Johns Hopkins Engineering

Applied Machine Learning for Mechanical Engineers

Optimization, Part 2, E

JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Introduction to Genetic Programming in MATLAB

- By the end of this lecture you will be able to:
  - Describe “ga” package in MATLAB
  - Implement “ga” in MATLAB

Introduction to Genetic Programming in MATLAB

- Formal linear/nonlinear optimization problem with one objective function

$$minimize\ f(\boldsymbol{x})$$
$$subject\ to \begin{cases} g_j(\boldsymbol{x}) \leq 0 & j \in \{1, 2, \dots, J\} \\ h_k(\boldsymbol{x}) = 0 & k \in \{1, 2, \dots, K\} \end{cases} \qquad (2-5)$$

Introduction to Genetic Programming in MATLAB

- Genetic programming (linear/nonlinear)

$$minimize f(\boldsymbol{x})$$
$$subject\ to \begin{cases} g_j(\boldsymbol{x}) \leq 0 \\ h_k(\boldsymbol{x}) = 0 \\ \boldsymbol{G}.\boldsymbol{x} \leq \boldsymbol{A} \\ \boldsymbol{H}.\boldsymbol{x} = \boldsymbol{B} \\ \boldsymbol{L} \leq \boldsymbol{x} \leq \boldsymbol{U} \\ \hat{\boldsymbol{x}}: \hat{x}_l \in \boldsymbol{x} \end{cases} \qquad (2-6)$$

where $\hat{\boldsymbol{x}}$ is a list of integer variables

Introduction to Genetic Programming in MATLAB

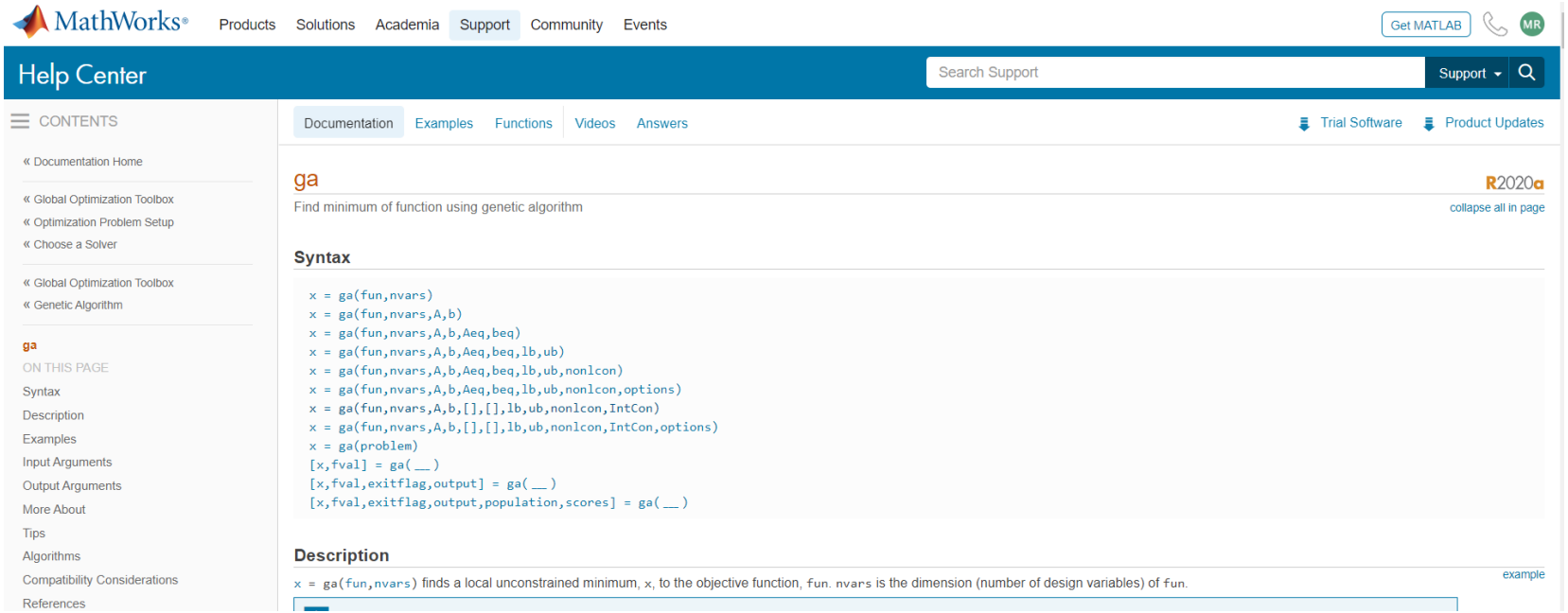
- MATLAB genetic programming
  - Different annotations

$$\min f(x) \text{ such that } \begin{cases} c(x) \leq 0 \\ ceq \leq 0 \\ A.x \leq 0 \\ Aeq.x = beq \\ lb \leq x \leq ub \\ IntCon \end{cases}$$

Figure 2-3 Annotations used to address genetic optimization problems at https://www.mathworks.com/help/gads/ga.html

Introduction to Genetic Programming in MATLAB

- MATLAB genetic programming (‘ga’ function)



Introduction to Genetic Programming in MATLAB

Let’s jump to Module02_E.mlx

Introduction to Genetic Programming in MATLAB

- In this lecture, you learned about:
  - “ga” package in MATLAB
  - Implementation of “ga” package in MATLAB
- In the next lecture, we will overview other optimization algorithms available in Python and MATLAB.