Pso Report

Configuration	Mean	Standard Deviation	Median
Random Search	375.06	22.85	366.94
PSO-1	66.66	12.19	67.66
PSO-2	129.12	25.79	123.08
PSO-3	371.75	26.95	380.25
PSO-4	380.41	24.04	382.72

Configuration	W	C1	C2
PSO-1	0.729844	1.496180	1.496180
PSO-2	0.4	1.2	1.2
PSO-3	1.0	2.0	2.0
PSO-4	-1.0	2.0	2.0

The results of the experiment have a few clear indications of quality of results based on the parameters. We can see the results of a high inertia value (or W) with a high cognitive term (or C1), and social term (or C2) have potential to yield results that are even worst than random search. As seen in the results of PSO-3.

However, as observed from the values of PSO-1, this parameter setting yielded the best solutions, indicating an inertia values, cognitive term and social term have a significant impact on both performance, and convergence speeds. We can observe PSO-1 has the best convergence as indicated by the standard deviation, and PSO-2,3,4 and random search have a relatively high standard deviation, farther suggesting these parameters are not optimal for convergence. This is also suggesting the velocity updates may need a balance between explorations and exploitations.

This PSO is written directly as instructed by TA Kyle in his tutorials. The following classes are used in the design:

Main – Execution component of the program, accepting input, producing output, etc

PSO – Algorithm and Driver component. This implements all classes, where it will terminate after running 5000 iterations.

Particle – Store information about the particle including position, velocity, and personal best

Problem – Provide the problem set and implementing an evaluation function to return fitness

Solution – Store information about a particular solution, including position, and fitness score

Swarm – Stores information, and includes manipulation functions for the swarm. Contains a collection of particles, global best solution, a velocity calculator, and problem of problem type.

Velocity calculator – Provide a velocity calculating function based on user parameters.

The simple approach was used in this design where the position of the particle is the solution. This is also implementing the Velocity Clamping equation that is provided in the slides where V_{max} is the largest allowable step size, and $-V_{max}$ is the smallest allowable step in any dimension. V_{max} is calculated with the equation $V_{max} = (X_{max} - X_{min})/2$. Although this may not be necessary for the first PSO-1 parameter setting, the other experiments may benefit from this Velocity Clamping. Since this assignment is based on Synchronous PSO, the global best position is updated after all particles have updated their position, so particle movements are concurrent.

In conclusion, parameter settings have a very high impact on the quality of PSO solutions, where relatively high inertia weight, cognitive acceleration, and social accelerations are beneficial, but values too high or low may reduce the solution quality to even lower than random search.