수치해석
HW #11

correlation coefficients
between color components in the images

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– 컬러풀한 이미지 10장을 모은다
– 이미지의 RGB/YUV요소들 사이의 correlation coefficients를 구해본다

```
path = 'C:\\Users\\LG\\Desktop\\colorimage\\1.jpg'
img = cv2.imread(path,cv2.IMREAD_COLOR)

b,g,r = cv2.split(img)

# 가로, 세로 픽셀을 0으로 채우고, 채널을 빨강, 초록, 파랑으로
zeros = np.zeros(img.shape[:2], dtype="uint8")
cv2.imshow("Red", cv2.merge([zeros, zeros, r]))
cv2.waitKey()
cv2.imshow("Green", cv2.merge([zeros, g, zeros]))
cv2.waitKey()
cv2.imshow("Blue", cv2.merge([b, zeros, zeros]))
cv2.waitKey()    (이미지를 r,g,b 한 요소씩 표현해봄)

b = b.flatten()
g = g.flatten()
r = r.flatten()
                    G-R correlation coefficients in RGB space
df = pd.DataFrame({'g':g, 'r':r})
corr = df.corr(method='pearson')

print(corr)
```

```
# YUV correlation coefficients
img_yuv = cv2.cvtColor(img, cv2.COLOR_BGR2YUV)

y,u,v = cv2.split(img_yuv)

cv2.imshow('Y',y)
cv2.waitKey()
cv2.imshow('U',u)
cv2.waitKey()
cv2.imshow('V',v)
cv2.waitKey()

y = y.flatten()
u = u.flatten()
v = v.flatten()
                    Y-U correlation coefficients in YUV space
df = pd.DataFrame({'y':y, 'u':u})
corr = df.corr(method='pearson')
print(corr)
```

[1]

Correlation of 2 variables
- Similarity measure of two variables
- Normalized measure: −1 ~ +1

[Correlation coefficients의 의미]
0에 가까울수록 서로 연관성이 적음을 뜻한다
절대값이 1에 가까울수록 서로 연관성이 많음을 뜻한다

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.476302
r	0.476302	1.000000

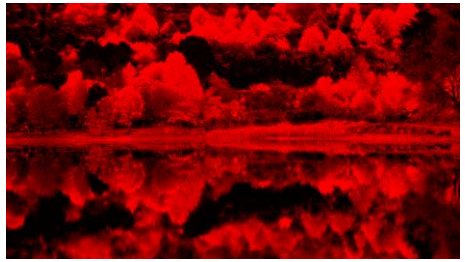
G-B in RGB space

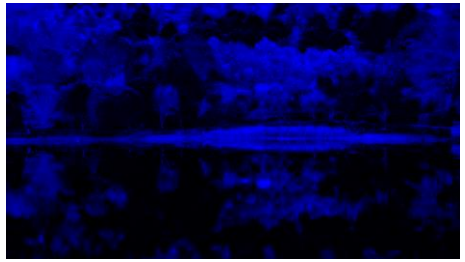
	g	b
g	1.000000	0.372589
b	0.372589	1.000000

R-B in RGB space

	r	b
r	1.000000	-0.037632
b	-0.037632	1.000000

(RGB)





Y-U in YUV space

	y	u
y	1.000000	-0.428482
u	-0.428482	1.000000

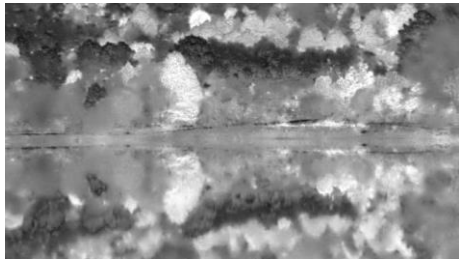
Y-V in YUV space

	y	v
y	1.00000	0.08764
v	0.08764	1.00000

U-V in YUV space

	u	v
u	1.000000	-0.501344
v	-0.501344	1.000000

(YUV)



[2]

이미지의 RGB의 correlation coefficients를 보면
연관성이 있으면 –〉 중복된 정보가 있다 –〉 데이터 용량 차지
=〉 신호 압축 : YUV (jpeg, mpeg 이미지, 영상 압축 시 사용하는 컬러 표준)
(컬러 성분들 간에 변환을 해서 서로 간의 correlation이 더 줄어드는 방향으로 만든다
–〉 상관성이 떨어지고, 각각의 정보로 전체를 표현한다)

일반적으로 RGB사이의 correlation 계수보다
YUV사이의 correlation 계수가 더 작다

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.960405
r	0.960405	1.000000

G-B in RGB space

	g	b
g	1.00000	0.90804
b	0.90804	1.00000

R-B in RGB space

	r	b
r	1.000000	0.856437
b	0.856437	1.000000

(RGB)

대부분의 중요한 영상정보는
Y에 들어가 있다

(YUV)

Y-U in YUV space

	y	u
y	1.000000	-0.821629
u	-0.821629	1.000000

Y 흑백성분과
굉장히 유사한
신호 성분을
갖는게 G

Y-V in YUV space

	y	v
y	1.000000	0.741915
v	0.741915	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.804059
v	-0.804059	1.000000

[3]

green 녹색 성분은 흑백 영상과 굉장히 유사한 성분이다
G, Y에 대한 컬러 성분의 correlation을 비교해보면 값이 큰 것을 볼 수 있다

	g	y
g	1.000000	0.978136
y	0.978136	1.000000

information이 Y, G 성분에 많이 몰려 있다
R, B에 G성분이 많이 중복되어 있어서
중복된 값을 없애 버린 것이 U, V 성분
-〉 YUV를 이용하면 훨씬 더 단순한 형태의 영상이 나와서
압축률이 높아진다

(RGB)

(YUV)

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.874911
r	0.874911	1.000000

G-B in RGB space

	g	b
g	1.000000	0.704452
b	0.704452	1.000000

R-B in RGB space

	r	b
r	1.00000	0.64894
b	0.64894	1.00000

Y-U in YUV space

	y	u
y	1.000000	-0.484603
u	-0.484603	1.000000

Y-V in YUV space

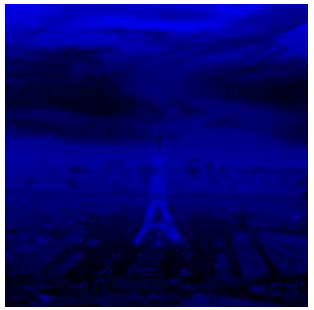
	y	v
y	1.000000	0.501436
v	0.501436	1.000000

U-V in YUV space

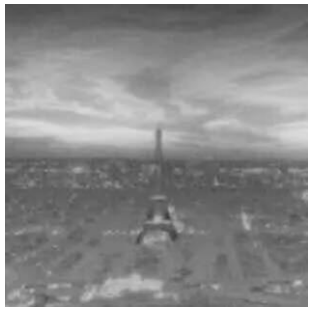
	u	v
u	1.00000	-0.48893
v	-0.48893	1.00000

[4]

(RGB)



(YUV)



[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.790462
r	0.790462	1.000000

G-B in RGB space

	g	b
g	1.000000	0.599723
b	0.599723	1.000000

R-B in RGB space

	r	b
r	1.000000	0.202033
b	0.202033	1.000000

Y-U in YUV space

	y	u
y	1.000000	-0.590504
u	-0.590504	1.000000

Y-V in YUV space

	y	v
y	1.000000	0.314772
v	0.314772	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.763416
v	-0.763416	1.000000

[5]

(RGB)

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.912093
r	0.912093	1.000000

G-B in RGB space

	g	b
g	1.000000	0.794556
b	0.794556	1.000000

R-B in RGB space

	r	b
r	1.00000	0.51555
b	0.51555	1.00000

(YUV)

Y-U in YUV space

	y	u
y	1.000000	-0.510195
u	-0.510195	1.000000

Y-V in YUV space

	y	v
y	1.000000	0.443912
v	0.443912	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.942944
v	-0.942944	1.000000

[6]

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.818779
r	0.818779	1.000000

G-B in RGB space

	g	b
g	1.000000	0.569238
b	0.569238	1.000000

R-B in RGB space

	r	b
r	1.000000	0.082211
b	0.082211	1.000000

(RGB)

Y-U in YUV space

	y	u
y	1.000000	-0.565794
u	-0.565794	1.000000

Y-V in YUV space

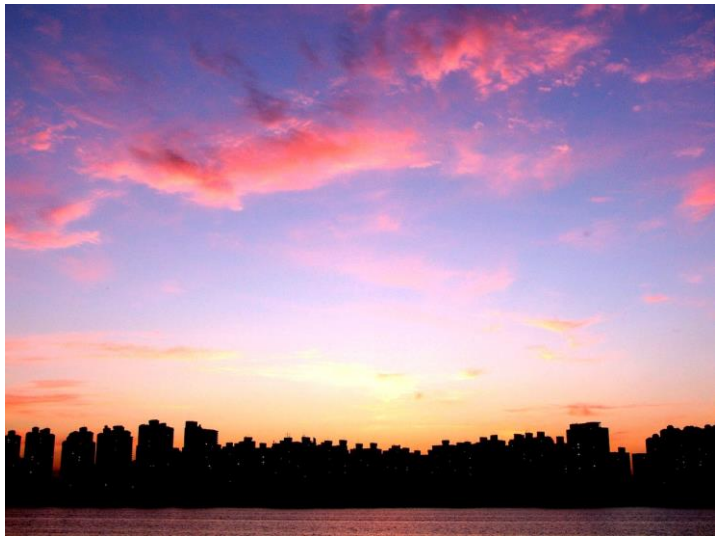
	y	v
y	1.000000	0.579987
v	0.579987	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.942956
v	-0.942956	1.000000

(YUV)

[7]



[correlation coefficients]

G-R in RGB space

	g	r
g	1.00000	0.93178
r	0.93178	1.00000

G-B in RGB space

	g	b
g	1.000000	0.883986
b	0.883986	1.000000

R-B in RGB space

	r	b
r	1.000000	0.797337
b	0.797337	1.000000

(RGB)

Y-U in YUV space

	y	u
y	1.000000	-0.172393
u	-0.172393	1.000000

Y-V in YUV space

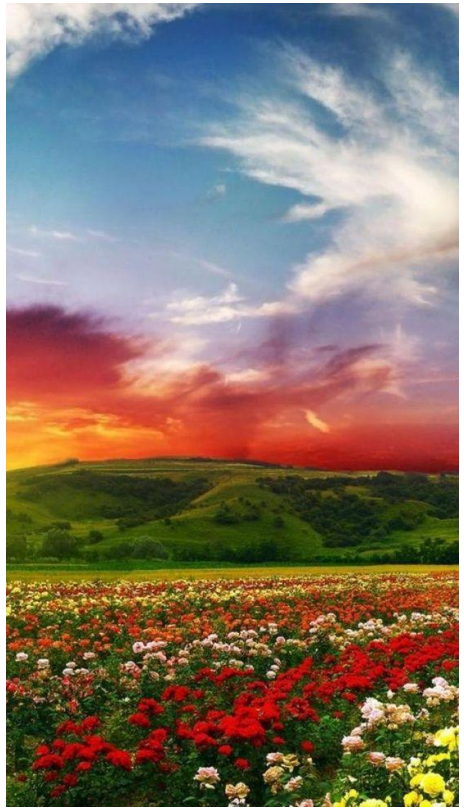
	y	v
y	1.000000	0.308109
v	0.308109	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.582898
v	-0.582898	1.000000

(YUV)

[8]



[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.978974
r	0.978974	1.000000

G-B in RGB space

	g	b
g	1.00000	0.97871
b	0.97871	1.00000

R-B in RGB space

	r	b
r	1.00000	0.94031
b	0.94031	1.00000

Y-U in YUV space

	y	u
y	1.000000	-0.868558
u	-0.868558	1.000000

Y-V in YUV space

	y	v
y	1.000000	0.641821
v	0.641821	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.835273
v	-0.835273	1.000000

(RGB)

(YUV)

[9]

[correlation coefficients]

G-R in RGB space

	g	r
g	1.000000	0.705495
r	0.705495	1.000000

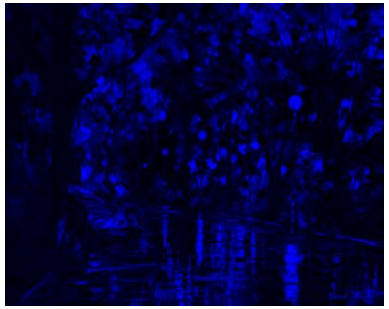
G-B in RGB space

	g	b
g	1.000000	0.660678
b	0.660678	1.000000

R-B in RGB space

	r	b
r	1.000000	0.201025
b	0.201025	1.000000

(RGB)



Y-U in YUV space

	y	u
y	1.000000	-0.534838
u	-0.534838	1.000000

Y-V in YUV space

	y	v
y	1.000000	0.121366
v	0.121366	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.672376
v	-0.672376	1.000000

(YUV)

[10]

(RGB)

(YUV)

[correlation coefficients]

G-R in RGB space

	g	r
g	1.0000	0.9786
r	0.9786	1.0000

G-B in RGB space

	g	b
g	1.000000	0.996181
b	0.996181	1.000000

R-B in RGB space

	r	b
r	1.00000	0.97409
b	0.97409	1.00000

Y-U in YUV space

	y	u
y	1.000000	-0.820023
u	-0.820023	1.000000

Y-V in YUV space

	y	v
y	1.000000	0.658805
v	0.658805	1.000000

U-V in YUV space

	u	v
u	1.000000	-0.857654
v	-0.857654	1.000000