Content Aware Resize

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Abstract:

- The purpose of this project is to reduce or resize the images without affecting its Content to avoid stretching or the elongation.
- We used dynamic programming algorithms to help us resize the images.

Introduction:

- Content-aware resizing, or seam carving, is a technique for resizing images non-uniformly while preserving important content. Dynamic programming is used to find and remove seams of least importance, minimizing distortion. This approach differs from traditional resizing methods by focusing on content preservation.

Methodology:

- The algorithm that we implemented is dynamic programming to find the seam (path) of pixels with the lowest cumulative energy. Calculate the cumulative energy at each pixel as the sum of its energy and the minimum cumulative energy of the three pixels above it in the previous row.
- We create a 2D matrix to store in it the energy required to reach each pixel by using a simple formula that is [dp[I,j]=energyMatric[I,j]+min(left,mid,right)] and after that we iterate over the last row to find the lowest cumulative energy by then we would have gotten the min energy required and from there we backtrack to find the path and store the coordinates the list coord.
- We used c# and .NetFrameWork for our programe.

Results:

- Traditional resizing methods typically have a linear or O(n) complexity and n is the number of pixels in the image. But the content-aware resizing algorithm using dynamic programming may have a higher complexity, such as O(n^2) or O(n*m), and n, m are the dimensions of the image.

In the next slides you will see the examples

the energy matrix

5	**6**	**7**	**2**	**3**	**4**	**8**	**1**
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

First row in the dp equation id d[i,j]=energy[i,j]

the energy matrix

5	6	7	2	3	4	8	1
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

5	6	7	2	3	4	8	1
9+5 =11	10+ 5 =15	11+ 2 =13	6+2 =8	7+2 =9	5+3 =8	3+1 =4	2+1 =3

The next row will be dp[I,j]= energy [I,j]+min(upleft,up,upright)

the energy matrix

5	6	7	2	3	4	8	1
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

5	6	7	2	3	4	8	1
11	15	13	8	9	8	4	3
19	18	14	13	12	7	5	4

All the next rows will be the same as the previous

the energy matrix

5	6	7	2	3	4	8	1
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

5	6	7	2	3	4	8	1
11	15	13	8	9	8	4	3
19	18	14	13	12	7	5	4
23	18	16	14	8	7	7	8
24	21	18	11	9	10	11	12
28	24	16	13	12	13	15	17
32	23	19	17	16	17	19	22
33	27	24	22	21	22	24	27

All the next rows will be the same as the previous

the energy matrix

5	6	7	2	3	4	8	1
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

5	6	7	2	3	4	8	1
11	15	13	8	9	8	4	3
19	18	14	13	12	7	5	4
23	18	16	14	8	7	7	8
24	21	18	11	9	10	11	12
28	24	16	13	12	13	15	17
32	23	19	17	16	17	19	22
33	27	24	22	21	22	24	27

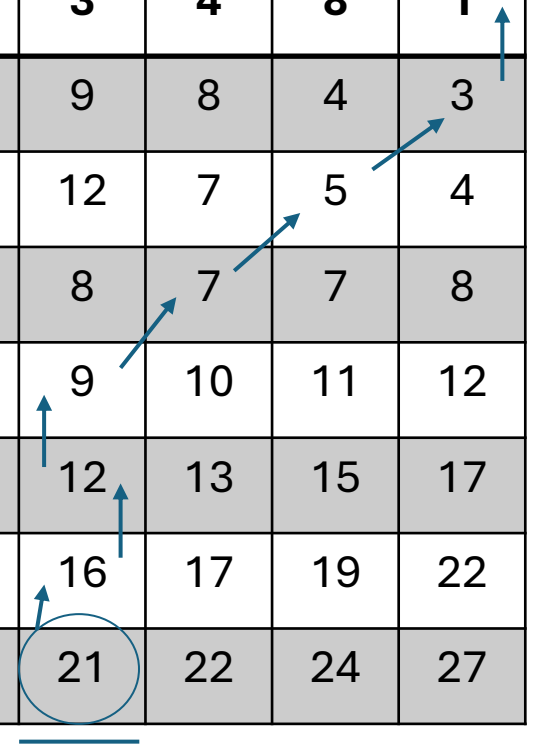
Now we iterate over the last row to get the minimum energy :

the energy matrix

5	6	7	2	3	4	8	1
9	10	11	6	7	5	3	2
8	7	6	5	4	3	2	1
5	4	3	2	1	2	3	4
6	5	4	3	2	3	4	5
7	6	5	4	3	4	5	6
8	7	6	5	4	5	6	7
9	8	7	6	5	6	7	8

The dp table

5	6	7	2	3	4	8	1
11	15	13	8	9	8	4	3
19	18	14	13	12	7	5	4
23	18	16	14	8	7	7	8
24	21	18	11	9	10	11	12
28	24	16	13	12	13	15	17
32	23	19	17	16	17	19	22
33	27	24	22	21	22	24	27



Now we backtrack from here to get the path:

Conclusion:

- In this project, we developed a way to resize images without stretching or distorting them. By using a technique called content-aware resizing and dynamic programming, we can resize images while keeping the important parts intact. Our method, implemented in C# and the .NET Framework, offers a better way to resize images compared to traditional methods. It shows how dynamic programming can be used effectively in image processing to preserve the content of images.