Signal representation & learning

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  - Domain adaptation
  - Adapting neural networks
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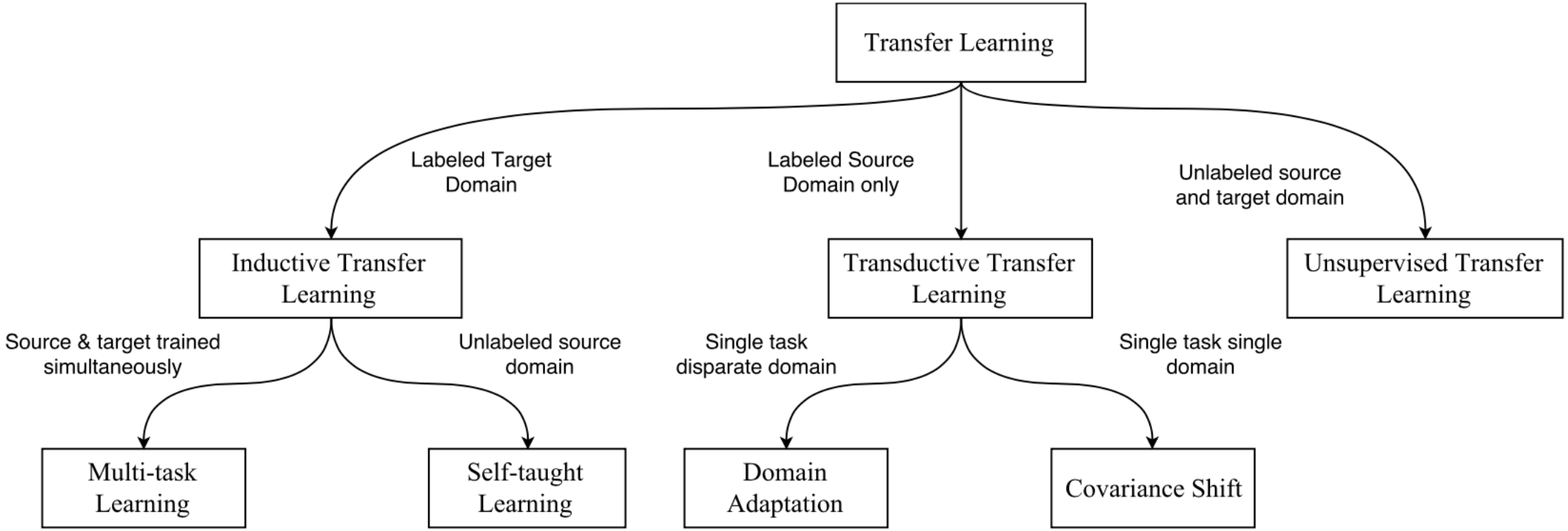
Transfer learning

- Transferring the knowledge of one model to perform a new task
  - Domain adaptation
- Reuse the better signal representations learnt from “a lot of data”
- Deep learning methods are data-hungry
- The distributions of the source and target data must be the same
- Labeled data in the target domain may be limited

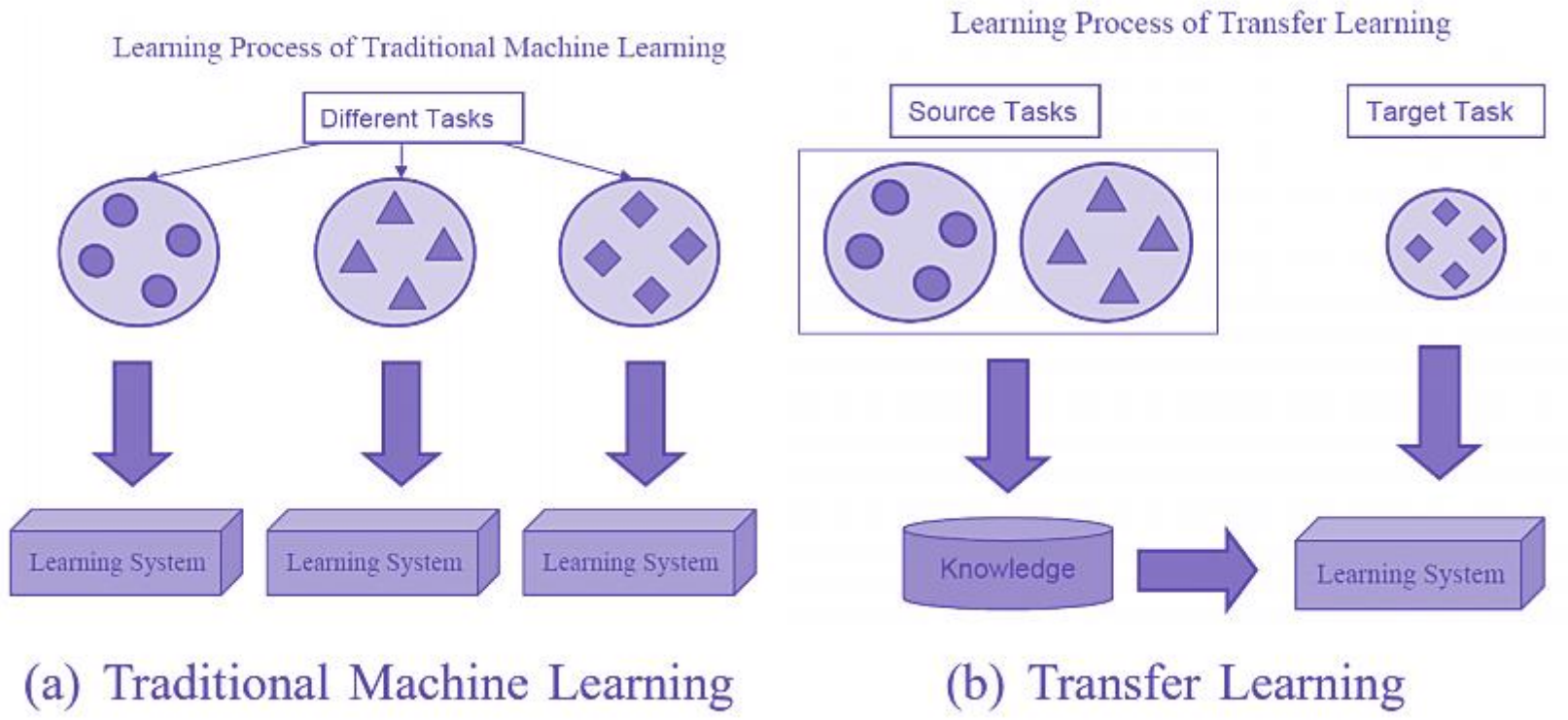
Approaches


Transfer Learning
Labeled Target Domain
Labeled Source Domain only
Unlabeled source and target domain
Inductive Transfer Learning
Transductive Transfer Learning
Unsupervised Transfer Learning
Source & target trained simultaneously
Unlabeled source domain
Single task disparate domain
Single task single domain
Multi-task Learning
Self-taught Learning
Domain Adaptation
Covariance Shift

Motivation

- Lots of data, time, resources needed to train and tune a neural network from scratch
- An ImageNet deep neural net can take weeks to train and fine-tune from scratch.
- Bring the better signal representation from one domain to another domain
- Cheaper, faster way of adapting a neural network by exploiting their generalization properties

Traditional vs Transfer Learning



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TL in NN

- NN layers
  - Bottom/first/earlier layers: general learners
    - Low-level notions of edges, visual shapes
  - Top/last/later layers: specific learners
    - High-level features such as eyes, feathers

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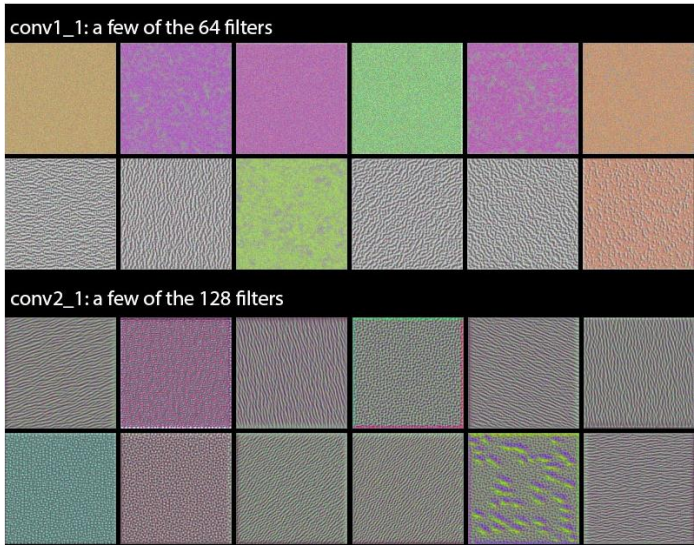
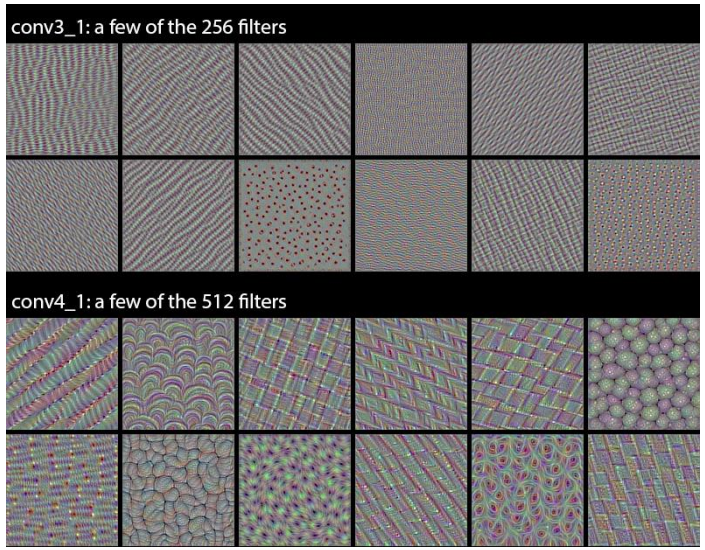
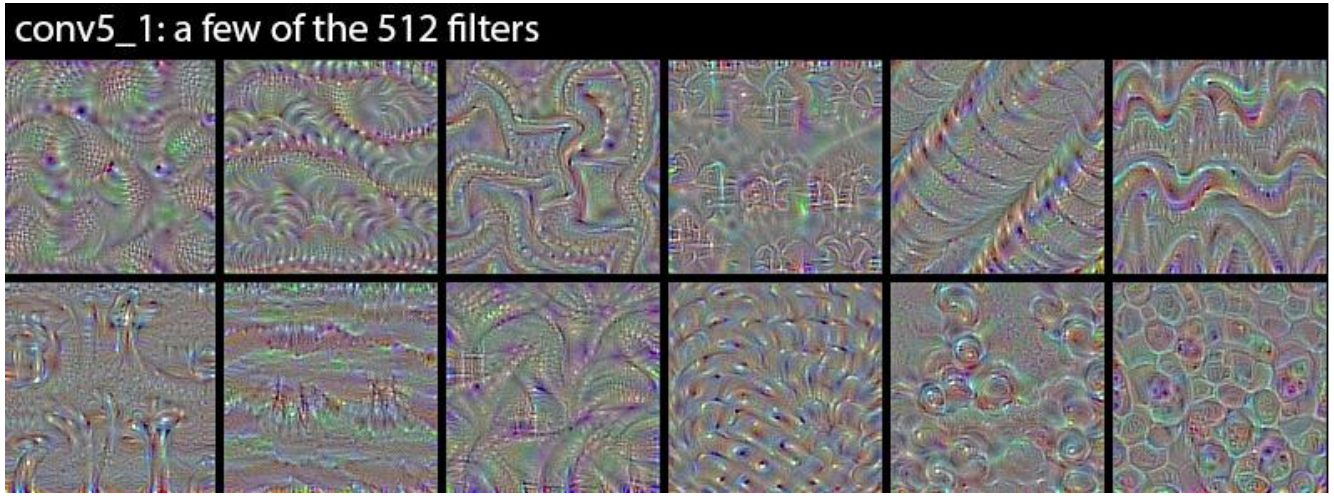
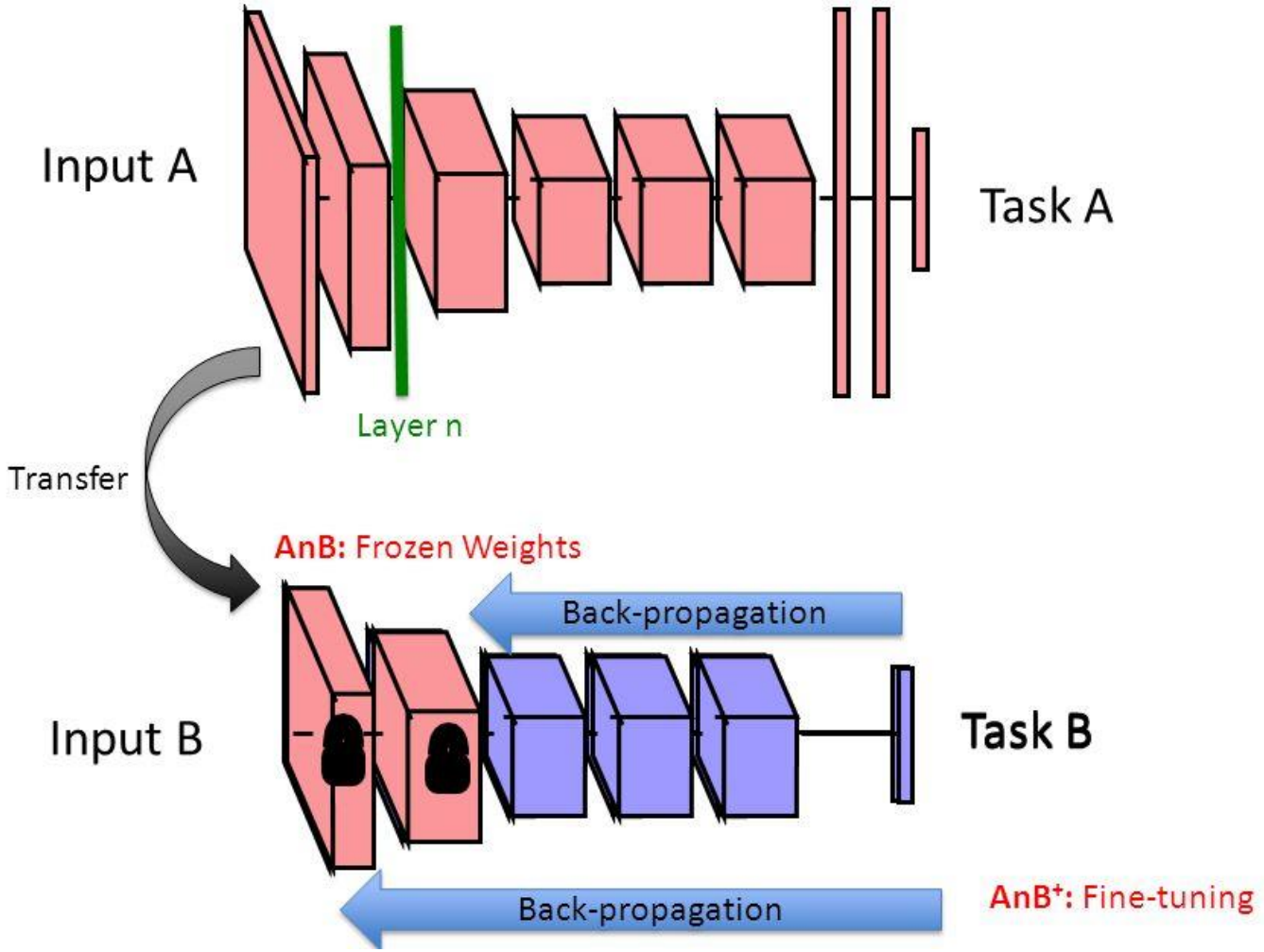
Example: VGG16







Transfer Learning Overview



(image: Aghamirzaie & Salomon)

Process

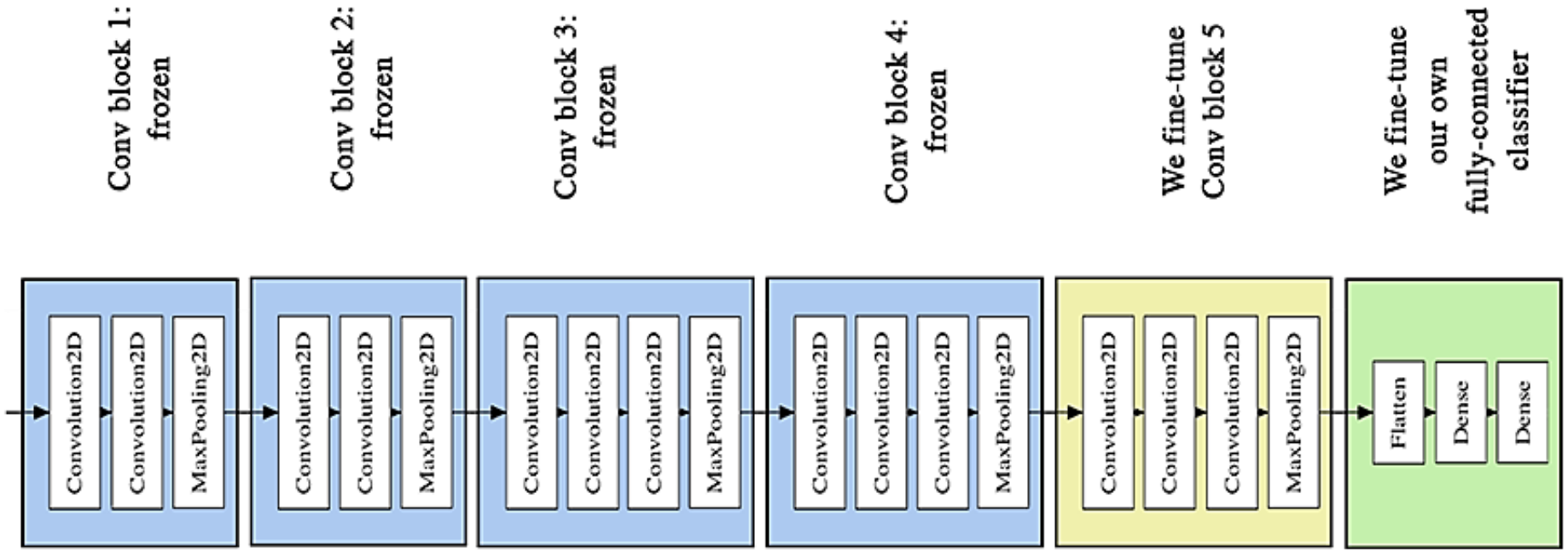
1.Start with pre-trained network

2.Partition network into:
   1. Features: identify which layers to keep
   2. Classifiers: identify which layers to replace

3.Re-train classifier layers with new data

4.Unfreeze weights and fine-tune whole network with smaller learning rate

Freezing



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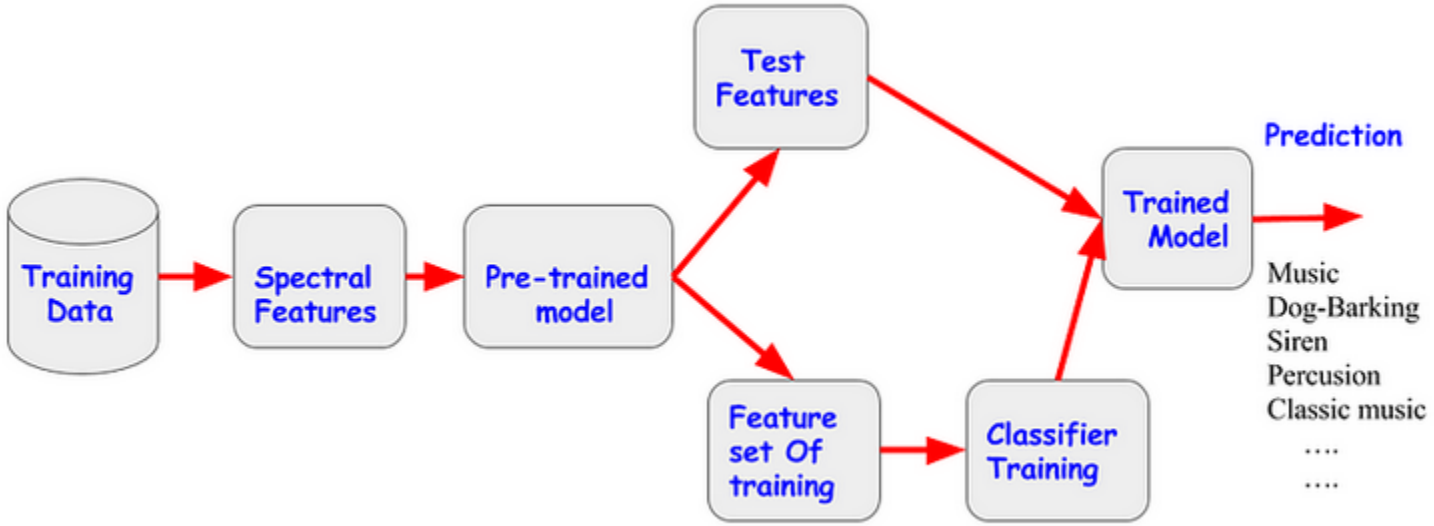
Audio signal type classification

- Representation
  - spectrogram



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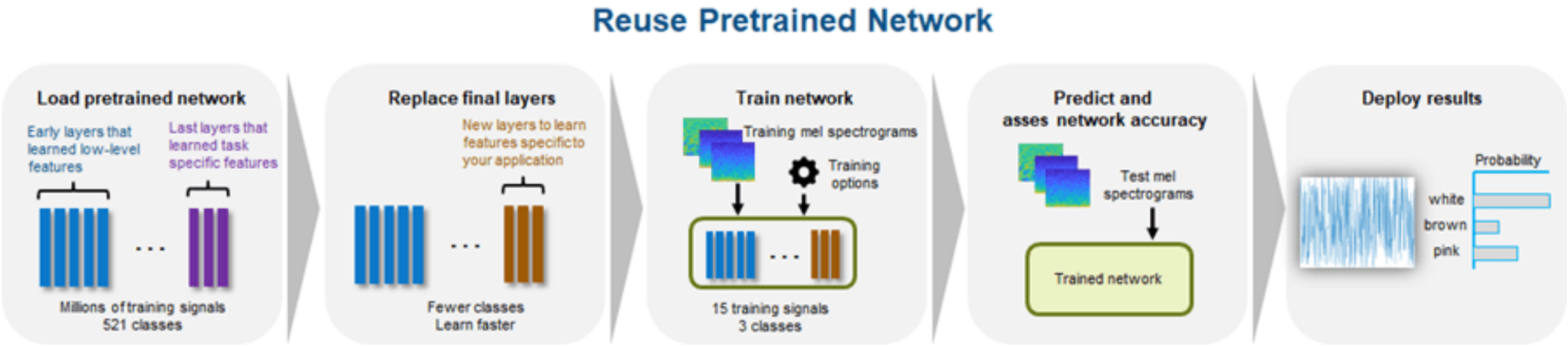
Pretrained audio networks

- reference
  - Matlab audio toolbox



Thank you

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