

Hypothesis

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Human Perceptions Based on Translations of Recurrent Neural Networks Principles for Low Latency Applications

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Keywords: Neural Networks; Data Screening; Human Perception



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Article

Human Perceptions Based on translations of Recurrent Neural Networks Principles for Low Latency Applications

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Abstract: The Necessity of Human resources beyond perception of human understanding towards the Evaluation of video quality or Data screening methodology is conducted based on human perception level since it is concerned with how visual content is perceived by a observer based on observations with his/ her perception on a particular video sequence. Therefore, we considered that the subject has to grade the encoded video sequences under certain test environment conditions based on ITU-Recommendations. Since Human perception is considered as the true judgment and precise measurement of visual content, data screening has become quite essential and quite comfortable to general public due to introduction of User Experience(UX) concept by User Experience community. User Experience is an concept based on translations of A recurrent neural network which is mostly used algorithm based on certain principles, for instance we considered natural language processing and moreover recurrent neural networks is adaptable towards understanding sequential data and use patterns to predict the consistency within observers by invited subjects for quality assessment. In our research, we adapted principles based on Recurrent Neural Networks while assuming consistency within observers for predicting video quality within data screening environment towards subjective experiments. Moreover, this research work explores the trade offs between Human perception on visual content and consistency of observations within individual observer.

Keywords: H.264; VQM; RNN; MOS; NLP; ANN

1. Introduction

Presently, Objective Video Quality Assessment is become essential for references towards Human Visualization characteristics and moreover Some features of HVS like contrast, orientation sensitivity, spatial and temporal masking effects, color perception and frequency selectivity are considered towards incorporating in real time scenarios Even though it is computationally very complex to incorporate above aspects in real time issues which are useful for a wide range if it correlates well with human perception. The impairments visibility is subjected to spatial and temporal properties of visual content, more over spatial and temporal complexity is quite expensive and time conservative method while considering within Human Visual characteristics.

2. Reference Works of ITU Recommendations

Since our methodology of data screening is limited to visual content excluding audio because we considered out test video sequences data at frame by frame level or macro block level where complexity of motion content is essential and audio visual data is negligible. Results of subjective assessment largely dependents on the factors like selection of test video sequences and welly defined evaluation procedure. In our research work, we carefully employed the specifications recommended by ITU-R BT 500-10 [1] as mentioned and VQEG Hybrid test plan in which is explained briefly in following sections.

Test Video Sequences

Shahid et.al [2] considered six different video sequences of CIF and QCIF spatial resolutions were selected in raw progressive format based on different motion content and including various levels of spatial-temporal complexity recommended by ITU-R P.910.

Specifications of Data Screening Methodology

The involvement of human observers within laboratory viewing environment specified by ITU-R BT.500-12 Standards are mentioned for Single Stimulus Continuous Quality Evaluation(SSCQ) process out of Single Stimulus which includes Stimulus Comparison Quality Evaluation.

3. Estimation of Motion Dynamics while Considering User Experience(UX)

Investigation of unidentified error at decoder side has been considered into account because of missing motion vectors in reconstructed frames which resulted in increase computational complexity within motion vectors and its not due to poor coding or compression nor because of delay. Amitesh et al. [3] proposed an approach towards identifying tradeoff between of image compression and quality estimation more over based on assumptions if b frame size is less than predetermined threshold the we must not consider motion intensity feature which was traced out by User Experience, so decision making tree decides either to consider the motion intensity features out of all or not based on conditional acceptance.

4. Translations of Recurrent Neural Networks

The measurement of spatial-temporal information is essential due to quality of transmitted video sequence is highly dependent on this whereabouts. The formulations for quantifying spatial and temporal perceptual information of test sequences are shown in following sections.

Spatial Information

SI is calculated for each frame of video sequence within luminance plane, which leads in obtaining spatial information for n frames and it is expressed as

$$SI = \max_{time} [std_{space}[sobel(f_n)]] \quad (1)$$

- $sobel(f_n)$ is each frame at time n which is filtered with sobel filter.
- std_{space} is standard deviation over pixels.
- $\max_{time}$ is maximum value in time series.

Temporal Information

TI is calculated for amount of temporal changes of a video sequence on luminance plane and measurement of temporal perceptual information is computed as

$$TI = \max_{time} [std_{space}[M_n(i, j)]] \quad (2)$$

$M(i, j)$ is motion difference between pixel values in space for sequential frames on the luminance plane. $M_n(i, j)$ as a function of frame(n) and it is expressed as

$$M_n(i, j) = f_n(i, j) - f_{n-1}(i, j)$$

$f_n(i, j)$ is pixel at i^{th} row and j^{th} column of a n^{th} frame in a video sequence and $f_{n-1}(i, j)$ is pixel at i^{th} row and j^{th} column of a (n-1) frame in a video sequence. The higher motion content in successive frames of a video sequence leads to higher temporal content. The below scatter plots shows spatial and temporal perceptual content obtained from above equations, which were computed on luminance plane for all CIF and QCIF test sequences.

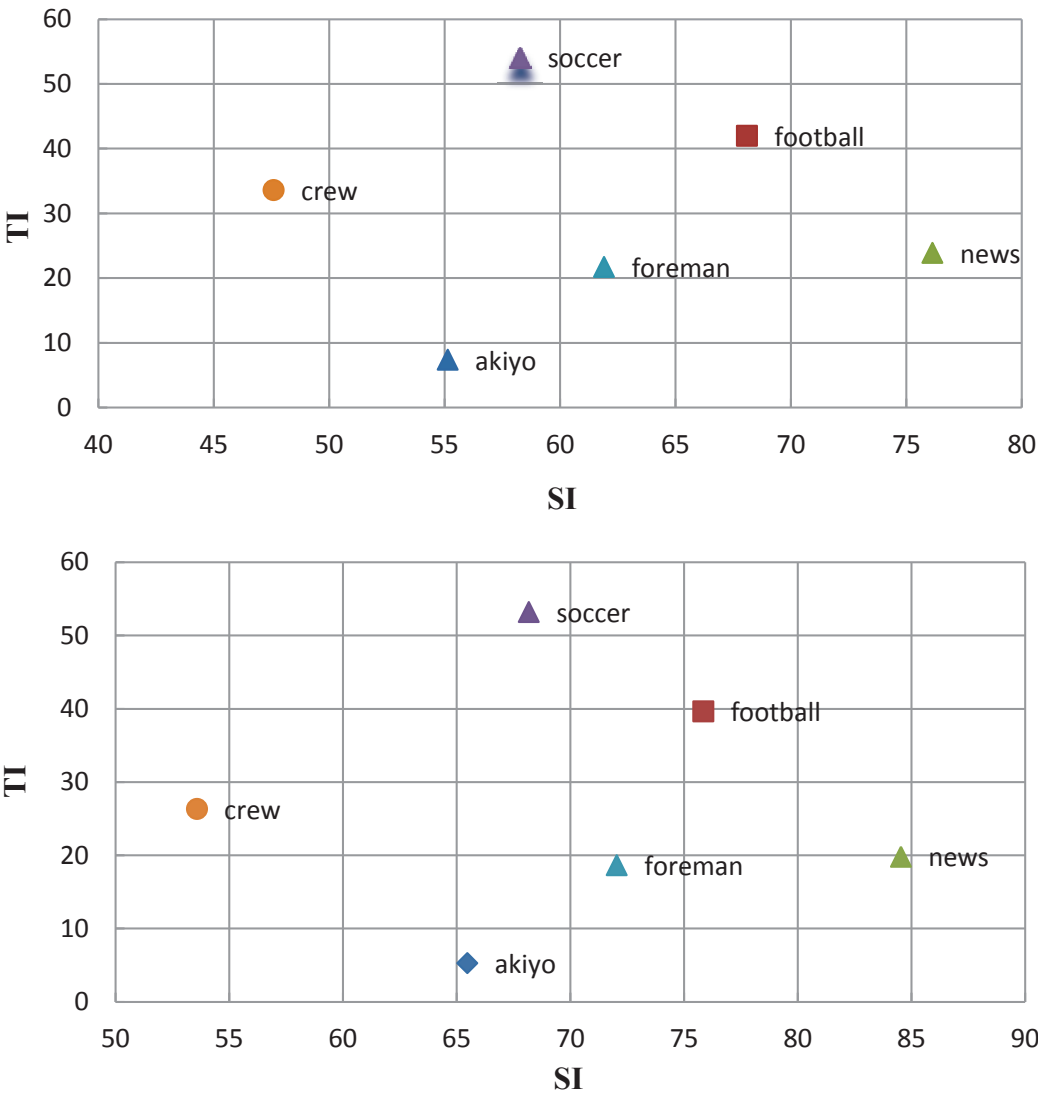


Figure 1. Spatial and Temporal information computed for luminance component of selected CIF and QCIF videos.

4.1. Principles Based on Translations

- **Structural Information and Motion Content:** Out of all existing features within structural information of bit stream data, motion vector plays quite essential role for quantifying dedicated features such as motion intensity, more over Motion vector complexity is quite high at macro block layer as mentioned in [4].
- **Coding Distortion:** The effectiveness of changes for identifying the errors within data transmitted due to interruption in signal within a channel is completely based on coding theory and amitesh et al.[5] explained in detail information about rate distortion control and information theory.

5. Confidence Interval of Observations and Consistency Based on Decision Making Tree

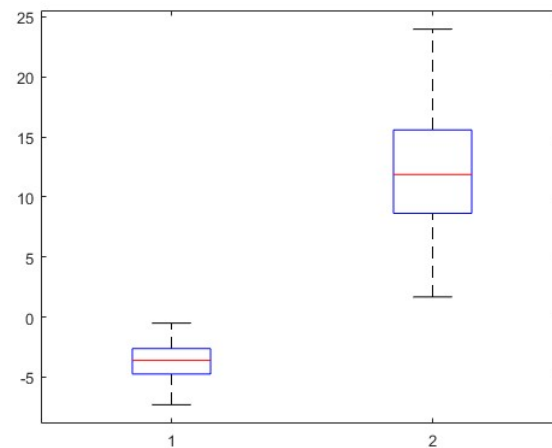


Figure 2. 99 % Confidence Interval between observations and consistency for Two Decisions

This above box plot shows inconsistency between outcome of two possibilities based on decision making tree which concludes that there is huge difference in prediction between observations within observers based on comparison of consistency.

6. Conclusion

Statistical analysis illustrates that our principles based on Recurrent Neural Networks predicted with acceptable consistency which is expected. Since all the 120 video sequences which we generated for our research work are encoded in JM Reference 16.1 based on H.264/AVC software uses Rate distortion optimization algorithm for improving video quality while video compression and distortion measure in JM encoder is MSE by default[6]. It concludes that our assumptions based on RNN principles are within reach of Human Perception level because subjective scores are considered as true or standard scores of video quality.

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