Image Quality Assessment on IETR Dataset using Cross Entropy

Author:

Alokendu Mazumder
Dept. of CSE
IIT Jammu

Platform used: Jupyter Notebook
Library used: numpy, scipy, os, open CV, matplotlib

Algorithm: I have used **Cross Entropy Loss** for computing scores.

1. I have taken all the parent images and computed their PMF's.
2. Same done with all distorted images.
3. Now in the dataset, we have 70% images which are real and remaining 30% which are synthetic in nature.
4. I have subtracted the mean from each image pixel value.
5. I have computed the cross entropy loss of all images pairwise with their parent image.
6. Normalized the cross entropy loss to have value in the range of [0,1] (used mod function wherever necessary and possible).
7. The final score is a weighted score:

   Final Score: $A^{\alpha} + B^{\beta}$
8. A is the score of all the real images and B is the score of all the synthetic images.
9. α is the weightage given to real images and β is the weightage given to synthetic images in the dataset.
10. As mentioned earlier, due to 70% presence of real images, weightage given to real scores is 0.7 and weightage given to synthetic scores are 0.3.
11. I have used cross entropy loss because it measures the difference between two PMF's or PDF's (in continuous case). And each image follows a certain PMF's based on their pixel values, and it is obvious that any distortion in image will result in slight (Not as massive as changing the shape of PMF) deviation in their PMF's.

Observation:

While computing the correlation of synthetic images, the results are pretty promising and high as in range of 0.6-0.8 but in case of real images the results fail and fall between the range of 0.01-0.04. Hence, it is clear that Cross Entropy loss fails to generalize over the whole dataset.

So, to compensate for the failure of generalization of Cross Entropy loss, Weighted Correlation scores were computed as mentioned above.

Results:

Weighted Results:

1. Pearson's Correlation Coefficient: 0.68
2. Spearman's Correlation Coefficient: 0.71

Non-Weighted Results:

1. Pearson's Correlation Coefficient: 0.0133
2. Spearman's Correlation Coefficient: 0.0407

 # All the results can be verified in the code attached with this file.