Transfer learning

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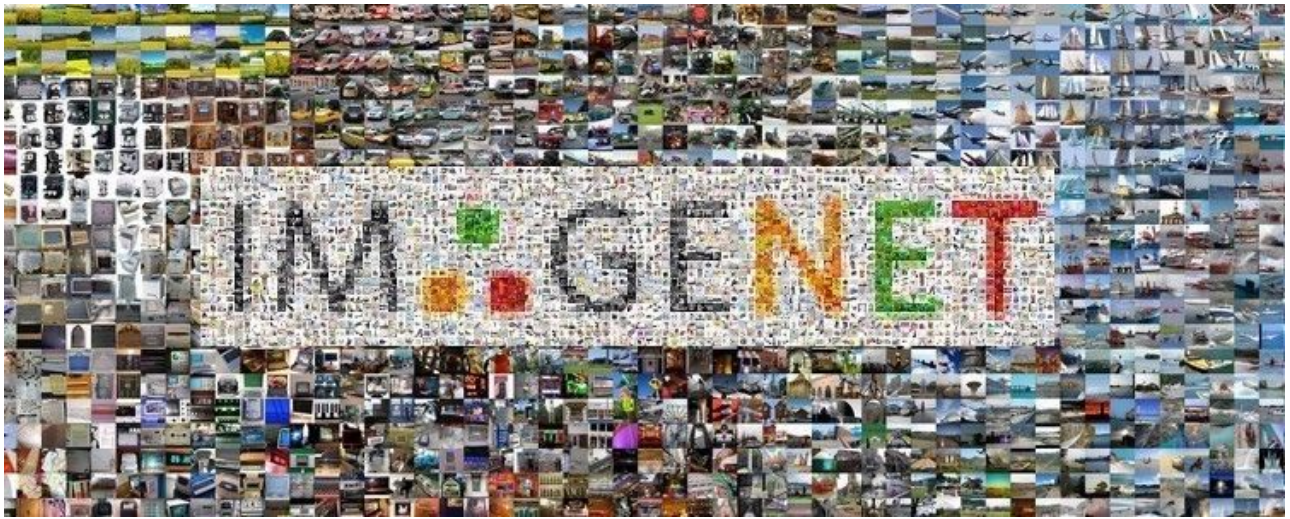
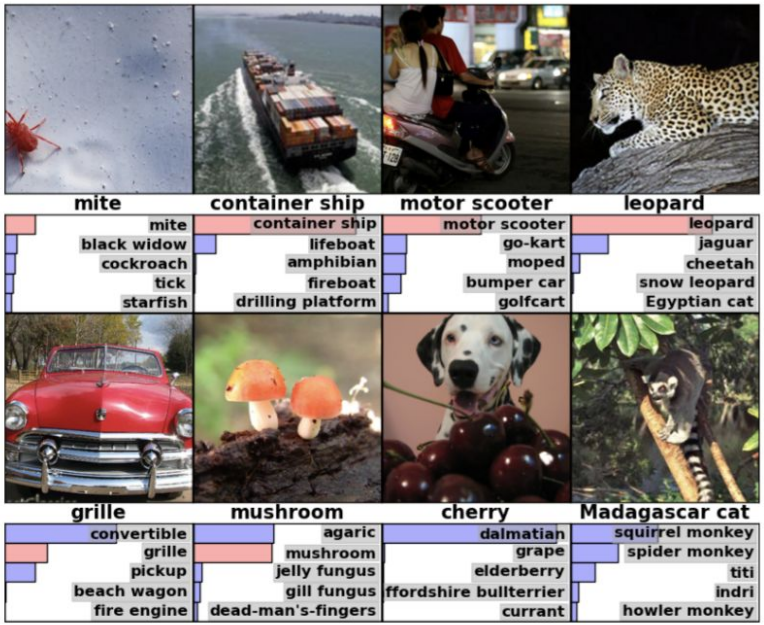
Transfer learning: idea

Transfer learning is a machine learning method where a model developed for a task A is reused as the starting point for a model on a task B.

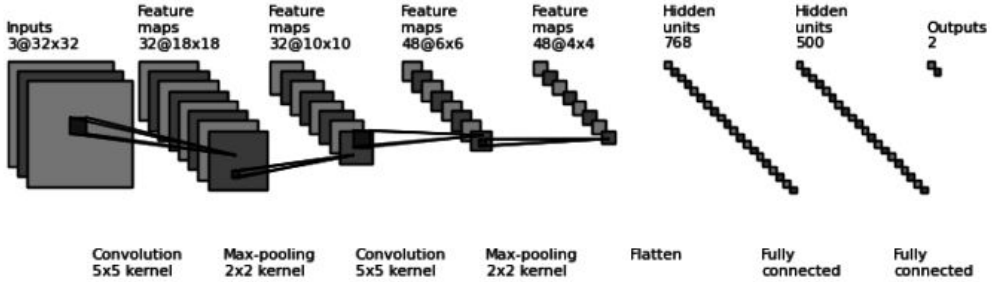
ImageNet Large Scale Visual Recognition Competition (ILSVRC)

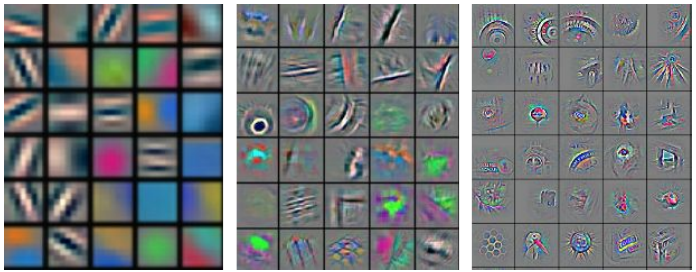


Object classes: 1000. Images: 1.2 M train, 100k test

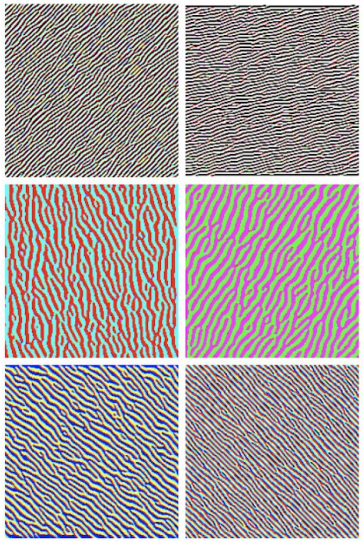

mite
mite
black widow
cockroach
tick
starfish
container ship
container ship
lifeboat
amphibian
fireboat
drilling platform
motor scooter
motor scooter
go-kart
moped
bumper car
golfcart
leopard
leopard
jaguar
cheetah
snow leopard
Egyptian cat
grille
convertible
grille
pickup
beach wagon
fire engine
mushroom
agaric
mushroom
jelly fungus
gill fungus
dead-man's-fingers
cherry
dalmatian
grape
elderberry
ffordshire bullterrier
currant
Madagascar cat
squirrel monkey
spider monkey
titi
indri
howler monkey

General vs specific

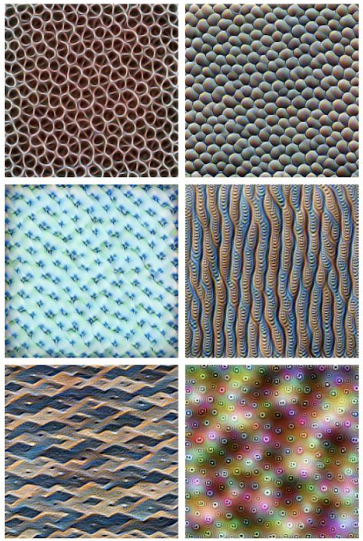




General vs specific



Edges (layer conv2d0)



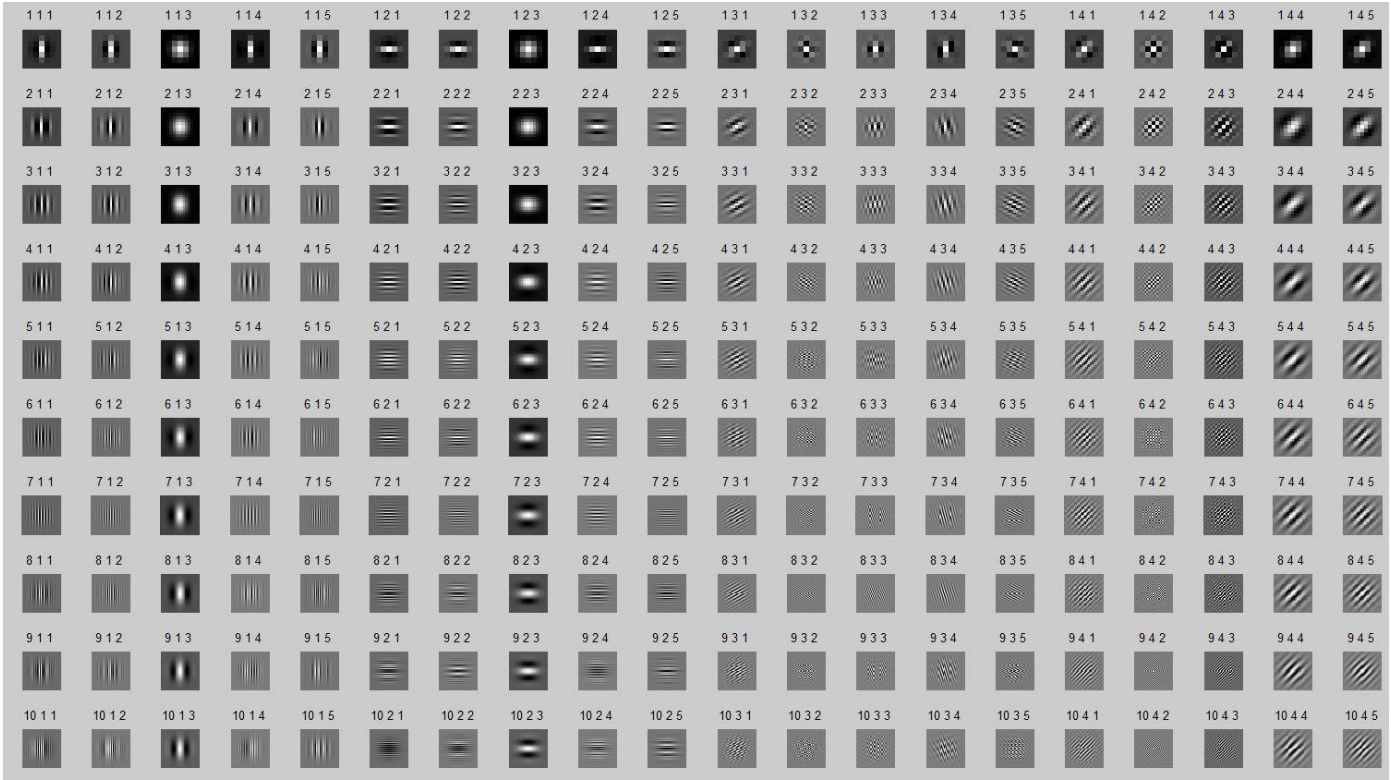
Textures (layer mixed3a)

Patterns (layer mixed4a)

Parts (layers mixed4b & mixed4c)

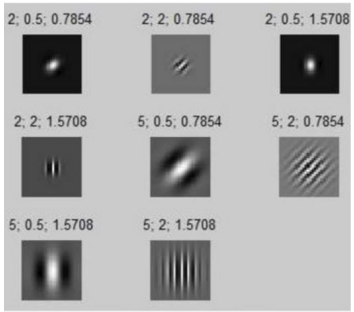
Objects (layers mixed4d & mixed4e)

Gabor filters



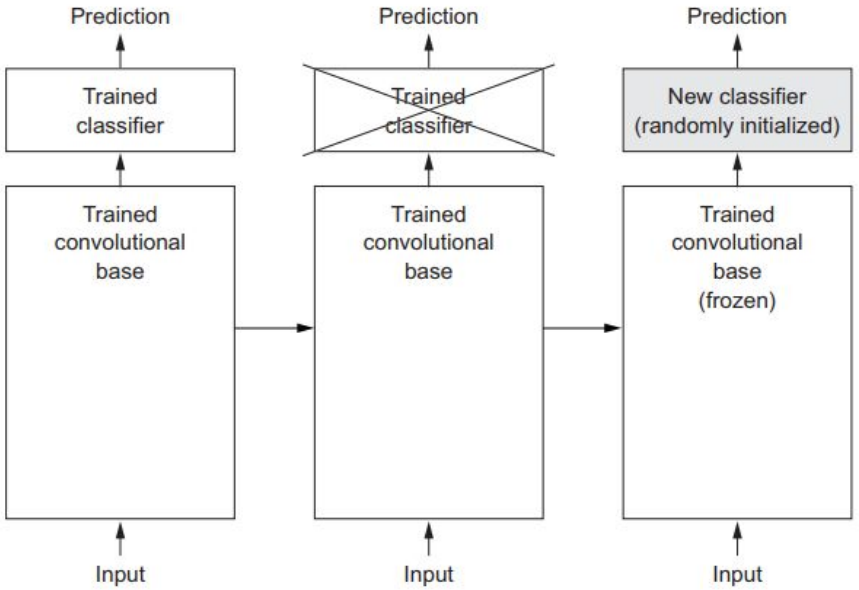
Gabor filters

$$g(x, y; \lambda, \theta, \psi, \sigma, \gamma) = \exp(-\frac{x'^2 + \gamma^2 y'^2}{2\sigma^2}) \cos(2\pi \frac{x'}{\lambda} + \psi)$$



Feature extraction

Feature extraction consists of using the representations learned by a previous network to extract interesting features from new samples. These features are then run through a new classifier, which is trained from scratch.



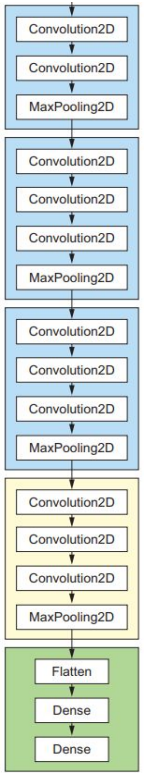
Fine-tuning

UNFREEZED BACKBONE + CUSTOM HEAD + BACKPROPAGATION

Replace and retrain the classifier on top of the pretrained neural network on the new dataset, but to also fine-tune the weights of the backbone by continuing the backpropagation.

FINE-TUNE:

- ALL LAYERS
- FIX LOW-LEVEL
- ONLY HIGH-LEVEL



Fine-tuning

1. Add your custom HEAD on a top of pretrained BACKBONE.
2. Freeze the BACKBONE.
3. Train the HEAD.
4. Unfreeze some layers in the BACKBONE.
5. Jointly train (low lr) unfreezed layers + HEAD.