**Overview**

- **Problem**: Supervised learning methods where correct behavior is explicitly given have been adopted in the study of learning to control robotic arm. However, it is difficult to use such methods to learn obstacle avoidance, because the sample of correct behavior is hard to generate.

- **Solution**: This thesis develops an alternative approach where potential field is used to generate sample behavior for learning where neural network structure is evolved. The sample generator is exterior to neural network and is implemented by solving Laplace equation, where target and obstacle locations are input and a unique trajectory is guaranteed and stored as output. A neural network structure is designed and optimized according to data distribution in the sample.

**Experiment Results**

- **Potential Field**
  - Potential field method can successfully detect whether there exists a trajectory to avoid obstacles.
  - If there exists at least one trajectory, a trajectory will be found and the avoidance is guaranteed 100%.
  - The trajectories found are consistent every time when the same input is given.
  - The trajectories generated are smooth in shape and they are similar to the behavior of human being.
  - The trajectories are generated in a relatively fast speed.

- **Neural Network**
  - Neural network is tested with different structures and the error rates are compared. The results showed that a structure using 2D Gaussian to activate the second layer and without the hyperbolic layer performs the best.
  - The error rate is quite low which is only 0.02% while the highest error rate is 1.

**Conclusion**

With the help of potential field to provide sample behaviors, neural network can be used as a supervised learning method to control the robotic arm to avoid obstacles.