Cubic Spline Fitting Program

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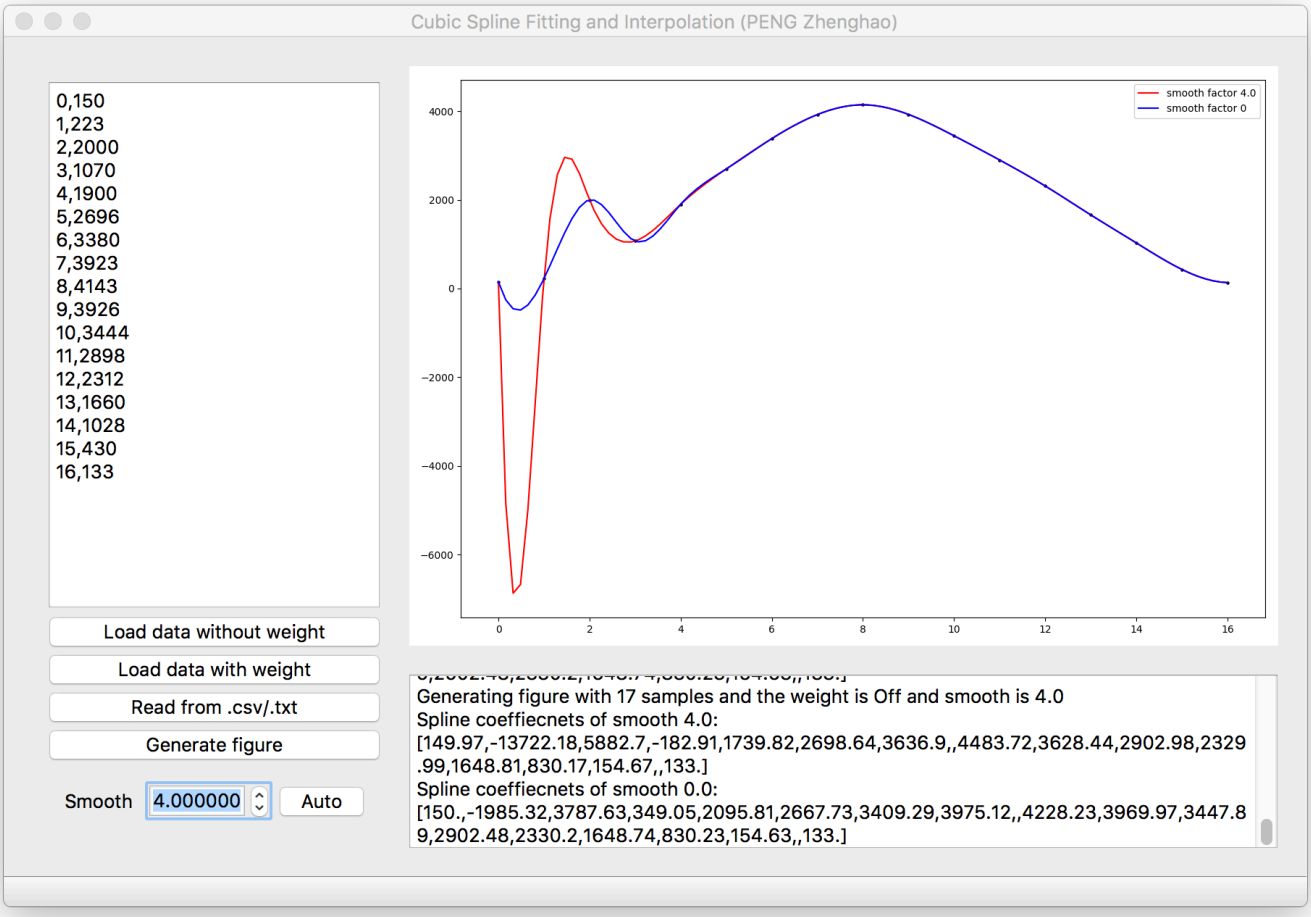
Abstract

This program provides the interface to draw interpolated cubic spline according to a set of 2D points provided by users from typing or files.

To open it, open `main.py` by `python main.py` or `main.exe` if you are windows user.



Introduction

This program: Cubic Spline Interface is developed by myself. I use python, leverage PyQt library as GUI, and use scipy as scientific computation backend.

In mathematics, a spline is a special function defined piecewise by polynomials. In this program, cubic spline is used. Cubic spline has this form:

$$y = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \sum_{i=2}^{n-1} a_{i+2}(x - x_i)^3$$

To solve the unknown parameters, applying the least-square method, we need to minimize:

$$I = \sum_{i=1}^{n} W_i(\Delta y)^2 + q_1(\Delta y_1')^2 + q_n(\Delta y_n')^2 + \sum_{i=2}^{n-1} S_i a_{i+2}^2$$

wherein W_i is called weight factor, which is supported by this program. S_i is called smooth factor. If the spline is uniform, S_i is equivalent. This program support dynamically adjust it.

Code strcuture

- backend.py ---math done here
- mplcanvaswrapper.py ---merge `matplotlib` into QT window.
- MplMainWindow.py ---automatically generated file from QT designer.
- window.py ---window object, make interaction respones.
- main.py ---main entry of all. You can simpy `python main.py` to run.

Usage

Click `main.exe` to begin or use `python main.py` if you have all dependencies. In the interface, you have to import data before starting anythings.

You have three ways to import data:

- clicked `Load data with weight` or `Load data without weight` to insert some builtin data collected by me from previous ship drawing lesson.
- type or paste the data you like in the text window. Remember, use the standard `csv` form:

```
(x,y):
        1.0,2.0
        2.0,3.0
or (x,y,weight):
        1.0,2.0,1.0
        2,3.1,1
```

- read from `.csv` or `.txt` file.

After importing data, click `generate figure` to get the curves. By default, the smooth factor is set to 0, so the two curves are overlapped. You can change the smooth factor and see what happens.

After generated, click `Auto` to get a series of curves. They have varied smooth factors.