OPTIMIZING WEIGHTED COLOR TRANSFER USING AVERAGE MEAN COLOR DISTANCE (AMCD)

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METHODS

- METHOD 1: GAUSSIAN MEMBERSHIP FUNCTION (GMF)
- METHOD 2: HISTOGRAM CORRELATION METHOD (HCM)
- METHOD 3: THE COLOR DISTANCE IN THE RGB COLOR SPACE (COLDIST) (ASSIGNMEN 07 AND ASSIGNMENT 07A)
- METHOD 4: THE AVERAGE MEAN COLOR DISTANCE IN THE RGB COLOR SPACE (AMCD) (ASSIGNMENT 08)

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COLOR DISTANCE IN RGB COLOR SPACE

- LET P(R1, G1, B1) BE A COLOR VECTOR IN RGB COLOR SPACE
- LET Q(R2, G2, B2) BE A COLOR VECTOR IN RGB COLOR SPACE
- ΔR=R2-R1
- ΔG=G2-G1
- ΔB=B2-B1
- COLOR DISTANCE (CD) BETWEEN P AND Q IS DEFINED AS
- $CD = \sqrt{3(\Delta R)^2+4(\Delta G)^2+2(\Delta B)^2}$

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EXAMPLE

	R	G	B
P	30	87	9
Q	31	88	10
Delta^2	1	1	1
weight	3	4	2
CD^2	9		
CD	3		

	R	G	B
P	255	0	0
Q	251	0	0
Delta^2	16	0	0
weight	3	4	2
CD^2	48		
CD	6.9282		

OPTIMAL WEIGHTED COLOR TRANSFER

- **COLOR TRANSFER (CT): ORIGINAL FORM**
- $GCT_i = \frac{\sigma_t}{\sigma_s}(S_i - \mu_s) + \mu_t$ (1)
- **GENERALIZED WEIGHTED COLOR TRANSFER (GWCT)**
- $GWCT_i = \frac{W_i\sigma_t + (1-W_i)\sigma_s}{\sigma_s}(S_i - \mu_s) + W_i\mu_t + (1-W_i)\mu_s$ (2)

  $0.0 \le W_i \le 1.0$
- **WE CAN PRODUCE N+1 WEIGHTS WITHIN THE RANGE [0, 1]**
- $W_k = 0 + \frac{k}{N}(1-0),\ k = 0, 1, \ldots, N$ **IF N=100,** $W_0 = 0.0$, W_1**=0.01, …,** W_{101}**=1.0**
- **FOR EACH WEIGHT** W_i**, WE CAN CONDUCT GWCT TO PRODUCE AN INTERMEDIATE IMAGE,** I_i

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AVERAGE MEAN COLOR DISTANCE (AMCD)-1

- **GENERALIZED COLOR TRANSFER (GCT)**
- $GCT_i = \frac{W_i\sigma_t + (1-W_i)\sigma_s}{\sigma_s}(S_i - \mu_s) + W_i\mu_t + (1-W_i)\mu_s \quad 0.0 \le W_i \le 1.0$ **(2)**
- **MS:** (Rs, Gs, Bs) **AVERAGE MEAN OF PIXELS IN THE SOURCE IMAGE IN THREE CHANNELS**
- **MI:** (Ri, Gi, Bi) **AVERAGE MEAN OF PIXELS IN AN INTERMEDIATE IMAGE IN THREE CHANNCELS**
- $\Delta R_{SI} = (Ri - Rs)$; $\Delta G_{SI} = (Gi - Gs)$; $\Delta B_{SI} = (Bi - Bs)$;
- **AVERAGE MEAN COLOR DISTANCE (AMCD) BETWEEN SOURCE AND INTERMEDIATE**
  - $AMCD_{SI}^2 = 3(\Delta R_{SI})^2 + 4(\Delta G_{SI})^2 + 2(\Delta B_{SI})^2$
- **MT:** $(Rt\ Gt, Bt)$ **AVERAGE MEAN OF PIXELS IN THE TARGET IMAGE**

  $\Delta R_{TI} = (Ri - Rt)$; $\Delta G_{SI} = (Gi - Gt)$; $\Delta B_{SI} = (Bi - Bt)$;
- **COLOR DISTANCE BETWEEN TARGET AND INTERMEDIATE IMAGE**
  - $AMCD_{TI}^2 = 3(\Delta R_{TI})^2 + 4(\Delta G_{TI})^2 + 2(\Delta B_{TI})^2$

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AVERAGE MEAN COLOR DISTANCE (AMCD-2)

- $AMCD_{SI}^2 = 3(\Delta R_{SI})^2 + 4(\Delta G_{SI})^2 + 2(\Delta B_{SI})^2$
- $AMCD_{TI}^2 = 3(\Delta R_{TI})^2 + 4(\Delta G_{TI})^2 + 2(\Delta B_{TI})^2$
- Define a Total Color Distance for an intermediate image

  $TAMCD_i = |AMCD_{SI}^2 - AMCD_{TI}^2|$
- We can produce a sequence of weights w_i, where each weight corresponds to an intermediate image
- Note: w=0, intermediate image is the source image
- Note: w=1.0 intermediate image is a color transfer result produced by the conventional color transfer formula (eq. 1)
- Define An optimal Weighted Color Transfer:

  an optimal weight w_{op} such that $TAMCD_i$ is MINIMUM

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ASSIGNMENT 08

- Implement Generalized Weighted Color Transfer Using Average Mean Color Distance (AMCD)
- Produce TWO examples:
- First example: a default pair of source and target images that will be provided
- Second example: Your own sample pair of source and target images
- Calculate Features of source image , 99 intermediate images (w=0.01, 0.02, …, 0.98, 0.99), and target images in an excel file (see the file given) including
- 1. mean in R, G, B channel
- 2. Standard deviation in R, G, B channel
- 3. $AMCDE_{SI}^2$, $MCDE_{TI}^2$, and $TAMCD_i$
- Submission Rule: see the next slide

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ASSIGNMENT 08-CONT.

- Submission Rule: Please name your submission files as follows:
- 1. Source images: First case: S1, Second case: S2
- 2. Target images: First case: T1, Second case: T2
- 3. Optimal Weighted Color Transfer images: show optimal weights in the file name
  - For example: Let optimal weights are 0.38 and 0.64 for the first case and the second case, respectively, then rename the Optimal Weighted Color Transfer images as
  - First case: AMCD1-0.38, Second Example: AMCD2-0.64
- 4. Color transfer result image using w=1.0. Please name these images as CT1 and CT2
- 4. Optimal Weighted Color Transfer Excel file, where statistics of the first case and second case are recorded in two sheets (see example excel file provided):
  - AMCD-excel.xlsx
- 5. The excel provided has a pre-computed mean and standard deviation for the source image for First case. You can verify your results first with these statistics.
- 6. A resultant image for the first case (CT1) produced by optimal weighted color transfer using weight w=1.0 is also provided for checking purpose.
- Deadline: 2019/05/13 23:30 (more than one week after from Now)

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