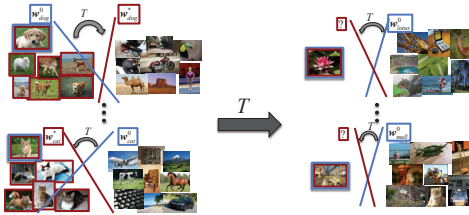


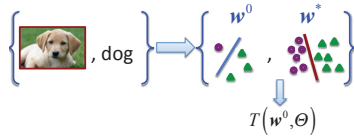
MOTIVATION

- **Inter-class knowledge:** A generic transformation  $T$ : small-sample models  $w^0 \rightarrow$  large-sample models  $w^*$
- **Recognition of novel categories from few examples:** Predict the target models  $w$  by transferring  $T$



LEARNING MODEL TRANSFORMATION

- $T$  learns **predictive structures** in the model space
  - Discriminative representation of natural intra-class variability: Sparse samples  $\rightarrow$  a category cluster
  - Duality perspective: Feature  $\leftrightarrow$  classifier spaces
  - Alternative parametric way of model distillation
- $T$  can be learned
  - On a large collection of model pairs  $\{(w^0, w^*)\}$
  - By a high-capacity regression function  $T(w^0, \theta)$

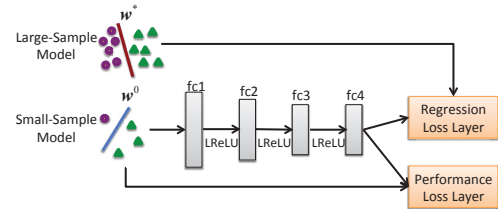


MODEL REGRESSION NETWORK

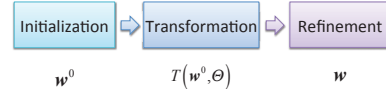
- **Feature space:** Pre-trained Alexnet CNN on ILSVRC
- **Classification model:** Linear SVMs
- **Generation of model pairs**  $\{(w_j^0, w_j^*)\}_{j=1}^J$ 
  - **Training set:** 700,000 model pairs of 1,000 categories
  - $w^0$ : Trained from random small-sample sets  $\{(x_i, y_i)\}_{i=1}^M$  with different SVM parameters (data augmentation)
- **Loss function**  $L(\theta)$

$$\sum_{j=1}^J \left\{ \frac{1}{2} \|w_j^* - T(w_j^0, \theta)\|_2^2 + \lambda \sum_{i=1}^M [1 - y_i^j (T(w_j^0, \theta)' x_i^j)]_+ \right\}$$

- **Regression network**



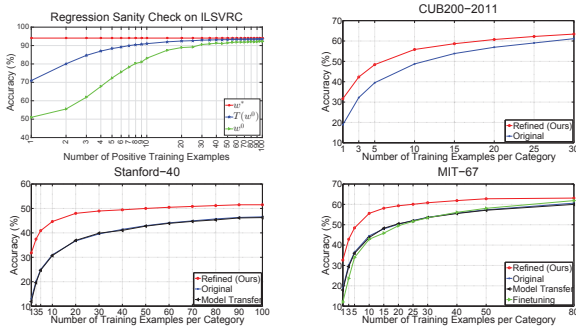
TARGET MODEL PREDICTION



$$R(w) = \frac{1}{2} \|w - T(w^0, \theta)\|_2^2 + \eta \sum_{i=1}^K [1 - y_i (w' x_i)]_+$$

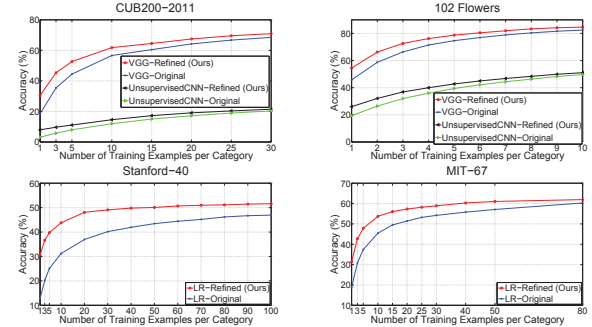
FAMILIAR/NOVEL CATEGORY RECOGNITION

- **Evaluation:** Fine-grained, action & scene classification
- **Baselines:** Models learned from scratch & model parameter transfer & fine-tuning



EVALUATION OF FEATURE & MODEL TYPES

- **Feature spaces:** VGG19 CNN on ILSVRC & unsupervised CNN on YouTube videos
- **Classification models:** Logistic regression



ONE-SHOT DOMAIN ADAPTATION

Prior knowledge	Method	Acc (%)	Prior knowledge	Method	Acc (%)
Data	SVM (target only)	62.28	Feature	GFK	65.16
	SVM (source only)	53.51		SA	59.30
	SVM (source and target)	56.68		Daumé III	59.21
Model parameter	PMT	66.30		MMDT	59.21
	Late fusion (Max)	59.59		Fine-tuning	61.13
	Late fusion (Lin. Int. Avg)	60.64	Model transformation	Regression network (Ours)	<b>68.47</b>