

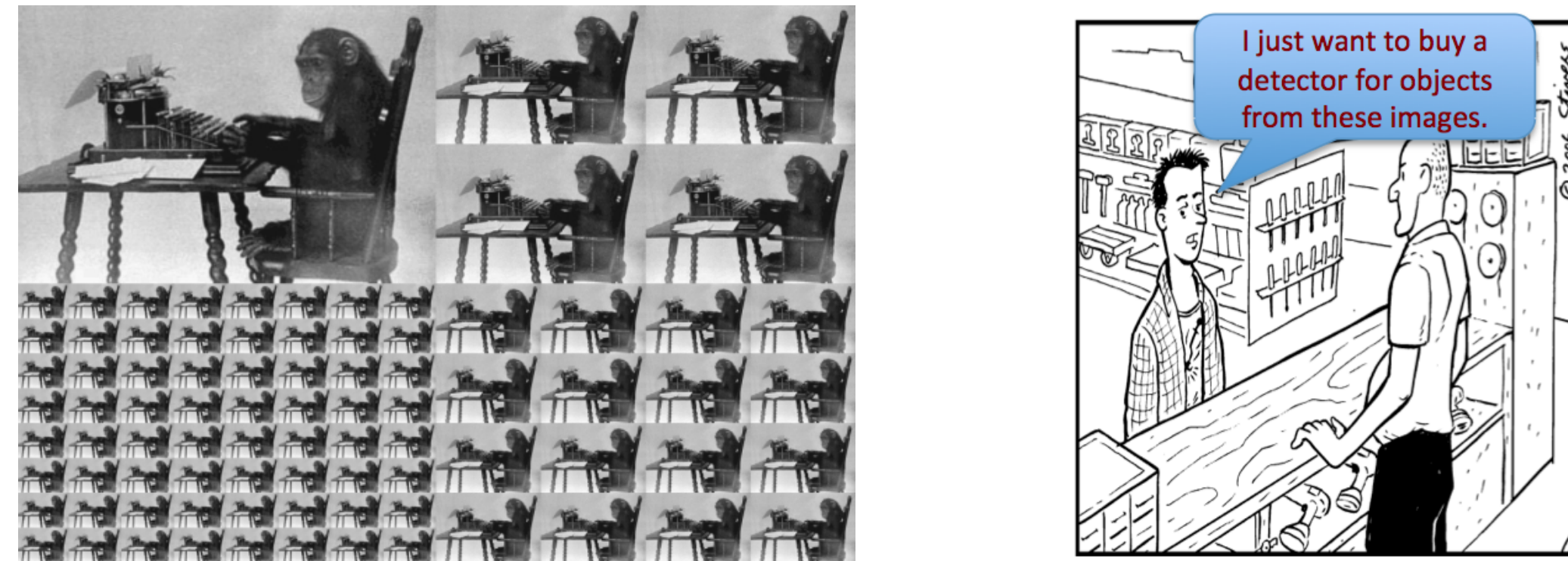
MOTIVATION

Learning from supervised data → Learning from **experience**

- A large annotated dataset → A large library of **pre-trained models**
- Expensive training from scratch → **Selecting** most suitable store models

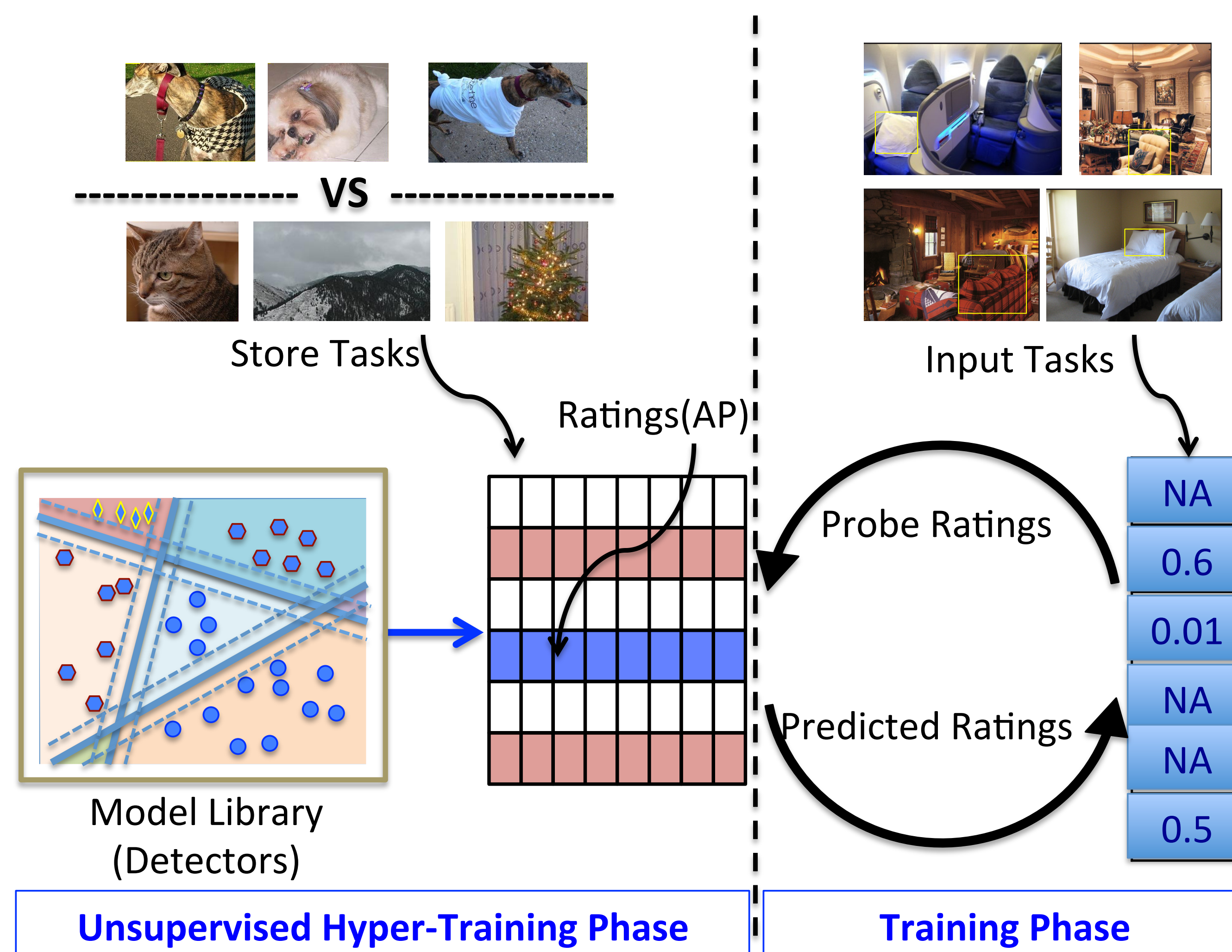
Recommender systems → **Vision domain**

- Items → **Models**
- Users → **Tasks**

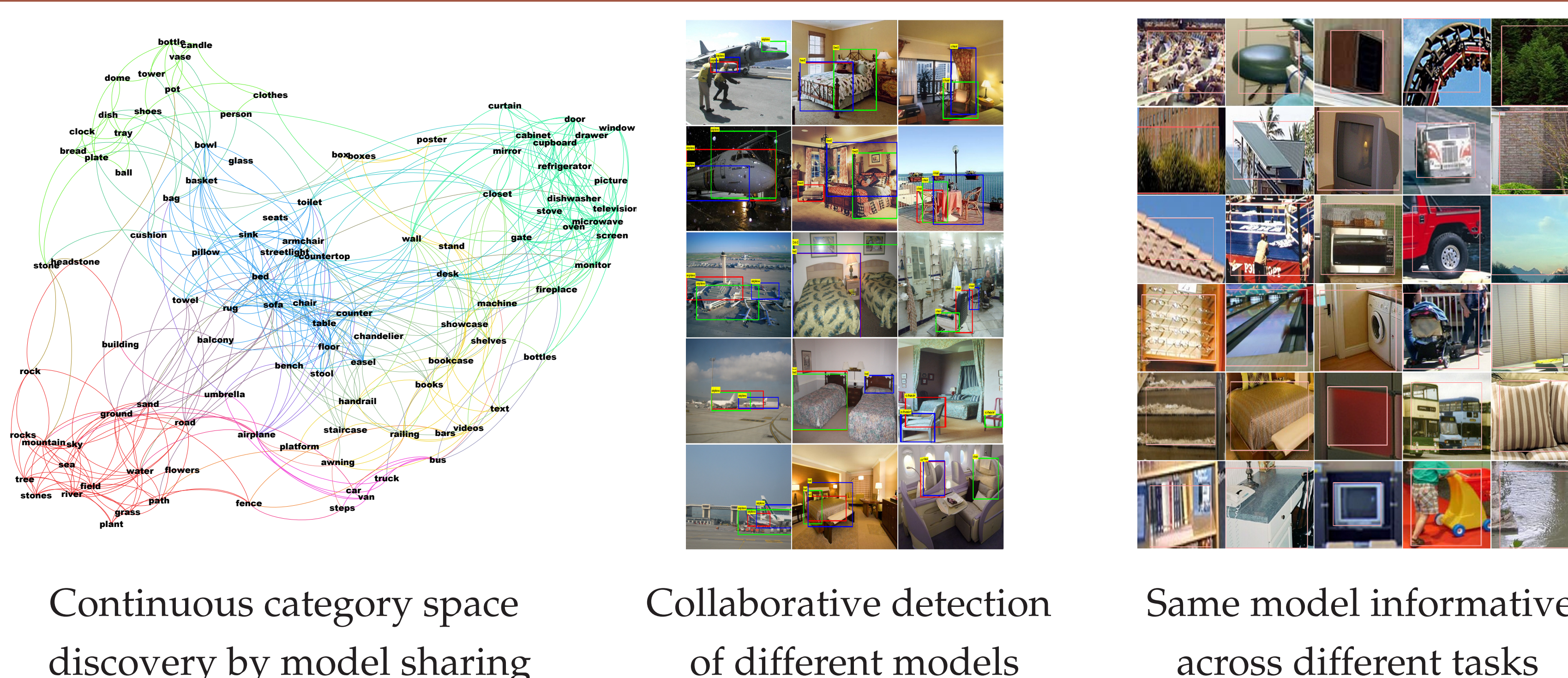


Infinite Monkey Theorem [Wikipedia]

PIPELINE



QUALITATIVE VISUALIZATION



COLLABORATIVE FILTERING

Joint latent factor space for task-model interactions

- Estimate of rating r_{ij} of model M_i on task T_j : $\hat{r}_{ij} = u_i^T v_j$

Low-rank matrix factorization

- SVD with biases

$$\hat{r}_{ij} = \mu + q_i + p_j + u_i^T v_j, \quad \bar{R} = ESF \approx (E_d S_d) F_d = UV$$

- NMF

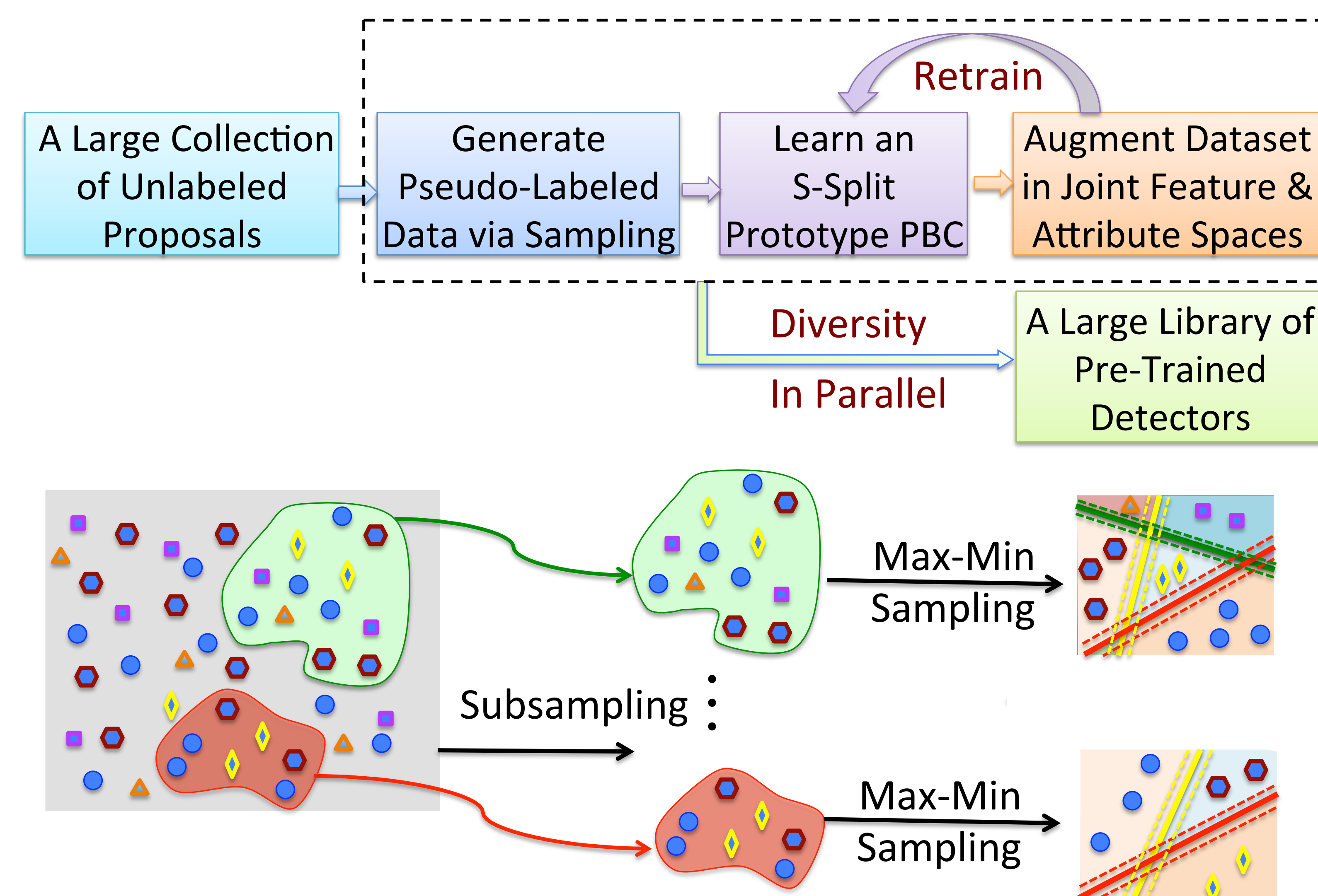
$$R \approx UV = \sum_{l=1}^d U_l V_l$$

- Estimate of ratings r for an input task given k probe ratings

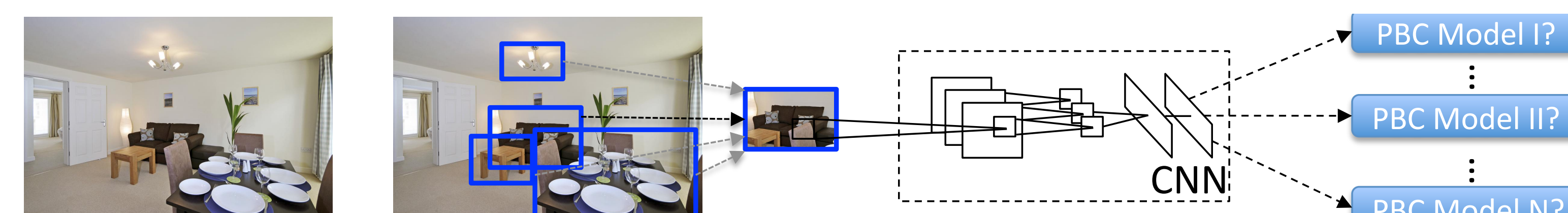
$$(\tilde{U}_k) v = r_k, \quad \hat{r} = Uv$$

UNSUPERVISED HYPER-TRAINING: PBC-CNN

- **Feature Space**: Pre-trained CNNs on ILSVRC 2012
- **Processing Units**: Region proposals
- **Unsupervised Discovery** of Predictable Discriminative Binary Codes (PBCs [Rastegari et al.]

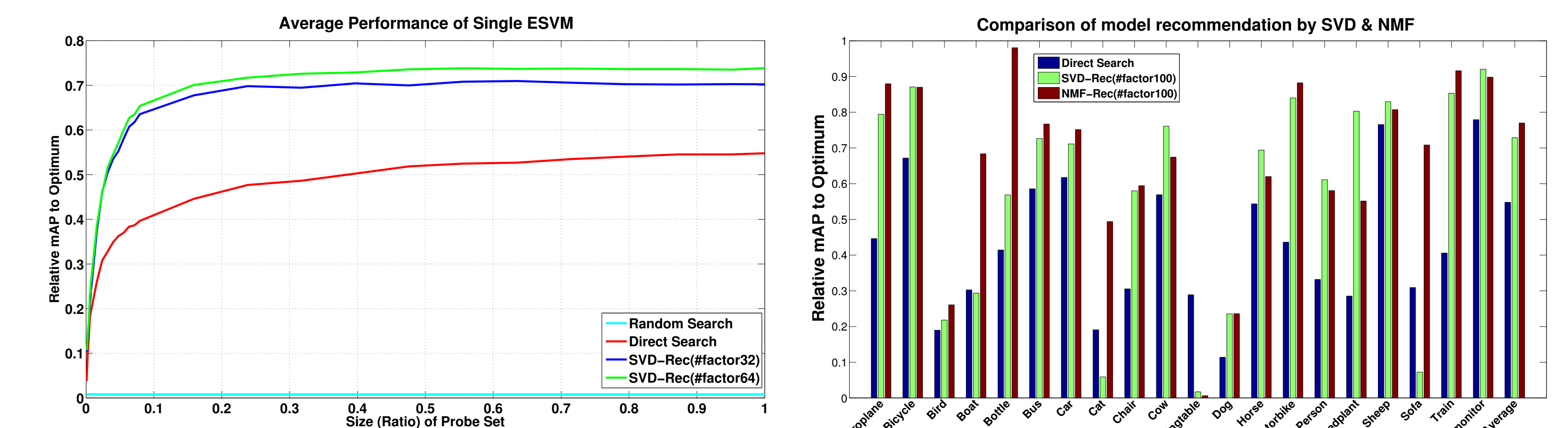


- **Detection Process**



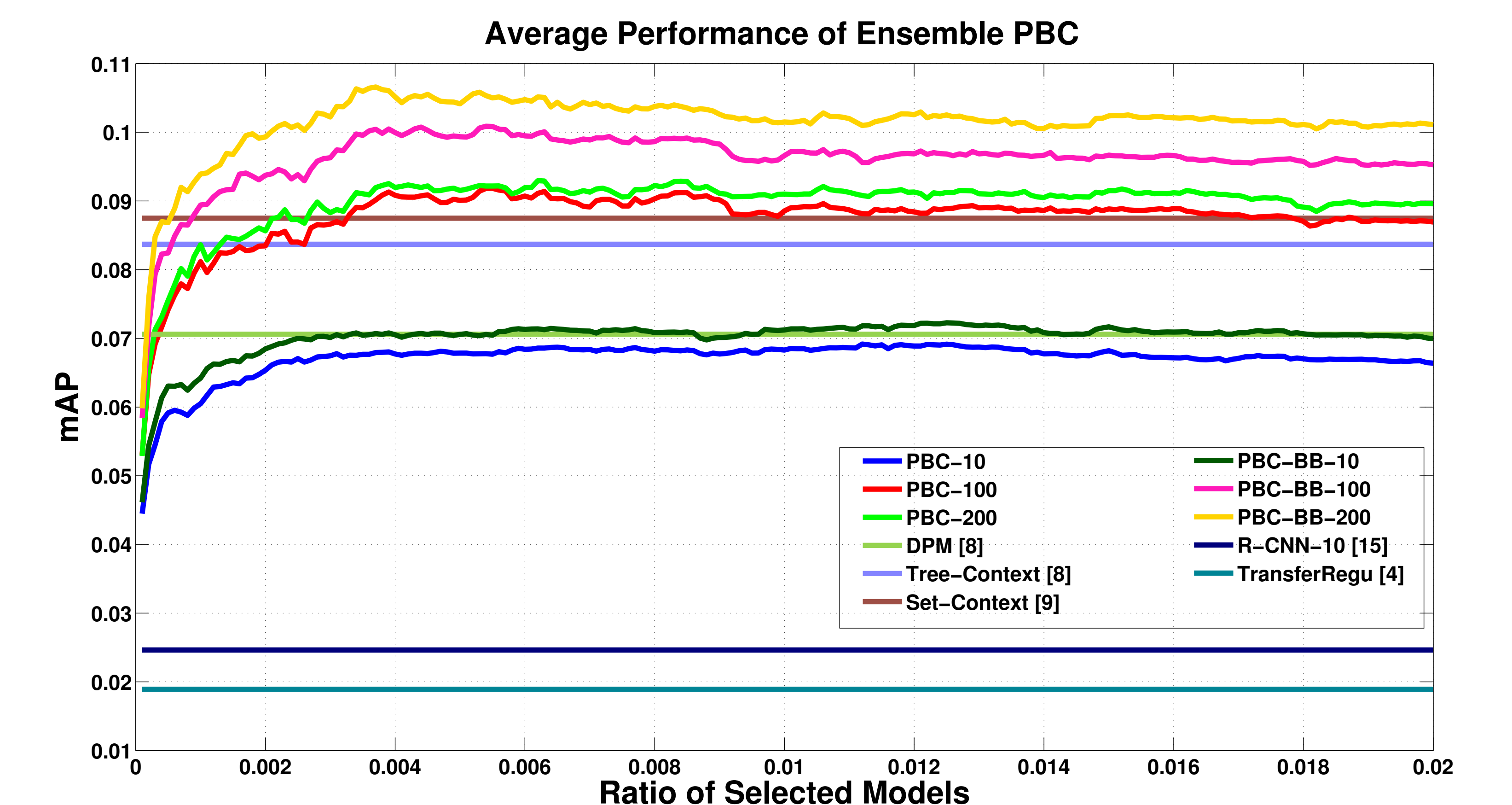
RECOMMENDER SYSTEM ANALYSIS

- **Model Library**: ESVMs
- **Store Tasks**: Random detection tasks on PASCAL 2007 trainval
- **Ratings Store**: $12,608 \times 10,000$
- **Target Tasks**: Detection of 20 categories on PASCAL 2007 test



ENSEMBLE MODEL RECOMMENDATION

- **Model Library**: Unsupervised PBCs hyper-trained on PASCAL 2007
- **Store Tasks**: Random detection tasks on PASCAL 2007
- **Ratings Store**: $10,000 \times 10,000$
- **Target Tasks**: Detection of 107 categories on SUN 09 test
- **Input Tasks**: 10 random images per category on SUN 09 training



CONCLUSIONS

- A large collection of universal and expressive models in an unsupervised manner (pre-trained features + models)
- A far smaller set of annotated samples
- An efficient way to generate new models by recommending
- A promising mechanism for a broader range of vision tasks