


MuJoCo: Nonlinear Optimization

Decision variables 

$$\begin{aligned} & \min_x f(x) && \text{Cost} \\ & \text{subject to:} \\ & lb \leq x \leq ub && \text{Bounds on } x \\ & c_{eq} = 0 && \text{Equality constraints} \\ & c \leq 0 && \text{Inequality constraints} \end{aligned}$$

MuJoCo: Installing nlopt (I)*

1. Download latest version of nlopt: <https://nlopt.readthedocs.io/en/latest/> or search nlopt + download.
2. Unzip in a suitable location. Say Documents.
3. In terminal navigate to nlopt folder and type
 - mkdir build
 - cd build
 - cmake .
 - make
 - sudo make install

* I don't have instructions for Windows. For Windows, use Ubuntu via Virtualbox.

MuJoCo: Installing nlopt (2)*

4. Download `template_nlopt` from tiny.cc/mujoco.
5. Navigate to `template_nlopt` and type the following
 - `gcc tutorial.c -o tutorial -w -lnlopt -lm`
 - `./tutorial`
6. If everything worked fine you will see the following:
found minimum at $f(0.333333, 0.296296) = 0.5443310474$

* I don't have instructions for Windows. For Windows, use Ubuntu via Virtualbox.

MuJoCo: Example Nonlinear optimization(I)

Decision variables \rightarrow $\min_x f(x) = a_1 x_1^2 + a_2 x_2^2 + a_3 x_3^2 + a_4 x_4^2 + a_5 x_5^2$ Cost

subject to:

$$\left. \begin{aligned} -\infty &\leq x_1, x_2, x_4 \leq \infty \\ 0.3 &\leq x_3 \leq \infty \\ -\infty &\leq x_5 \leq 5 \end{aligned} \right\} \text{Bounds on } x$$

$$\left. \begin{aligned} x_1 + x_2 + x_3 &= c_{eq1} \\ x_3^2 + x_4 &= c_{eq2} \end{aligned} \right\} \text{Equality constraints}$$

$$x_4^2 + x_5^2 \leq c_{in} \quad \text{Inequality constraints}$$

$$a_i = 1, \text{ where } i = 1, 2, 3, 4, 5$$

$$c_{eq1} = 5, \quad c_{eq2} = 2, \quad c_{in} = 5$$

Parameters

MuJoCo: Example Nonlinear optimization(2)

1. Navigate to `template_nlopt` and type the following

- `gcc constrained.c -o constrained -w -lnlopt -lm`
- `./constrained`

2. If everything worked fine you will see the following:

found minimum at

$f(1.77378, 1.77354, 1.45269, -0.110295, 4.95945e-05) =$
`8.414180297`

Let us look at `constrained.c` closely

API: https://nlopt.readthedocs.io/en/latest/NLopt_Reference/