

Multimedia Database building

CSCI576 Multimedia System Design, Fall 2003

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ABSTRACT

In this project, we construct a multimedia database system based on motion catachrestic. Our goal is to determine a best match video from our exiting database catalogs compare with a new video stream. The system will browse the index catalog and determine a best "matching" catalog for the coming video. The database is based on 10 movie streams which are group in 4 different catalogs classes.

ALGORITHM OUTLINE

In this paper we will separate our solution to construct a multimedia data base into 4 subtopic, they are:

1. down-sample images
2. determine motion vector
3. barcode
4. construct catalog

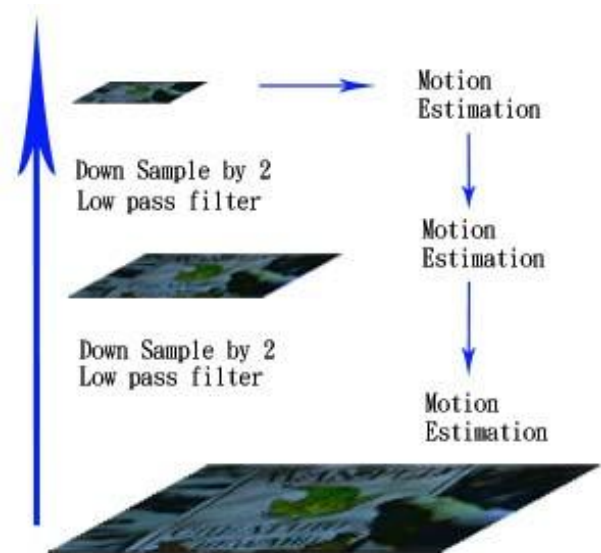
1. down-sample images

To reduce the calculating in run time, it's necessary to down-sample our original images. In our code we build a image pyramid by down-sampling the 176 * 144 image 2 times into 44 * 36 image. According to the microblock size (we'll discuss the detail in next subtopic), we have to compare every 16 * 16 neighborhood pixels from every pixel. Therefore we'll need to do the comparison at least 16 * 16 * 176 * 144 times. After down-sample, every vertex in the coarsest image will project to the original image at $(4i, 4j)$, where i and j are integers. We'll determine the motion vector in coarsest level image by dividing the images into 4 * 4 blocks, therefore every pixels in the block only need to calculate it's 4 neighborhood pixels in the next fine level image. (figure 1.1)

2. Determine motion vector

The algorithm we used is base on motion prediction which is used for MPEG compression. We divide the frames in video stream into 16 * 16 microblocks. Each micro block in the current frame will find a best

match from the previous frame (reference frame) and determine a 2D



(figure 1.1).

motion vector. Because that we have already down-sample the original image and find the motion vector $(4u, 4v)$, we only need to refine the motion vector from $(4u, 4v)$ to $(4u + 2k, 4v + 2m)$ in the next fine level and find the final motion vector $(4u + 2k + i, 4v + 2m + j)$ at the original image.

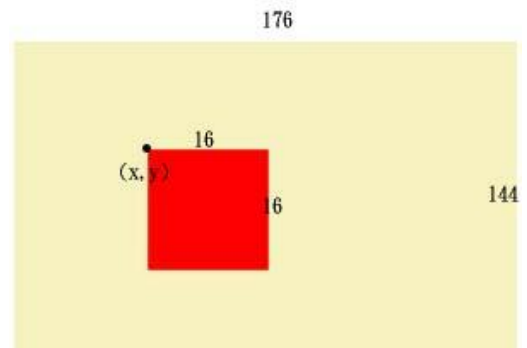


figure 1.2.a – Target image

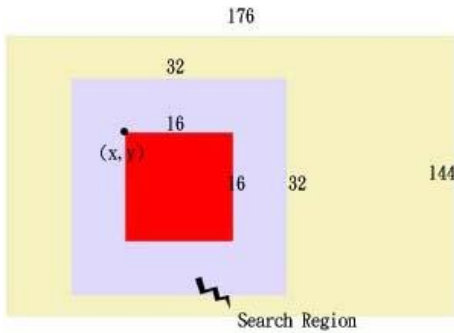


figure 1.2.b – reference image

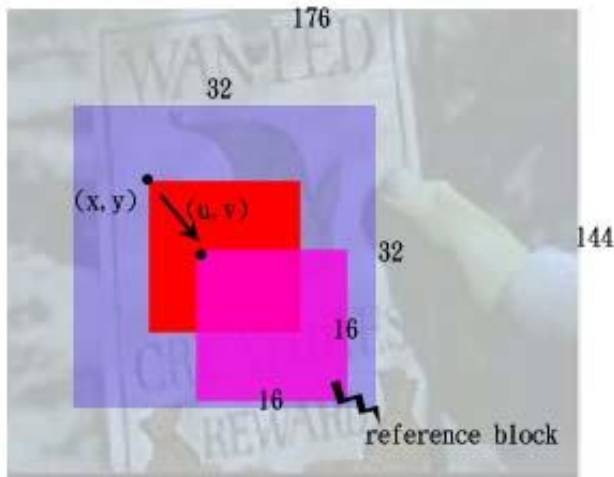


figure 1.2.c – final result

3. Barcode

Our barcode shows the comparison of motion vector distance in different frames in the same movie. The barcode is scaled into 0 to 255 by

$$\text{Barcode \#} = \sum (\text{blocks}) * (\text{motion vector distance in each block})$$

The white part (255) is where the scene changes in the movie. If the color changes from frame to frame (as the 8th , 10th and 15th frame of the movie “Phil” is determined as the scene change.

The barcode gets better result when we calculate only the distance instead of the error or (error * distance). As we see it, it is because when the background or foreground change, microblocks will show the result as random vector and the distance will get greater in this situation.

4. Construct catalog

We construct our catalog by the following solution:

group sport	
🚩	total error in all frame > 13000000
🚩	more than 50 frames (error > 100000)
single sport	
🚩	less than 10 frames (error < 10000)
Animation	
🚩	More than 40 frame ,less than 60 frames (error < 10000)
🚩	more than 1 frames (motion vector distance >230) (at least 1 Scene changes)
talking head	
🚩	total error in all frames < 2000000
🚩	more than 80 frames (motion vector distance <15)
sea world	
🚩	more than 70 frames (error < 10000)

The new coming movie will be compared to the movie existed in the database with Current Movie

$$X = \sum \sum (\text{Error in each frame}) * (\text{motion vector distance in each frame})$$

And new movie

$$Y = \sum \sum (\text{Error in each frame}) * (\text{motion vector distance in each frame})$$

With $\text{abs}((X-Y)/X * 100)$ or $\text{abs}((Y-X)/Y * 100)$ to get a percentage and choose a “ least difference “ movie in “ determined “ stream catalog.

Other movie in the database will also show their comparison result with the new coming movie by score.

CONCLUSION and FUTURE WORKS

We have learned a great experience from the project, the coding process strengthen our knowledge about the motion vector and also we also get more lesson to efficiently do a team job.

According to the time limit, we are not able to use different solution in each part. We wish we can do more and use this valuable experience in the future.

Appendix A

1. Our solution to categorize the videos.

file name	class	total error	error in each frame < 10000	error in each frame > 100000	Motion vector distance in each frame > 230
flying.576v	2	5815626	0	5	0
dive.576v	2	11486918	0	44	0
flying_spin.576v	2	4304273	3	0	0
fastslow.576v	3	15907211	36	56	0
cyclers.576v	3	17141727	36	59	0
ai.576v	1	2166037	47	1	4
shrek.576v	1	4231074	51	15	1
chickenrun.576v	1	6832958	51	22	1
phil.576v	0	1646059	67	6	2
fishing.576v	2	3575228	79	16	0

2. result Demo

