Conclusion

In our research, we discussed a plausible interaction between the immune system, and the nervous system. We simulated the immune system by designing an Artificial Immune Network (AIN) that is capable of interacting with a change in the environment (Antigen attack). The components of AIN interact among each other to reach the desired goal. The goal in our case is controlling a robot arm to reach a certain location in its working space. The designed learning algorithm for the AIN was modified to extend the training time when needed. With the assumption that there is a direct interaction between the brain and the immune system, we constructed a memory for the AIN and used this memory to enhance the performance of the Neuro – Immune – Network (NIN).

The Artificial Immune Memory (AIM) uses a preprocessed training set of examples resulting from the AIN learning. After performing a sufficient number of training sessions, the AIM performance was tested; it was found that a jump-start response in all cases is noticed reducing the number of steps required to reach the goal. This follows the response of a human immune system following the repeated invasion of similar germs. We proved that the use of AIM as a memory helps to simulate the behavior of acquired immunity, and reduces the time needed to reach the desired goal, or in another words suppresses the antigen behavior more quickly.

Many researchers have tried to tackle different points in mimicking the biological immune system, but no one previously has proposed such an acquired memory. This contribution is made as a "proof of concept" to the field of biological immune system simulation as a start of further research efforts in this direction. Many applications can potentially use our designed NIN, especially in the area of autonomous robotics. We demonstrated the use of the designed NIN to control a robot arm in an unknown or unpredicted environment. As the system encounters new cases, it will increase its ability to deal with old and new situations encountered. Regarding future work, the use of VLSI neural networks to enhance the speed of the system for real time applications can be investigated along with possible methods of design and implementation of a similar VLSI chip for the AIN.