Research Internship: Task 2

Sriram dhanasekaran

December 2025

Problem 1

What is the difference between PLCC and SRCC in Underwater Image Quality Assessment?

The main difference between the Pearson linear correlation coefficient (PLCC) and the Spearman Rank Correlation Coefficient (SRCC) is that PLCC measures the linearity of the data, i.e, the accuracy of the values, in contrast, SRCC measures the monotonicity of the data, i.e, the accuracy of the order.[1, 2] PLCC checks how close the values are to a linear relationship, while SRCC checks whether the ranking order is done correctly.

problem 2

Describe the specific steps used to extract the 10 structure features in the gradient domain and the 15 color features in the HSV space as detailed in the paper[3].

The authors suggest a metric measuring 25 features (10 structural features in the gradient domain and 15 colour features in the HSV colour space) The 25 features include structural (F_S) and colour (F_C) features.

Structural Features (F_S)

$F_S = F_{GD} + F_{EQ}$ where F_{GD} is a 9-dimensional vector that captures the statistical distribution of edge structures across the entire image, and F_{EQ} is the measure of sharpness and contrast of edges across the image. For F_{GD}, first, the Gradient map G is calculated by convolving the images with Sobel filters to find gradients in horizontal (G_x) and vertical (G_y) directions, and then finding the magnitude $G = \sqrt{G_x^2 + G_y^2}$. Now apply Local Binary Patterns (LBP) which compares each value to its 8 neighbors, the author creates a weighted histogram

(i.e,)

$$GD_i = \sum_{y=1}^{M} \sum_{x=1}^{N} G(x,y)\delta(i - LBP(x,y))$$

This is used to create a 9 dimensional feature vector $(GD_0, ..., GD_8)$. F_{EQ} is done by first calculating the Enhancement Measure of Entropy (EME) for each map. EME splits the image into blocks (k_1, k_2) and computes the logarithmic ratio of maximum to minimum intensity in each block (i.e,)

$$EME = \frac{2}{k_1 k_2} \sum_{l=1}^{k_1} \sum_{k=1}^{k_2} log(\frac{I_{max,k,l}}{I_{min,k,l}})$$

The final Edge Quality score (EQ) is the weighted sum of the EME values from the three channels. This gives out a single feature vector $F_{EQ} = [EQ]$.

Color Features (F_C)

$F_C = F_{CM} + F_{CE}$ where F_{CM} is the colour moments, which are three statistical values for three HSV channels, i.e, Mean (m), Standard deviation (d), Skewness (s) for three channels, which yields 9 features

$$F_{CM} = [m_H, d_H, s_H, m_S, d_S, s_S, m_V, d_V, s_V]$$

. Now F_{CE} is the colour entropy, which quantifies the structural randomness in the colour domain. The MSCN (Mean Subtracted Contrast Normalized) coefficient (I_C) is calculated for all three HSV channels. An average Filter is now applied to them, creating a secondary map (I_{CA}). Entropy is calculated for all three channels (i.e,)

$$F_{CE} = [CE_H^C, CE_H^{CA}, CE_S^C, CE_S^{CA}, CE_V^C, CE_V^{CA}]$$

. Summing all the features gives us a 25-dimensional feature vector proposed by the authors

References

[1] J. Benesty, J. Chen, Y. Huang, and I. Cohen, "Pearson correlation coefficient," in *Noise Reduction in Speech Processing*, pp. 1–4, Springer, 2009.

[2] J. H. Zar, *Biostatistical Analysis*. Prentice Hall, 5 ed., 2005.

[3] H. Chen, X. Chai, F. Shao, X. Wang, Q. Jiang, X. Meng, and Y.-S. Ho, "Perceptual quality assessment of cartoon images," *IEEE Transactions on Multimedia*, vol. 25, pp. 140–153, 2023.