

Interlace and De-interlace Application on Video

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ABSTRACT

Media is developed as a medium of exchanging data demands speed and data accuracy. Both of these need for greater storage and bandwidth as a challenge. While a large storage and bandwidth costs are greater. To face the challenges that exist, compression and interlace video techniques are most often used. Both are at risk video quality decrease but can achieve the desired results.

In this research, we use interlace as a solve method in our developed application. The goal of our application is to deliver a video file through a limited bandwidth. Instead passing the fully video, it will deliver a part of the file. Before display the video, de-interlace method will manipulate the delivered file and reconstruct the not-delivered part.

Test results indicate that the client does not affect the amount of bandwidth consumption during multicast, but the file format. Smoothness of multicast depends on several factors like the type of image compression, including interlaced video. In several cases, when the delivery delay time is big enough, deinterlace method cannot reconstruct the image fully.

Categories and Subject Descriptors

[Multimedia Application]

General Terms

Algorithms, Performance, Design, Reliability, Experimentation.

Keywords

Interlaced Video, Deinterlacing, bandwidth, compression

1. INTRODUCTION

In recent years, the speed and accuracy in a data access through a medium is very important, especially via internet. Frequently accessed data video is displayed through streaming or buffering. In the process of streaming video through the Internet, the buffering process will download data before being displayed on the user. Buffering data before downloaded by a user is placed on the memory area. The major challenge to be faced is the video data size is large enough for loading images as well as sound contained in it.

If a user requests a video on a web page, such as Youtube, Youtube will take the data source from the server and will be displayed on the client's screen. However, because of the limitations of hardware devices that are owned by the user, such as bandwidth limitations, will make the data load process longer. Data load process with a very large size, will require greater bandwidth.

There are several ways to speed up the process of sending it. Firstly, compression, it will reduce the physical size (the size or color quality on the video) before sending data. Secondly, the video delivery is resolved into two parts and sent one of them. This is called interlace method. For the data is transmitted partially, the resulting quality is also only a part of it. There are several techniques to manipulate the transmitted data. De-interlace is one of those[1],[2],[5].

Interlace method is often seen in the information conveyed through the television where noise is often seen on the displayed image. Therefore, the purpose of this study is to create an application that can process video data in order to produce a video that has a smaller size than the original data, much faster in delivering data, but still maintain the existing quality of the original video data.

2. AVI (Audio Video Interleave)

AVI is one of interlace methods. It breaks audio and video streams into several parts. Each part is arranged so it can represent its neighbor parts which appear at each time period. This regulation allows linear reading along the video playback, but doesn't allow writing whole file before displaying it one by one. There are two video displaying methods, progressive and interlace scan.

2.1 Progressive scan

It is a method for displaying each frame of a video sequentially. Each appearance of the frame shown in full image without any removal field. Scanning using this method is usually done at 50 fps. At 50 fps motion can produce the perfect motion sequence, the high temporal and vertical resolution[1],[2].

2.2 Interlace scan

It is a method for displaying a video which only shows a part of an image on every frame of it. This method is the most commonly used in television[1]-[2]. Interlacing is done by only displaying either even or odd rows, or diagonally. Interlace scan often shows the effect of horizontal lines, especially on the moving object. The effect is called mice teeth combing effect, see Fig 1. This effect is sometimes seen clearly, but sometimes it is almost invisible.

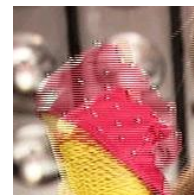


Figure 1. Mice Teeth effect from Interlaced Video

source: <http://casualmuxer.wordpress.com/2008/07/22/sekilas-tentang-interlaced-video/>

In the interlaced video, combing effect caused by the woven of the two fields becomes one whole frame, see Fig 2. A field has half the vertical resolution (spatial) of a frame. An interlaced video with a resolution of 640×480 pixels at 30 frames per second (fps) has sixty 640×240 fields per second. To render the fields had become one whole frame, each of the two fields are woven by put the pixel rows are alternately into one frame. Weaving process is the cause the effect of combing[5].

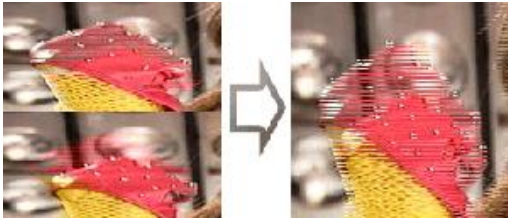


Figure 2. Combining 2 Field become 1 Frame

source: <http://casualmuxer.wordpress.com/2008/07/22/sekilas-tentang-interlaced-video/>

3. DE-INTERLACE

De-interlace is a converting process of interlaced video which composed of a set of half part images to be whole image (non-interlaced). Several types of methods are commonly used are blend, bob, discard, linear, doubler, mean, motion blur, and motion compensation.

Blend method is often used on the TV screen. De-interlacing blending produces a little bit blur effect. Blending method performs mixing between the simulated and motion blur as well as combining two consecutive images together sequentially. This method reduce the quality a quarter of the original quality [1]-[4].

Area-based methods do not blend in all the parts, but only in the nice teeth area. This can be done by comparing the frame by time or position. This way will give good results in scenes that do not involve a lot of movement, so, no blur is produced.

Another frequently used method is the method doubler. After the disposal of one field, e.g. the even lines, then on even-numbered rows are filled with previous odd lines copy value. This method is often used because it does not require a long processing time.

Interpolation method calculates the mean or average of the remaining neighbor fields[5]. For example, there is an image resolution of 5×5 as in Fig 3 (left). From the top to bottom are line [0..4] and from left to right are columns [0..4]. If interlace even fields only is applied, then the even lines will be eliminated, and the rest is just odd lines will produce an image as shown in Fig 3 (middle). If diagonal interlace is applied, then it will produce Fig 3 (right), where 'X' states the removing data, and O states remaining data.

	0	1	2	3	4		0	1	2	3	4		0	1	2	3	4
0	O	O	O	O	O	0	X	X	X	X	X	0	X	O	X	O	X
1	O	O	O	O	O	1	O	O	O	O	O	1	O	X	O	X	O
2	O	O	O	O	O	2	X	X	X	X	X	2	X	O	X	O	X
3	O	O	O	O	O	3	O	O	O	O	O	3	O	X	O	X	O
4	O	O	O	O	O	4	X	X	X	X	X	4	X	O	X	O	X

Figure 3. Original image (left), even field only (centre), diagonal interlace (right)

4. GENERAL SOFTWARE SYSTEM

This application is divided into two sections, client interface as a medium for displaying results of interlaced video, and server as data processing before data is sent. The outline of the system software can be seen in Fig 4.

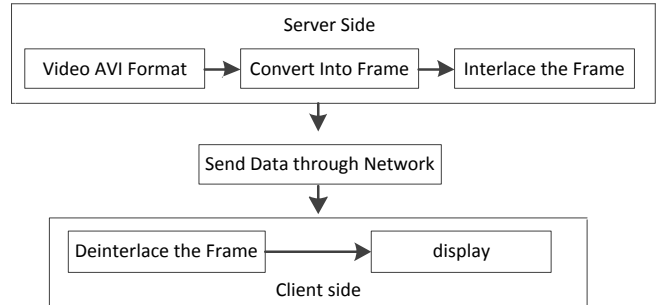


Figure 4. General Software System

4.1 Server System

In the server side, there are several important steps that must be done. There are three main processes on the server, the Open Video Publication, Video Registration, Publication and Video.

Open Video Publication

The first time the server runs, the Open Publication Video will be done. The server chooses a video file which will be published. Then the server initiates the publication of the desired video. The server will send information about the video which will be published as well as the server IP multicasting to all active clients. Data contain author, title of video, ports, and video address.

Registration Video

In the video the registration process, the server receives the IP of the client listed in the published video group. Video's information will be displayed on the user screen. Beside that, the server can perform other activities, multicast features. Through these features the server sends the output of send-image to the client that has been registered earlier. When the client receives the IP of the user who access the video, the server will perform its data storage. After storing the data, the server can perform multicast to do at any time, not only occur during multicast.

Video Publication

In the process of publication of this video, the server sends the result of the converted video image. Before the image is sent to the client, the image will be processed first, using the interlace method. Then server multicast to all clients connect to the server.

Interlace Scanning Frame

At this stage it will be scanning the frame diagonally. Scanning process will be done starting from the top left corner to the right-moving frame. After arriving at the border width or horizontal image frame, it will form a line, then going back to start scanning from the left under the line that had been made earlier. Flowchart of Frame Interlace Scanning can be seen in Fig 5.

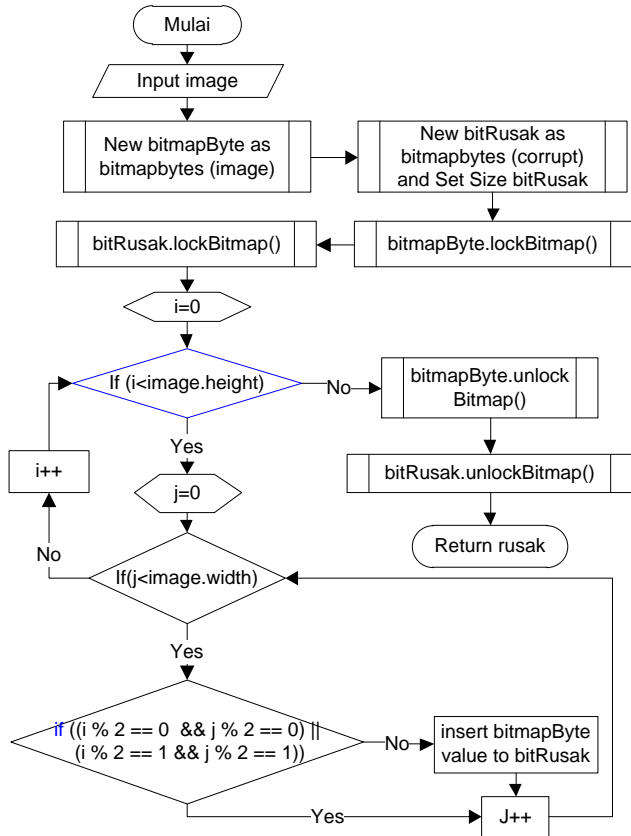


Figure 5. Interlace Scanning Frame Flowchart

4.2 Client System

Client side has many features, Refresh, Join Video, Pause, Download Video. General flowchart of the server side is showed in Fig 6.

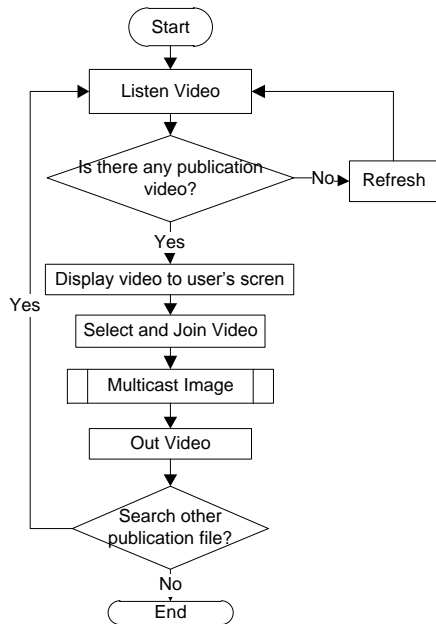


Figure 6. Interlace Scanning Frame Flowchart

Multicast Image

The multicast process starts by setting up image image stream through a socket for receiving the transmitted image server. Once the image is received, the image data stream is not directly displayed on the screen. It would be processed first, which performed in order to regenerate normal size image and the fulfil particular pixel on the image which is remain, processed by interpolation de-interlace or mean. Flowchart multicast image can be seen in Fig 7.

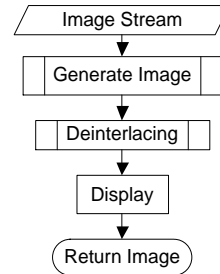


Figure 7. Multicast Image

Generate Image

This proses produces whole size image and then entry the pixel value from bitRusak to the new image. The complete process can be shown in Fig 8.

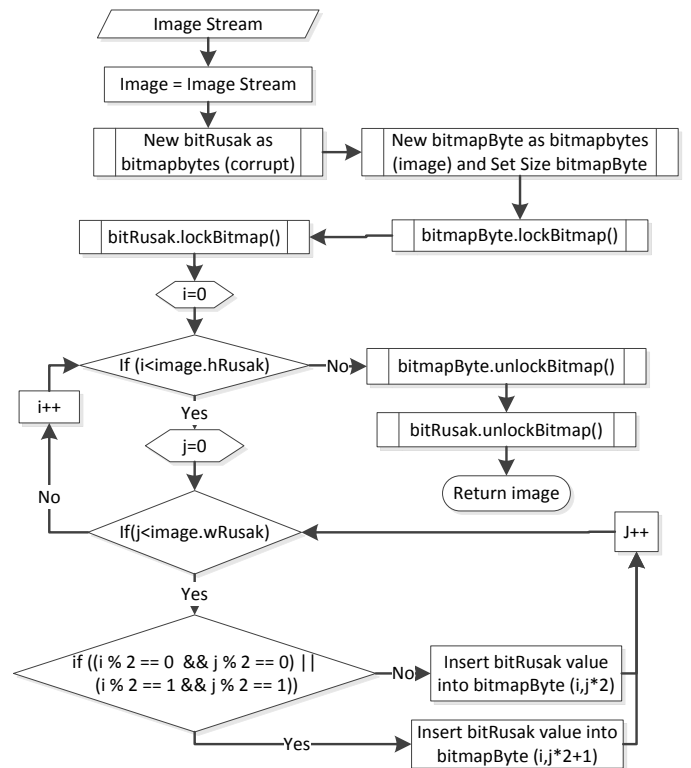
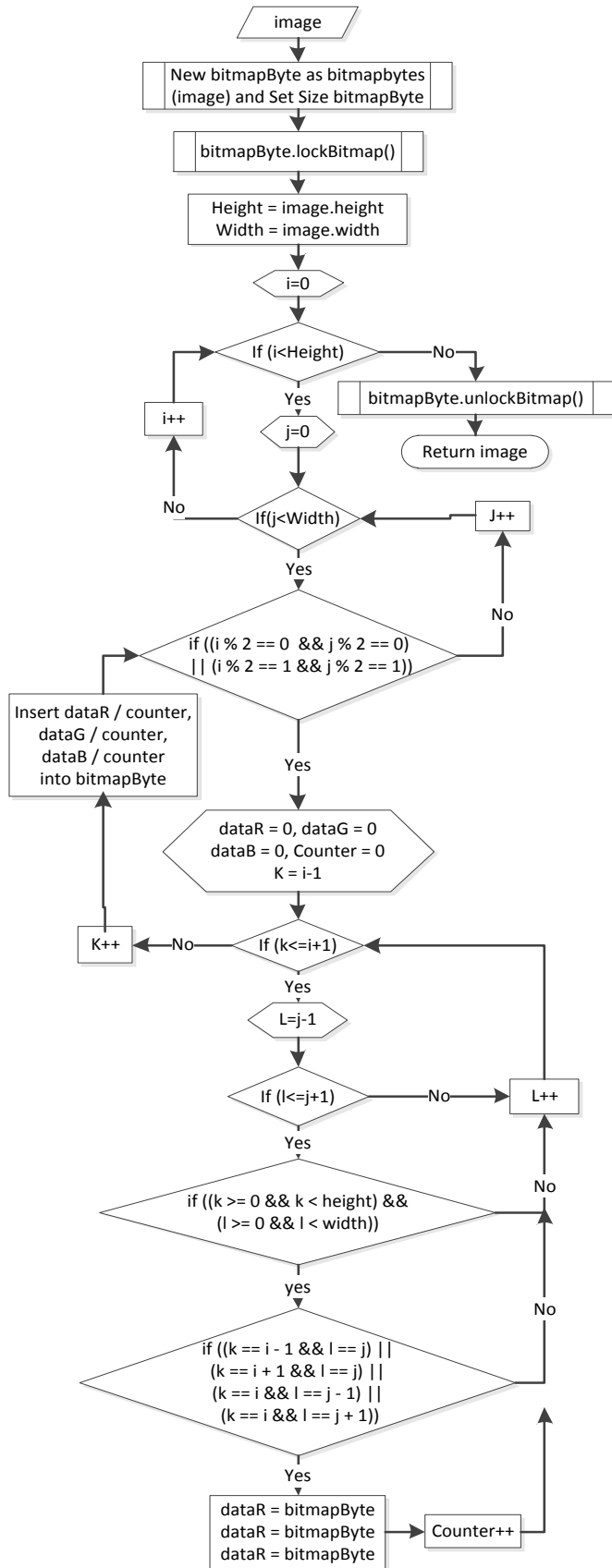


Figure 8. Generate Image Process

De-interlacing

Before displaying the image to screen, it will apply de-interlace method which is shown in Fig 9.

Figure 9. Deinterlacing Proses



5. EXPERIMENTS

Experiments are conducted to determine the delay generated by each image format. We use four kinds of image format, JPEG, BMP, GIF, and PNG. Testing is performed by comparing the application using the interlace method and without interlacing. Testing is done by taking the initial 10 frames are displayed, the calculation is based on the difference in time required to display each frame received. Testing will calculate the time difference between the current frame and the next appearance on a client. The experimental results using the interlacing and the delay that occurred is displayed in Table 1 and Table 2, while those without interlace shown in Table 3 and Table 4.

Table 1. Time at taking frame using interlace

Frame	JPEG	BMP	GIF	PNG
1	7949030	8301421	8891432	8798425
2	7949514	8305212	8892275	8799766
3	7949982	8309050	8893164	8800578
4	7950372	8326319	8894007	8801748
5	7950793	8333994	8894880	8802902
6	7951183	8455924	8895723	8803791
7	7951636	8482070	8896596	8804587
8	7952041	8549369	8897485	8805570
9	7952447	8562458	8898000	8806490
10	7952884	8588650	8898375	8807410

Table 2. Delay frame produced from tabel 1

Frame	JPEG	BMP	GIF	PNG
1-2	0.484	3.791	0.843	1.341
2-3	0.468	3.838	0.889	0.812
3-4	0.390	17.269	0.843	1.170
4-5	0.421	7.675	0.873	1.154
5-6	0.390	121.930	0.843	0.889
6-7	0.453	26.146	0.873	0.796
7-8	0.405	67.299	0.889	0.983
8-9	0.406	13.089	0.515	0.920
9-10	0.437	26.192	0.375	0.920
Average	0.428	31.914	0.771	0.998

Tabel 3. Time at taking frame without interlace

Frame	JPEG	BMP	GIF	PNG
1	9305662	9916094	9854083	9602984
2	9305724	9921211	9854520	9604310
3	9305834	9923769	9854988	9605699
4	9305943	9949431	9855441	9607103
5	9306052	10159923	9855877	9608460
6	9306130	10252510	9856299	9609380
7	9306208	10270544	9856704	9610332
8	9306286	10278250	9857110	9611330
9	9306380	10373224	9857531	9612329
10	9306442	10378372	9857952	9613202

Tabel 4. Delay frame produced from Tabel 3

Frame	JPEG	BMP	GIF	PNG
1-2	0.062	5.117	0.437	1.326
2-3	0.110	2.558	0.468	1.389
3-4	0.109	25.662	0.453	1.404
4-5	0.109	210.492	0.436	1.357
5-6	0.078	92.587	0.422	0.920
6-7	0.078	18.034	0.405	0.952
7-8	0.078	7.706	0.406	0.998
8-9	0.094	94.974	0.421	0.999
9-10	0.062	5.148	0.421	0.873
Average	0.087	51.364	0.430	1.135

From table 2 and table 4, the result of compressed videos such as JPEG and GIF are not suitable with this method. It is because of the compact information from the compressed file. It will take no time delay in delivering the file. While the uncompressed video, such as BMP and PNG, this method is well done. This method will make a significant result as expected.

6. CONCLUSION

Based on the test results can be summed up some of these following:

- Image format types affect the amount of data loss in the event of multicast. Type JPEG format has a lower data rate than the three types, e.g BMP, GIF, and PNG. Raw format file consumes a large time in delivery. It makes our system reconstruct the full image with only a part of the image.

- The type of image format type affects delay in the event of multicast. BMP format type provides the greatest delay compared to other types, JPEG, PNG and GIF. Selection of the proper type of format is recommended to reduce the delay in the event of multicast.

- Diagonal interlace method has less degradation than the odd events interlace method.

- The decline is caused by interlace method is not very significant, considering the parts are sent only half of the original image.

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