

Laboratory

Transfer Learning

Deep Learning for Artificial Intelligence (DLAI)

DEEP LEARNING FOR ARTIFICIAL INTELLIGENCE

Masters @ UPC TelecosBCN BARCELONA (6TH Edition).

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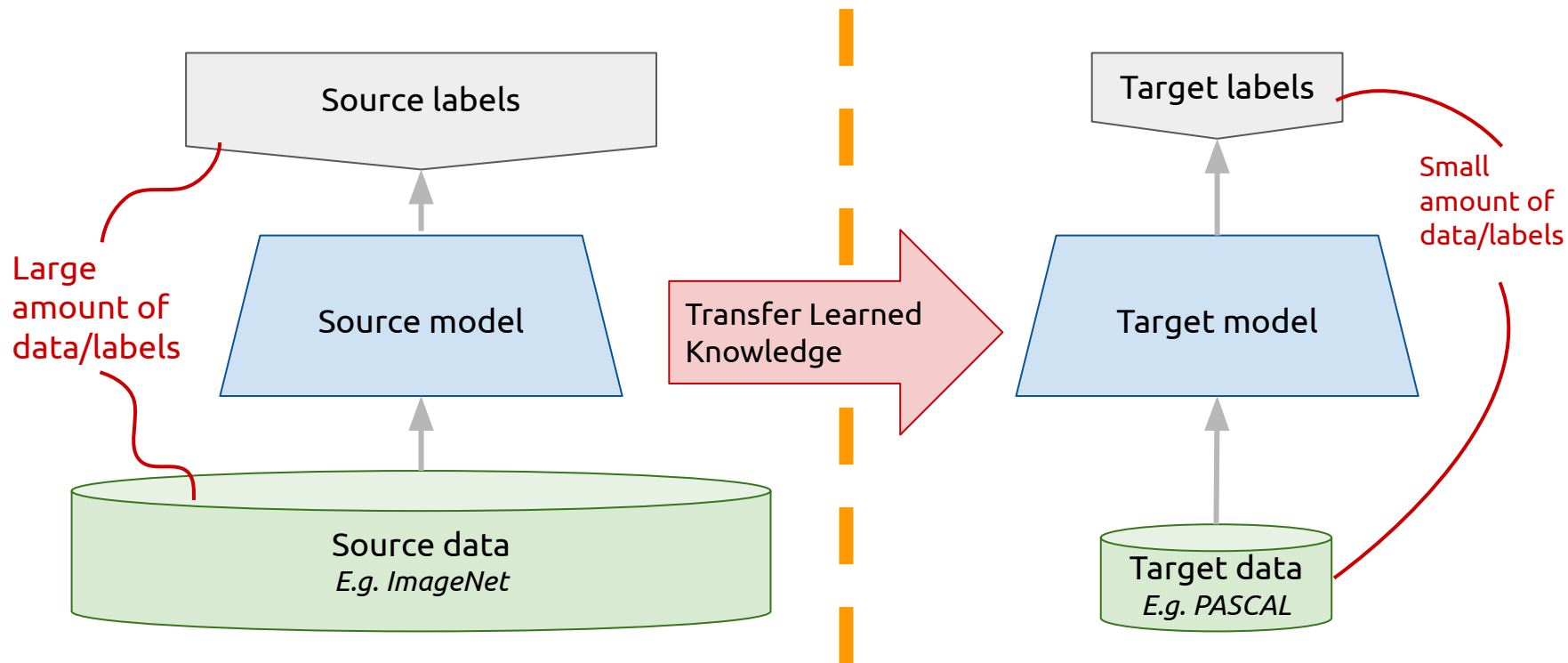
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Transfer Learning

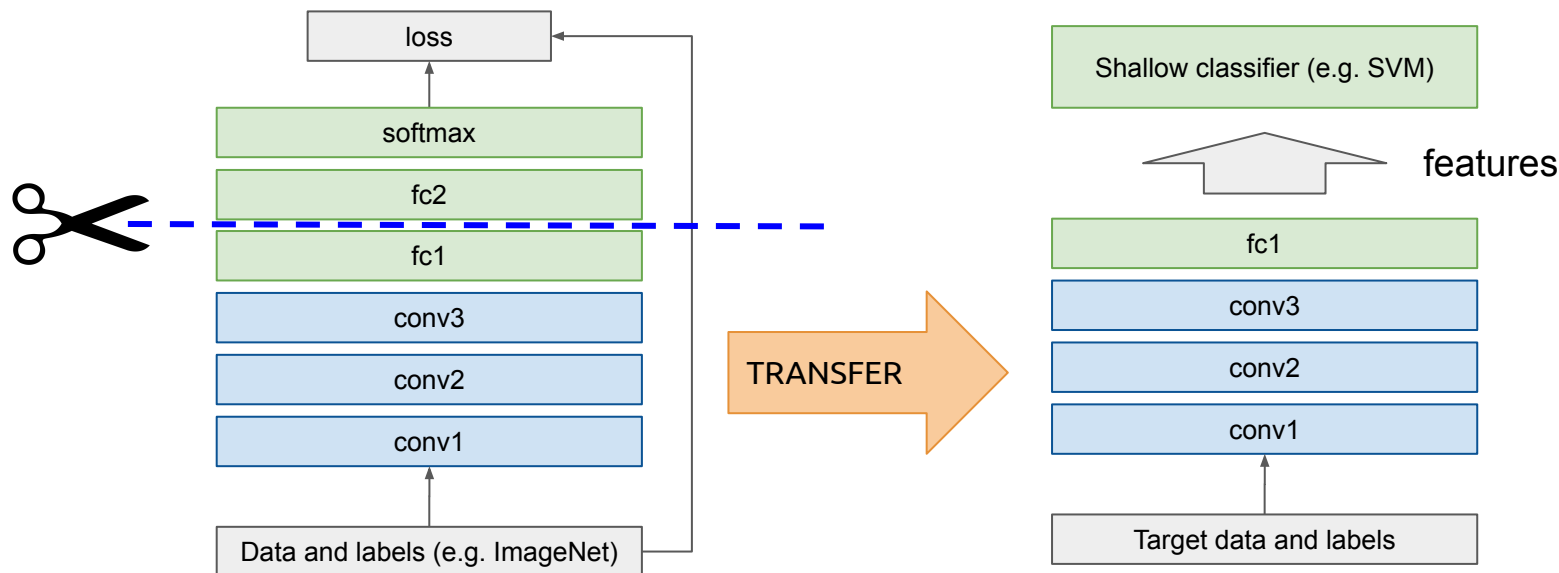
- The ability to apply knowledge learned in a previous task to a different one.
- Based on human learning. People can often transfer knowledge learned in previously to novel situations.
- **Motivation:** In many cases, not enough training data is available to estimate the large number of parameters required by a deep neural network in a supervised manner.

Transfer Learning: idea



“Off-the-shelf”

Use outputs of one or more layers of a network trained on a different task as generic feature detectors. Train a new shallow model on these features.

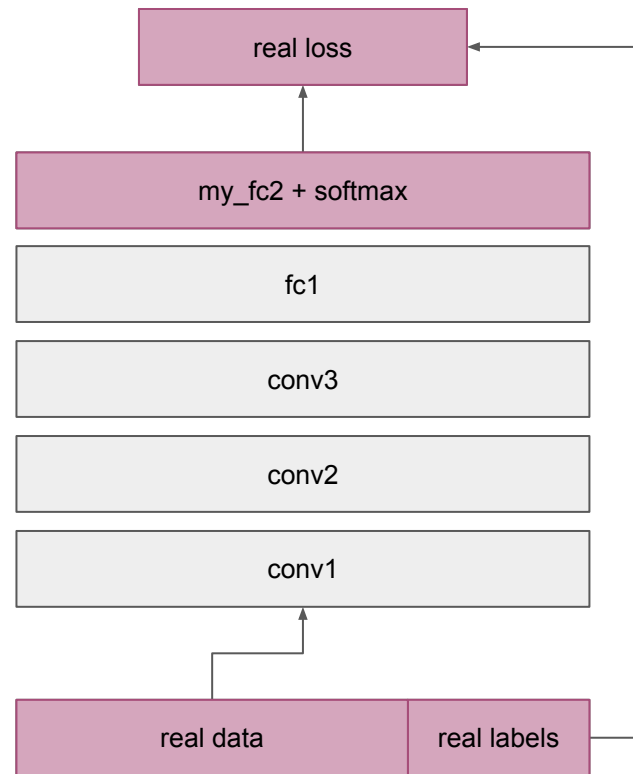


Fine-tuning: supervised task adaptation

Train deep net on “nearby” task for which it is easy to get labels using standard backprop.

Cut off top layer(s) of network and replace with supervised objective for target domain.

Fine-tune network using backprop with labels for target domain until validation loss starts to increase.



Freeze or fine-tune?

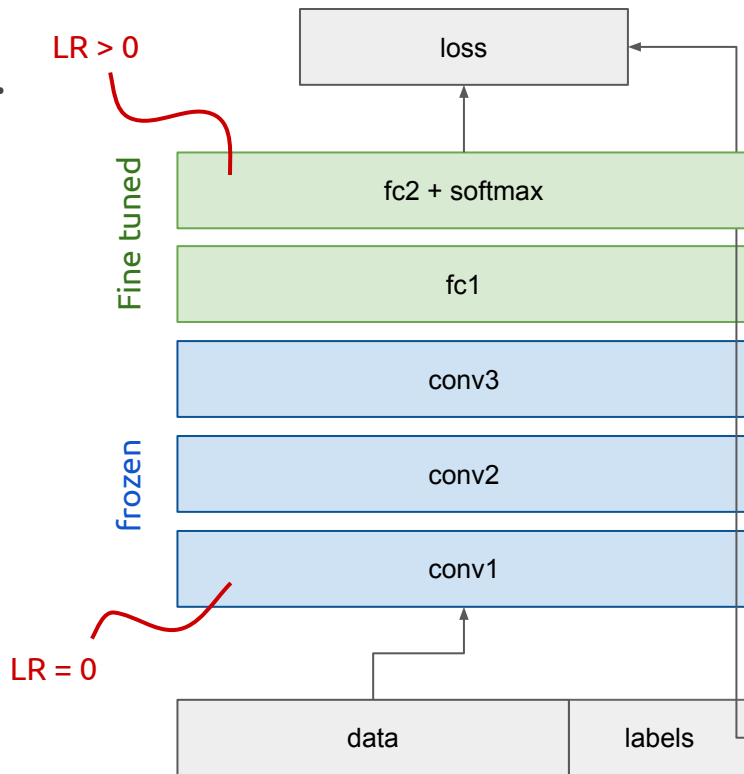
Bottom n layers can be frozen or fine-tuned.

- **Frozen:** not updated during backprop
- **Fine-tuned:** updated during backprop

What to do depends on target task:

- **Freeze:** target task labels are scarce, and we want to avoid overfitting
- **Fine-tune:** target task labels are more plentiful

In general, we can set learning rates to be different for each layer to find a trade-off between freezing and fine-tuning



Task: Binary classification

Dogs vs. Cats dataset:

- Dataset of dogs and cats images.
- Training set of 60K samples.
- We will use only 400 samples.



VGG-16

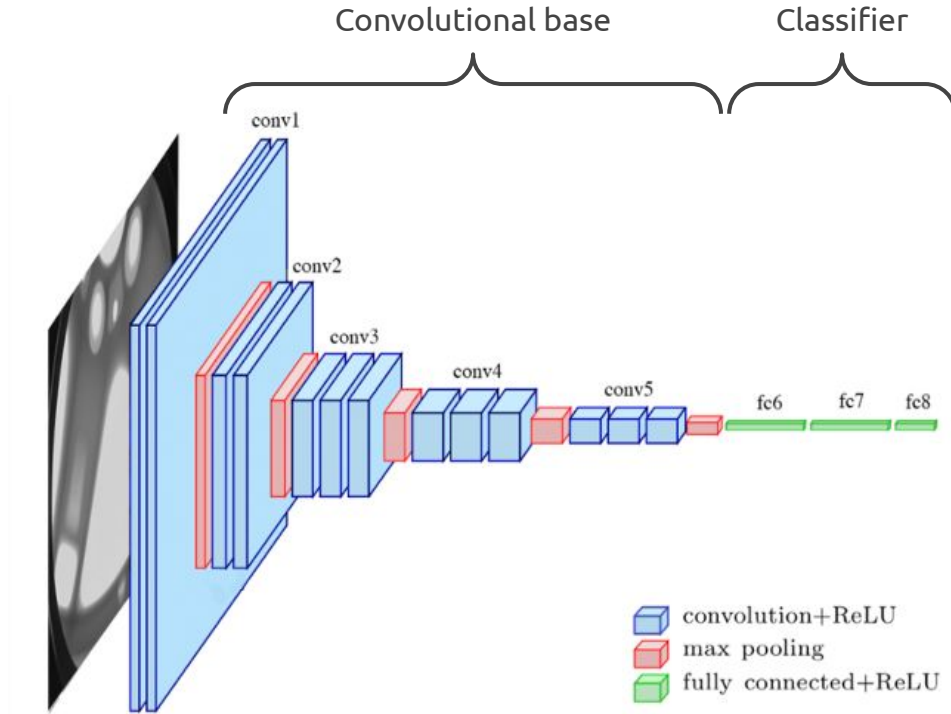


Figure: Vaibhav Khandelwal, [“The Architecture and Implementation of VGG-16”](#) (2017)

Session summary

- Training a network from scratch
- Training a network from scratch with:
 - Data augmentation
 - Regularization
- Using a pretrained network “off-the-shelf”
- Using a pretrained network and fine-tune it

Kick off the lab

1. Launch a web browser (Chrome recommended).
2. Login with your @estudiantat.upc.edu GSuite account.
3. Create a copy [the notebook](#) of this lab to your Gdrive.
4. (Right) Click on the file and choose Open File with “[Google Colaboratory](#)”

