Let us consider the following chance-constrained programming in which there are three decision variables and nine stochastic parameters,

\[
\begin{align*}
\max \ & \mathcal{J} \\
\text{subject to:} \ & \Pr \{\xi_1 x_1 + \xi_2 x_2 + \xi_3 x_3 \geq \mathcal{J}\} \geq 0.90 \\
& \Pr \{\eta_1 x_1^2 + \eta_2 x_2^2 + \eta_3 x_3^2 \leq 8\} \geq 0.80 \\
& \Pr \{\tau_1 x_1^3 + \tau_2 x_2^3 + \tau_3 x_3^3 \leq 15\} \geq 0.85 \\
& x_1, x_2, x_3 \geq 0
\end{align*}
\]

where $\xi_1, \eta_1, \text{ and } \tau_1$ are uniformly distributed variables $U(1, 2), U(2, 3), \text{ and } U(3, 4)$, respectively, $\xi_2, \eta_2, \text{ and } \tau_2$ are normally distributed variables $N(1, 1), N(2, 1), \text{ and } N(3, 1)$, respectively, and $\xi_3, \eta_3, \text{ and } \tau_3$ are exponentially distributed variables $\exp(1), \exp(2), \text{ and } \exp(3)$, respectively.

We employ stochastic simulation to generate input-output data for the uncertain function $U : x \mapsto (U_1(x), U_2(x), U_3(x))$, where

\[
\begin{align*}
U_1(x) &= \max \left\{ \mathcal{J} \mid \Pr \{\xi_1 x_1 + \xi_2 x_2 + \xi_3 x_3 \geq \mathcal{J}\} \geq 0.90 \right\}, \\
U_2(x) &= \Pr \{\eta_1 x_1^2 + \eta_2 x_2^2 + \eta_3 x_3^2 \leq 8\}, \\
U_3(x) &= \Pr \{\tau_1 x_1^3 + \tau_2 x_2^3 + \tau_3 x_3^3 \leq 15\}.
\end{align*}
\]

Then we train an NN (3 input neurons, 15 hidden neurons, 3 output neurons) to approximate the uncertain function $U$. Finally, we integrate the trained NN and GA to produce a hybrid intelligent algorithm.

A run of the hybrid intelligent algorithm (5000 cycles in simulation, 3000 training data in NN, 1000 generations in GA) shows that the optimal solution is

$$(x_1^*, x_2^*, x_3^*) = (1.458, 0.490, 0.811)$$

with objective value $\mathcal{J}^* = 2.27$. 