

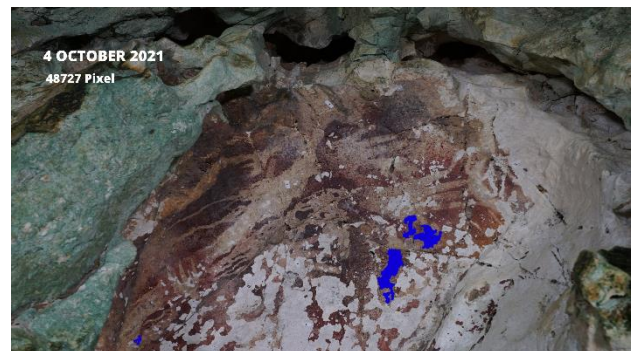
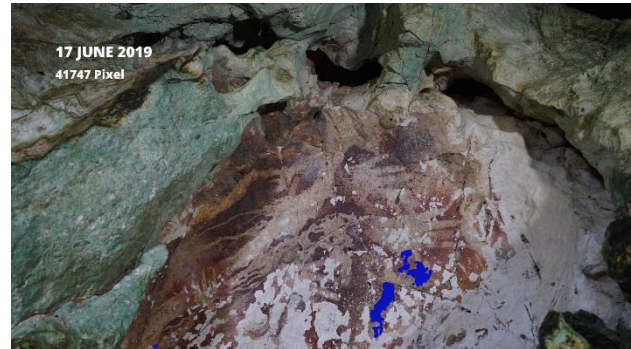
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LAMPIRAN

Lampiran 1. Gambar Hasil Polygon



Lampiran 2. Data Julian Day dan Kerusakan Lukisan

WAKTU MONITORING	JULIAN DAY	HARI	TAHUN	PERSENTASE KERUSAKAN (%)	LAJU KERUSAKAN (%/Years)
19-Mar-2019	2458561,5	0	0	0	0
17-Jun-2019	2458651,5	90	0,24658	0,03296	7,481488338
25-Mar-2020	2458933,5	282	0,7726	0,05758	13,41845283
4-Nov-2020	2459157,5	224	0,6137	0,11211	5,473985905
23-Mar-2021	2459296,5	139	0,38082	0,16957	2,245865724
4-Oct-2021	2459491,5	195	0,53425	0,20567	2,597638997
28-Mar-2022	2459666,5	175	0,47945	0,22831	2,100038452
23-Oct-2022	2459875,5	209	0,5726	0,24414	2,345367358

Lampiran 3. Hasil Perhitungan Data Temperatur Dalam dan Luar Gua

WAKTU MONITORING	PERSENTASE KERUSAKAN (%)	LAJU KERUSAKAN (%/Years)	SELISIH TEMPERATUR DALAM GUA (°C)	SELISIH STD. TEMPERATUR DALAM GUA (°C)	SELISIH TEMPERATUR LUAR GUA (°C)	SELISIH STD. TEMPERATUR LUAR GUA (°C)
19-Mar-2019	0	0	0	0	0	0
17-Jun-2019	0,03296	7,481488338	0,35	0,356041378	0,448	0,414542739
25-Mar-2020	0,05758	13,41845283	6,21	3,930642652	0,399	-0,430416872
4-Nov-2020	0,11211	5,473985905	-5,05	-3,551446677	1,193	0,494732906
23-Mar-2021	0,16957	2,245865724	-1,315555556	-0,551872456	-1,905	-0,338148865
4-Oct-2021	0,20567	2,597638997	0,675555556	0,003392866	0,506	0,365122268
28-Mar-2022	0,22831	2,100038452	-2,09	-0,119919208	-1,532	-0,626710508
23-Oct-2022	0,24414	2,345367358	0,96	-0,012295986	2,539	0,30735558

Lampiran 4. Hasil Perhitungan Data Kelembaban Dalam dan Luar Gua

WAKTU MONITORING	PERSENTASE KERUSAKAN (%)	LAJU KERUSAKAN (%/Years)	SELISIH KELEMBABAN DALAM GUA (Rh)	SELISIH STD. KELEMBABAN DALAM GUA (Rh)	SELISIH KELEMBABAN LUAR GUA (Rh)	SELISIH STD. KELEMBABAN LUAR GUA (Rh)
19-Mar-2019	0	0	0	0	0	0
17-Jun-2019	0,03997	6,169154995	-12,1	-0,4071191	-11,831	2,347633963
25-Mar-2020	0,04364	17,70536902	6,4	2,241238095	2,038	-1,06501371
4-Nov-2020	0,12555	4,888246183	-4,1	-1,512620669	-5,055	2,009922561
23-Mar-2021	0,19016	2,002587679	9,3	1,836843171	13,286	-1,56679857
4-Oct-2021	0,1986	2,690092586	-6	1,211929036	-7,407	1,967898629
28-Mar-2022	0,22846	2,098604107	6,5	-2,793067866	8,507	-3,92306257
23-Oct-2022	0,26219	2,183889087	0,7	-2,213594362	-6,293	2,931262063

Lampiran 5. Hasil Pengolahan Matlab Cuaca Dalam Gua

```
%Nonlinear modeling of Rate of Cave-art damages at Leang
Pettae
%inputs: hourly manual in-situ temperatures and humidities
%during monitoring projects (3 times a year) by pak Rustan
et al of
%BPCB (Badan Pelestarian Cagar Budaya Sulsel)
%halmar halide
%Lab. Hidrometeorologi, Dept. Geofisika FMIPA Unhas
%Makassar, 20/12/2022
clear
clf
%https://www.mathworks.com/help/stats/regress.html
%[b,bint,r,rint,stats] = (y,X)
load DLM.txt % {damage rate_of_damage meanT stdT meanRh
stdRh}
dmg=DLM(:,1)
dmg =
    0.0330
    0.0576
    0.1121
    0.1696
    0.2057
    0.2283
    0.2441
rod=DLM(:,2)
rod =
    7.4815
   13.4185
    5.4740
    2.2459
    2.5976
    2.1000
    2.3454
mT=DLM(:,3)
mT =
    0.3500
    6.2100
   -5.0500
   -1.3156
    0.6756
   -2.0900
    0.9600
sT=DLM(:,4)
sT =
```

```

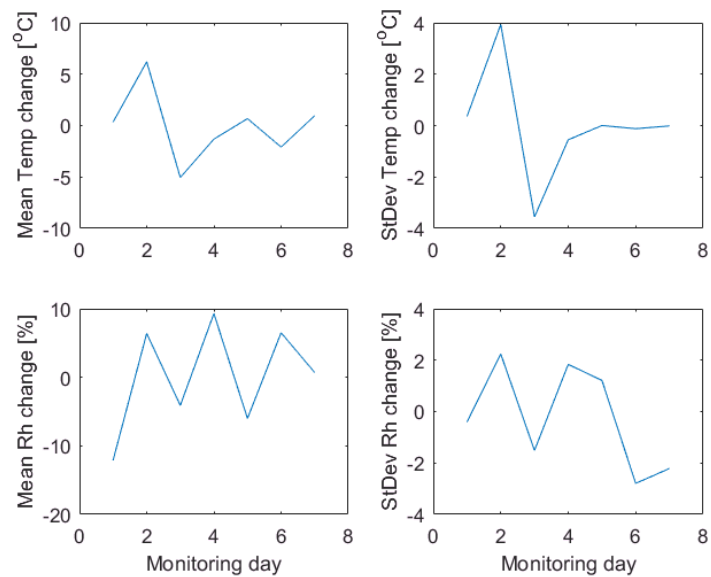
    0.3560
    3.9306
   -3.5514
   -0.5519
    0.0034
   -0.1199
   -0.0123
mRh=DLM(:,5)
mRh =
   -12.1000
    6.4000
   -4.1000
    9.3000
   -6.0000
    6.5000
    0.7000
sRh=DLM(:,6)
sRh =
   -0.4071
    2.2412
   -1.5126
    1.8368
    1.2119
   -2.7931
   -2.2136
y1=dmg
y1 =
    0.0330
    0.0576
    0.1121
    0.1696
    0.2057
    0.2283
    0.2441
y2=rod
y2 =
    7.4815
   13.4185
    5.4740
    2.2459
    2.5976
    2.1000
    2.3454
X= [ones(size(dmg)) mT mRh mT.*sT mRh.*sRh mT.*sRh] %OK
X =

```

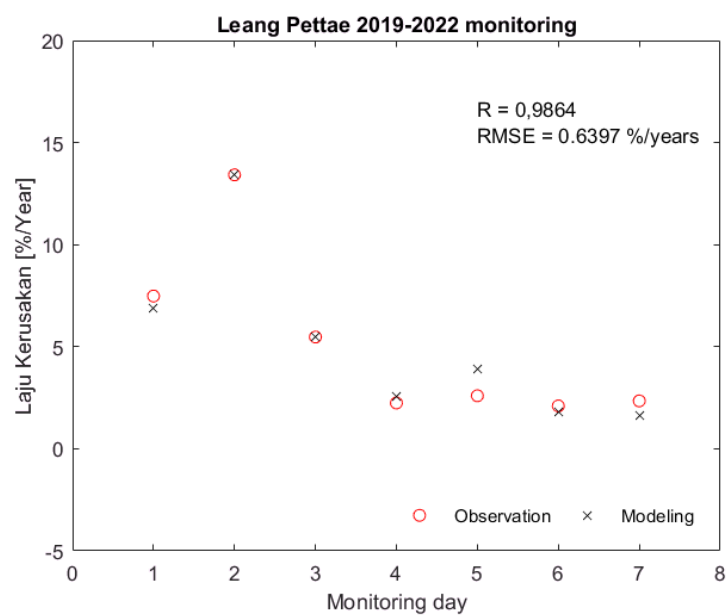
```

1.0000    0.3500   -12.1000    0.1246    4.9261   -0.1425
1.0000    6.2100    6.4000   24.4093   14.3439   13.9181
1.0000   -5.0500   -4.1000   17.9348    6.2017    7.6387
1.0000   -1.3156    9.3000    0.7260   17.0826   -2.4165
1.0000    0.6756   -6.0000    0.0023   -7.2716    0.8187
1.0000   -2.0900    6.5000    0.2506  -18.1549    5.8375
1.0000    0.9600    0.7000   -0.0118   -1.5495   -2.1251
b = regress(y2,X)
b =
    3.3616
    0.4187
   -0.2010
   -0.2225
    0.2181
    0.7925
out=X*b
out =
    6.8738
   13.4042
    5.4873
    2.5914
    3.9124
    1.7903
    1.6034
t=1:7;
% Menghitung korelasi person dan rmse
R= corr(y2,out)
R = 0.9864
RMSE = sqrt(mean((y2-out).^2))
RMSE = 0.6397
%plotting inputs
subplot(2,2,1),plot(t,mT)
ylabel('Mean Temp change [^oC]')
subplot(2,2,2),plot(t,sT)
ylabel('StDev Temp change [^oC]')
subplot(2,2,3),plot(t,mRh)
xlabel('Monitoring day')
ylabel('Mean Rh change [%]')
subplot(2,2,4),plot(t,sRh)
ylabel('StDev Rh change [%]')
xlabel('Monitoring day')

```



```
clf
%modeling result
plot(t,y2,'or',t,out,'xk')
axis([0 8 -5 20])
legend('Observation','Modeling','location','southeast','orientation','horizontal')
legend boxoff
xlabel('Monitoring day')
ylabel('Laju Kerusakan [%/Year]')
str = {'R = 0,9864','RMSE = 0.6397 %/years'};
text(5,16,str)
title('Leang Pettae 2019-2022 monitoring')
```



Lampiran 6. Hasil Pengolahan Matlab Cuaca Luar Gua

```
%Nonlinear modeling of Rate of Cave-art damages at Leang
Pettae
%inputs: hourly manual in-situ temperatures and humidities
%during monitoring projects (3 times a year) by pak Rustan
et al of
%BPCB (Badan Pelestarian Cagar Budaya Sulsel)
%halmar halide
%Lab. Hidrometeorologi, Dept. Geofisika FMIPA Unhas
%Makassar, 20/12/2022
clear
clf
%https://www.mathworks.com/help/stats/regress.html
%[b,bint,r,rint,stats] = (y,X)
load LR.txt % {damage rate_of_damage meanT stdT meanRh
stdRh}
dmg=LR(:,1)
dmg =
    0.0330
    0.0576
    0.1121
    0.1696
    0.2057
    0.2283
    0.2441
rod=LR(:,2)
rod =
    7.4815
   13.4185
    5.4740
    2.2459
    2.5976
    2.1000
    2.3454
mT=LR(:,3)
mT =
    0.4480
    0.3990
    1.1930
   -1.9050
    0.5060
   -1.5320
    2.5390
sT=LR(:,4)
sT =
```

```

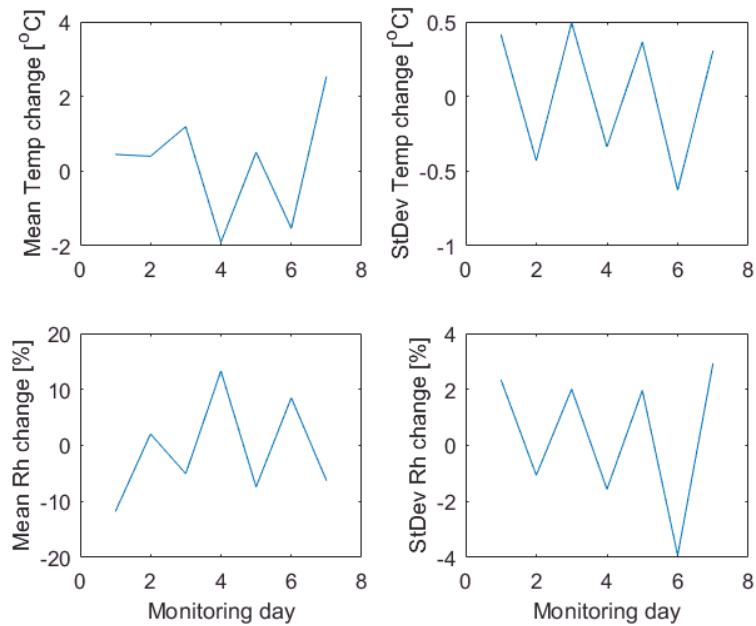
    0.4145
    -0.4304
    0.4947
    -0.3381
    0.3651
    -0.6267
    0.3074
mRh=LR(:,5)
mRh =
    -11.8310
         2.0380
        -5.0550
        13.2860
        -7.4070
         8.5070
        -6.2930
sRh=LR(:,6)
sRh =
         2.3476
        -1.0650
         2.0099
        -1.5668
         1.9679
        -3.9231
         2.9313
y1=dmg
y1 =
    0.0330
    0.0576
    0.1121
    0.1696
    0.2057
    0.2283
    0.2441
y2=rod
y2 =
    7.4815
   13.4185
    5.4740
    2.2459
    2.5976
    2.1000
    2.3454
X= [ones(size(dmg)) mT mRh mT.*sT mRh.*sRh mT.*sRh] %OK
X =

```

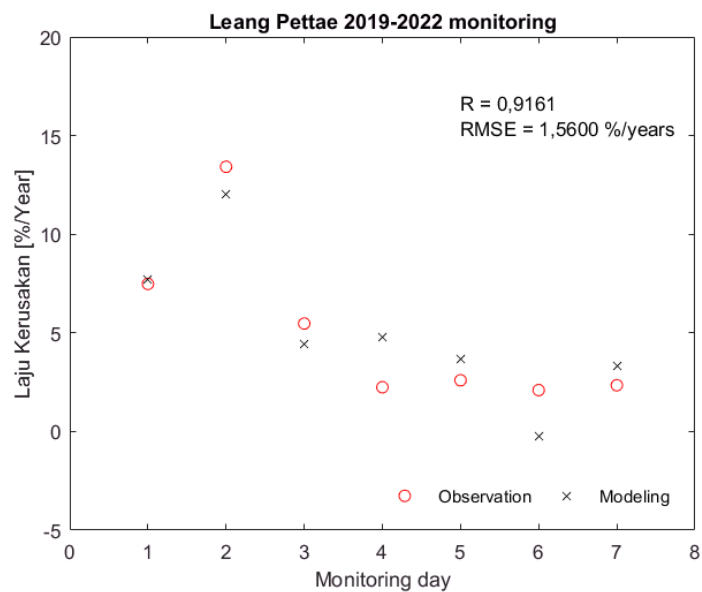
```

1.0000    0.4480   -11.8310    0.1857   -27.7749    1.0517
1.0000    0.3990    2.0380   -0.1717    -2.1705   -0.4249
1.0000    1.1930   -5.0550    0.5902   -10.1602    2.3978
1.0000   -1.9050   13.2860    0.6442   -20.8165    2.9848
1.0000    0.5060   -7.4070    0.1848   -14.5762    0.9958
1.0000   -1.5320    8.5070    0.9601   -33.3735    6.0101
1.0000    2.5390   -6.2930    0.7804   -18.4464    7.4425
b = regress(y2,X)
b =
    0.8801
   10.7814
    1.4738
   -1.2773
   -0.8630
   -4.1122
out=X*b
out =
    7.6798
   12.0253
    4.4456
    4.7898
    3.6668
   -0.2405
    3.2959
t=1:7;
% Menghitung korelasi person dan rmse
R= corr(y2,out)
R = 0.9161
RMSE = sqrt(mean((y2-out).^2))
RMSE = 1.5600
%plotting inputs
subplot(2,2,1),plot(t,mT)
ylabel('Mean Temp change [^oC]')
subplot(2,2,2),plot(t,sT)
ylabel('StDev Temp change [^oC]')
subplot(2,2,3),plot(t,mRh)
xlabel('Monitoring day')
ylabel('Mean Rh change [%]')
subplot(2,2,4),plot(t,sRh)
ylabel('StDev Rh change [%]')
xlabel('Monitoring day')

```



```
clf
%modeling result
plot(t,y2,'or',t,out,'xk')
axis([0 8 -5 20])
legend('Observation','Modeling','location','southeast','orientation','horizontal')
legend boxoff
xlabel('Monitoring day')
ylabel('Laju Kerusakan [%/Year]')
str = {'R = 0,9161','RMSE = 1,5600 %/years'};
text(5,16,str)
title('Leang Pettae 2019-2022 monitoring')
```



Lampiran 7. Hasil Perhitungan Pixel

Nilai Pixel Kerusakan lukisan leang Pettae 19 Maret 2019

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('19a.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 40415 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.40 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');
```



Nilai Pixel Kerusakan lukisan leang Pettae 17 Juni 2019

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('19b.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 41747 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.41 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
```

```
subplot(2,3,3),imshow(rgbBlue),title('blue');
```



Nilai Pixel Kerusakan lukisan leang Pettae 23 Maret 2020

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('20a.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 42742 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.42 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');
```



Nilai Pixel Kerusakan lukisan leang Pettae 4 November 2020

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('20b.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 44946 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.44 percent blue
```

```

rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');

```



Nilai Pixel Kerusakan lukisan leang Pettae 23 Maret 2021

```

%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('21a.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 47268 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.47 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');

```



Nilai Pixel Kerusakan lukisan leang Pettae 04 Oktober 2021

```

%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('21b.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));

```

```
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 48727 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.48 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');
```



Nilai Pixel Kerusakan lukisan leang Pettae 28 Maret 2022

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
-number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
-colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('22a.jpg');
rgb=A;
bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 49642 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.49 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');
```



Nilai Pixel Kerusakan lukisan leang Pettae 23 Oktober 2022

```
%menghitung piksel
%https://www.mathworks.com/matlabcentral/answers/350623-how-to-compute-
-number-of-pixels-in-images
%https://www.mathworks.com/matlabctral/answers/489002-counting-pixels-of-
-colored-objects-in-an-image
%https://www.rapidtables.com/web/color/RGB_Color.html
clear all;close all;clf
A=imread('22b.jpg');
rgb=A;
```

```

bluePoints=rgb(:,:,1)<=20 & rgb(:,:,2)<=180 & rgb(:,:,3)>=180; % 0 0 255
total=size(rgb,1)*size(rgb,2)
total = 10108160
percentBlue = 100*(sum(sum(bluePoints))/(total));
fprintf('Image has %d blue pixels\n',sum(sum(bluePoints)))
Image has 50282 blue pixels
fprintf('Image is %.2f percent blue\n',percentBlue)
Image is 0.50 percent blue
rgbBlue = uint8(cat(3,bluePoints,bluePoints,bluePoints)).*rgb;
subplot(2,3,1),imshow(rgb),title('raw');hold on
subplot(2,3,3),imshow(rgbBlue),title('blue');

```

raw



blue

