

Augmentation of image datasets

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Definition of data augmentation

Data augmentation - extend training set $\{(x_n, y_n)\}_{n=1}^N$ with $\{(f_\theta(x_m), y_m)\}_{m=1}^M$ where

- $f_\theta(x)$ is label preserving transformation
 - in case of image: horizontal flipping, cropping, scaling, small rotation, small change in brightness, contrast, saturation, hue.
 - it may combine several transformations.
- θ are randomly sampled parameters of the transformation
- M is amount of new samples.

Applications of data augmentation

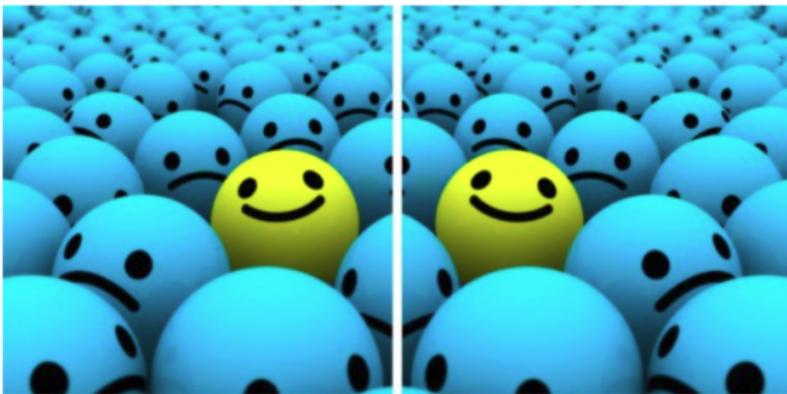
- Enlarge training set - estimate network parameters better.
 - feasible to estimate many parameters
 - less overfitting
- Enforce prediction invariance to transformation.
 - transfer learning: $f_\theta(\cdot)$ maps training domain to target domain.
 - e.g. have labeled *day-time* images, but need *night-time* classification.

#objects vs. #parameters¹

	VGGNet	DeepVideo	GNMT
Used For	Identifying Image Category	Identifying Video Category	Translation
Input	Image 	Video 	English Text 
Output	1000 Categories	47 Categories	French Text
Parameters	140M	~100M	380M
Data Size	1.2M Images with assigned Category	1.1M Videos with assigned Category	6M Sentence Pairs, 340M Words
Dataset	ILSVRC-2012	Sports-1M	WMT'14

¹Image source.

Horizontal flipping²



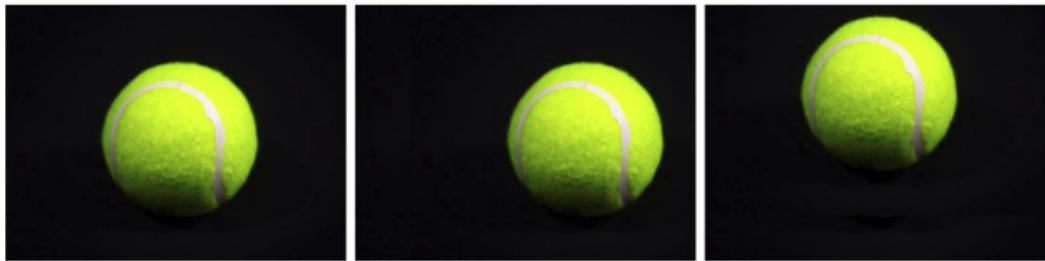
²Image source.

Rotations³



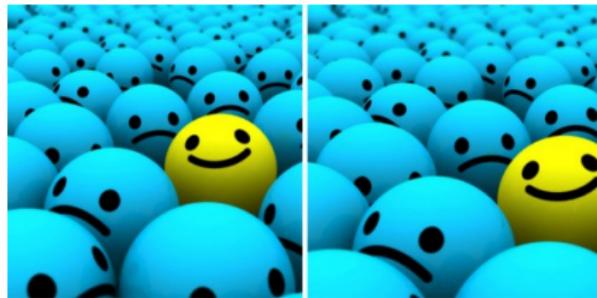
³Image source.

Translations⁴



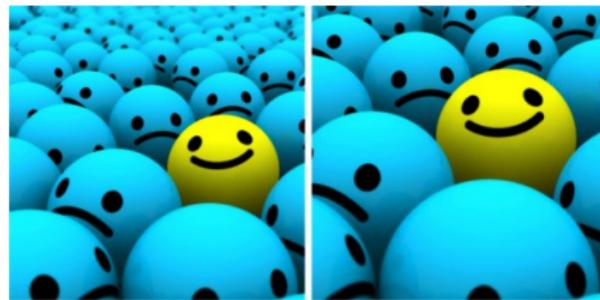
⁴Image source.

Scaling⁵



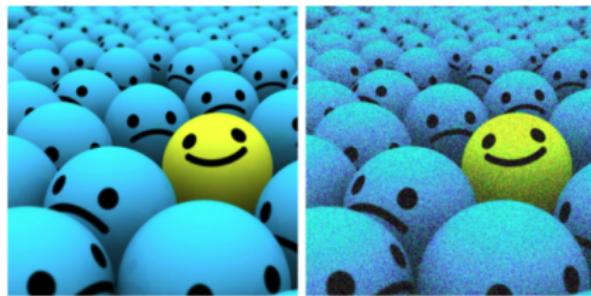
⁵Image source.

Cropping⁶



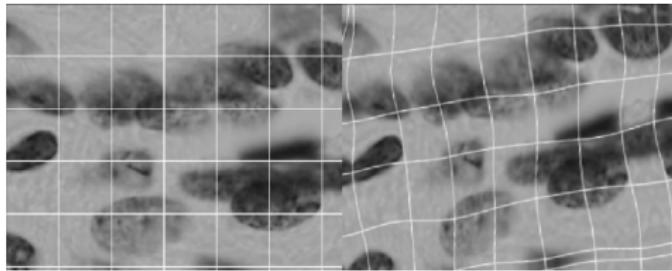
⁶Image source.

Adding noise (Gaussian, salt&pepper, etc.)⁷



⁷Image source.

Elastic deformation⁸



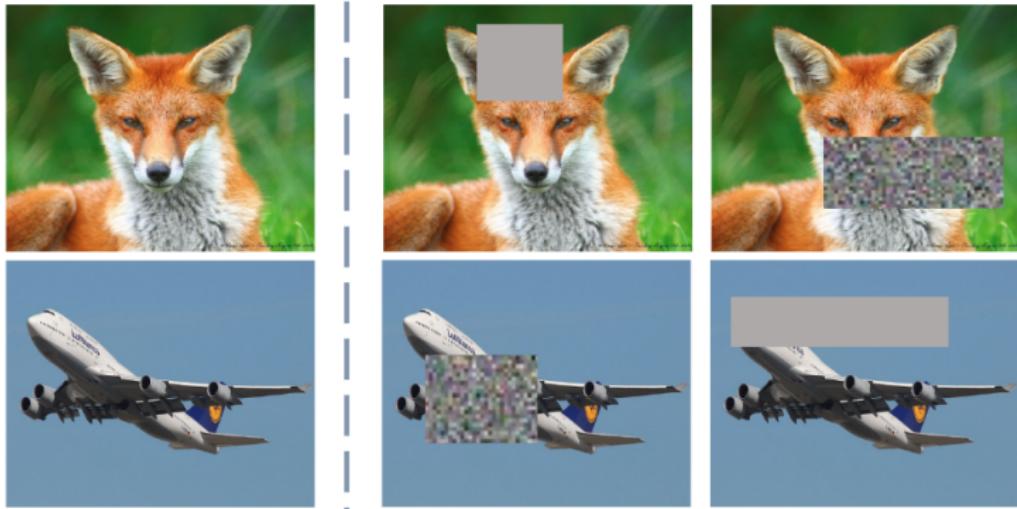
⁸Image source.

Randomly adjust brightness and contrast⁹



⁹Image source.

Random erasing augmentation¹⁰



¹⁰Image source.

Hue (add random offsets to RGB channels)¹¹



¹¹ [Image source](#).

Style transfer demo

Style transfer - rendering image in the style of another image.



Augmentation with ST



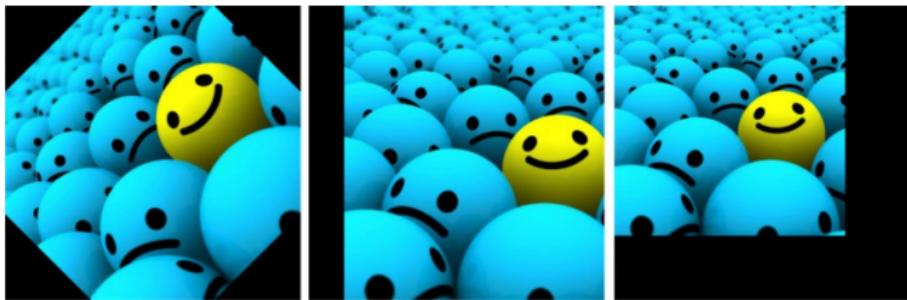
Augmentation with ST



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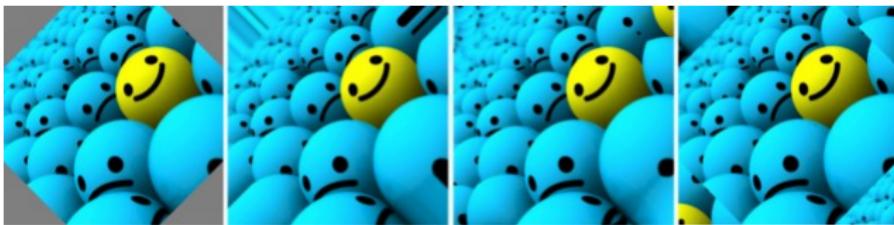
- 1 Padding data

Transformation uncovers unknown data¹²



¹²Image source.

Methods to pad unknown data¹³



Unknown data padding methods (left to right):

- constant
- extend edge values
- mirror
- wrap around

¹³[Image source.](#)