

# QOE Forecast Under the WSN Internet of Things

Yibin Hou<sup>1</sup>, Jin Wang<sup>1,2,3</sup>

<sup>1</sup>School of Software Engineering, Department of Information, Beijing University of Technology, Beijing, China

<sup>2</sup>Computer Science and Technology, Shijiazhuang Railway University, Shijiazhuang, China

<sup>3</sup>Computer Center, Navy General Hospital, Beijing, China

## Email address:

yhou@bjut.edu.cn (Yibin Hou), ybhou@bjut.edu.cn (Yibin Hou), 805372192@qq.com (Jin Wang)

## To cite this article:

Yibin Hou, Jin Wang. QOE Forecast Under the WSN Internet of Things. *Internet of Things and Cloud Computing*.

Vol. 5, No. 2, 2017, pp. 29-37. doi: 10.11648/j.iotcc.20170502.12

Received: February 21, 2017; Accepted: April 13, 2017; Published: June 7, 2017

---

**Abstract:** The Internet of things, including Internet technology, including wired and wireless networks. In this paper, we investigate on the QOE because QOE is important in the network and packet loss rate is the key point in many papers. In order to study the QOE forecast under the Internet of things, building a NS2+MyEvalvid simulation platform, by the method of modifying QoS parameters to simulate different degrees of packet loss, focus on the QOE forecast under the Internet of things. Experimental results show that, QOE forecast under the Internet of things have many methods and is very important. SVM+PCA is an important method in the field of Internet of things, the Internet of things, including Internet technology, WSN networks, RFID can be part of the WSN network.

**Keywords:** QOE, Forecast, Internet of Things

---

## 1. Introduction

Lot of QOE prediction mainly includes the MOS, subjective and objective forecast and DMOS religion and resolving PSNR and SSIM. MOS subjective values can predict QOE, objective value can be predicted PSNR. MOS method, including subjective value and objective value of religion is shown below, SVM+PCA is an important method in the field of Internet of things, the Internet of things, including Internet technology, WSN networks, RFID can be part of the WSN network [1].

## 2. QOE Forecast Method One

Method one: MOS of subjective value [2]. This is for Live library, fitting results:

$$\text{MOS} = -24.3816 * (0.5 - 1. / (1 + \exp(-0.56962 * (\text{PSNR} - 27.49855)))) + 1.9663 * \text{PSNR} - 2.37071;$$
$$\text{MOS} = 2062.3 * (1 / (1 + \exp(-11.8 * (\text{SSIM} - 1.3)))) + 0.5 + 40.6 * \text{SSIM} - 1035.6$$

Or

$$\text{MOS} = 2062.3 * (1 / (1 + \exp(-11.8 * (\text{ssim} - 1.3)))) + 0.5 + 40.6 * \text{ssi} - 1035.6$$

Have the MOS, using this formula can't take the SSIM, if

have the SSIM can calculate MOS.

Promote and extend to the field of video I still intend to use these two formulas, the two formulas can be PSNR to MOS, recycle the second formula and SSIM, SSIM distortion cannot used when it is calculated before and after the distortion of the two video, just need to MOS seek out SSIM values can be obtained. For SRC13, X input, the use of  $y = 24.3816 * (0.5 - 1 / (1 + \exp(0.56962 * (27.49855 - X)))) + 1.9663 * X - 1.9663$ , there is no space between the symbols in the matlab can run successfully. This formula can be used to find out the MOS distortion. After the distortion of MOS values into a 0-100 range is as follows: MOS\*5 distortion can be characterized to the range of 0-100. Calculation of MOS value is above the MOS value after the distortion, the following using  $\text{MOS} = y / (1 - x)$  calculate the original MOS, x represents the packet loss rate, 1 - x indicates no lost that part, y is the PSNR, video distortion after the objective quality of divided by that part without distortion, MOS value is the original [3].

Calculation of the MOS of the original use of MOS distortion calculation: after the MOS original = MOS distortion (no into the range of 0-100) / (1-x) = y / (1-x), calculate the MOS original later, 5 times to expand, as computing DMOS the 0-100 range. 15.7022 the calculate, after using it again.

Calculate the DMOS.  $DMOS = x - y + 5$ , MOS distortion  $x$ ,  $y$  MOS original (into the range of 0-100). Calculate the DMOS is negative, so plus 5 can, such as DMOS is 1.6850, and after 5 is 3.1831708. SRC13 second cross group data cable as examples. MOS0 is MOS of the original meaning.

$x=[14.672341, 14.682139, 14.388424, 14.388424, 14.388424, 14.682139, 14.682139, 16.324315, 14.736256, 15.054570, 14.262893, 14.297665, 14.387770, 14.387770, 14.424601, 14.382842, 14.465971, 14.465971, 14.437866, 14.437976, 14.437866, 14.437866, 14.437866, 14.682139, 14.682139, 14.682139, 14.682139, 14.682139, 14.659295, 14.689716, 14.659295, 14.659295, 14.659295, 14.660929, 14.660929, 14.660929, 14.659886, 14.682139, 14.544389, 14.391538, 14.385956, 14.385956, 14.387814, 14.387814, 14.387814, 14.279177, 14.279177, 14.278516, 14.682139, 14.278516, 14.262044, 14.278516, 14.271338, 14.514082, 14.386667, 14.373042, 14.373042, 14.373042, 14.399853, 14.399853, 14.689716, 14.580482, 14.388229, 14.642998, 14.700992, 14.887952, 15.060173]$ , as shown in figure 1.

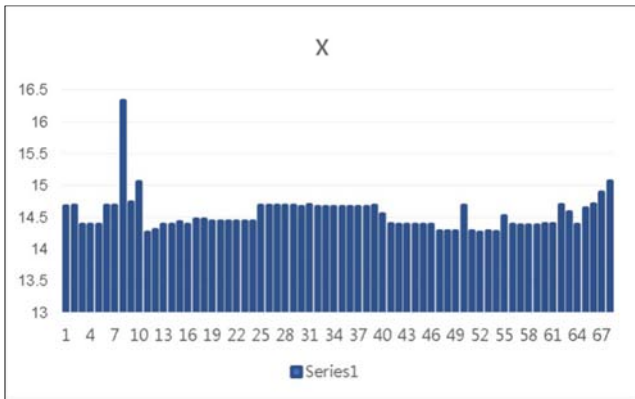


Figure 1. Data of x.

$$y = -24.3816 * (0.5 - 1 / (1 + \exp(-0.56962 * (x - 27.49855)))) + 1.9663 * x - 2.37071$$

$y=[14.3051, 14.3244, 13.7444, 13.7444, 13.7444, 14.3244, 14.3244, 17.5789, 14.4314, 15.0606, 13.4966, 13.5652, 13.7431, 13.7431, 13.8158, 13.7333, 13.8975, 13.8975, 13.8420, 13.8422, 13.8420, 13.8420, 13.8420, 13.8420, 14.3244, 14.3244, 14.3244, 14.3244, 14.3244, 14.2793, 14.3394, 14.2793, 14.2793, 14.2793, 14.2825, 14.2825, 14.2825, 14.2805, 14.3244, 14.0523, 13.7505, 13.7395, 13.7395, 13.7432, 13.7432, 13.7432, 13.5287, 13.5287, 13.5274, 14.3244, 13.5274, 13.4949, 13.5274, 13.5132, 13.9925, 13.7409, 13.7140, 13.7140, 13.7140, 13.7669, 13.7669, 14.3394, 14.1236, 13.7440, 14.2471, 14.3617, 14.7312, 15.0717]$

Calculation of the original MOS, by computing the distortion after MOS: the original MOS / =MOS distortion  $(1-x) = y / (1-x)$  (not put to the range of 0-100 MOS) [4].

$y=[14.3051, 14.3244, 13.7444, 13.7444, 13.7444, 14.3244, 14.3244, 17.5789, 14.4314, 15.0606, 13.4966, 13.5652, 13.7431, 13.7431, 13.8158, 13.7333, 13.8975, 13.8975, 13.8420, 13.8422, 13.8420, 13.8420, 13.8420, 13.8420, 14.3244, 14.3244, 14.3244, 14.3244, 14.3244, 14.2793, 14.3394, 14.2793, 14.2793, 14.2793, 14.2825, 14.2825, 14.2825, 14.2805, 14.3244, 14.0523, 13.7505, 13.7395, 13.7395, 13.7432, 13.7432, 13.7432, 13.5287, 13.5287, 13.5274, 14.3244, 13.5274, 13.4949, 13.5274, 13.5132, 13.9925, 13.7409, 13.7140, 13.7140, 13.7140, 13.7669, 13.7669, 14.3394, 14.1236, 13.7440, 14.2471, 14.3617, 14.7312, 15.0717]$

$14.3394, 14.2793, 14.2793, 14.2793, 14.2825, 14.2825, 14.2825, 14.2805, 14.3244, 14.0523, 13.7505, 13.7395, 13.7395, 13.7432, 13.7432, 13.7432, 13.5287, 13.5287, 13.5274, 14.3244, 13.5274, 13.4949, 13.5274, 13.5132, 13.9925, 13.7409, 13.7140, 13.7140, 13.7140, 13.7669, 13.7669, 14.3394, 14.1236, 13.7440, 14.2471, 14.3617, 14.7312, 15.0717]$ , as shown in figure 2.

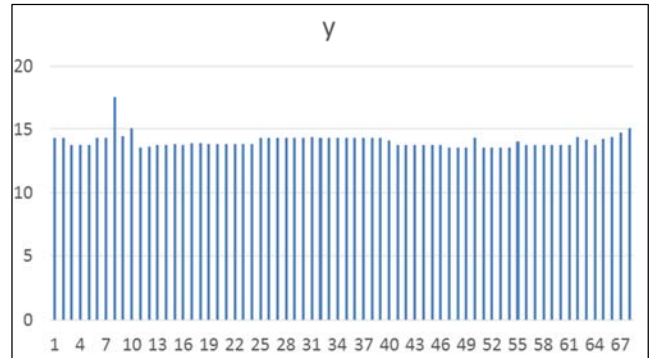


Figure 2. Data of y.

$x=[0.553226, 0.550704, 0.982976, 0.556273, 0.549443, 0.549758, 0.552805, 0.283545, 0.540145, 0.537262, 0.538203, 0.539702, 0.542737, 0.541647, 0.542729, 0.545425, 0.545541, 0.547346, 0.547459, 0.549063, 0.548133, 0.548719, 0.552747, 0.550203, 0.548882, 0.555249, 0.54923, 0.54973, 0.55027, 0.55124, 0.55099, 0.55124, 0.55159, 0.55181, 0.55225, 0.55264, 0.55264, 0.55301, 0.54923, 0.5543, 0.55501, 0.55729, 0.5564, 0.55595, 0.55869, 0.56101, 0.5579, 0.56059, 0.55784, 0.54923, 0.55897, 0.560698, 0.55934, 0.561969, 0.560797, 0.56393, 0.560823, 0.565552, 0.564101, 0.563499, 0.567126, 0.556936, 0.087745, 0.094223, 0.233489, 0.271164, 0.134722, 0.196683]$ , as shown in figure 3.

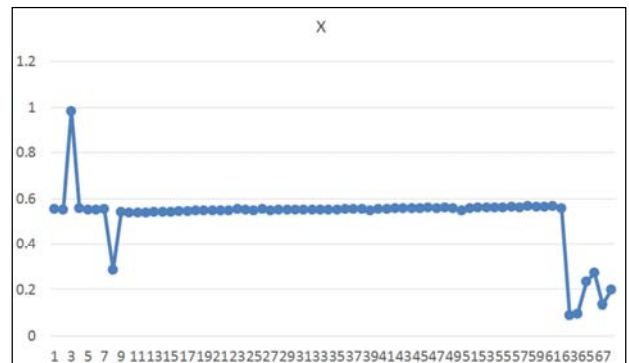


Figure 3. Data of x.

$mos=y/(1-x), mos = 15.6810, 15.7022, 15.0664, 15.0664, 15.0664, 15.7022, 15.7022, 19.2697, 15.8195, 16.5092, 14.7948, 14.8700, 15.0650, 15.0650, 15.1447, 15.0542, 15.2342, 15.2342, 15.1734, 15.1736, 15.1734, 15.1734, 15.1734, 15.1734, 15.1734, 15.7022, 15.7022, 15.7022, 15.7022, 15.7022, 15.6528, 15.7186, 15.6528, 15.6528, 15.6528, 15.6563, 15.6563, 15.6563, 15.6541, 15.7022, 15.4039, 15.0731, 15.0610, 15.0610, 15.0651, 15.0651, 15.0651, 14.8300, 14.8300, 14.8285, 15.7022, 14.8285, 14.7929,$

14.8285, 14.8130, 15.3384, 15.0626, 15.0331, 15.0331, 15.0331, 15.0911, 15.0911, 15.7186, 15.4821, 15.0660, 15.6175, 15.7431, 16.1481, 16.5214

MOS original expand five times =[76.1850, 78.5110, 75.3320, 75.3320, 75.3320, 76.1955, 76.1965, 96.3485, 79.0975, 82.5460, 73.9740, 74.3500, 75.3250, 75.3250, 75.7235, 75.8715, 75.9610, 75.9610, 75.8670, 75.9310, 75.8670, 75.8670, 75.8670, 75.8670, 78.5110, 78.5110, 78.5110, 78.5110, 78.2640, 78.5930, 78.2640, 78.2640, 78.2640, 78.2815, 78.2815, 78.2815, 78.2705, 78.5110, 77.0195, 75.3655, 75.3050, 75.3050, 75.3255, 75.3255, 75.3255, 74.1500, 74.1500, 74.1425, 78.5110, 74.1425, 73.9645, 74.1425, 74.1425, 74.0650, 76.6920, 75.3130, 75.1655, 75.1655, 75.1655, 75.4555, 75.4555, 78.5930, 77.4105, 75.3300, 78.0875, 78.7155, 80.7405, 82.6070], as shown in figure 4.

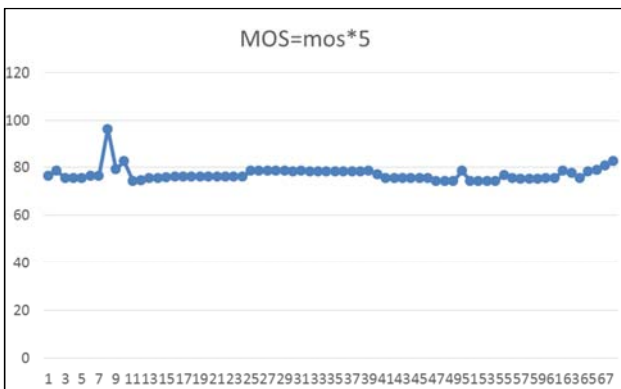


Figure 4. Data of MOS.

Calculation of DMOS method:  $x = 69.5000, 71.6220, 68.7220, 68.7220, 68.7220, 69.5095, 69.5105, 87.8945, 72.1570, 75.3030, 67.4830, 67.8260, 68.7155, 68.7155, 69.0790, 69.2140, 69.2960, 69.2960, 69.2100, 69.2685, 69.2100, 69.2100, 69.2100, 69.2100, 71.6220, 71.6220, 71.6220, 71.3965, 71.6970, 71.3965, 71.3965, 71.3965, 71.4125, 71.4125, 71.4125, 71.4025, 71.6220, 70.2615, 68.7525, 68.6975, 68.6975, 68.7160, 68.7160, 68.7160, 67.6435, 67.6435, 67.6370, 71.6220, 67.6370, 67.4745, 67.6370, 67.5660, 69.9625, 68.7045, 68.5700, 68.5700, 68.5700, 68.8345, 68.8345, 71.6970, 70.6180, 68.7200, 71.2355, 71.8085, 73.6560, 75.3585$ , as shown in figure 5.

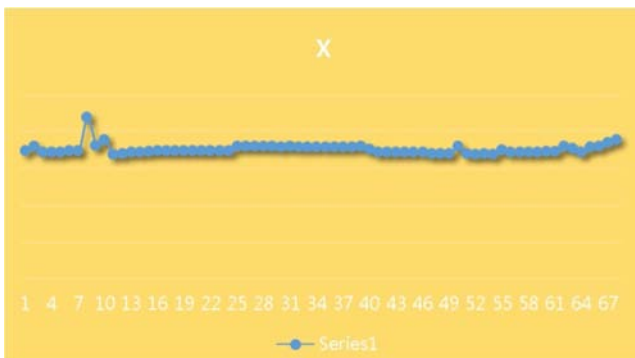


Figure 5. Data of x.

$y = [76.185, 78.511, 75.332, 75.332, 75.332, 76.1955, 76.1965, 96.3485, 79.0975, 82.546, 73.974, 74.35, 75.325, 75.325, 75.7235, 75.8715, 75.961, 75.961, 75.867, 75.931, 75.867, 75.867, 75.867, 75.867, 78.511, 78.511, 78.511, 78.511, 78.511, 78.264, 78.593, 78.264, 78.264, 78.264, 78.2815, 78.2815, 78.2815, 78.2705, 78.511, 77.0195, 75.3655, 75.305, 75.305, 75.3255, 75.3255, 75.3255, 74.15, 74.15, 74.1425, 78.511, 74.1425, 73.9645, 74.1425, 74.1425, 74.065, 76.692, 75.313, 75.1655, 75.1655, 75.1655, 75.4555, 75.4555, 78.593, 77.4105, 75.33, 78.0875, 78.7155, 80.7405, 82.607]$ , as shown in figure 6.

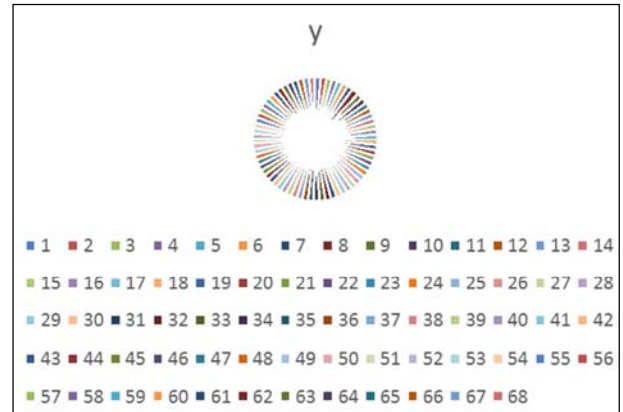


Figure 6. Data of y.

DMOS= $x-y+5$   
 DMOS = -1.6850, -1.8890, -1.6100, -1.6100, -1.6100, -1.6860, -1.6860, -3.4540, -1.9405, -2.2430, -1.4910, -1.5240, -1.6095, -1.6095, -1.6445, -1.6575, -1.6650, -1.6650, -1.6570, -1.6625, -1.6570, -1.6570, -1.6570, -1.6570, -1.8890, -1.8890, -1.8890, -1.8890, -1.8675, -1.8960, -1.8675, -1.8675, -1.8675, -1.8690, -1.8690, -1.8690, -1.8690, -1.8680, -1.8890, -1.7580, -1.6130, -1.6075, -1.6075, -1.6095, -1.6095, -1.6095, -1.5065, -1.5065, -1.5055, -1.8890, -1.5055, -1.4900, -1.5055, -1.4990, -1.7295, -1.6085, -1.5955, -1.5955, -1.5955, -1.6210, -1.6210, -1.8960, -1.7925, -1.6100, -1.8520, -1.9070, -2.0845, -2.2485, as shown in figure 7.

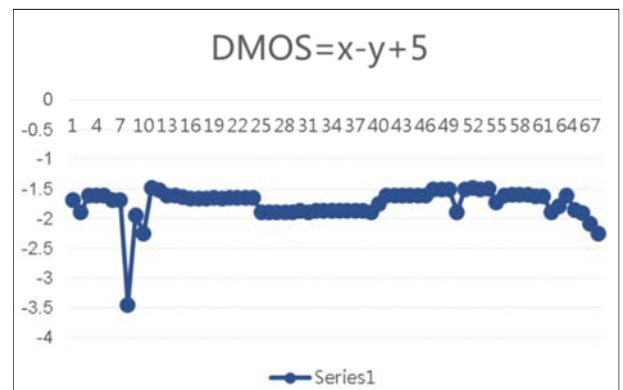


Figure 7. Data of DMOS.

### 3. QOE Forecast Method Two

Method 2:  
 MOS = 5-4 \* VQM, first using the VQM BVQM [5],

because is not in the interval [0, 1], so as to [0, 1] interval can, finally find out the MOS. BVQM is the development of ITS group a for video quality assessment software, the evaluation method and calibration method have respectively been ITU - T Recommendation j. 144, ITU - T Recommendation j. 244 standard included, have high evaluation accuracy [6], through the calculation of BVQM, can be in the interval [0, 1] on the objective value for the video (VQM). Put `bvqm_src_v21` in D dish my database - MATLAB folder, and then open the MATLAB BVQM operation. Results are shown below as figure 8 and figure 9 [7].

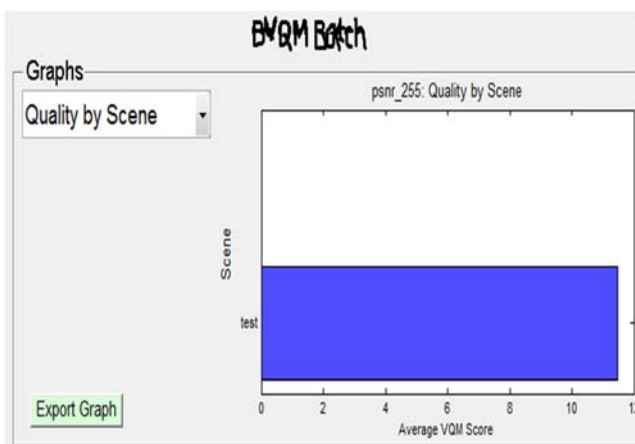
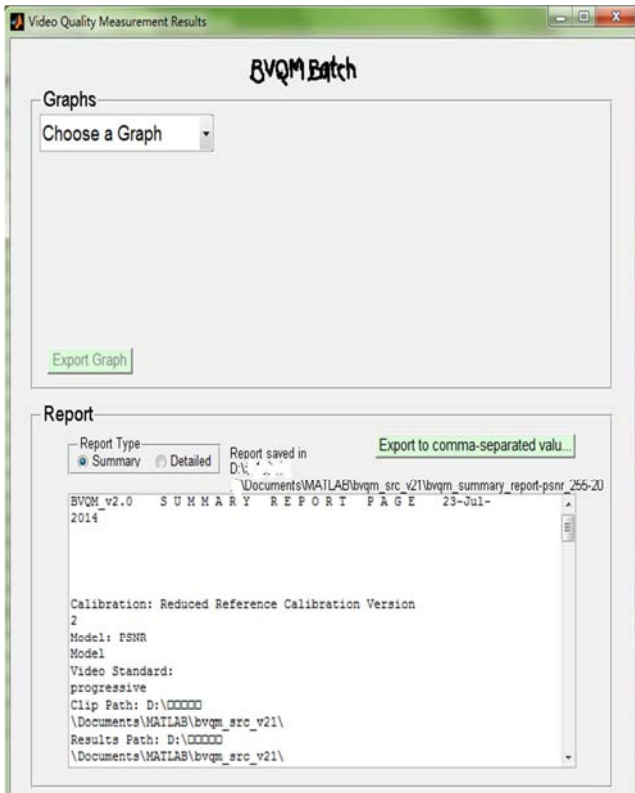


Figure 8. VQM use psnr\_255.

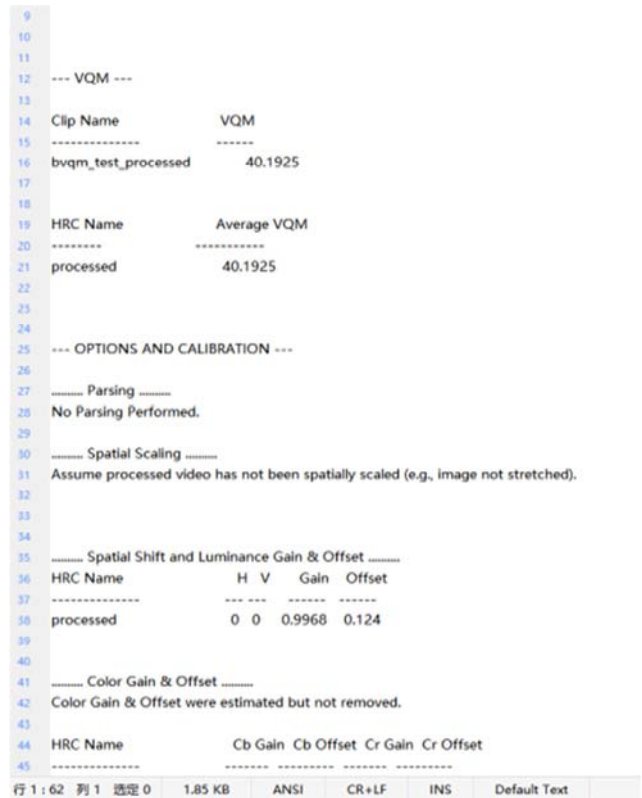


Figure 9. BVQM summary report results.

### 4. QOE Forecast Method Three

Method 3: MOS of objective value is the quantitative method of QOE MOS.  $MOS = PSNR / 10$ , MOS quantitative method of QOE.

DMOS: objective quality assessment MOS. Video quality as subjective testing - a brownie points (scheme Option Score, MOS) or difference divide (Differential Mean Opinion Score, DMOS) measurement. In order to eliminate this problem, the author maintain the see the original frame rate, subjective test.  $DMOS = MOS(\text{distorted}) - MOS(\text{original}) + 5$

SSIM: calculate SSIM to MSU. MSU's official website to download the latest version of the MSU. MSU\_VQMT\_9.0 r11658beta\_free\_64. Method of use as shown below figure 10 [8].

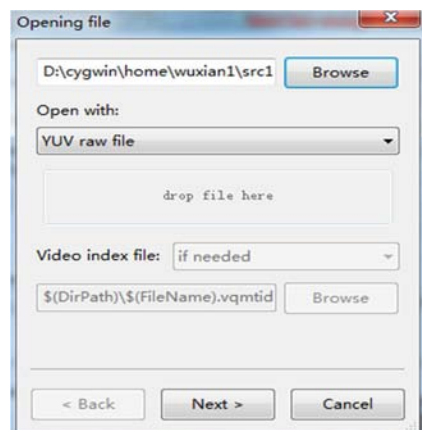


Figure 10. opening file src13.

So choose the original video and the compressed video as shown in figure 11.

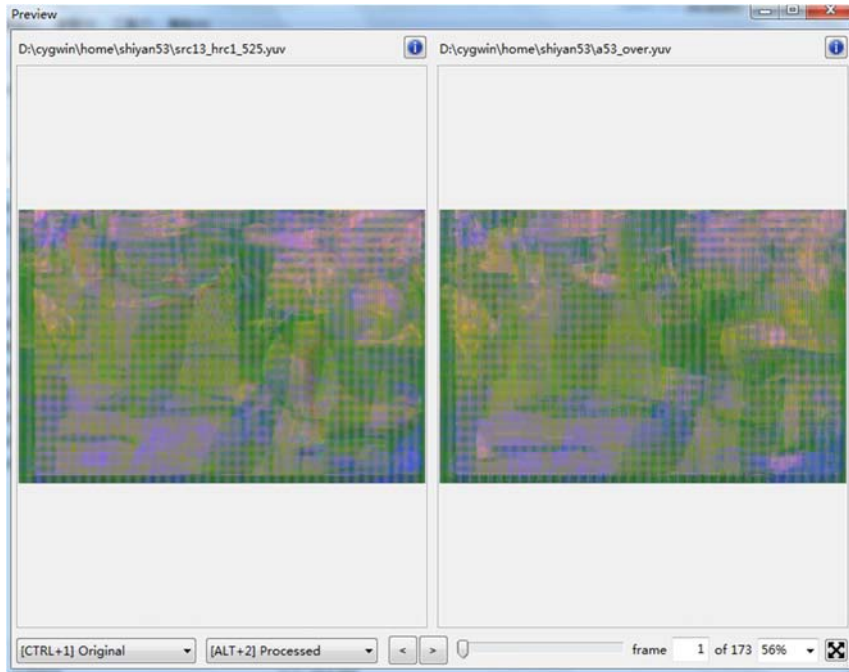


Figure 11. Src13 wired the original video and the compressed video.

In front of the Comparative analysis is not on the hook, you can process, as shown in figure 12.

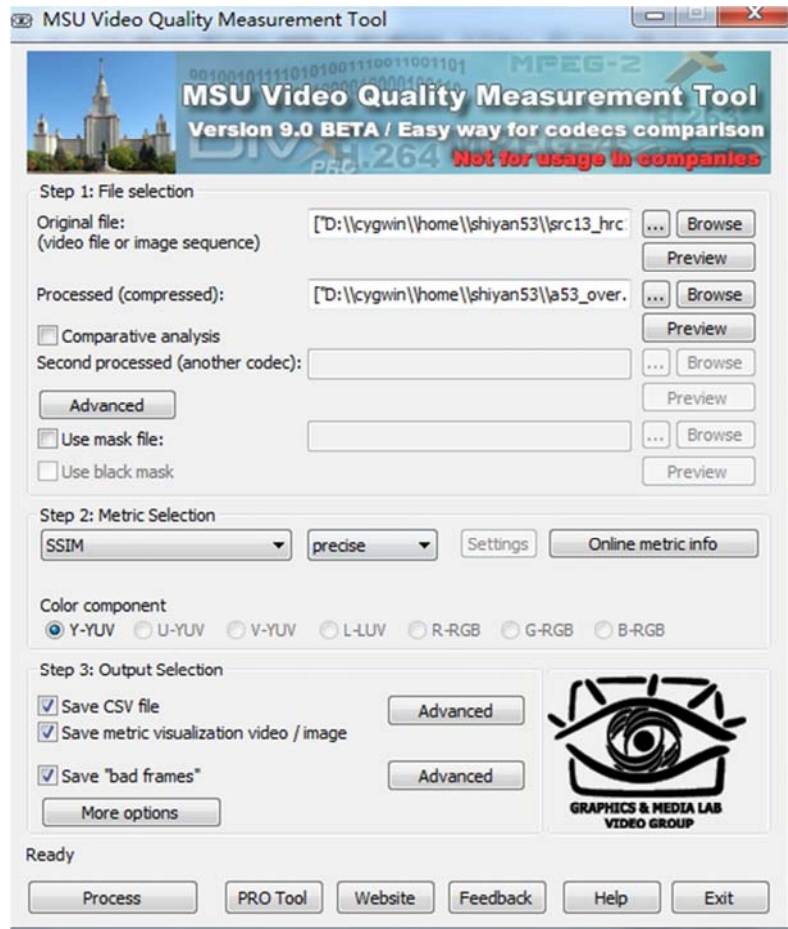


Figure 12. Src13 wired process.

SRC13 wired: SSIM as shown in figure 13.

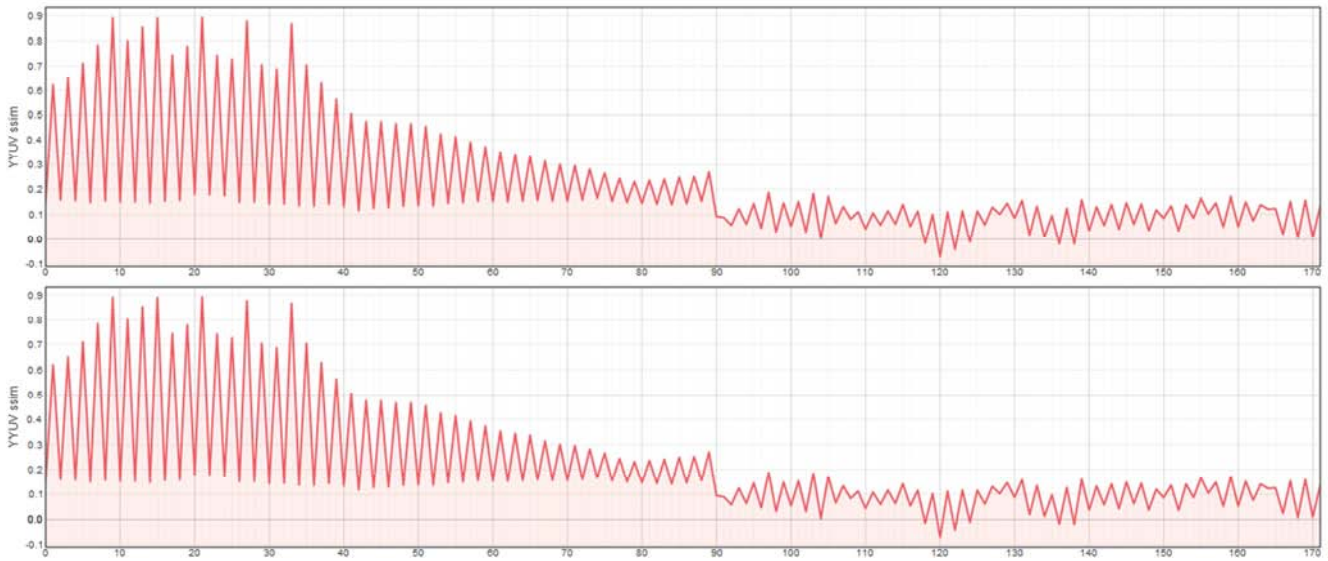


Figure 13. Src13 wired SSIM.

Among them, the horizontal axis shows video frames, the value of the longitudinal axis SSIM. SRC13 wireless the original video and the compressed video as shown in figure 14, SSIM as shown in figure 15, VQM as shown in figure 16 [9], PSNR as shown in figure 17 [10].

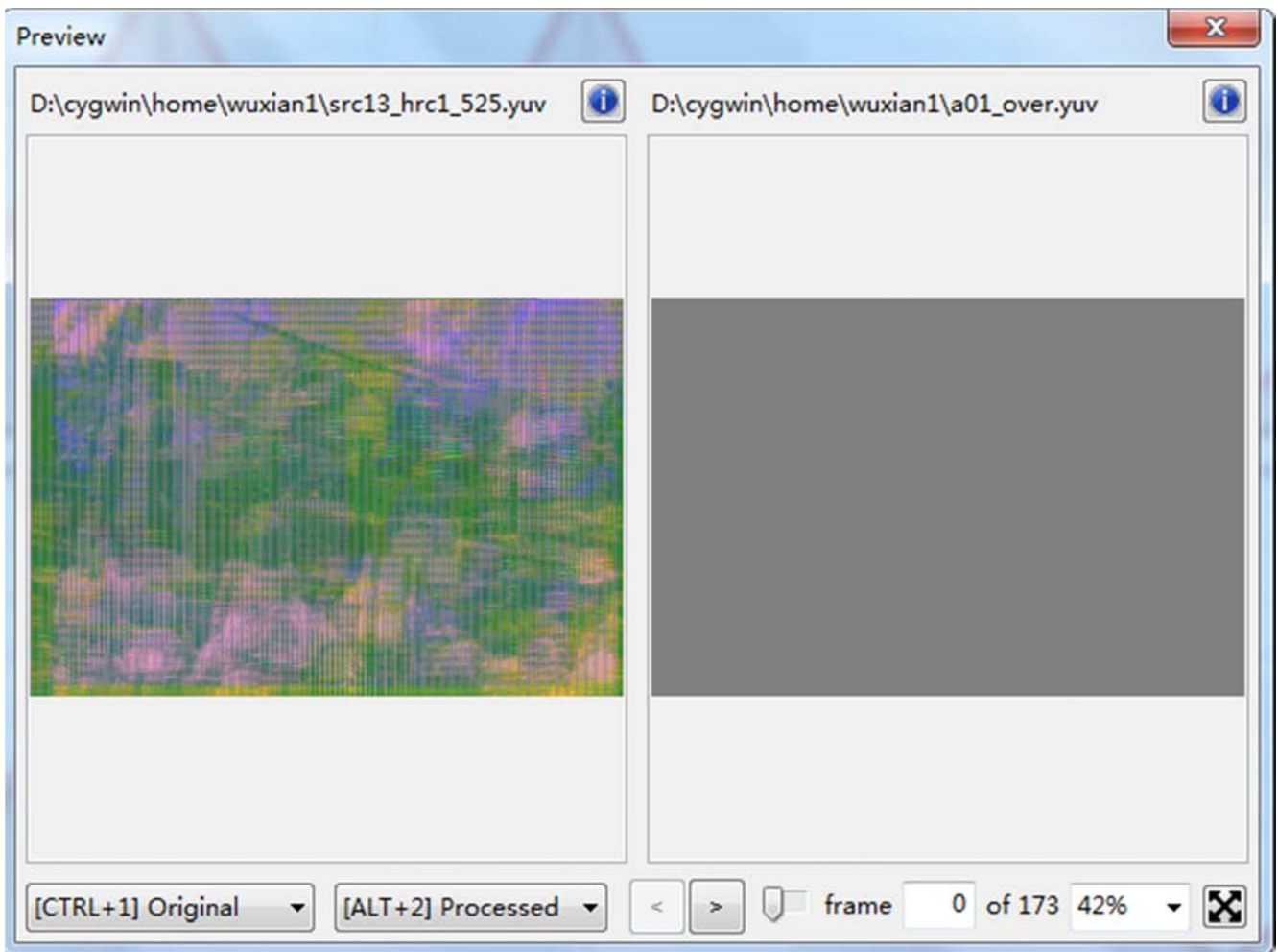


Figure 14. SRC13 wireless the original video and the compressed video.

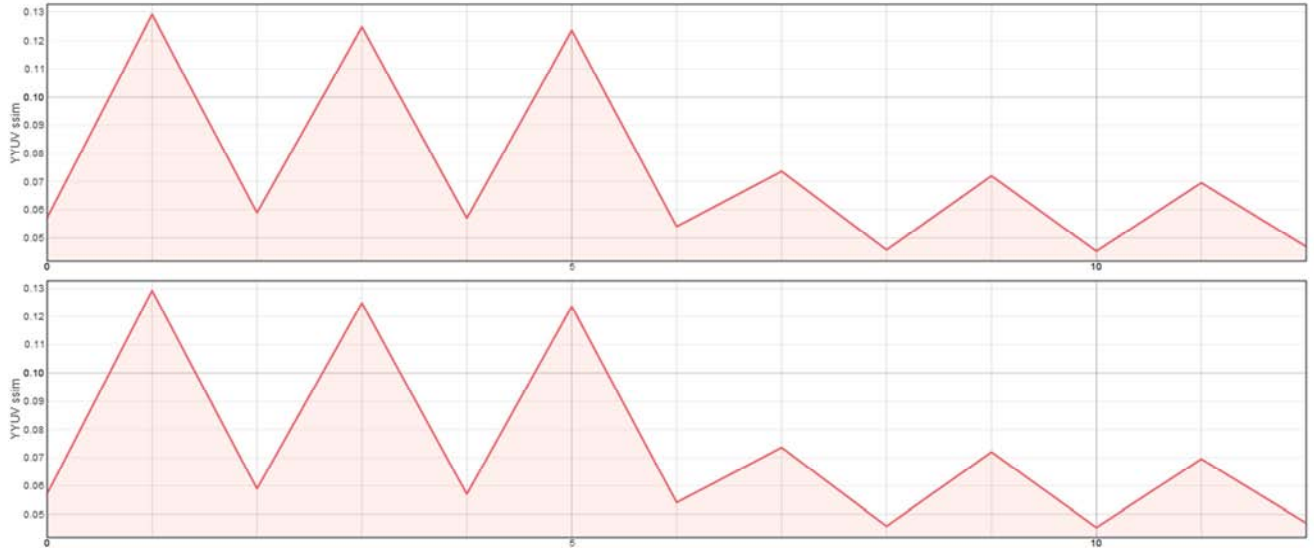


Figure 15. SRC13 wireless SSIM.

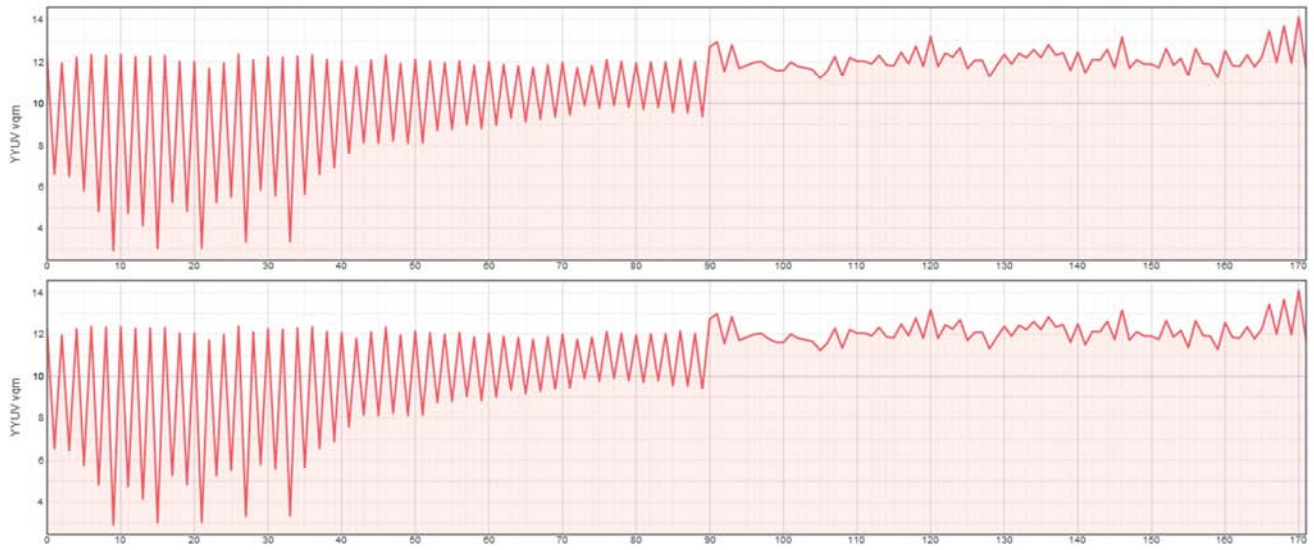


Figure 16. SRC13 wireless VQM.

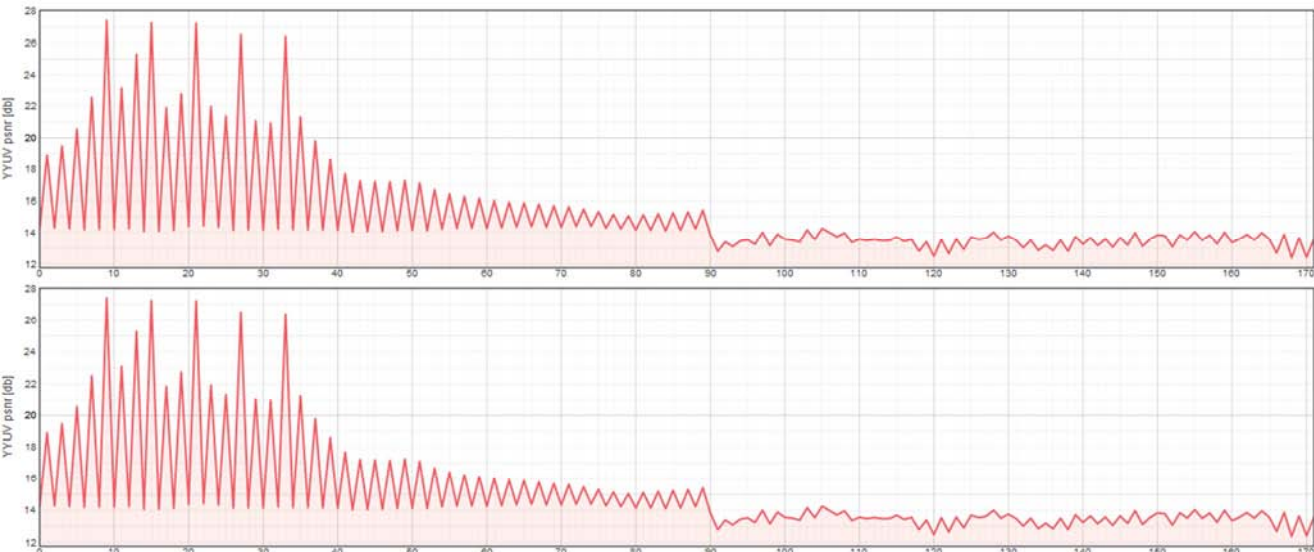


Figure 17. SRC13 wireless PSNR.

## 5. Conclusion

The objective evaluation method is better than the subjective evaluation method. Method three is better than the method two and method one. SSIM evaluation method is more accurate than other objective assessment methods of QOE. In the future work, we can use genetic and ant colony algorithm to build QOE model.

The popularity of the Internet of things, so that objects more convenient through the network for business exchange and communication, which led to the Internet of things platform for the popularity of e-commerce. The test cost, alliance, network bank, electronic commerce, Jingdong 51 single brush collar and collar and the first trial and pull the net interest and suning.com has become increasingly popular. Internet plus object is how to achieve it? Take the test for example, collar net, upload the real baby pictures and taobao.com evaluation screenshots. Testoff Union, upload baby true or real screenshot screenshot and taobao.com evaluation both screenshots. Taobao doesn't evaluate photos. Don't let Taobao know the customer information so as not to upload the real pictures, online test collar can pass real pictures and non Taobao evaluation of real pictures. No contact, contact QQ and WeChat on the line. Don't want to mention off collar back. Hurry back instead of WeChat QQ Wangwang, urged Wangwang delivery and refund. Collar and testoff union platform automatic refund. This is the e-commerce platform below the Internet of things. The advantage of e-commerce is that you can buy cheap trendy products. The store is a discount, basically over the season, or not the new year. Online shopping and shopping time almost, that is, eyes. Now the society is indeed a lack of people, lack of people everywhere, so the most wicked thing what? The wicked is money. Communication with mentors is between paternalistic and boss style. This is a very good opportunity to connect with the community. Expression of courage, dedicated to learning, diligent in thinking, good at adhering to, in line with responsibility, in good faith. Research work and learning experience for a person's comprehensive ability, especially the ability and social ability, learning useless is not appropriate, schools is the basis for future work, knowledge although not fully used, but not useless, so after completing the work of the students. At the same time must not forget to learn: 1 lower prices, maintain a common heart, don't overestimate yourself. 2, there is no easy road, and good preparation for hardship. 3 inside the unit to listen more, see more, more, more modestly learn from others. 4, if there are entrepreneurial intentions, we must set up a very good team. The doctor's office is mainly to strengthen the communication between doctors.

Implementation of intelligent medical treatment of Internet of things based on JSP, medical card reader and electronic medical record. The main purpose of this study is to establish the information model of electronic medical records and develop an electronic medical record management system. The main content of the study is to establish an electronic medical record information model, develop an electronic

medical record management system, and produce medical image acquisition software. The research method mainly adopts literature research method, practice research methods, using UML and Rose software to establish the information model and the use of B/S structure and JSP development of electronic medical records management system, the software of medical image acquisition. The research results are mainly to establish a good information model and a developed electronic medical record management system and to produce a good collection of medical image software. The research conclusion is that the newly developed electronic medical record is superior to the traditional electronic medical record, and the new medical image acquisition software is superior to the former medical image acquisition software. Scientific research methods, study and summary. The software engineering group study summary, in the face of the information system of excessive development, group competition, the group's R & D, production of safe and reliable software so that a new project can be referred to as the "group of software engineering". The main contents include the architecture of the software engineering group must be a system structure, multilayer shielding principle, the combination principle of multiple groupware service, the principle of user identity, developers choose competition principle, competitive and adversarial safety test. Study of Lorawan technology, what is, and how to do doctoral students, how to do and how to do doctoral research, LoRaWAN technology was launched by the LoRa alliance a low power wide area network is a protocol specification. The emphasis is on its low power and wide area features. Technical agreement is the technical contract signed by the manufacturer and the design institute and the owner's units, which includes the technical requirements of the design institute and the owners and the technical response of the manufacturer. The doctor is an engineer and a researcher. A doctor needs intensive and narrow studies. Doctor's research is international scientific research. Dr. topic analysis, artificial neural network feedforward LS-SVM study summary, BP: Back Propagation network is a group of scientists led by Rumelhart in 1986 and McClland, is a kind of error back propagation training algorithm for the multilayer feedforward network, the neural network model is one of the most widely used. BP networks can learn and store a large number of input-output mapping relationships without the need to reveal the mathematical equations describing such mappings. Its learning rule is to use the steepest descent method to continuously adjust the weights and thresholds of the network by back-propagation, so that the error sum of the network is minimum. BP neural network model topology includes input layer (input), hidden layer (hide, layer) and output layer (output layer). An intelligent flying ball monitoring software robot based on the Internet of things. In 2010, the China Internet of things application alliance pointed out that robot is one of the 100 frontier technologies of Internet of things. In 2015, the most advanced field of robotics, TOP10 technology, including Internet of things, embedded technology, simulation technology, big data



technology, cloud computing robot, robot autonomous technology, and so on. The robot uses sensor technology in the key technologies of the Internet of things. In order to make life better and convenient, to study the technology and application of Internet of things, this paper focuses on intelligent robot monitoring software based on the Internet of things. In this paper, matlab simulation robots and programming algorithms can be used to develop intelligent flying robots using high-level programming language.

## Acknowledgements

This work was partially supported by the Tutor scholarship and grants, Beijing University of Technology doctoral student scholarship and grants, Beijing University of Technology software college scholarship and grants. Thanks to Yi bin Hou, the Beijing University of Technology and School of software and Shijiazhuang Tiedao University. Thank Navy General Hospital. Thanks to the tutor and his family, thanks to the teacher's scholarship and careful guidance, to provide a good scientific research environment, every step of the growth and each letter in the paper can not be separated from Hou teacher guidance. Thanks to all the teachers of the Beijing University of Technology and the software institute, thanks to the valuable suggestions of the experts and professors. Thanks to Lin Chongbo, Tsinghua University. Thanks to the director of the Navy General Hospital, Luo crystal. Thanks to family Wang Yinfu, Wang Guifen, etc.. Thank you for all the software engineering doctoral master's students, thank you with the doctoral students, thank Dr. university English class and dormitory students. Thanks to the staff of the Beijing University of Technology and the software institute. Thanks to the staff of dormitory building 9, Beijing University of Technology. As a railway hostel long, thank you for your master's classmates. Thanks to undergraduate classmates and dormitory students.

## References

- [1] Kim H J, Choi S G. A study on a QoS/QoE correlation model for QoE evaluation on IPTV service[C]//Advanced Communication Technology (ICACT), 2010 The 12th International Conference on. IEEE, 2010, 2: 1377-1382.
- [2] Khan A, Sun L, Jammeh E, et al. Quality of experience-driven adaptation scheme for video applications over wireless networks [J]. IET communications, 2010, 4(11): 1337-1347.
- [3] Zhang F, Steinbach E, Zhang P. MDVQM: A novel multidimensional no-reference video quality metric for video transcoding [J]. Journal of Visual Communication and Image Representation, 2014, 25(3): 542-554.
- [4] Khan A, Sun L, Jammeh E, et al. Quality of experience-driven adaptation scheme for video applications over wireless networks[J]. Communications, IET, 2010, 4(11): 1337-1347.
- [5] Maisonneuve J, Deschanel M, Heiles J, et al. An overview of IPTV standards development [J]. Broadcasting, IEEE Transactions on, 2009, 55(2): 315-328.
- [6] NACCARI M, TAGLIASACCHI M, TUBARO S. No-reference video quality monitoring for H.264/AVC coded video [J]. IEEE Transactions on Multimedia, 2009.
- [7] Yang F, Wan S, Xie Q, et al. No-reference quality assessment for networked video via primary analysis of bit stream [J]. Circuits and Systems for Video Technology, IEEE Transactions on, 2010, 20(11): 1544-1554.
- [8] Tao S, Apostolopoulos J, Guérin R. Real-time monitoring of video quality in IP networks [J]. IEEE/ACM Transactions on Networking (TON), 2008, 16(5): 1052-1065.
- [9] Chen J, Ji G. Weighted least squares twin support vector machines for pattern classification[C]//Computer and Automation Engineering (ICCAE), 2010 The 2nd International Conference on. IEEE, 2010, 2: 242-246.
- [10] CHEN Jing, JI Guang-rong. Weighted least squares twin support vector machines for pattern classification. Proceedings of the 2nd International Conference on Computer and Automation Engineering. 2010.

## Biography



**Yi bin Hou** graduated from xi'an jiaotong university computer science department, with a master's degree in engineering, graduated from the Netherlands EINDHOVEN university of technology department, received a doctor's degree from the department of engineering. From 2002 to 2013 as vice President of Beijing university of technology. The Beijing university of technology, professor, doctoral supervisor, dean of the school of software, embedded computing, director of the institute, Beijing university of technology, deputy director of academic committee and secretary-general, Beijing Internet software and systems engineering technology research center director. His research interests are the Internet of things and software engineering.



**Jin Wang** received a Bachelor's degree in Software Engineering from Beijing University of Chemical Technol-ogy, Beijing, China, in 2012.6. And won the National Scholarship in 2010 and won the National Endeavor Fellowship in 2009. She received a master graduate in Computer Application Technology in Shijiazhuang Tiedao University in 2015.1. And published many papers including ISTP, EI and SCI. Now from 2015.4 she is in the school of software engineering, Department of information, Beijing University of Technology, read her PHD, Her research interests are the Internet of things and software engineering and Embedded and image and video quality assessment in distorting network.