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Adaptive compression method for underwater images based on perceived quality estimation

Key words: Underwater image compression; Set partitioning in hierarchical trees; Compressive sensing; Compression quality estimation

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Motivation

- Underwater images have a visual effect that is difficult to express with voice or text. The main difficulty in current underwater image applications is the contradiction between large volume of data in an underwater image and the limited acoustic communication bandwidth.
- To improve the efficiency of image communication, image data needs to be compressed as much as possible. To guarantee the quality of the reconstructed image, the transmitter needs to reserve as much image data as possible. An important part of image compression is an effective trade-off between the compression ratio and compression quality.

Main idea

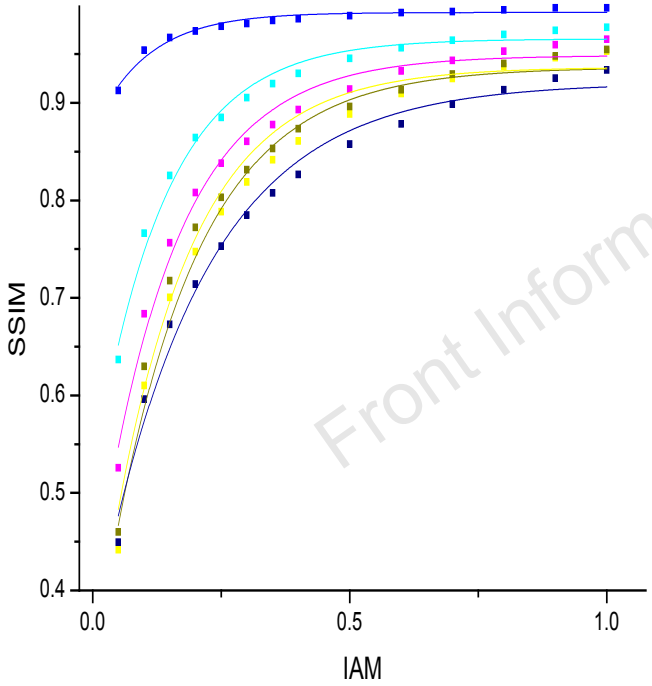
- In underwater communication, storage space and bandwidth allocation and algorithm complexity need to be considered.
- A model for quickly estimating the quality of compressed images is proposed, based on a perception mapping and underwater image adaptive compression method.

Method

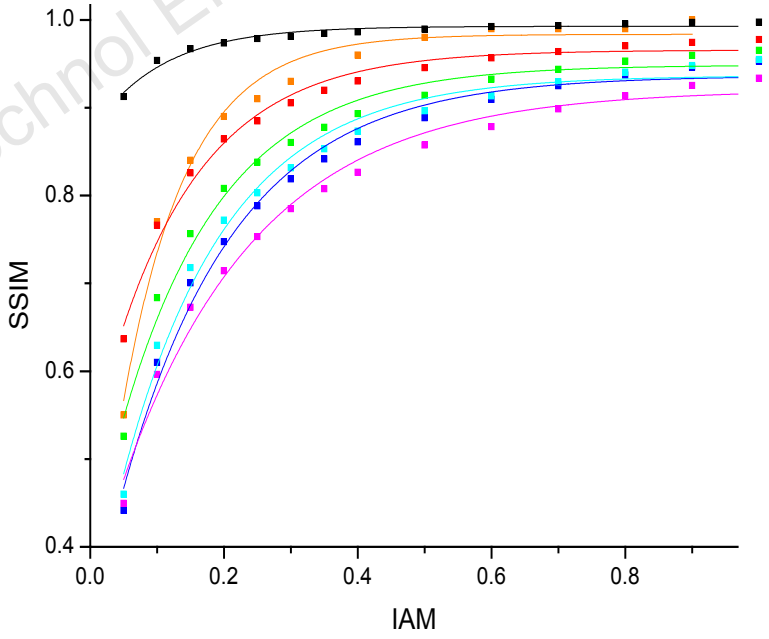
1. Image activity measurement (IAM) is used to distinguish the different image characteristics. Based on a summation of the rules of different image compressions, a perceived service quality vector is used to deconstruct the IAM-BPP (bits per pixel)-SSIM (structural similarity) relationship into several two-dimensional relationships.
2. An estimation formula is obtained to estimate the image compression quality quickly using the IAM value of an image. The quality of the compressed images can thus meet the needs of human eyesight. In addition, storage space can be better used and bandwidth source better allocated.

Major results

- The SSIM value of each image can be fitted with a small error.



(a) SPIHT compression fitting



(b) Adaptive CS compression fitting

Conclusions

- IAM can measure the texture complexity of an image, and has a close relationship with the image compression quality.
- The method can guarantee the quality of a compressed image. The prediction results can be used to guide the choice of the encoding strategy and determine the coding parameters.
- Using the inverse function prediction formula, the relationship between the image compression ratio and compression quality can be obtained, and the linear interpolation improvement scheme can be used to further improve the image compression quality.