

# 《最优化方法》软件课

Matlab & CVX

2020年4月

# CVX

- CVX is a modeling system for [convex programming](#);
- It can solve: LP, QP, SOCP(second-order cone program), SDP(semidefinite program), GP(geometric program);

# CVX Module

## ■ 格式:

```
cvx_begin  
define variables;  
minimize(objective expression);  
subject to  
constraint1 <= 0;  
constraint2 >= 0;  
constraint3 == 0;  
variable == set;  
cvx_end
```

## 声明问题类型或者控制screen output

- `cvx_begin`: start a cvx problem.
- `cvx_begin quiet`: Prevents producing any screen output while it is being solved.
- `cvx_begin sdp`: semidefinite programming mode.
- `cvx_begin gp`: geometric programming mode.

# 定义变量

变量类型:

- variable  $x(20)$ ;
- variable  $y(20,30)$  complex;
- variable  $X(20,20)$  symmetric;
- variables  $x(20)$   $Y(10,20)$ ;

- Define objective function (must be convex):
  - linear:  $c^\top x$ ,  $\text{trace}(A * X)$ ;
  - quadratic:  $x^\top Qx$ ;
  - 2-norm:  $\text{norm}(Ax - b)$ ;
- Enter constraint:
  - linear:  $b^\top x \leq a$ ,  $A^\top x \leq b$ ;
  - quadratic:  $x^\top Qx \leq a$ ;
  - SOCP:  $x_1^2 + x_2^2 - x_3^2 \leq 0, x_3 \geq 0$ ;
  - SDP:  $X \succeq 0$  ( $X$  is a square matrix variable);

## Define set

- nonnegative set:  $x == \text{nonnegative}(n)$  (equals to  $x \geq 0$ );
- simplex:  $x == \text{simplex}(n)$  (equals to  $\sum_{i=1}^n x_i = 1, x \geq 0$ );
- semidefinite set:  $X == \text{semidefinite}(n)$  (equals to  $X \geq 0, \text{symmetric}$ );

例:

- Linear program: ...;
- Quadratic program: Mean-Variance model;



其他设置:

- Solver precision: `cvx_precision` default (low/medium/high/best);
- Selecting a solver: `cvx_solver` `sedumi`