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Quality Assessment of Web Multimedia Data using Quartile Measure

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Abstract: *As web is gaining popularity day by day, it has become an excellent source for gathering multimedia data for the web multimedia researchers. Each multimedia data hosted a web has quality. Generally these qualities are of four types, viz., higher, high, medium and low. The assessment of multimedia quality is one of the interesting and challenging tasks nowadays. In this paper we present effective technique to assess multimedia quality based on quality parameter of the multimedia data. The proposed technique to assess the multimedia quality involves the following approaches. 1) Quality assessment through quartile measure. 2) Quality assessment through majority voting rules. The quartile measure assessment technique is applied for multimedia data whose quality parameters are in the same quartile range. The majority voting rule applied for multimedia data whose quality parameters are in different quartile range. The results are analyzed and compared for the both approaches.*

Keyword: *Multimedia Metadata, Quartile measure, Majority voting, Multimedia Quality assessment.*

1. INTRODUCTION

In the past, multimedia quality has been assessed in several different ways depending on the goal defined in each study. Methods like living labs, interviews, diaries or questionnaires are frequently used during a creative development phase [1]. The understanding of users' behavior and needs is then generally used to create new features. Multimedia quality assessment instead is performed by using quantitative methods [2],[3]. In the latter, it is very important to be able to exclude variations due to non targeted influence factors, normally performed in laboratories where the environment can be controlled. On the other side, in our daily life the users' consumption context differs more and more from the controlled setting of lab tests and obtained results might not be representative for the real subjective anymore. Hence, experiments performed under quartile measure represent the multimedia data and new assessment methodologies need to be developed.

The rest of the paper is organized as follows: The section 2 represents related works on the quality of web multimedia, In Section 3; we present the proposed technique of quality assessment of web multimedia data based on a quartile measure. Section 4 shows the experimental results and finally section 5 represents conclusion and future work.

2. RELATED WORK

In digital broadcasting, video and audio signals are broadcast at low bit rates 2 by employing efficient compression schemes. Audio signals are compressed using so-called perceptual audio coding whereby the noise components caused by compression artifacts are controlled in frequency bands where they have little effect on the perceived quality. Subjective evaluation is the ideal method for assessing the audio quality of these encoded signals, but this is a time-consuming process which is unsuitable for real-time audio quality assessments. The proposed classified method sound quality measurement methods and introduce some objective measurement methods for telephony speech quality, taking IP telephony as an example. Next, the auditory mechanisms and perception processes that form the basis of objective measurement methods for the perceptual quality of audio signals, and we introduced the full-reference PEAQ method that can objectively estimate the sound quality of high-quality coded audio signal, and some applications of this algorithm [4]. With the PEAQ method, it was possible to make objective sound quality measurements correlated to the perceptual audio quality that could not be measured with the traditional SN ratio.

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Image Quality assessment plays an important role in various image processing applications. It is still an active area of research. A great deal of effort has been made in recent years to develop objective image quality metrics that correlate well with perceived human quality measurement. Most full reference techniques were derived based on pixel to pixel error such mean square error or peak signal to noise ratio structural similarity index metric. In the proposed method of image quality assessment is a fundamental and challenging problem with many interests in a variety of applications, such as dynamic monitoring and adjusting image quality, optimizing algorithms and parameter settings of image processing systems, and benchmarking image processing system and algorithms. So full reference(FR) methods like structural similarity index metric(SSIM),mean structural similarity index metric(MSSIM) are more efficient because some mathematical formula like peak signal to noise ratio(PSNR), mean square error(MSE) become unstable if image has a significant amount of degradation[5].

Objective image/video quality measures play important roles in various image/video processing applications, such as compression, communication, printing, analysis, registration, restoration and enhancement. The proposed quality assessment approaches in the literature are error sensitivity-based methods. In this proposed work, new philosophy in designing image/video quality metrics, which uses structural distortion as an estimation of perceived visual distortion [6].

Multimedia quality assessment has been performed in dedicated laboratories according to well known standards. In this paper, a short overview on ongoing research in the field of mobile subjective quality measurement has been presented. The central focus is put on the discussion whether a time-continuous assessment methodology should be adopted for the mobile scenario or not. First results on how to solve a critical issue of data acquisition for time-continuous methods undermine the position of favoring this strategy [7].

Continuous subjective multimedia quality assessment is generally performed by using a slider. In this study, a glove containing sensors on each finger is proposed for mobile video quality evaluation. The suitability of the glove for this task is tested by comparing its performance to the one of a linear slider that represents the commonly used rating equipment. The selected criteria for this evaluation are rating delay, precision, distraction and user satisfaction [8].

3. PROPOSED TECHNIQUE

We propose a novel and effective technique to extract the multimedia data from the web and assess their quality based on metadata. We define four types of multimedia qualities, in which the range of each quality is associated with quartile measures of metadata values. The proposed four qualities of multimedia data are as follows:

i) Higher Multimedia Quality (Q1): It is the one which contains - 'Video Bitrate Values', in the range of 3/4 (VB_{max}) to VB_{max}, 'Audio Bitrate Values', in the range of 3/4 (AB_{max}) to AB_{max} and 'Image Resolution' in the range of 3/4 (IR_{max}) to IR_{max}.

ii) High Multimedia Quality (Q2): It is the one which contains - 'Video Bitrate Values', in the range of 2/4 (VB_{max}) to 3/4(VB_{max}), 'Audio Bitrate Values', in the range of 2/4 (AB_{max}) to 3/4 (AB_{max}) and 'Image Resolution' in the range of 2/4 (IR_{max}) to 3/4 (IR_{max}).

iii) Medium Multimedia Quality (Q3): It is the one which contains - 'video bitrate values', in the range of 1/4 (VB_{max}) to 2/4(VB_{max}), 'Audio Bitrate Values', in the range of 1/4 (AB_{max}) to 2/4 (AB_{max}) and 'Image Resolution' in the range of 1/4 (IR_{max}) to 2/4 (IR_{max}).

iv) Low Multimedia Quality (Q4): It is the one which contains - 'Video Bitrate Values', in the range of (VB_{min}) to 1/4(VB_{max}), 'Audio Bitrate Values', in the range of (AB_{min}) to 1/4 (AB_{max}) and 'Image Resolution' in the range of (IR_{min}) to 1/4 (IR_{max}).

The proposed technique, namely, 'Quality Assessment of Multimedia Data' using quartile measure consists of the following steps:

- Multimedia metadata extraction
- Quartile Measure
- Majority voting
- Multimedia quality assessment

The functionality of each component of the proposed system model is discussed in the following subsections.

3.1 Multimedia metadata extraction and Description

To assess the quality of multimedia data only audio, video and image in the proposed work are considered and the text is not considered since, the text quality statements which must be interpreted for the expectations of the user and suitability for automatic natural language processing separately. It is observed that, the dataset has 27 attributes, out of which 22 are significant and 5 are insignificant. The insignificant metadata attributes such as codec id/info, frame rate mode, color space, scan type and compression mode are excluded since, the values of these metadata are constant for each tuple as discussed in chapter 4. The remaining twenty two metadata are - video duration, video bit rate kbps, maximum video bit rate kbps, width pixels, height pixels, display aspect ratio,

ISSN: 2456 - 3935
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bits/(pixel*frame), video stream size mib, audio duration, audio bit rate kbps, maximum audio bit rate kbps, audio stream size mib, image resolution, image height, image width, text page, word count, character count, line count, paragraph count, text size in kbps, class. In the proposed work out of 22 attributes only 03 attributes namely "Video Bit rate kbps", "Audio Bit rate kbps", "Image Resolution" are considered for this experiment based on related works discussed in this thesis. The extracted metadata will be stored in the form of CSV data file.

3.2 Quartile Measure

The second component of the proposed system groups multimedia into four groups by applying quartile measure techniques on the values of extracted metadata. The extracted each metadata of every group are used for assessing the multimedia data into four groups.

Quartile measure is a statistical term describing a division of observations in to four intervals. Each quartile contains one–fourth of the maximum value of metadata. In this study, the metadata are grouped into four types, namely, higher, high, medium and low multimedia quality. The algorithmic steps to assess multimedia quality are represented in algorithm 1.

ALGORITHM Multimedia_Quality_Assessment
Input: Multimedia "Video Bitrate", "Audio Bitrate", "Image Resolution".
Output: Multimedia Quality: Higher, High, Medium, Low.
Algorithm:
{
If ($M_{VBR} \geq 1984$) && (M_{ABR}=192) && ($M_{IR} \geq 1280$)
Q1 = Higher Multimedia Quality
else If ($1977 \leq M_{VBR} \geq 1984$) && ($M_{ABR}$=128) && ($1182 \leq M_{IR} \geq 1280$)
Q2 = Multimedia High Quality
else If ($1320 \leq M_{VBR} \geq 668$) && ($M_{ABR}$=96) && ($720 \leq M_{IR} \geq 640$)
Q3 = Multimedia Medium Quality
else If ($M_{VBR} \leq 660$) && (M_{ABR}=72) && ($M_{IR} \leq 540$)
Q4 = Multimedia Low Quality
else
Majority_Voting (M_{VBR}, M_{ABR}, M_{IR})
}

Algorithm 1: Multimedia Quality Assessment

3.3 Majority voting

A majority is the greater part, or more than half, of the total. It is a subset of a set consisting of more than half of the set's elements. "Majority" can be used to specify the voting requirement, as in a "majority vote". A majority vote is more than half of the votes cast. A majority can be compared to a plurality, which is a subset larger than any other subset considered. A plurality is not necessarily a majority as the largest subset considered may consist of less than half the set's elements. This can occur when there are three or more possible choices. This measure is simply a measure of majority voting error rate. The algorithmic steps to assess multimedia quality are represented in algorithm 2.

ALGORITHM Majority_Voting (M_{VBR}, M_{ABR}, M_{IR})
Input: Multimedia "Video Bitrate", "Audio Bitrate", "Image Resolution".
Output: Multimedia Quality: Higher, High, Medium, Low.
Algorithm:
{
If ($M_{VBR} \in$ Q1) && ($M_{ABR} \in$Q1)
Q1 = Multimedia Higher Quality
else If ($M_{VBR} \in$ Q1) && ($M_{IR} \in$ Q1)
Q1 = Multimedia Higher Quality
else If ($M_{ABR} \in$ Q1) && ($M_{IR} \in$ Q1)
Q1 = Multimedia Higher Quality
else If ($M_{VBR} \in$ Q2) && ($M_{ABR} \in$ Q2)
Q2 = Multimedia High Quality
else If ($M_{VBR} \in$ Q2) && ($M_{IR} \in$ Q2)
Q2 = Multimedia High Quality
else If ($M_{ABR} \in$ Q2) && ($M_{IR} \in$ Q2)
Q2 = Multimedia High Quality
else If ($M_{VBR} \in$ Q3) && ($M_{ABR} \in$ Q3)
Q3 = Multimedia Medium Quality
else If ($M_{VBR} \in$ Q3) && ($M_{IR} \in$ Q3)
Q3 = Multimedia Medium Quality
else If ($M_{ABR} \in$ Q3) && ($M_{IR} \in$ Q3)
Q3 = Multimedia Medium Quality
else If ($M_{VBR} \in$ Q4) && ($M_{ABR} \in$ Q4)
Q4 = Multimedia Low Quality
else If ($M_{VBR} \in$ Q4) && ($M_{IR} \in$ Q4)
Q4 = Multimedia Low Quality
else ($M_{ABR} \in$ Q4) && ($M_{IR} \in$ Q4)
Q4 = Multimedia Low Quality
}

Algorithm 2: Majority voting for Multimedia Quality Assessment

In case of heterogeneous or distinguished combination of higher multimedia components we employ

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majority voting method to assess the multimedia quality as follows:

- If any two metadata are in the range of first quartile then according to majority voting rule the overall quality of the multimedia data will be consider as Higher quality irrespective of the values of third metadata value.
- If any two metadata are in the range of second quartile then according to majority voting rule the overall quality of the multimedia data will be consider as High quality irrespective of the values of third metadata value.
- If any two metadata are in the range of third quartile then according to majority voting rule.

The overall quality of the multimedia data will be consider as Medium quality irrespective of the values of third metadata value.

- If any two metadata are in the range of fourth quartile then according to majority voting rule the overall quality of the multimedia data will be consider as Low quality irrespective of the values of third metadata value.

4. EXPERIMENTAL RESULTS

The effectiveness of the proposed technique is demonstrated through experimental observation in assessing the quality of multimedia in terms of video, audio and image of the multimedia metadata. The results demonstrate the efficacy of the proposed technique.

4.1 Multimedia Quality Assessment

Experiments have been conducted by taking multimedia from the web pages and assessing them as higher, high, medium and low multimedia quality. The proposed work considers 800 multimedia metadata of video bitrate, audio bitrate and image resolution, out of which, 400 multimedia metadata are used to develop the proposed model and the remaining 400 are used to assess the multimedia quality.

TABLE I QUALITY ASSESSMENT OF MULTIMEDIA DATA

Category	Total Instances	Higher Multimedia		High Multimedia		Good Multimedia		Low multimedia	
		Quality Assessment through Quartile Measure	Quality Assessment through Majority voting rule	Quality Assessment through Quartile Measure	Quality Assessment through Majority voting rule	Quality Assessment through Quartile Measure	Quality Assessment through Majority voting rule	Quality Assessment through Quartile Measure	Quality Assessment through Majority voting rule
Sports	131	26	4	2	6	14	0	29	50
Entertainment	112	34	9	1	44	0	0	15	9
News	157	0	0	6	9	40	14	27	61
Total	400	60	13	9	59	54	14	71	120

The experimental results given in the Table 6.1 provides the quality assessment of the multimedia data of three categories namely ‘sports’, ‘entertainment’ and ‘news’.

4.1.1 Higher Multimedia Quality

In the ‘sports’ category 26 multimedia data are assessed through quartile measure whereas 4 multimedia data has been assessed through majority voting rule. In the ‘Entertainment’ category 34 multimedia data has been assessed through quartile measure whereas 9 multimedia data has been assessed through majority voting rule. The ‘News’ category no multimedia data has been assessed through quartile measure as well as majority voting rule. Out of 73 Higher quality multimedia data, 60 multimedia data has been assessed through quartile measure whereas 13 multimedia data has been assessed through majority voting rule.

4.1.2 High Multimedia Quality

In the ‘sports’ category 2 multimedia data are assessed through quartile measure whereas 6 multimedia data has been assessed through majority voting rule. In the ‘Entertainment’ category 1 multimedia data has been assessed through quartile measure whereas 44 multimedia data has been assessed through majority voting rule. The ‘News’ category 6 multimedia data has been assessed through quartile measure whereas 9 multimedia data has been assessed through majority voting rule. Out of 68 High quality multimedia data, 9 multimedia data has been assessed through quartile measure whereas 59 multimedia data has been assessed through majority voting rule.

4.1.3 Medium Multimedia Quality

In the ‘sports’ category 14 multimedia data are assessed through quartile measure whereas no multimedia data has been assessed through majority voting rule. In the ‘Entertainment’ category no multimedia data has been assessed through quartile measure as

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well as majority voting rule. The 'News' category 40 multimedia data has been assessed through quartile measure whereas 14 multimedia data has been assessed through majority voting rule. Out of 68 Medium quality multimedia data, 54 multimedia data has been assessed through quartile measure whereas 14 multimedia data has been assessed through majority voting rule.

4.1.4 Low Multimedia Quality

In the 'sports' category 29 multimedia data are assessed through quartile measure whereas 50 multimedia data has been assessed through majority voting rule. In the 'Entertainment' category 15 multimedia data has been assessed through quartile measure whereas 9 multimedia data has been assessed through majority voting rule. The 'News' category 27 multimedia data has been assessed through quartile measure whereas 61 multimedia data has been assessed through majority voting rule. Out of 85 Low quality multimedia data, 14 multimedia data has been assessed through quartile measure whereas 71 multimedia data has been assessed through majority voting rule.

5. CONCLUSION

In this paper, a novel and effective web mining technique is proposed for assessing the multimedia quality based on quality parameter of the multimedia data. This is performed in two steps: 1) Quality assessment through quartile measure. 2) Quality assessment through majority voting rules. The experimental results show that, there are large numbers of multimedia belonging to low quality group. They do not give a quality of multimedia significantly. Hence, such multimedia may be ignored while downloading the multimedia data. Our future work, first we will enlarge our datasets. Second, we will explore more audio/video/image metadata and learning algorithms to gain the effectiveness of multimedia quality assessment.

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