# Master’s Thesis: Pre-manipulation for grasping – Using Model-free Visual Reinforcement Learning to manipulate fabric to expose a seam for grasping operation

## Background

Deformable object manipulation is a significant problem in robotics due to two challenges – unclear state representation and complex non-linear dynamics. A model free approach offers a promising way of manipulating the fabric without the complex dynamics of fabrics.

## Description

At sewts before grasping the towel for straightening it, we have an additional step called pre-manipulation the sole purpose of which is to expose a straight seam that can be further used to grasp. Currently this is being done by a separate robot which grasps the robot and places it to a mechanical assembly which increases the chances of exposing the seam for grasping by another robot. Since we are mechanically trying to increase the probability of getting a seam and the dynamics of the fabric are highly uncertain, a straight full seam is not exposed in all the cases. In case, we do not get a proper exposed seam, the towel is rejected and the process is repeated. By using a model-free reinforcement learning approach, there is a possibility that a single robot could perform pre-manipulation and then grasping. So both the additional robot and the mechanical add-on are eliminated. The only challenge remains that of time required for exposing the seam, which is

Additional :

Reward function linked with the amount of seam

Using simulated images to avoid sim-to-real transfer (Seam segmentation map)

Explore the possibility of imitation learning

since these methods do notrequire an explicit model of the object [29], they can overcomethe challenge of having complex deformable object dynamics

But model-free learning has notoriously poor sample com-plexity .state-based policies can provide simulated demonstrationsto learn cloth manipulation from visual observations. we demonstrate how this policycan be transferred from a simulator to a real robot usingsimple domain randomization without any additional real-world training or human demonstrations. Reinforcement Learning (RL) has made significant progressin many areas including robotics. RL has enabled robotsto handle unstructured perception such as visual inputs andreason about actions directly from raw observations

* Explore various learning algorithms for picking and compare for accelerated learning-

a) Maximum Value under Picking

* Dataset creation
* Domain randomization
* Choosing the right simulation environment
* Combining with Learning from Demonstration to check performance improvement
* Designing reward function to identify one seam
* Training on Simulation
* Transfer on real robot