Tech. Topic 2: Multimedia and Encoding Techniques

I. INTRODUCTION

In this week's technical topic on Multimedia and Encoding Techniques, we have three papers[1], [2], [3] as part of the reading list. In this report, we choose to present a review of "MPEG: A Video Compression Standard for Multimedia Applications" in detail [2]. This paper is chosen, because it describes the initial work that had been done to set standards for audio and video compression and transmission. MPEG was formed by ISO and was established in 1988.

II. PAPER 1 REVIEW: "MPEG: A VIDEO COMPRESSION STANDARD FOR MULTIMEDIA APPLICATIONS"

Video compression is the process of reducing the amount of data that is used to represent video images, and involves a combination between spatial image compression and temporal motion compensation.

This article discusses MPEG, a video compression standard, how it was conceived, what were its influences, and what its features are. They start by giving a historical background of how MPEG was conceived in terms of its background as well as the standards that were relevant to its conceivement. The article also discusses and provides insights into the politics of how MPEG came to be and the efforts involved in MPEG's standardization. This is very useful since it helps the reader understand the technical and political conditions under which this standard was conceived and what was the current state-of-affairs. This rounded approach is an interesting method to start the article, since it puts things into perspective and helps the reader understand the practical motivation behind the design.

Although this article provides an interesting historical background, they do not provide much of a justification (at least from the authors' personal opinions) of how effective its conceivement was and whether MPEG's development was really a logical progression - this becomes clearer as read further.

They then move on to discuss both the hardware and software requirements or constraints on MPEG-Video. This was very useful in understanding the requirements of MPEG-Video.

The division of sections in this article is confusing. The titles sometimes do not seem appropriate for the information in the section, such as the sub-section titled "Bit Stream and Decoding Process", which also addresses the encoding schemes. Furthermore, in the bullet for *efficiency* as one of the goals of the MPEG standard and its quality, they also mention robustness, which is a separate metric.

At several points in the article, the authors make statements which are not properly justified. There are multiple examples of unjustified statements. For example, when describing the digital storage media, they say that a certain compressed rate is "perfectly suitable". However, they do not describe why it would be suitable.

As we read through the article, we notice that it is targeted towards, and necessitates a certain level of technical knowledge in the multimedia field. For those that are not in the field, it requires a little research; the authors do not make sure that the reader gets a good understanding of the ideas and points presented. For example, there are multiple cases where an example can be given to improve understanding, such as when describing asymmetric and symmetric applications.

Furthermore, we notice that there is no particular flow to the paper. Information is given, but we can not follow which story it is telling. There is no progressive movement from one point to the other. The article is not efficiently divided or sectioned; it could get confusing and it is hard to move back and forth between sections to revisit ideas or information.

When describing particular words and their definition, we notice that simple terms are explained in a complicated, often roundabout, manner which is not entirely necessary. In some cases, it is useful to make a correlation between the definition and the practical use, which is left to the reader to do, such as when describing asymmetric and symmetric applications and making the correlation to the example applications given in the tables provided.

The description of the features of the video compression algorithm are useful and make sense. Examples of the identified requirements would have been useful, such as the *editability* requirement.

The authors take a lot for granted, without proper justification. A few examples, statements such as the "algorithm should perform well" without an explanation of what performing well means, "quality requirements demand a very high compression not achievable with intraframe coding alone" without explaining why it is not achievable (has this been studied before), "the motion information is part of the necessary information to recover the picture and has to be coded appropriately" without a clear explanation of what appropriate coding entails, and "since the technical trade-offs have been widely discussed" without discussing what tradeoffs are and the results of these "wide" discussions. For readers that are not well-informed in the field, it feels like we have to take the author's word for certain issues that they bring up or discuss.

When describing motion compensation, there is a major disadvantage to the technique which comes to mind, and it is that you can not predict or generate B frames unless you have future ones - you need or require out-of-order delivery of frames for this technique to succeed. Therefore, the article provides no real analytical discussion or detailed description of the features of MPEG; it simply presents these features. Furthermore, not only is motion compensation described in difficult terms, but it is also described too late in the article. It is mentioned as an important feature earlier, and the reader remains confused about the particular relevance of motion compensation until they reach that dedicated section (unless the reader is in the field or does their own research).

The authors make a lot of statements which generally feel random, for example "these techniques are preferred..." or "these techniques are likely to be used" without any indication of why, because there appears to be no support to these statements. Keeping this in mind, the paper does not have a good list of related work or references; it might be relying on the reader's understanding of information and news. Additionally, the authors use statements such as "best" or "fastest" without presenting the alternatives which it appears to be comparing against. Therefore, the latter is either a bad use of English, or things are taken for granted, or this information is generally intuitive for someone already in the field.

There are terminology that are not explained that would have been useful to explain, such as recursive and non-recursive temporal redundancy. The authors do not describe the difference between the two, although they present them as alternative options for each other. We do not understand what the difference between them is.

The figures in this article are not clearly separated, and are not all very useful in expressing a particular point, such as Figures 3 and 4.

For the motion representation macroblock, no where do they mention whether the blocks overlap or whether they are non-overlapping. Do the vectors tell where the block moves to? Although the authors go so far as to present the motion estimation technique, a little effort should be given to explain the motion vectors further.

It is clear that this paper is written by technical people and is presented as such. It is probably meant to appeal to a particular audience since most of the discussion throughout the paper is given in a matter-of-fact way, which will not be as intuitive for someone outside of the field, granted that the authors statements are intuitive and do not support. However, at the same time, it is unclear how useful this article, which discusses MPEG, its features, and how it came to be, might have been since a description of the alternatives to MPEG's features is not provided. Therefore, one can say that this article was both an article and a technical report.

All said, critical reading of this article could give you good insight into the relevant topics and concerns in video compression. It is definitely insightful to important issues in video compression, especially since it presents the first efforts to develop a standard. The topics in this paper, however, were not clearly presented or properly explored.

There are a few sentences which clearly indicate weak English, such as using two colons in a single sentence, and using "however" in two consecutive sentences without proper comma separation.

REFERENCES

[1] H. Schwarz, D. Marpe, and T. Wiegand, "Overview of the scalable video coding extension of the h.264/AVC standard," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 17, no. 9, pp. 1103–1120, Sep. 2007.

[2] D. L. Gall, "Mpeg: A video compression standard for multimedia applications," *Communications of the ACM*, vol. 34, pp. 46–58, 1991.

[3] T. Kim and M. H. Ammar, "A comparison of heterogeneous video multicast schemes: Layered encoding or stream replication," *IEEE Transactions on Multimedia*, vol. 7, no. 6, pp. 1123–1130, 2005.