Tactile only Active Sensing using Reinforcement Learning

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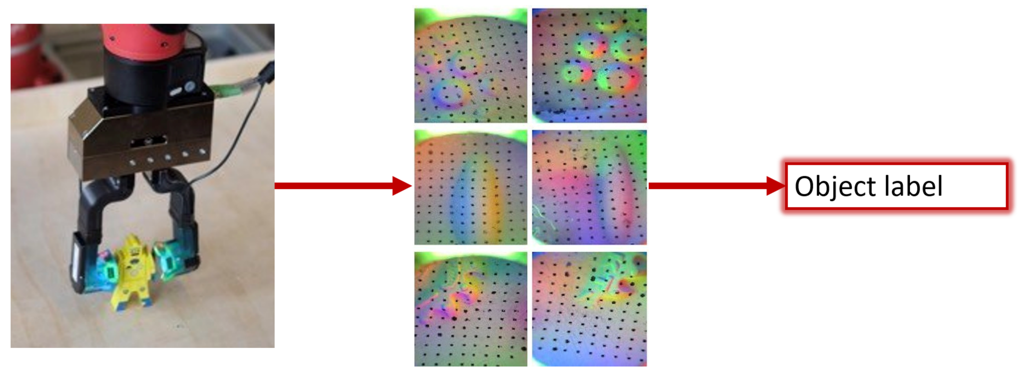
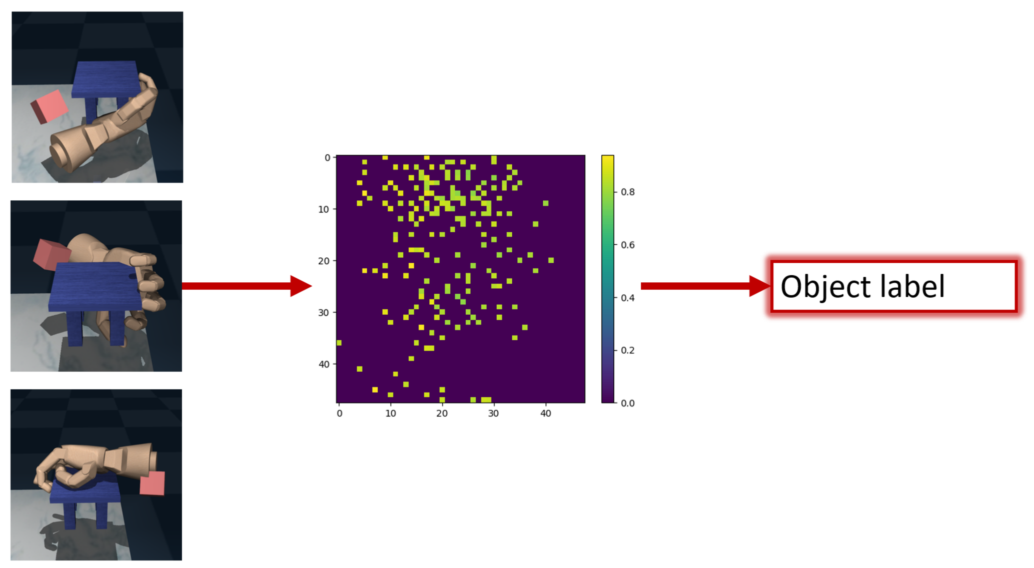
1 Introduction

Current works on tactile sensing and recognizing objects using a dense tactile sensor with fixed touching policy. Here we are proposing an active touching policy that improves the tactile information efficiency. And we also proposed an alternative training method to keep improving the cooperation between active touching policy and classification network.



Previous touching policy and classify procedure

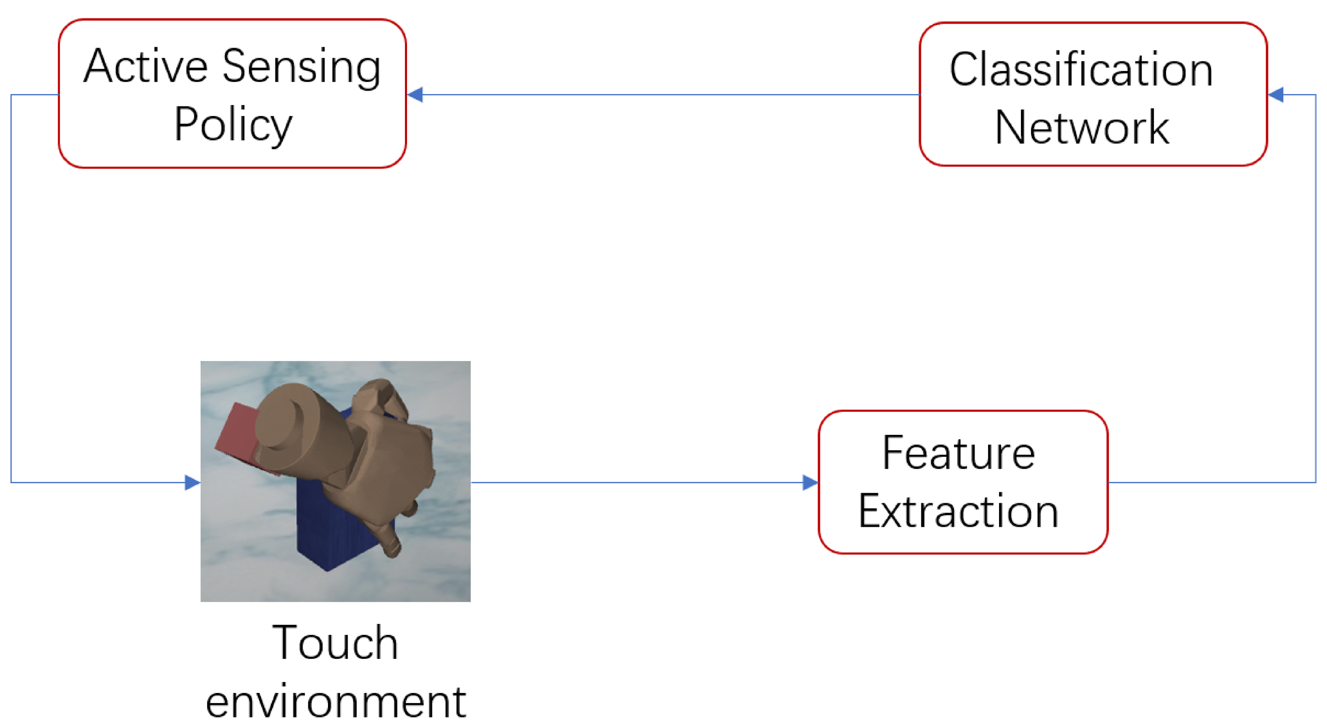


Proposed touching policy and classify procedure

2 Methodology

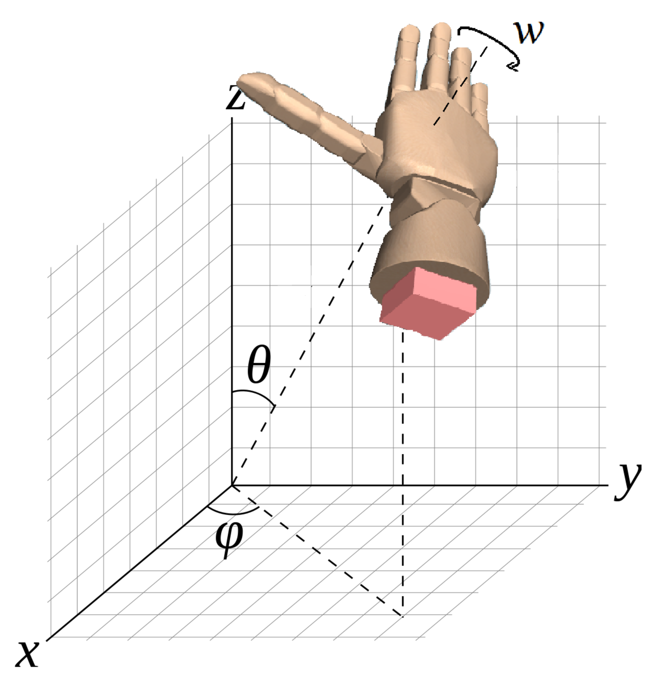
Active Sensing

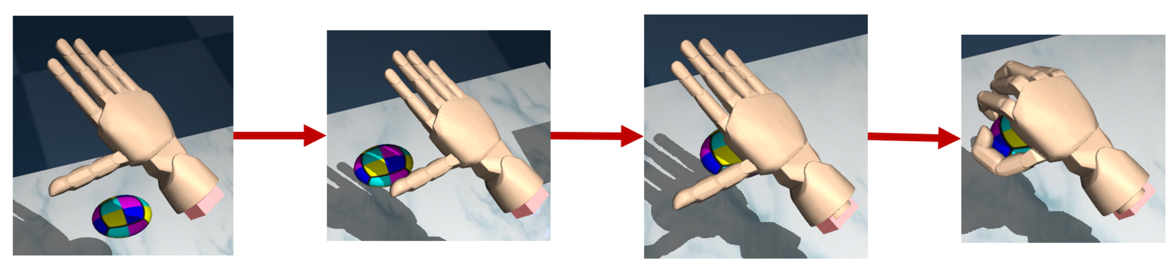
Active touching makes a circle where active sensing policy keeps interacting with the touching environment.



High to Low Level Touch control

Under high level, the command is represented as a 3D vector, telling controller the spherical direction of getting close and the hand twisting angle.

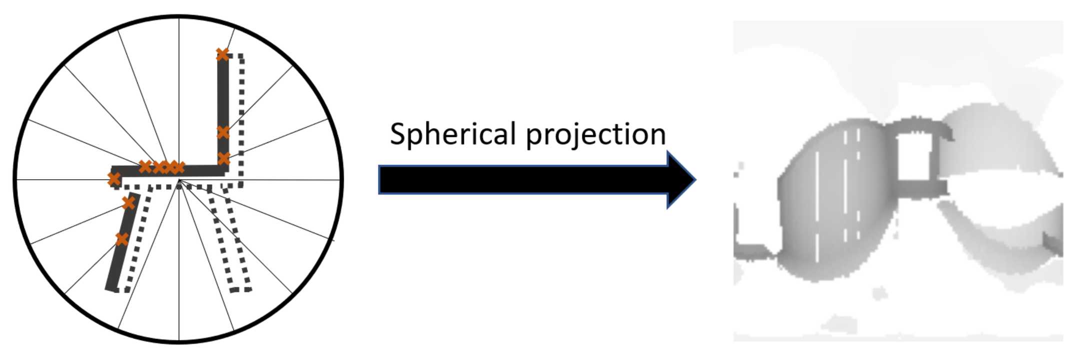




low level touching sequence

Then, it is able to simplify the learning algorithm action complexity.

Spherical Projection



Using spherical project to make geometrical feature map

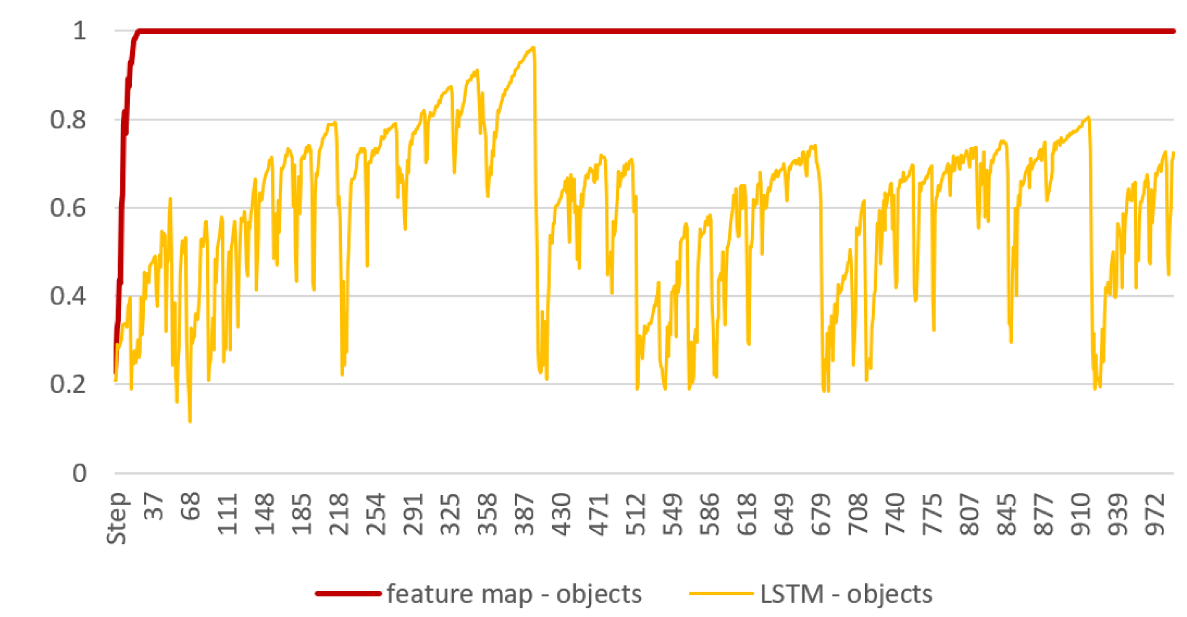
The feature extracted using spherical project is fed in to the classification net and get the classification answer.

Alternative Training Algorithm

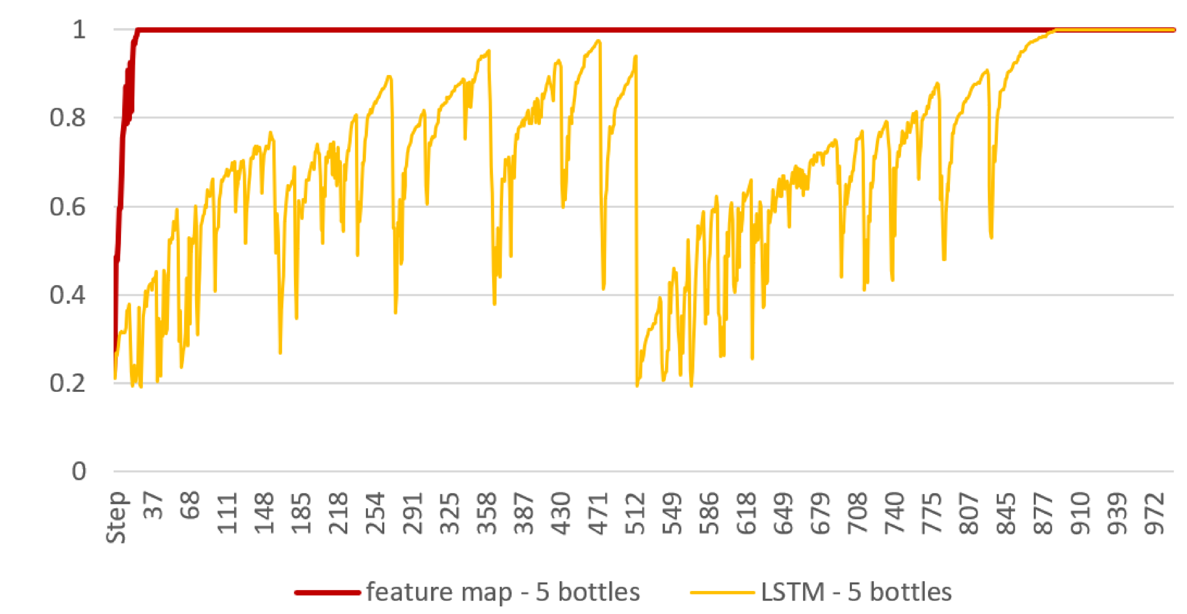
Algorithm 1 Alternative training classification network and active touching policy

procedure ALTERNATIVELY TRAINING
  Collect feature image from random touching policy
  Train classification network using feature map
  for $i = 1, \cdots$ **do**
    Collect feature image using active touching policy
    Optimize active touching policy using PPO
    if $i \bmod t == 1$ **then**
      Train classify net using latest feature image

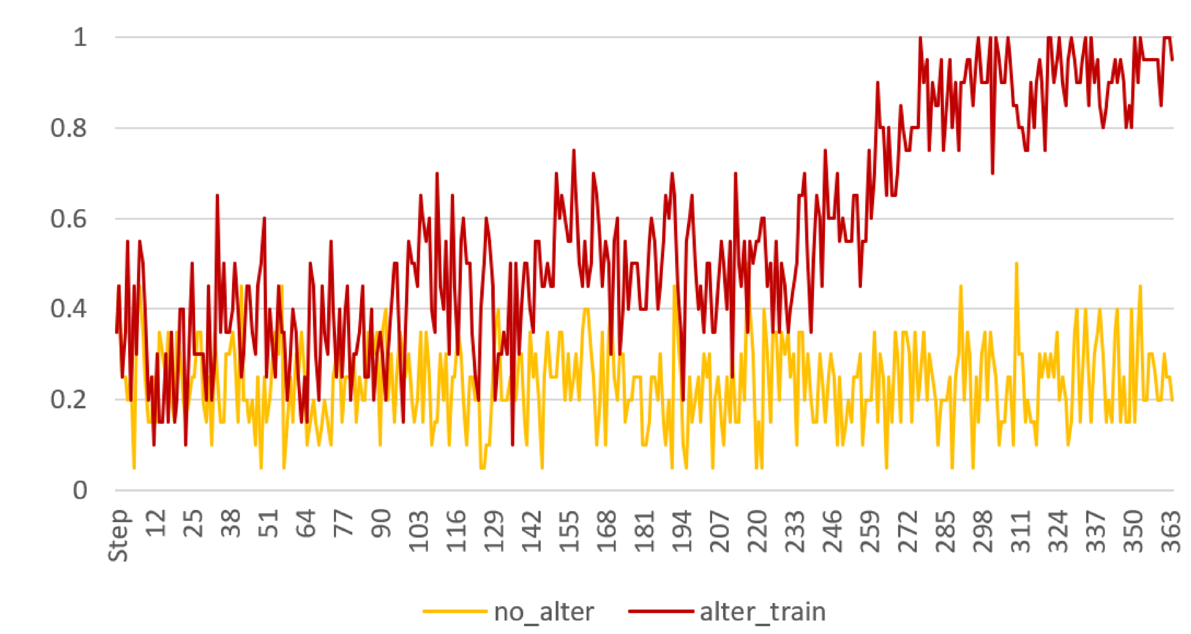
3 Result



Accuracy learning curve in 5 primitive objects



Accuracy learning curve in 5 similar shaped bottles



Alternatively training did help improve the classification accuracy, but only training active touching policy only makes the prediction worse.

4 Acknowledgement

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