Robots small set of motor skills that

Robots are increasingly being used today in industries and homes for a wide variety of tasks.

Most of these robots have pre-programmed controllers fine-tuned for specific tasks by human engineers. The programming and fine-tuning take a lot of skill and time and are performed for a particular robot and environment. While this method is highly effective for tasks requiring high level of accuracy like precision welding and spray painting, the engineers have to manually reprogram the robot for even a slightly different task or environment. In order for the robots to autonomously adapt to changes, it must be able to learn how to handle these changes. Most of the general machine learning techniques are not effectively scalable to robots with high degrees of freedom. Taking inspiration from the way humans and animals learn, people have focused on imitation and reinforcement learning to teach robots new motor skills with a small set of motor skills that are initially demonstrated to it. Demonstrations can be got by three major approaches. One approach is to directly record human motions using motion tracking with special trackers, these motions are then mapped to corresponding motions of the robot’s joints.

Another approach is kinesthetic teaching, where a human physically guides the robot through the task. As this approach uses the robot’s own body to perform the task it is easy to replicate these motions but the humans have to use more degrees of freedom than they are trying to control. The third approach uses a remote control device or haptic device to control the robot relying on different sensor data to have visual and/or haptic feedback.

Combining teleoperation and kinesthetic teaching cite{barros2015bimanual} to perform tasks in a virtual environment provides a convenient way to record multiple demonstrations of the tasks. In this project a robot and its real-time teleoperated simulation will act as a master-slave system guided by visual feedback for recording manipulation tasks performed in the slave’s environment. Having a one-to-one correspondence between joints allow for straightforward replication of the joint motions. The recorded demonstrations will help it learn to autonomously manipulate an object in a modified task.