A Quick Guide on CVXPY

Step 1: Install CVX (http://cvxr.com/cvx (Links to an external site.)) You can choose to use any programming platform (Matlab, Julia, Python, R, C etc). Information on cvxpy can be found here (https://www.cvxpy.org/index.html#)

Step 2: Read the user manual to get an idea of how to setup and solve optimization problems.

Step 3: Try the following examnple on solving least square problem. Make sure that you can solve it and get correct answer.

Install

Pip

(Windows only) Download the Visual Studio build tools for Python 3 (instructions).

(macOS only) Install the Xcode command line tools.

(optional) Create and activate a virtual environment.

Install CVXPY using pip:

```
! pip install cvxpy
```

Conda

conda is a system for package and environment management.

(Windows only) Download the Visual Studio build tools for Python 3.

Install conda.

Create a new conda environment,

```
conda create --name cvxpy_env
conda activate cvxpy_env
```

Install cvxpy from conda-forge

```
conda install -c conda-forge cvxpy
```

Example

In the following code, we solve a least-squares problem with CVXPY.

$$\underset{x}{minimize} \; \| Ax - b \|_2^2$$

$A \in R^{m \times n}$ and $b \in R^m$ are problem data and $x \in R^n$ is the optimization variable.

```python
import cvxpy as cp
import numpy as np
# Generate data.
m = 20
n = 15
np.random.seed(1)
A = np.random.randn(m, n)
b = np.random.randn(m)
# Define and solve the CVXPY problem.
x = cp.Variable(n)
cost = cp.sum_squares(A@x - b)
prob = cp.Problem(cp.Minimize(cost))
prob.solve()
# Print result.
print("\nThe optimal value is", prob.value)
print("The optimal x is")
print(x.value)
print("The norm of the residual is ", cp.norm(A@x - b, p=2).value)
```

```
The optimal value is 7.005909828287485
The optimal x is
[ 0.17492418 -0.38102551  0.34732251  0.0173098  -0.0845784  -
0.08134019
  0.293119    0.27019762  0.17493179 -0.23953449  0.64097935 -
0.41633637
  0.12799688  0.1063942  -0.32158411]
The norm of the residual is  2.6468679280023557
```