

Consider first the following fuzzy expected value model,

$$\begin{cases} \max E \left[\sqrt{|x_1 + \xi_1| + |x_2 + \xi_2| + |x_3 + \xi_3|} \right] \\ \text{subject to:} \\ x_1^2 + x_2^2 + x_3^2 \leq 10 \end{cases}$$

where ξ_1 , ξ_2 and ξ_3 are triangular fuzzy variables (1, 2, 3), (2, 3, 4), and (3, 4, 5), respectively.

In order to solve this model, we first generate input-output data for the uncertain function

$$U : \mathbf{x} \rightarrow E \left[\sqrt{|x_1 + \xi_1| + |x_2 + \xi_2| + |x_3 + \xi_3|} \right]$$

by fuzzy simulation. Then we train an NN (3 input neurons, 5 hidden neurons, 1 output neuron) to approximate the function $U(\mathbf{x})$. After that, the trained NN is embedded into a GA to produce a hybrid intelligent algorithm.

A run of the hybrid intelligent algorithm (6000 cycles in simulation, 2000 data in NN, 1000 generations in GA) shows that the optimal solution is

$$x_1^* = 1.8310, \quad x_2^* = 1.8417, \quad x_3^* = 1.8043$$

whose objective value is 3.80.