

SM-2302 - GROUP ASSIGNMENT 2

Spline your name

Semester 1, 2023/24

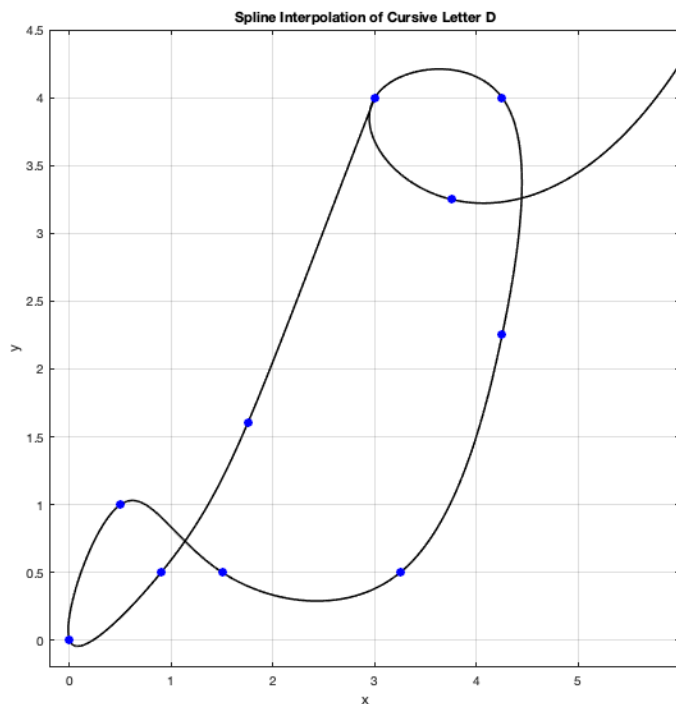
Splines are an efficient method used for interpolating data points, yielding smooth interpolations. They are computationally inexpensive, and MATLAB provides built-in functions, like `spline`, allowing for easy creation and evaluation of resulting polynomials without needing a deep dive into the intricate details.

This technique is particularly useful in creating cursive letters, where splines can form letters with just a few defining points. By separately applying splines to functions $x(t)$ and $y(t)$, we can approximate parametric curves and subsequently plot the resulting function y against x .

Here's an example of MATLAB code that creates a parametric spline with the specified data points:

t	0	1	2	3	4	5	6	7	8	9	10	11
x	3	1.75	0.9	0	0.5	1.5	3.25	4.25	4.25	3	3.75	6.00
y	4	1.60	0.5	0	1.0	0.5	0.50	2.25	4.00	4	3.25	4.25

Note that in the resulting curve, y is not a function of x . Hence, a parametric spline is constructed.



MATLAB code:

```
1 % Define data points for x and y coordinates
2 x = [3 1.75 0.9 0 0.5 1.5 3.25 4.25 4.25 3 3.75 6.00];
3 y = [4 1.60 0.5 0 1.0 0.5 0.50 2.25 4.00 4 3.25 4.25];
4
5 n = length(x);
6 t = 0:n-1; % Parametric coordinate t
7 tt = 0:0.01:n-1; % More dense coordinate tt for spline interpolation
8
9 % Compute spline interpolation
10 xx = spline(t, x, tt);
11 yy = spline(t, y, tt);
12
13 % Plot settings
14 figure(1)
15 plot(xx, yy, 'k', 'LineWidth', 1.5) % plot spline
16 hold on
17 plot(x, y, 'bo', 'MarkerFaceColor', 'b') % plot data points
18 axis([-0.2 6 -0.2 4.5])
19 grid on
20 title('Spline Interpolation of Cursive Letter D')
21 xlabel('x')
22 ylabel('y')
23 set(gca, 'FontSize', 10, 'LineWidth', 1)
24 grid on
```

This MATLAB script serves as a starting point for your assignment tasks. Make sure that you understand what each line command actually does, for example, by typing `help spline` in the command window. To animate the drawing of the letter, try typing `shg, comet(xx,yy)` after having run the script.

Instructions

1. Graph paper transcription:

- As a team, each member is to write their (short-hand) name in cursive on graph paper.
- For each letter, select 6-12 defining points in the letter (letters with extra strokes, 'f', 'i', 'j', 't', and 'x', require extra care), and record their x and y coordinates as your data points.

2. Digital reconstruction:

- Using a spline interpolation, reconstruct each member's name from the recorded coordinates.
- Similar to the code above, implement the following steps:
 - Derive the interpolating spline polynomials.
 - Evaluate the polynomials to obtain additional points points.
 - Plot the resulting (x, y) spline curve, depicting the reconstructed name.

- Submit a MATLAB script file, `'names.m'`, that plots the cursive names of all group members.

3. Word combination & function scripting

- Develop a method to combine letters into words.
- Create a function script, `'plotWord.m'` that takes as input a string, and outputs the corresponding cursive-written word(s).
- Ensure that your code is flexible enough to deal with the letters 'f', 'i', 'j', 't', and 'x'.
- Consider using a map type container to hold your data. Refer to `help containers.Map`.

Submission checklist

1. Submit the script `'names.m'` which should plot all the transcribed names of your group members.
2. Submit the function script `'plotWord.m'` which can plot any given word in cursive based on input strings. Make sure your function script works by calling it, for example, `>> plotWord('Name')`.

Tips

- Handling spacing between letters, and dealing with the difference in height or size among letters, needs additional consideration and adjustment.
- Case sensitivity needs to be managed properly, especially if you have different data for uppercase and lowercase letters
- Ensure that each step is meticulously followed, and the letters are carefully selected and plotted to avoid inaccuracies in the final representation.
- Keep your code well-commented and organized for ease of understanding and evaluation.
- Marks are awarded for clarity. Apart from the required script m-files, you may turn in other format of your solutions (figures, animations, etc.)
- You are expected to submit code that are able to run without any errors.