

# Artificial intelligence in data science

## Data augmentation

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# Why do we need data augmentation? Example: VGG16

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 224, 224, 64)	1792
conv2d_2 (Conv2D)	(None, 224, 224, 64)	36928
max_pooling2d_1 (MaxPooling2D)	(None, 112, 112, 64)	0
conv2d_3 (Conv2D)	(None, 112, 112, 128)	73856
conv2d_4 (Conv2D)	(None, 112, 112, 128)	147584
max_pooling2d_2 (MaxPooling2D)	(None, 56, 56, 128)	0
conv2d_5 (Conv2D)	(None, 56, 56, 256)	295168
conv2d_6 (Conv2D)	(None, 56, 56, 256)	590880
conv2d_7 (Conv2D)	(None, 56, 56, 256)	590880
max_pooling2d_3 (MaxPooling2D)	(None, 28, 28, 256)	0
conv2d_8 (Conv2D)	(None, 28, 28, 512)	1180160
conv2d_9 (Conv2D)	(None, 28, 28, 512)	2359808
conv2d_10 (Conv2D)	(None, 28, 28, 512)	2359808
max_pooling2d_4 (MaxPooling2D)	(None, 14, 14, 512)	0
conv2d_11 (Conv2D)	(None, 14, 14, 512)	2359808
conv2d_12 (Conv2D)	(None, 14, 14, 512)	2359808
conv2d_13 (Conv2D)	(None, 14, 14, 512)	2359808
max_pooling2d_5 (MaxPooling2D)	(None, 7, 7, 512)	0
flatten_1 (Flatten)	(None, 25088)	0
dense_1 (Dense)	(None, 4096)	102764544
dropout_1 (Dropout)	(None, 4096)	0
dense_2 (Dense)	(None, 4096)	16781312
dropout_2 (Dropout)	(None, 4096)	0
dense_3 (Dense)	(None, 2)	8194

Total params: 134,268,738  
Trainable params: 134,268,738  
Non-trainable params: 0

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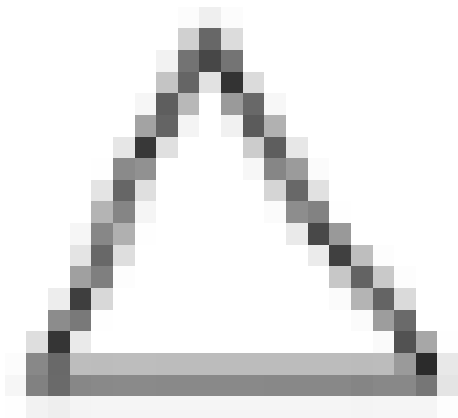
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- ▶ We have millions of weights especially for large images
- ▶ Generally we have few thousand images at most

# Data augmentation

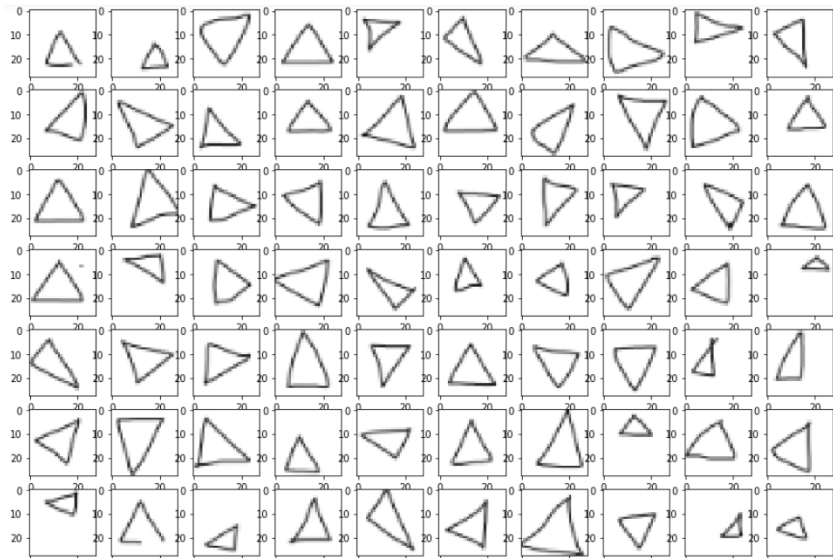
- ▶ Add noise
- ▶ Do convolution
- ▶ Geometric transformation
  - ▶ rotation (most neural networks do not recognize upside down objects)
  - ▶ distortion (viewed from angle, etc.)
  - ▶ partial image (most often part of the object is hidden in the image)

## Example

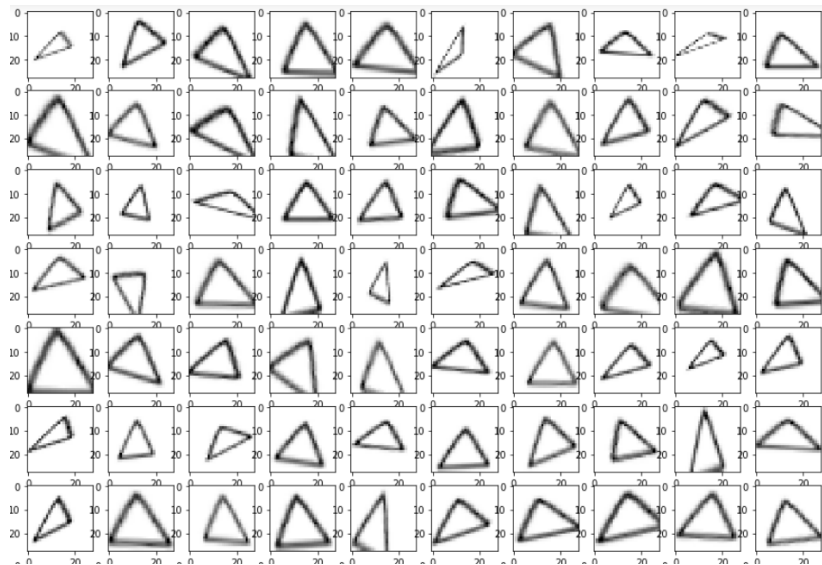


► One of the triangle from our shapes set

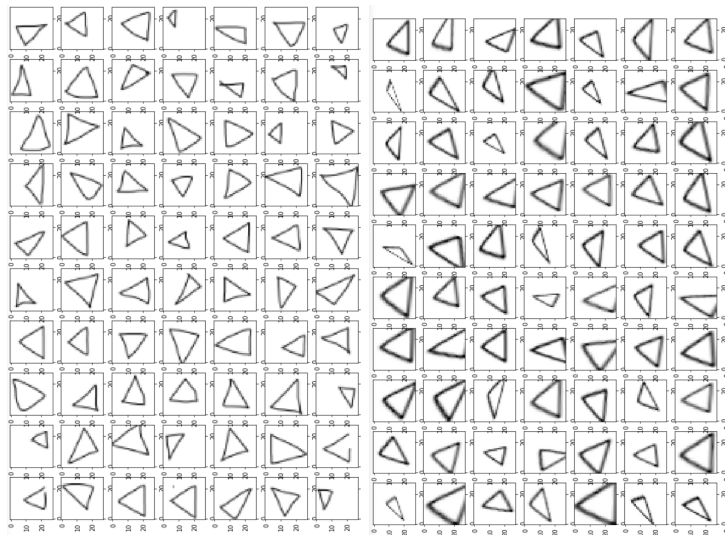
# Original set



## Augmented set from the fourth



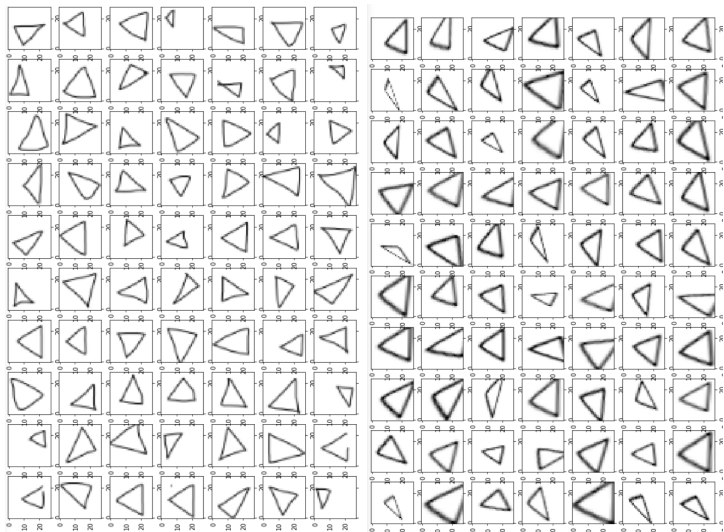
# Original set and augmented





# Original set and augmented

- ▶ Shapes are ok, but contrast and width is definitely off



# What kind of transformations?

- ▶ What you think may come for!

