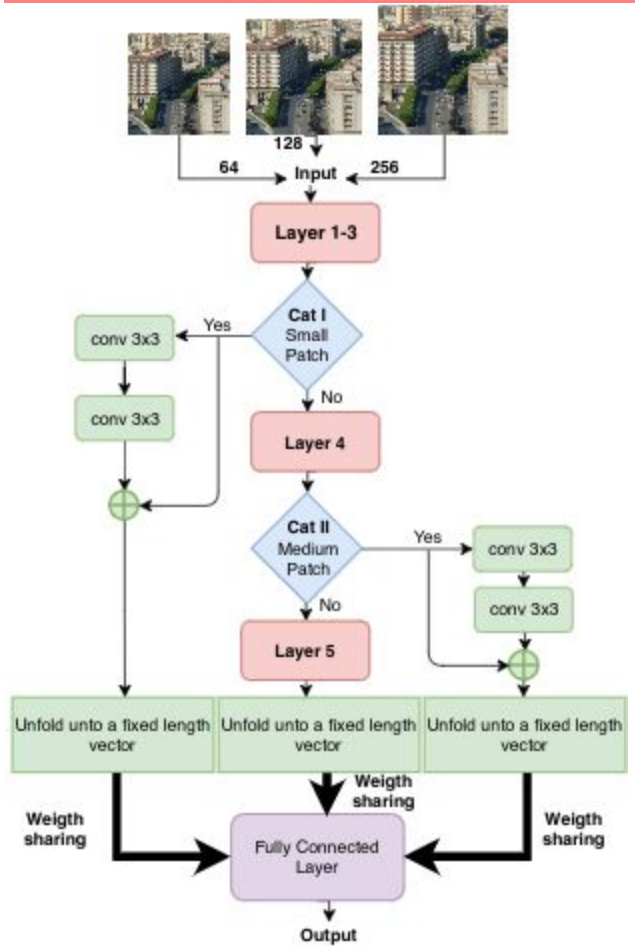
Input dimension : 256 x 256 x C

STEP 1 ----> 128 x 128 x C, STEP 2 ----> 64 x 64 x C,
STEP 3 ----> 32 x 32 x C, STEP 4 ----> 16 x 16 x C,
STEP 5 ----> 8 x 8 x C





Branched Network - A Non Blind Technique with priors



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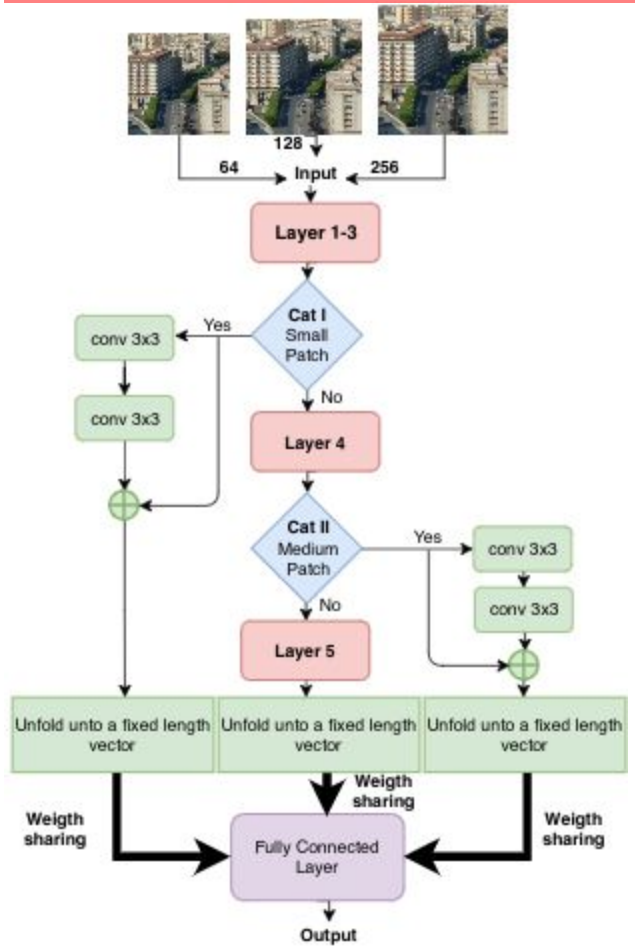

Category I
64x64 patch

Low-Resolution
< 512 x 512

Category II
128x128 patch

VGA-Resolution
~ 1024 x 1024

Category III
256x256 patch

High Definition
eg: 2000 x 4000

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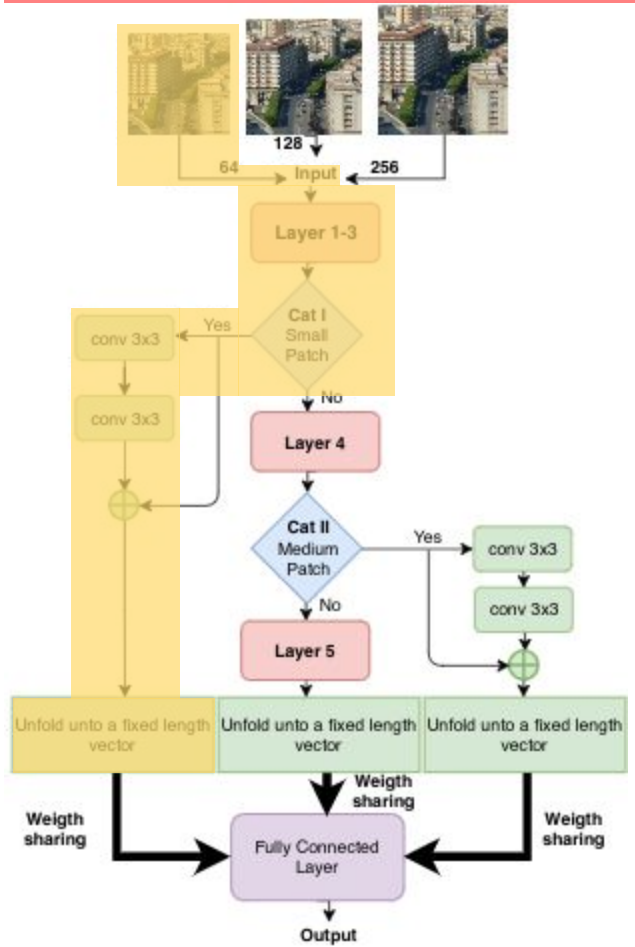

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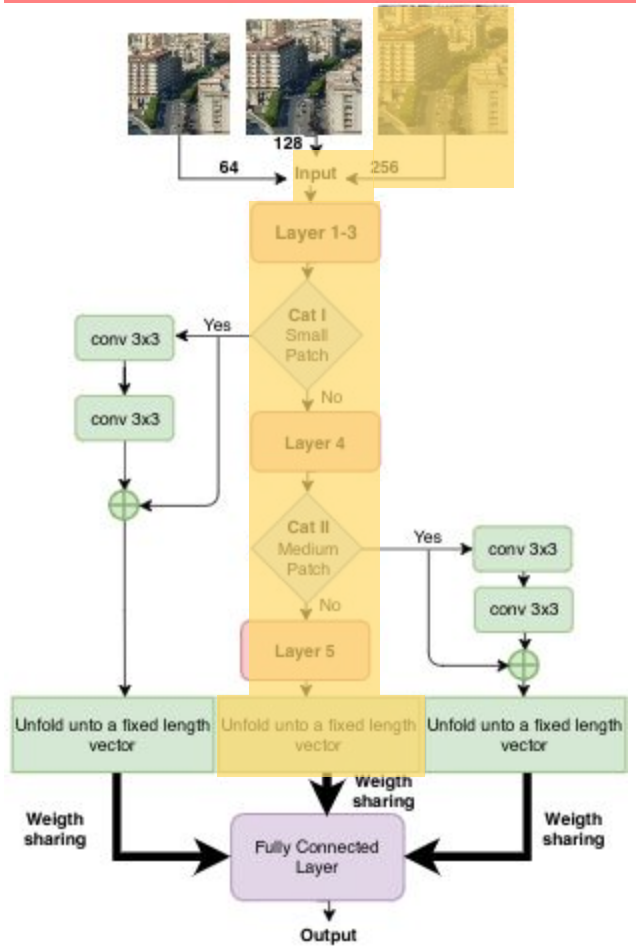

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Method	Resampling Factors					
	0.6	**0.8**	**1**	**1.2**	**1.4**	**Avg**
MISLnet (Bayar *et al.* TIFS 2018)	84.7	77.7	98.0	96.3	94.9	90.3
Quan *et al.* TIFS(2018)	80.4	78.9	97.3	97.1	95.8	89.9
Chen *et al.* JRTIP(2019)	73.4	79.13	97.3	94	94.9	87.7
Iterative Pooling Strategy (ours)	98.6	97.1	98.4	94.3	94.8	**96.6**
Branched Network (ours)	98.4	99.0	98.0	98.8	99.5	**98.7**

Image Resolutions: 512×512, 1024×1024, 3008×2000, 4288×2848 and 4928×3264

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MISLnet, Quan et al. & Chen et al. Give ~99% for fixed resolution images

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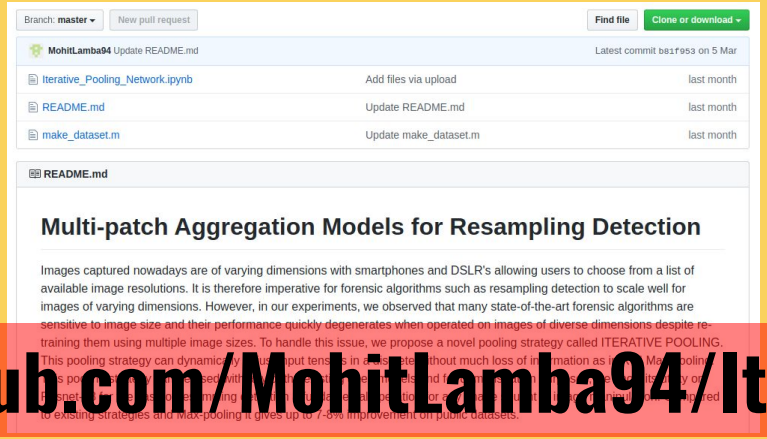
MISLnet, Quan et al. & Chen et al.

Give ~99% for fixed resolution images

But lose ~10% accuracy with images of variable resolution

Conclusion

- Flexible patch size at inference.
- Scales easily with variable resolution.
- Iterative Pooling Strategy w/o priors.
- Branched Network with priors.



Code : github.com/MohitLamba94/Iterative-Pooling