

25/11/24  
LAB-04:

## Particle swarm optimization:

### Algorithm:

- Step 1: Pick a mathematical fun  $f(x)$  to optimize
- Step 2: Set parameters  $N, w, c1, c2$  where  $c1$  is weight of personal best position and  $c2$  is weight of global best position.
- Step 3: Define the limits within which particle can move
- Step 4: Assign  $N$  with random velocity
- Step 5: for each particle calculate its fitness that is the best position
- Step 6: Update velocity based on the best velocity of its own and based on the best velocity found by the swarm.
- Step 7: It undergoes iterations to check the best solution found
- Step 8: Then in the final iteration it finds out the best value

### Pseudocode:

$$\text{velocity} = w * \text{velocity} + c1 * r1 * (\text{best-position} - \text{position}) + c2 * r2 * (\text{global-best-position} - \text{position})$$

step 1: def func(x)  
return  $x^2 + 2$

step 2: initialize parameters

$$N = 30, w = 0.5, c1 = 1.5, c2 = 1.5$$

step 3: for each particle initialize their position and velocity randomly within the range  $[-10, 10], [-1, 1]$

step 4: In this step we evaluate the fitness by sending values to function

step 5: Updating values if  $\text{curr-value} < \text{best-value}$   
update the best of its own particle



If  $\text{current\_value} < \text{global\_best\_value}$  update global best value that is velocity based on entire swarm

Step 6: Update velocity which will determine how the particle will move.

Step 7: display the best value found.

Step 8: for each particle  $i$  in  $N$ :  
 $\text{dist} = \text{distance}(\text{particle}[i], \text{best\_position})$   
 $\text{if } \text{dist} < \text{best\_dist}[i]$   
 $\text{best\_dist}[i] = \text{dist}$   
 $\text{best\_position}[i] = \text{particle}[i]$

If we calculate the fitness value of each particle which is calculated while traversing from fitness to fitness.

for each particle  $i$  in  $N$ :  
 $\text{dist} = \text{distance}(\text{particle}[i], \text{best\_position})$   
 $\text{if } \text{dist} < \text{best\_dist}[i]$   
 $\text{best\_dist}[i] = \text{dist}$   
 $\text{best\_position}[i] = \text{particle}[i]$

for each  $i$  in  $N$ :  
 $\text{dist} = \text{distance}(\text{particle}[i], \text{best\_position})$   
 $\text{if } \text{dist} < \text{best\_dist}[i]$   
 $\text{best\_dist}[i] = \text{dist}$   
 $\text{best\_position}[i] = \text{particle}[i]$

$\text{best\_dist} = \text{best\_dist}$   
 $\text{best\_position} = \text{best\_position}$

to find the best position of the entire swarm:  $\text{best\_dist}$  and  $\text{best\_position}$