Exploring CNN-based Feature Transfer for Robot Affordances

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Motivation

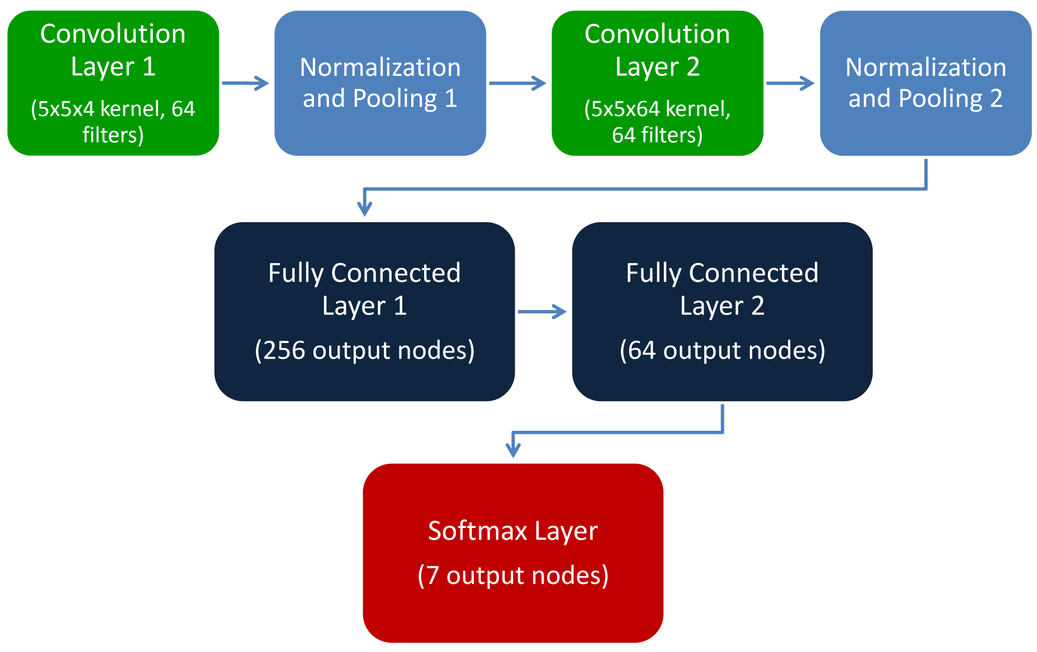
- Robots need to learn affordances of objects to manipulate them
- Need suitable features to predict affordances
- Deep neural networks can learn features, but require a lot of data
- Data is limited for new affordances

Using **feature transfer**, we explore:

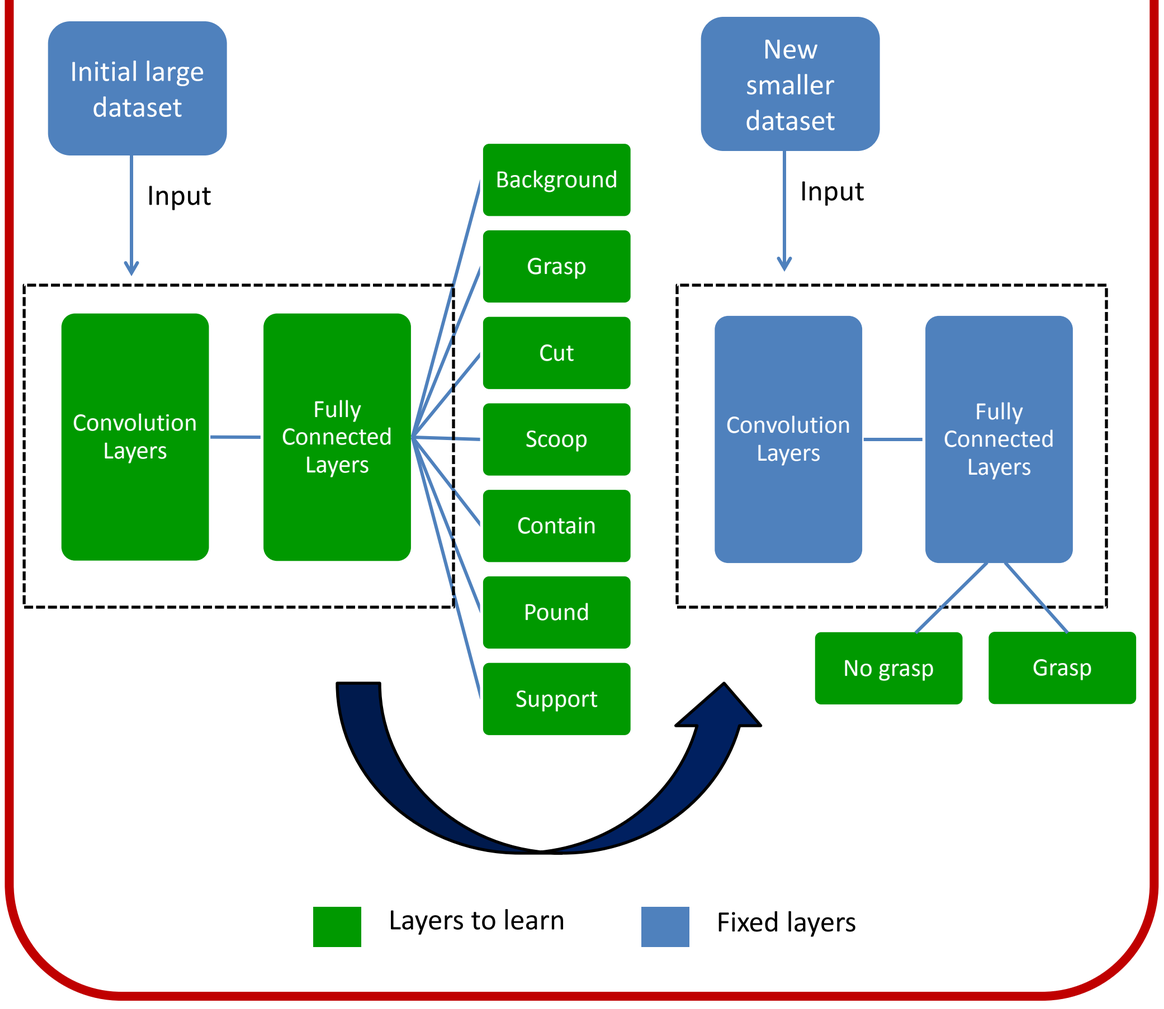
- Learning features from previous affordances with many samples
- Using learned features to predict new affordances with fewer samples

Method

Convolutional Neural Network

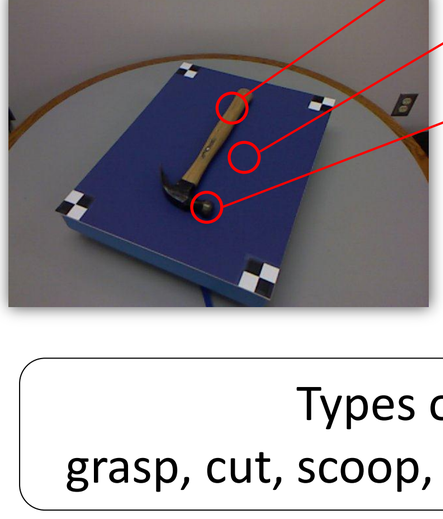


Transfer Learning



Dataset

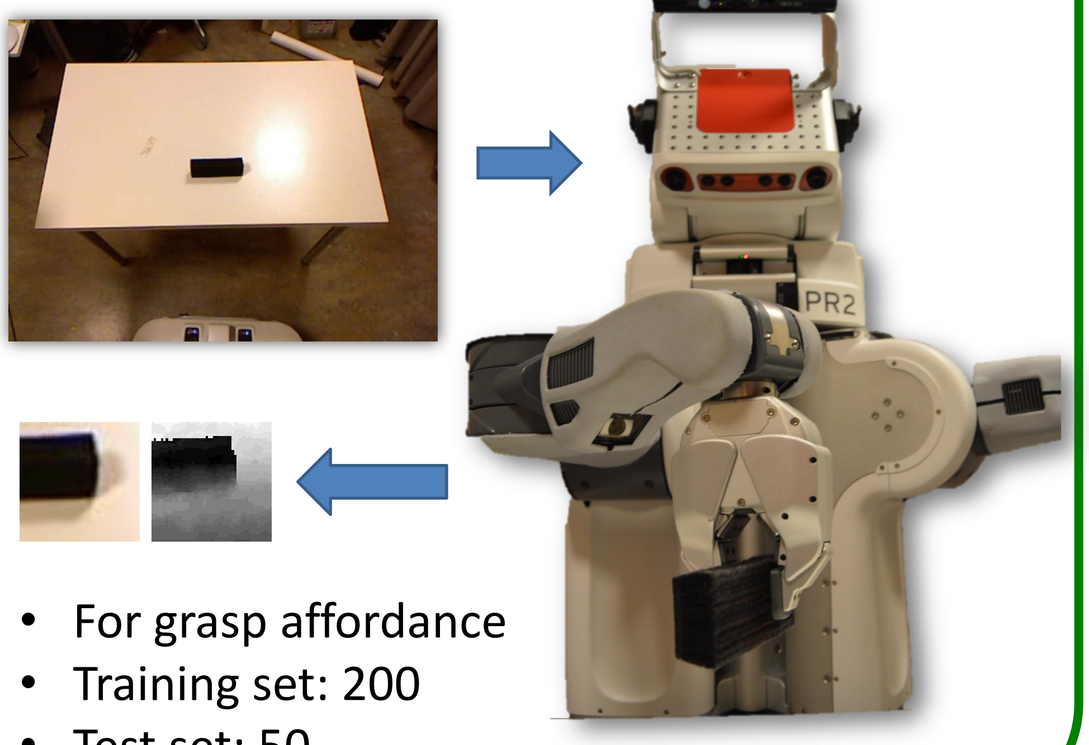
Source data



- Extract patches of 51x51
- Training set: 40,000
- Test set: 10,000

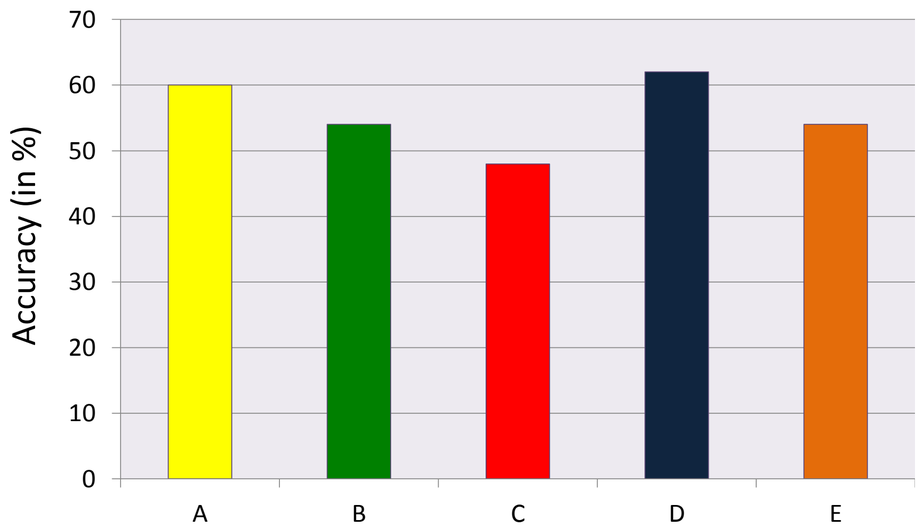
Types of affordance:
grasp, cut, scoop, contain, pound, support

Target data



- For grasp affordance
- Training set: 200
- Test set: 50

Experiments



A. Train CNN on all 6 affordances,
   Retrain output layer on target affordance
B. Train CNN on 5 non-grasping source affordances,
   Retrain output layer on target affordance
C. Train CNN on grasping source affordance,
   Retrain output layer on target affordance
D. Train CNN on grasping source affordance,
   NO retraining on target affordance
E. NO training on source affordances,
   Train CNN on target affordance directly