12SDD: Defining & Understanding and Planning & Design

Name

Defining & Understanding

Solution Overview

|  |
| --- |
| Program Description |
| The program needs to be able intake coloured bitmap image and use linear vectorisation to create a linear black and white vectorised image. Then the program must be able to intake the previous linear vector image and turn it into a regular vector image. It must also be able to intake a black and white image and directly vectorise it into a regular vector image. |

|  |
| --- |
| Functionality Requirements |
| Must be able to  - Convert coloured bitmap images into black and white linear vector images  - Convert black and white bitmap images into black and white vector images  - Convert linear black and white vector images to black and white vector images  -Accept different values for tolerence of what counts as a line |

|  |
| --- |
| System Boundaries |
| Must be able to  - Convert coloured bitmap images into black and white linear vector images  - Convert black and white bitmap images into black and white vector images  - Convert linear black and white vector images to black and white vector images  - Run in the background as other processes occur  Won’t be able to  - Intake and recognise future file formats  - Vectorise low quality images  - Intake files not in the bitmap format |

Planning & Design

General Planning & Design

|  |
| --- |
| Gantt Chart |
|  |

|  |
| --- |
| Context Diagram |
|  |

|  |
| --- |
| Story Board |
|  |

|  |
| --- |
| Screen Design |
|  |

|  |
| --- |
| Software Ergonomics & Inclusivity |
| The software will feature just a desktop icon with different downloads for different tolerences.  To use the user will drag a file into the icon and the result will be added on the desktop  This without many requirements for instructions and documentation with the required instructions able to be conveyed through images allows the greatest inclusivity in terms of language.  Further the program will be able to run in the background allowing other productive tasks to be done increasing ergonomics.  Ergonomics can also be increase through the design not requiring many actions from the user. |

Structural Planning & Design

|  |
| --- |
| Performance Considerations with Standard Algorithms |
| The algorithm requires the checking of each 2x2 square that can be formed in the array of pixels that makes up the image as part of the edge tracing process. Further this array cannot be sorted as that will jumble all the pixels of the image into strips of colour, meaning that algorithms such as binary search cannot be used. This results in an efficiency of approximately O(2n) as each pixel must be analysed in the edge seeking process and then again in the exporting as a vector. |

|  |
| --- |
| Data Structure Discussion |
| The main data manipulation will occur during the process of edge finding where each 2x2 adjacent square must be looped through and analysed to see if an edge exists. To find the edge random points between pixels will be chosen until a black pixel is adjacent to it. Then the line will keep the black pixel on its left and make turns accordingly. It will be easiest to use 2d array to arrange the pixels as the array will save the location of the pixels. The pixels can then be looped though using a nested “for” loop and compare whether a black pixel is on the left using the position of the pixel in the 2d array. Later the edges can be transformed into vectors using bezier curves and polygons the equations of which will be stored using 2d arrays |

|  |
| --- |
| Data Flow Diagram |
|  |

|  |
| --- |
| Data Dictionary |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Name | Data Type | Scope | Description | Example | | Input | Bitmap | Global | The raster file inputted by the user | Joe.bmp | | Pixels[][] | Array[][] of integers | Global | Array[][] of pixels converted from the input. May be black and white or colour | [[233,3,234,4,34,21,45],[45,34,5,76,65]] | | Colour | Boolean | Global | Records whether the input is coloured as different processes must be taken for coloured an black and white images | True | | Threshhold | Integer | Global | Preset threshold at which a line is considered line, uses the integer darkness of the pixel | 34 | | Vector[] | Array[] of equations | Global | An array of vector equations saved after the image has been vectorised | [2x +7] | | Export | PDF or SVG | Global | A vector image of the same name as the original image. The finish produce of the porcess | Joe.svg or Joe.pdf | |

|  |
| --- |
| Structure Chart |
|  |

Algorithm Planning & Design

Polygonvectorisation()

|  |
| --- |
| IPO Chart |
| |  |  |  | | --- | --- | --- | | Inputs | Processes | Outputs | | Nonlinearedges[][]  fileformat | Use Bezier functions with the inputs of the vertexes of the edges to smooth the staircasing of the image | Polygon equations of the traced edges | |

|  |
| --- |
| Pseudocode |
| START Polygonvectorisation(Nonlinearedges, fileformat)  ----- FOR i=0 to Nonlinearedges[].length  ----------bezier(Nonlinearedges[i])  -----END FOR  END Polygonvectorisation() |

|  |
| --- |
| Algorithm Flowchart |
|  |

|  |
| --- |
| Module-Level Test Data |
| |  |  |  |  | | --- | --- | --- | --- | | Test | Expected Output | Actual Output | Reason for Inclusion | | [0.5:3,4:3,5:4] | Bezier curve with anchor points 0.5:3 and 5:4 and control points 4:3 | Bezier curve with anchor points 0.5:3 and 5:4 and control points 4:3 | Tests if array and floats can be inputted into the bezier function | | [-4:3, 3:4, -5:3] | Bezier curve that goes off the screen | Bezier curve that goes off the screen | Tests the effects of negative values | | [120000003:34222; 233334:234552, 23452:2345234] | Overflow Error | Overflow Error | Tests what happens if an error occurs in previous subprograms resulting in extremely large values | | [0.00000123:0.00000000245, 0.000000234:0.234235] | Extremely small bezier curve | Extremely small bezier curve | Tests what happens if an error occurs in previous subprograms resulting in extremely small values | |