
Algorithm 1 Particle Swarm Optimization (PSO)

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1: Input: Objective function  $f(\mathbf{x})$ , number of particles  $n$ , number of dimensions  $d$ , maximum iterations  $MaxIter$ , inertia weight  $w$ , cognitive coefficient  $c_1$ , social coefficient  $c_2$ .
2: Output: Best solution  $\mathbf{x}_{best}$ .
3: Initialize particle positions  $\mathbf{x}_i$  and velocities  $\mathbf{v}_i$  for  $i = 1, \dots, n$ .
4: Initialize personal best positions  $\mathbf{p}_{best,i}$  for  $i = 1, \dots, n$ .
5: Initialize global best position  $\mathbf{g}_{best}$ .
6: for  $iter = 1$  to  $MaxIter$  do
7:   for  $i = 1$  to  $n$  do
8:     Update velocity  $\mathbf{v}_i$  using:
9:      $\mathbf{v}_i \leftarrow w \cdot \mathbf{v}_i + c_1 \cdot \text{rand}() \cdot (\mathbf{p}_{best,i} - \mathbf{x}_i) + c_2 \cdot \text{rand}() \cdot (\mathbf{g}_{best} - \mathbf{x}_i)$ 
10:    Update position  $\mathbf{x}_i$  using:
11:     $\mathbf{x}_i \leftarrow \mathbf{x}_i + \mathbf{v}_i$ 
12:    if  $f(\mathbf{x}_i) < f(\mathbf{p}_{best,i})$  then
13:      Update  $\mathbf{p}_{best,i} \leftarrow \mathbf{x}_i$ 
14:    end if
15:  end for
16:  if  $f(\mathbf{p}_{best,i}) < f(\mathbf{g}_{best})$  for any  $i$  then
17:    Update  $\mathbf{g}_{best} \leftarrow \mathbf{p}_{best,i}$ 
18:  end if
19: end for
20: return  $\mathbf{g}_{best}$ 
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