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Investigation on Mapping Model of Packet Loss Rate and the Quality of Experience

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Abstract — In order to study the influence of packet loss on the users' quality of experience QoE and establish the Mapping model of the two when the video transmit in the network, building a NS2+MyEvalvid simulation platform, by the method of modifying QoS parameters to simulate different degrees of packet loss, focus on the influence of packet loss on QoE and establish the mapping model between them. Experimental results show that, packet loss has a significant influence on Quality of experience. Packet loss rate and the Quality of experience presents a nonlinear relationship, and use mat lab to establish the mapping model, this model's accuracy is high, easy to operate, can real-time detect packet loss has influences on the user's quality of experience(QoE).

Keyword — packet loss; packet loss rate; influence; Quality of experience; Mapping model;

I. INTRODUCTION

Through in-depth analysis of network video distortion, we can know the major form of network video transmission distortion is delay, packet loss and jitter. Among them, delay almost has no effect on the quality of the video, and the effect caused by the network jitter is packet loss, so unified used the packet loss rate to measure the performance of the influence on the users' Quality of experience. Therefore, we study the influence of packet loss on QoE and establish the Mapping model of packet loss rate and the Quality of experience. Study on the mapping model of packet loss rate and the Quality of experience on the influence of packet loss on QoE is mainly for give the majority of the users bring good visual experience, for optimization of digital video assessment system, communication quality monitoring, provide theory, technology and method of support for the area of consumer media grading.

II. METHODOLOGY

Due to study the effect of packet loss on the user's quality of experience QoE's aim is to allow users to obtain good quality of experience, so needs to establish mapping model of packet loss rate and the Quality of experience by modifying the QoS parameters of the methods to make the packet loss rate small and user's quality of experience large. As is known to all, QoE evaluation method mainly includes subjective method and objective method, the subjective method is very difficult to operate. So objective QoE evaluation method that make the packet loss rate get from measured mapping into the user's quality of experience QoE become one new kind of thought. For the current mainstream video on demand for application of PPLIVE, Optimal library and so on, studied the relationship between PSNR and packet loss rate that when 400k code, through the linear, square, hybrid, logarithmic, power, third power after model match we can found between the packet loss rate and the PSNR value (MOS value) had third power relations, established the regression equation like:

$$y = ax + bx^2 + cx^3 + d \qquad [1]$$

In this paper, src13_hrc1_525.yuv video was used as an example, after the establishment of scattered plot of this video's packet loss rate and PSNR value, observed the scatter plot can be found, packet loss rate and the PSNR values were presented a nonlinear relationship, referenced the PPLIVE packet loss rate and the PSNR values' relation model, under wired and wireless environment we established the regression equation like:

$$y = ax + bx^2 + cx^3 + d$$

First of all, we used of mat lab conduct a nonlinear fitting to compute the coefficients of the regression equations and conducted the fitting curve of the src13_hrc1_525.yuv video's packet loss rate to the PSNR value's scatter plot. The second, we had the reliability test and the performance evaluation of the model. At last, used the regression equation to forecast and control. Reference [2, 3] puts forward that affecting the video quality's main network QoS parameters such as delay and jitter are characterized by packet loss, therefore, adopts packet loss rate for a unified measure of the quality of the video, combined with the human visual characteristics, and proposes a real-time video quality assessment model based on network packet loss. Reference [4] describes the factors affecting QoE include the perception the user's

emotional state to the video, also include packet loss. Forsrc13_hrc1_525.yuv video, in order to make more precise quantitative of QoE, used MOS quantitative QoE method, the mapping model of packet loss rate and the Quality of experience was as shown below:
Wired environment:

$$y=41.7383\,x^{3}-68.9554x^{2}+29.2980x+26.8264$$

Wireless environment:

$$y=18450x^{3}-211.3x^{2}+72.35x+23.61$$

However, it lack set up considering network packet loss of video quality evaluation model, on the basis of considering different packet loss rate and different content complexity has effects on QoE which conclude from packet loss has effects on QoE's part, combine consider other factors such as different packet loss models to establish video quality evaluation model consider the network packet loss, more accurate prediction of user's quality of experience QoE is the future work direction.

III. RESULTS AND DISCUSSION

For the src13_hrc1_525.yuv video, packet loss rate and the PSNR value relationship's scatter plot under the environment of the wired using a nonlinear regression analysis PSNR quantitative method after fitting the fitted curve is as shown in figure 1 and Wireless environment as shown in figure 2. Two figures' horizontal axis is packet loss rate; the vertical axis represents the PSNR values. Figure 1 curves first increased and then decreased and then increased, there are two turning points. Figure 2 that is why the src13 wireless environment data points less is that when obtained different packet loss rate in modifying parameters, in the case of different multiple parameter settings, the packet loss rate and the PSNR values are repeat in cycles. As a result, the final shape of the curve is roughly on the rise, no obvious turning point, can be thought of as in the wireless environment src13 with the increase of packet loss rate, PSNR value increased gradually. In the end, by comparing figure 1 and figure 2 we can be found, use the same video such as are all src13 video, can be thought of as due to the different topology structure and network environment which is the difference between wired and wireless environment resulted in the wire environment has two turning points and wireless environment do not have a turning point. The topology structure and different network environment has impact on users' quality of experience QoE. MOS quantitative QoE method is as shown in figure 3 and 4. Two figures' horizontal axis are packet loss rate, the vertical axis are MOS quantitative QoE values. Two figures' linear and PSNR method quantitative QoE is basically the same.

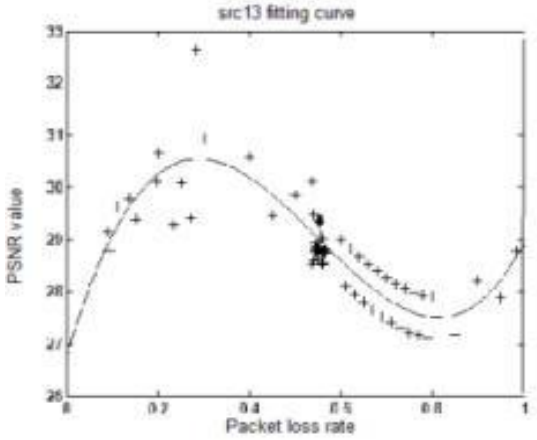

Fig 1. src13 wired Network environment

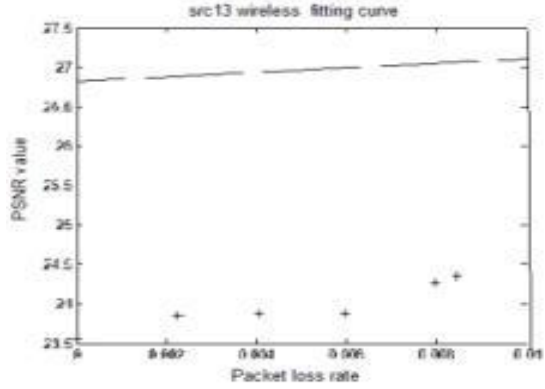

Fig 2. src13 wireless network environment

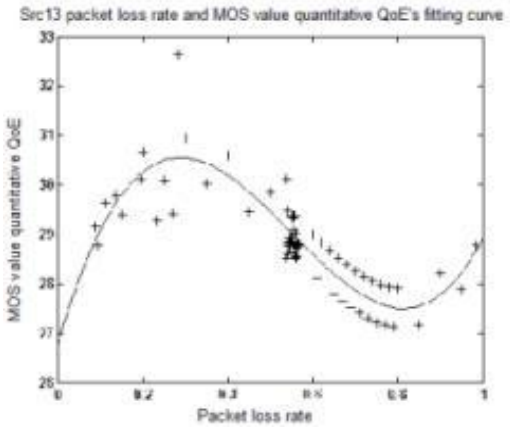

Fig 3. src13 wired Network environment

By observing the fitting curve, we can find that packet loss rate and the user's quality of experience QoE presents a nonlinear relationship. For src13_hrc1_525.yuv video, make the fitting curve of the scatter plot, wired and wireless environments respectively using PSNR method and MOS method quantitative QoE's performance index as follows in Table 1 and Table 2. The evaluation indexes are mainly R-square; RMSE (Root Mean Square Error, RMSE), SSE, SROCC (Spearman Rank Order Correlation Coefficient, SROCC), Pearson, OR (Outlier Ratio), Spearman, and these values are between 0 and

1. Which R-Square is called the adjusted coefficient of determination, the greater the value is, believe that the better the fitting effect of the model. RMSE is called the root mean square error, it is a kind of numerical indicators measuring accuracy of measurement, the smaller this value is, believe that the better fitting effect of the model. SSE is the sum of squared residuals, it is also a kind of numerical indicators measuring accuracy of measurement, the smaller this value is, believe that the better fitting effect of the model.

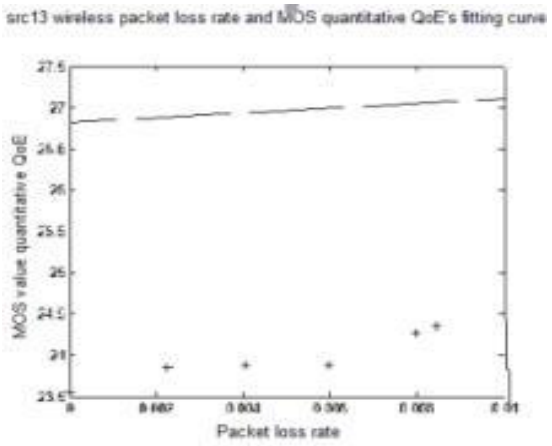

Fig 4. Src13 wireless network environment.

SROCC is the spearman correlation coefficient (SROCC) between objective and subjective score, used to detect the monotonicity of model prediction, the greater the coefficient is, the change trend increasingly relevant, methods are better. Pearson correlation coefficient is used to measure whether the two data sets on a line, it is used to measure linear relationship between the distance variables, the greater the correlation coefficient, the stronger the correlation. OR said out rate, a measure of the stability of model prediction, this value is small, the better the performance of the model. The greater the Spearman coefficient betters the performance of the model.

Table 1 PSNR quantitative QoE method

Video	R-square	RMSE	SSE	SROCC	Pearson	OR	Spearman
Src13*	0.7271	0.2188	4.69	0.888	0.9917	0	0.9832
13**	0.6779	0.0681	0.167	0.866	1	0	0.9789
PSNR	-0.588	0.16	0.2	0.634	0.71	0.543	0.688
SSIM	0.666	0.15	0.18	0.815	0.83	0.744	0.766
* Wired **Wireless							

Table 2 MOS quantitative QoE method

Video	R-square	RMSE	SSE	SROCC	Pearson	OR	Spearman
Src13*	0.7271	0.438	18.76	1	0.9917	0	0.9832
13**	0.8392	0.096	0.333	1	0.9163	0	0.9789
PSNR	0.588	20.16	0.2	0.634	0.71	0.543	0.688
SSIM	0.666	0.15	0.18	0.815	0.83	0.744	0.766
* Wired **Wireless							

Comprehensive look at table 1 and table 2 can be found, the horizontal header is coefficient of each measure, and the vertical header is a variety of methods, discovered by table 1 src13 wired indicators better than src13 wireless indicators, prove src13 wired fitting effect is better, discovered by table 2 src13 wired indicators better than src13 wireless indicators. Contrast table 1 and 2 can be found, MOS quantitative QoE method better than the PSNR quantitative QoE method. Due to the sum of squared residuals SSE is small, so the root mean square error RMSE is small, the adjust coefficient of determination R-Square is bigger, so you can think the fitting effect is better, the fitting is effective. The inspection of the fitting equation is mainly through the test of goodness of fit (Determination coefficient R-square test). Among them, determination coefficient R square is the most commonly used indicators used to determine regression model fitting degree pros and cons, the more close to 1, the higher of the degree of the fitting model. For src13_hrc1_525.yuv video, in the wired and wireless environment, in the case of using PSNR quantitative QoE method, determination coefficient R-square is 0.7271 and 0.6779, close to 1, the model is of good performance. SROCC is respectively 0.8884 and 0.8659, bigger than the traditional evaluation method PSNR and SSIM's SROCC, so think this model's fitting effect is well. In the case of using MOS quantitative QoE method, determination coefficient R-square is 0.7271 and 0.8392, close to 1, the model is of good performance. SROCC is respectively 0.9998 and 1, bigger than the traditional evaluation method PSNR and SSIM's SROCC, so think this model's fitting effect is well. At the same time, compared with PSNR quantitative QoE, SROCC is bigger than that one, so think MOS value quantitative QoE method is better than the PSNR value quantitative QoE. The experimental results show that the model accuracy is high, easy to operate, can real-time detect packet loss has influences on the user's Quality of experience.

IV.CONCLUSION

Experimental results show that packet loss rate and the Quality of experience presents a nonlinear relationship, and we use mat lab to establish the mapping model, this model's accuracy is high, easy to operate, and can real-time detect packet loss has influences on the user's quality of experience(QoE).

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REFERENCE

[1]. Huayong Liu, Lingyun Pan, Wenting Meng. Key Frame Extraction from Online Video Based on Improved Frame Difference Optimization Proceedings of 2012 IEEE 14th International Conference on Communication Technology 2012.

[2]. Amy R. Reibman, Vinay A. Vaishampayan, Yegnaswamy Sermadevi, Quality Monitoring of Video over a Packet Network, IEEE Transactions on Multimedia, 2004.

[3]. Verscheure Olivier, Frossard Pascal, Hamdi Maher.MPEG-2video services over packet networks: Joint effect of encoding rate and data loss on user-oriented QoS. Proceedings of the 8th International Workshop on Network and Operating Systems Support for Digital Audio and Video, 1998.

[4]. K. Yamagishi, T. Hayashi. Analysis of psychological factors for quality assessment of interactive multimodal service, Electronic Imaging, 2005:130-138.

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