# Lab of Applied Computational Intelligence

IST

2023/2024

# Deap – Particle Swarm Optimization

# Guide 10

13 October 2023

(Week 5)

## 1 – Objetives

With this work the student should be able to start using the Deap Library and solve some problems with Particle Swarm Optimization (PSO).

## 2 – Basic Example

The deap library url is the following:

https://deap.readthedocs.io/en/master/

We will start with the basic example. First read the documentation regarding this example in the following url:

https://deap.readthedocs.io/en/master/examples/pso_basic.html

You have several functions to define what is your population and how the individuals should be created. Then you have a function called updateParticle to update the speed of the particle. Find what is the formula that the algorithm is using to update the speed. To do that you need to find out what the function "map" does.

Run the example with the debugger and see what it does. See how the population evolves. Did it find the maximum value?

In the example the maximum and minimum value that the position can have is [-6, +6] and the speed is [-3, +3] do you think this values are good? Try other values for the max and min speed and find if it can find the maximum value of the function now.

The general formula to update the speed of a particle is:

$$Vi(t+1) = wVi(t)+c1r1(pbesti-Xi(t))+ c2r2(gbesti-Xi(t))$$

where r1 and r2 are random numbers between 0 and 1, constants w (inertia weight) , c1, and c2 are parameters to the PSO algorithm, and pbesti is the position that gives the best f(x) value ever explored by particle i and gbesti is the best position explored by all the particles in the swarm.

What are the differences for the formula in updateParticle? Can you change updateParticle to implement the previous formula.

**3 – New function Optimization**

Now lets try to solve a new problem with another function. Find the maximum value of the following function $f1(x1, x2)$:

$$Z1 = \sqrt{X1^2 + X2^2}$$

$$Z2 = \sqrt{(X1 - 1)^2 + (X2 + 1)^2}$$

$$f1 = (\sin(4 * Z1)\ /Z1) + (\sin\ (2.5 * Z2)/Z2)$$