

```

1  import numpy as np
2  import matplotlib.pyplot as plt
3
4  class PSO(object):
5      def __init__(self, population_size, max_steps):
6          self.w = 0.6
7          self.c1 = self.c2 = 2
8          self.population_size = population_size
9          self.dim = 2
10         self.max_steps = max_steps
11         self.x_bound = [-10, 10]
12         self.x1 = np.random.uniform(self.x_bound[0], self.x_bound[1],
13                                     (self.population_size, self.dim))
14         self.x2 = np.random.uniform(self.x_bound[0], self.x_bound[1],
15                                     (self.population_size, self.dim))
16         self.v1 = np.random.rand(self.population_size, self.dim)
17         self.v2 = np.random.rand(self.population_size, self.dim)
18
19         fitness = self.calculate_fitness(self.x1, self.x2)
20         self.p1 = self.x1
21         self.pg1 = self.x1[np.argmin(fitness)]
22
23         self.p2 = self.x2
24         self.pg2 = self.x2[np.argmin(fitness)]
25
26         self.individual_best_fitness = fitness
27         self.global_best_fitness = np.min(fitness)
28
29     def calculate_fitness(self, x1, x2):
30         return np.sum(np.square(x1)+np.square(x2), axis=1)
31
32     def evolve(self):
33         fig = plt.figure()
34         for step in range(self.max_steps):
35             r1 = np.random.rand(self.population_size, self.dim)
36             r2 = np.random.rand(self.population_size, self.dim)
37
38             self.v1 = self.w * self.v1 + self.c1 * r1 * (self.p1 - self.x1) +
39             self.c2 * r2 * (self.pg1 - self.x1)
40             self.v2 = self.w * self.v2 + self.c1 * r1 * (self.p1 - self.x2) +
41             self.c2 * r2 * (self.pg1 - self.x2)
42
43             self.x1 = self.v1 + self.x1
44             self.x2 = self.v2 + self.x2
45
46             plt.clf()
47             plt.scatter(self.x1[:, 0], self.x1[:, 1], s=30, color='k')
48             plt.scatter(self.x2[:, 0], self.x2[:, 1], s=30, color='r')
49             plt.xlim(self.x_bound[0], self.x_bound[1])
50             plt.ylim(self.x_bound[0], self.x_bound[1])
51             plt.pause(0.01)
52             fitness = self.calculate_fitness(self.x1, self.x2)
53
54             update_id = np.greater(self.individual_best_fitness, fitness)
55             self.p1[update_id] = self.x1[update_id]
56             self.p2[update_id] = self.x2[update_id]
57             self.individual_best_fitness[update_id] = fitness[update_id]
58
59             if np.min(fitness) < self.global_best_fitness:
60                 self.pg1 = self.x1[np.argmin(fitness)]
61                 self.pg2 = self.x2[np.argmin(fitness)]
62                 self.global_best_fitness = np.min(fitness)
63                 print('best fitness: %.5f, mean fitness: %.5f' %
64                       (self.global_best_fitness, np.mean(fitness)))
65
66 pso = PSO(100, 100)
67 pso.evolve()
68 plt.show()

```