A Video Quality Testing : Review of Human Visual Aspect

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Abstract - Various types of video player applications have been widely used by the community. The emergence of the latest version and a variety of features make people need to make a choice to use a video player application with a good visual level. The type of video that is often played is a file with an MP4 extension. This file type is not heavy but is usually intended for long file durations such as movies. In this paper, we will use a dataset in the form of a movie file with an MP4 extension. The video player applications used include VLC, Quick time, Potplayer, KMPLayer, Media Player Classic (MPC), DivX Player, ACG Player, Kodi, MediaMonkey. Through various empirical calculations, such as Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR), Structutral Similarity Index Measurement (SSIM), Threshold F-ratio, Visual Signal to Noise Ratio (VSNR), Visual Quality Metric (VQM), and Multiscale - Structutral Similarity Index Measurement (MS-SSIM) has analyzed the visual capabilities of each video player application. Experimental results prove that the KMPLayer application gets the best visual results compared to other selected applications.

Keywords – Application, video player, MP4, animation film.

1. INTRODUCTION

Video is a medium that displays audio and visuals. According to Wati, video is a fluorescent medium capable of producing images and sounds. Video has three main characters, namely showing, recording, and editing. Video art flourished in the mid-1960s internationally [1]. Video art works are integration between fine art and video media, including supporting devices such as monitors, video players, computers and model figures [2], [3]. Video is one of the media or entertainment facilities, but by humans video is also used for various things such as supporting facilities in learning, online communication facilities (video calls) and many more [4], [5].

Advances in technology make humans as creative, innovative and competitive creatures. One of the competitive forms of humans in the field of technology is the emergence of various video player applications offering different visual and audio quality due to the standard format used by each developer [6]. The following are video player applications that are often used by the public, namely VLC, Quick time, Potplayer, KMPLayer, Media Player Classic (MPC), DivX Player, ACG Player, Kodi, MediaMonkey, 5KPLayer, Plex, Fim & TV and SMPlayer. Some of the problems that are often encountered include [7], [8]: (1) Videos with poor visual quality have no appeal to watch and tend to make people quickly bored and bored so that a video player application with filters or standard settings is needed that is able to support the video so that able to slow down the feeling of saturation of society. (2) The diversity of video visual qualities produced by video player applications currently circulating makes people have to choose one of these applications. (3) Looking for an objective value of

the visual quality of the video produced by video player applications, so as to compare the visual quality between these applications. Therefore, this study was conducted to compare the image or visual quality produced by several video player applications by comparing the frames captured through these applications with the original frames of downloaded videos obtained from the video acquisition process. Through a computational method so that it can provide recommendations and it is hoped that when the community uses the application to watch a video it can slow down their feelings of saturation.

Measurement of the visual quality of the video player is carried out to obtain an objective assessment. In general, in providing an assessment of something, it can be done with two approaches, namely with a subjective approach and an objective approach [9]. Subjective assessment is obtained from the results of other people's opinions while objective assessment is obtained by measuring using certain measuring tools [10], [11]. In this case, a measurement of the visual quality produced by the video player application is carried out using a measuring instrument to produce an objective assessment where the visual quality is expressed by numerical numbers.

2. RESEARCH METHOD

2.1. Video

A video consists of several elements, including [12]:
- Frame Rate. When a continuous series of still images is played quickly and seen by the human eye, they will appear as a smooth movement. A minimum frame rate of 10 fps (frames per second) is required to produce smooth image movement. So it can be concluded that the frame rate is the number of images seen for each second.
- Aspect Ratio. Pixel aspect ratio describes the ratio or ratio between the width and the height of a pixel in an image. Frame aspect ratio describes the ratio of the width and height to the frame dimensions of an image.
- Spatial Resolution and Frame Size. Shows the width and height of a video frame or often referred to as the frame size, the unit used is the sample video pixels with a frame size of 640x480 pixels. Frame size can also be called resolution, the higher the image resolution, the greater the information that is loaded and the greater the memory requirement to read the information.
- Bit Level. Bit unit is the smallest unit in information storage, bit level or Bit depth states the number or number of bits stored to describe colors or pixels.
- Bit Rate. The bit rate is also known as the data rate. The bit rate determines the amount of data displayed while the video is playing. Data rates are expressed in units of bps (bits per second). The data rate itself is closely related to the use and selection of codecs (video compression methods).
- Video format. Video file formats are produced through video compression techniques, video file formats that are often used include AVI (Audio Video Interleaved), Matroska, FLV (Flash Video), and Video Codecs.

2.2. Proposed Method

The methods proposed in research are a method used by researchers to solve the problems raised. Likewise with this study, in this study there are several methods that will be used in each process as shown in Figure 1.
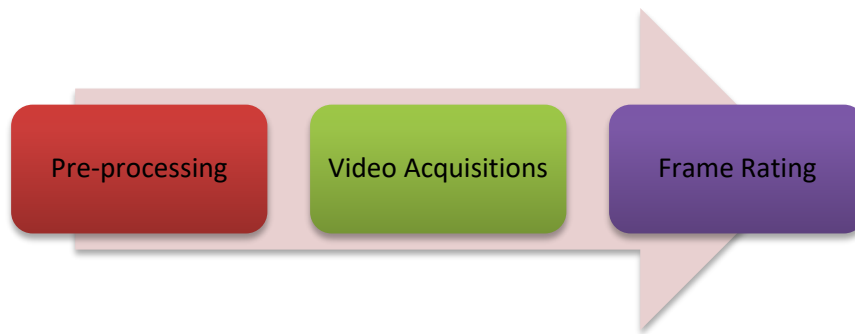
Figure 1. Proposed Method

The first stage is preprocessing. Before entering into the core process, namely the acquisition process and the SSIM calculation process, the video will be processed first. This process is in the form of a duration cutting process, where a long video with an average duration of 27 minutes will be cut into a video with an average duration of 47 seconds. Cutting the duration is used to make the video file can be loaded or read by Matlab. Matlab itself cannot read video files with long duration due to insufficient memory space. Therefore, this pre-processing needs to be done before entering the core process. To start this pre-processing stage, we need a tool that can cut the duration without destroying the original visuals of the video file to be studied. Therefore, here we will use the Free Video Cutter version 4.0.1 tool, with steps as shown in Figure 2.
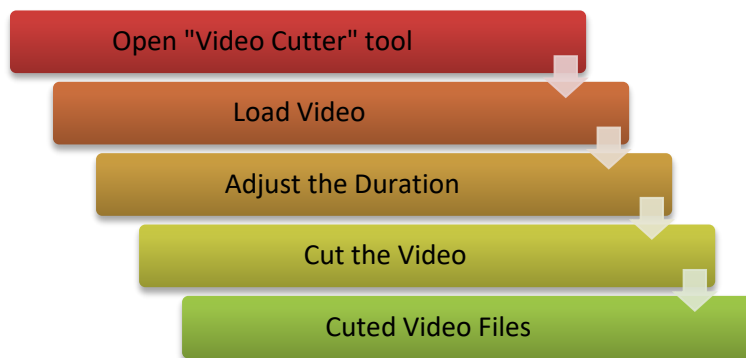
(a)
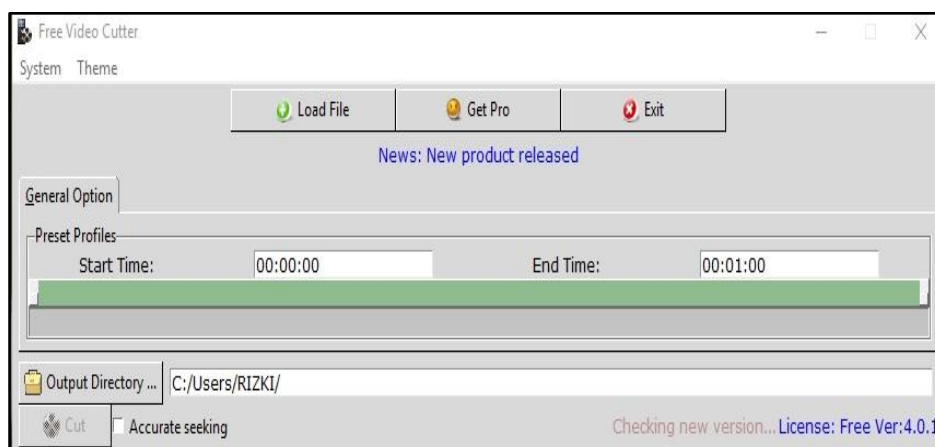
(b)

Figure 2. (a) Preprocessing Stage, (b) Free Video Cutter Display

Based on Figure 2 point a, the stages can be described as follows:

- Open the tool by double-clicking on the shortcut or the Free Video Cutter tool icon on the computer desktop.
- Load (input) the video file used in the study, by pressing the "Load File" button, then a dialog box will appear and select and double click on the video file or click once on the file then click open.
- Slide the tab duration on the "General Option - Preset Profiles" as desired, and press the "cut" button to save the video.

The second stage is image acquisitions. This video acquisition process is to get the frames in the video. In this process, two methods will be used, namely capturing and computation, as shown in Figure 3 below. The two methods below are used with the following conditions: the capturing method is used to obtain the test frame, while the computation method is used to obtain the original frame from the video file (frame reference). The video acquisition flow can be described as follows:

- The capturing method, where:
  - ✓ Reading of video files via video player applications,
  - ✓ The process of breaking the frame is done through the video capture feature, and
  - ✓ Saving of frames will be carried out automatically by the application.
- The computation method, where every process starting from the reading of the file to the storage process will be carried out using a series of functions and certain commands found in the matlab library [7].

In this paper, measurement of video quality in this study uses several calculations, including Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR) [13], Structutral Similarity Index Measurement (SSIM) [3], [14], [15], Threshold F-ratio, Visual Signal to Noise Ratio (VSNR), Visual Quality Metric (VQM) [13], and Multiscale - Structutral Similarity Index Measurement (MS-SSIM). Peak Signal-to-Noise Ratio (PSNR) is a simple function of Mean Squared Error (MSE) between reference and test video. Structural Similarity Index Measurement (SSIM) is a popular method for assessing the quality of still images. The SSIM index is applied frame by frame to the luminance component of the video. Multiscale SSIM (MS-SSIM) is an extension of SSIM that is also proposed for still images. The MS-SSIM index to video by applying it frame-by-frame to the video luminance component and the overall MS-SSIM to video is calculated as the average of the frame-quality score. Visual Signal-to-Noise Ratio (VSNR) is a quality rating algorithm proposed for still images. We applied frame-by-frame VSNR to the video lighting component and the overall VSNR index for the video was calculated as the average of the frame-by-frame VSNR scores. Video Quality Metric (VQM) is a video quality measurement algorithm developed by the National Telecommunications and Information Administration (NTIA).

3. RESULTS AND DISCUSSION

For each film, 3 different frames that are initialized with the letters A to C are selected according to the results of the pre-processing and video acquisition points as shown in Table 2.

Table 1. Dataset

No	Title	Link	Example frame
1	Tonikaku Kawaii Episode 9 Indonesian Subtitle	https://awsubs.co/tonikaku-kawaii-episode-9-subtitle-indonesia/#	
2	Maoujou de Oyasumi Episode 8 Indonesian Subtitle	https://awsubs.co/maoujou-de-oyasumi-episode-8-subtitle-indonesia/	
3	Shingeki no Kyojin: Chronicle Indonesian Subtitle	https://awsubs.co/shingeki-no-kyojin-chronicle-subtitle-indonesia-bd-bluray/	

Using the calculation of Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR), Structutral Similarity Index Measurement (SSIM), Threshold F-ratio, Visual Signal to Noise Ratio (VSNR), Visual Quality Metric (VQM), and Multiscale - Structutral Similarity Index Measurement (MS-SSIM, all video frames were tested using the VLC video player application, Quick Time, Potplayer, KMPLayer, Media Player Classic (MPC), DivX Player, ACG Player, Kodi, MediaMonkey as presented in Table 2 to Table 8.

Table 2. Comparison Results of MSE

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle										
1	A	0.8158	0.8625	0.8355	0.8655	0.8853	0.8332	0.8421	0.8563	0.8666
2	B	0.8677	0.8654	0.8625	0.8921	0.8455	0.8342	0.8221	0.8542	0.8541
3	C	0.8655	0.8966	0.8661	0.8774	0.8625	0.8741	0.8321	0.8544	0.8664
Maoujou de Oyasumi Episode 8 Indonesian Subtitle										
1	A	0.8644	0.8966	0.8687	0.8998	0.8224	0.8365	0.8112	0.8321	0.8233
2	C	0.8962	0.8455	0.8654	0.8825	0.8252	0.8633	0.8243	0.8551	0.8224
3	B	0.8799	0.8425	0.8824	0.8995	0.8362	0.8124	0.8143	0.8436	0.8223
Shingeki no Kyojin: Chronicle Indonesian Subtitle										
1	A	0.8567	0.8542	0.8577	0.8957	0.8421	0.8663	0.8335	0.8455	0.8425
2	B	0.8699	0.8654	0.8547	0.8957	0.8422	0.8542	0.8461	0.8441	0.8336
3	C	0.8762	0.8332	0.8622	0.8857	0.8622	0.8664	0.8426	0.8622	0.8265

Table 3. Comparison Results of PSNR

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle
1	A	81.22	69.58	72.16	89.93	73.54	68.89	63.98	70.15	73.06
2	B	82.65	72.11	73.15	89.65	73.69	72.65	72.58	73.25	75.14
3	C	80.09	71.05	72.58	88.72	74.99	77.45	69.99	73.59	77.69
Maoujou de Oyasumi Episode 8 Indonesian Subtitle
1	A	83.66	70.62	71.36	88.76	78.26	68.89	70.23	72.55	71.47
2	C	82.98	71.26	77.87	89.62	79.36	72.65	70.01	71.65	78.65
3	B	83.97	78.63	76.09	91.24	78.47	77.45	72.98	72.91	80.12
Shingeki no Kyojin: Chronicle Indonesian Subtitle
1	A	84.56	77.56	79.09	86.96	79.65	68.89	73.66	73.80	80.26
2	B	84.44	78.25	78.46	86.39	79.88	72.65	72.15	74.19	80.26
3	C	84.99	79.68	76.24	88.57	79.67	77.45	74.21	75.88	80.17

Table 4. Comparison Results of SSIM

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle
1	A	0.8766	0.8225	0.8677	0.9875	0.8669	0.9113	0.8867	0.8955	0.9106
2	B	0.8698	0.8356	0.8624	0.8988	0.8847	0.9017	0.8559	0.8567	0.9207
3	C	0.8665	0.8774	0.8772	0.9214	0.8962	0.9077	0.8795	0.8764	0.8897
Maoujou de Oyasumi Episode 8 Indonesian Subtitle
1	A	0.8765	0.8662	0.8655	0.9324	0.8911	0.8999	0.8966	0.8679	0.9920
2	C	0.8663	0.8775	0.8579	0.9554	0.8963	0.8756	0.8764	0.8887	0.8999
3	B	0.8766	0.8774	0.8647	0.9665	0.8977	0.8791	0.8237	0.8467	0.8977
Shingeki no Kyojin: Chronicle Indonesian Subtitle
1	A	0.8679	0.8567	0.8634	0.9677	0.8961	0.8697	0.8883	0.8817	0.8889
2	B	0.8673	0.8611	0.8633	0.9865	0.8965	0.9177	0.8749	0.8018	0.9017
3	C	0.8699	0.8730	0.8741	0.9736	0.8973	0.9189	0.8854	0.8907	0.9106

Table 5. Comparison Results of F-Ratio

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle
1	A	1.1055	0.9951	1.0068	1.1254	0.9987	0.9987	1.0006	0.8999	0.9998
2	B	1.1011	0.9968	1.0054	1.1368	1.0066	0.9668	1.0067	0.9999	1.0045
3	C	1.0651	0.9987	1.0540	1.1125	1.1107	0.9877	1.0068	1.0009	1.0689
Maoujou de Oyasumi Episode 8 Indonesian Subtitle
1	A	1.0687	1.0244	1.1035	1.1147	1.1097	0.8687	0.9999	1.0069	1.0899
2	C	1.0387	1.0670	1.0012	1.1125	1.0068	0.8775	0.9987	1.0687	1.0996
3	B	1.0688	0.9987	1.0068	1.1121	1.0998	0.9111	0.9888	1.1000	1.1000
Shingeki no Kyojin: Chronicle Indonesian Subtitle
1	A	1.1100	0.9999	0.9998	1.0699	1.0987	0.9241	1.0698	1.1008	1.0998
2	B	1.1103	0.9987	0.9587	1.0998	1.0966	0.9334	1.1089	1.0087	1.0987
3	C	1.0997	1.0005	0.9998	1.0997	1.1187	0.9279	1.1099	0.9999	0.9999

Table 6. Comparison Results of VSNR

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle										
1	A	156.26	162.78	153.87	168.99	162.77	156.99	156.77	161.27	160.00
2	B	155.25	161.77	155.74	167.71	157.99	157.63	158.33	160.77	160.89
3	C	157.69	160.78	155.89	165.89	157.06	159.70	156.97	160.87	158.62
Maoujou de Oyasumi Episode 8 Indonesian Subtitle										
1	A	161.25	157.56	162.38	169.37	159.27	152.73	158.67	161.22	159.67
2	C	162.34	157.66	163.66	168.99	159.89	154.96	156.91	160.89	162.78
3	B	165.88	160.44	164.87	167.00	157.66	157.22	156.77	152.74	163.55
Shingeki no Kyojin: Chronicle Indonesian Subtitle										
1	A	161.89	150.77	162.44	168.11	158.90	156.33	157.96	153.77	165.97
2	B	158.99	157.01	160.60	168.09	157.34	157.83	157.30	152.09	165.30
3	C	152.73	160.07	160.77	167.37	156.94	155.89	154.63	154.77	163.11

Table 7. Comparison Results of VQM

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle										
1	A	90.07	92.66	93.77	98.97	92.67	98.37	96.37	98.66	95.78
2	B	91.26	93.78	94.17	99.87	95.88	98.77	96.77	98.06	97.73
3	C	93.77	93.89	96.35	98.89	96.71	98.88	95.03	96.08	95.89
Maoujou de Oyasumi Episode 8 Indonesian Subtitle										
1	A	92.33	94.27	95.70	98.99	96.37	95.74	96.87	96.01	96.99
2	C	91.47	98.00	96.88	98.99	98.01	95.78	96.00	94.99	94.09
3	B	91.43	98.21	98.00	98.76	97.89	96.78	95.30	95.47	93.77
Shingeki no Kyojin: Chronicle Indonesian Subtitle										
1	A	92.70	97.67	98.87	99.06	96.87	95.99	96.07	97.68	96.74
2	B	93.88	95.11	96.77	99.67	96.77	96.78	95.09	97.56	98.62
3	C	93.67	95.30	97.31	98.88	96.16	96.28	98.01	98.00	97.61

Table 8. Comparison Results of MS-SSIM

No	File name	VLC	Quick time	Potplyer	KMPlayer	MPC	DivX Player	ACG Player	Kodi	MediaMonkey
Tonikaku Kawaii Episode 9 Indonesian Subtitle										
1	A	154.69	155.67	166.07	169.22	166.08	166.27	164.33	163.98	164.08
2	B	160.39	159.68	165.09	168.87	166.87	167.00	164.07	166.57	164.09
3	C	162.33	158.63	165.34	168.22	165.00	165.09	164.58	166.37	167.08
Maoujou de Oyasumi Episode 8 Indonesian Subtitle										
1	A	162.37	166.22	166.89	167.86	164.87	166.07	165.00	166.27	166.31
2	C	163.74	166.59	166.88	169.77	165.33	164.29	166.00	166.08	165.33
3	B	165.96	165.99	163.33	168.97	165.01	163.77	164.39	166.87	164.06
Shingeki no Kyojin: Chronicle Indonesian Subtitle										
1	A	164.07	163.79	164.80	169.23	164.08	164.99	163.87	166.07	165.07
2	B	166.07	165.77	165.44	168.63	164.09	166.78	163.57	167.21	166.88
3	C	164.98	165.09	164.59	168.77	164.33	166.89	167.77	163.09	165.44

Based on the results obtained in Table 2 to Table 8, the best value of each result has been taken and has been compared with the aim of further analysis to determine the video player application that produces the best quality. It can be seen that KMPlayer produces the highest score among other video player applications that have been selected in this paper, so

it can be concluded that KMPlayer is the best video player application that can be used by the public.

4. CONCLUSION

Based on 3 films with a duration of 47 seconds with a total of 3 frames (taken randomly), in this study 9 video player applications were used, namely VLC, Quick Time, Potplayer, KMPLayer, Media Player Classic (MPC), DivX Player, ACG. Player, Kodi, MediaMonkey which have been tested visually using the capturing and computation methods using Matlab software, have obtained various results using various calculations to analyze visual results on Mean Square Error (MSE), Peak Signal to Noise Ratio (PSNR), Structutral Similarity Index Measurement (SSIM), Threshold F-ratio, Visual Signal to Noise Ratio (VSNR), Visual Quality Metric (VQM), and Multiscale - Structutral Similarity Index Measurement (MS-SSIM). Based on the calculation results, it is known that KMPlayer shows the best results in all calculations performed. KMPlayer can be used as a recommendation as the best video player.

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