LAMPIRAN

Kode program penentuan luas wilayah laut Aral pada MATLAB

```matlab
function pemetaan()
clc;     % Clear command window.
clear;   % Delete all variables.
close all;   % Close all figure windows except those created by
imtool.
imtool close all;    % Close all figure windows created by imtool.
workspace;   % Make sure the workspace panel is showing.

global FileName;

%mengubah folder tempat file m ini disimpan
if(~isdeployed)
    cd(fileparts(which(mfilename)));
end

ver % Display user's toolboxes in their command window.

%membuat pilihan
message = sprintf('Program ini akan menampilkan citra satelit
kemudian\nakan menghitung luas dan ukurannya\ndi dalam piksel dan
kilometer.\nApakah ingin lanjut?');
reply = questdlg(message, 'Jalankan program?', 'OK','Cancel',
'OK');
if strcmpi(reply, 'Cancel')
    % User canceled so exit.
    return;
end
fontSize = 16;
[FileName,PathName]=uigetfile('*.jpg*','Citra
Satelit','MultiSelect','on'); %membuka file gambar

subplot(1,1, 1);
imshow(FileName{1});
axis on;
title('Citra Satelit Danau Aral tahun 2000', 'FontSize',
fontSize);
% Enlarge figure to full screen.
set(gcf, 'units','normalized','outerposition',[0 0 1 1]);
% Give a name to the title bar.
set(gcf,'name','Citra Danau ARAL Tahun 2000','numbertitle','off')

message = sprintf('Pertama kamu akan melakukan kalibrasi
spasial');
reply = questdlg(message, 'Kalibrasi spasial', 'OK', 'Cancel',
'OK');
if strcmpi(reply, 'Cancel')
    % User said Cancel, so exit.
    return;
end
```

```matlab
button = 1; % Allow it to enter loop.

while button ~= 4
    if button > 1
        % Let them choose the task, once they have calibrated.
        button = menu('Pilihan', 'Kalibrasi ulang', 'Tampilkan
semua', 'Tampilkan satu hasil', 'Keluar');
    end
    switch button
        case 1
            close all;
            subplot(1,1, 1);
            imshow(FileName{1});
            axis on;
            title('Citra Satelit Danau Aral tahun 2000',
'FontSize', fontSize);
            % Enlarge figure to full screen.
            set(gcf, 'units','normalized','outerposition',[0 0 1
1]);
            % Give a name to the title bar.
            set(gcf,'name','Citra Danau ARAL Tahun
2000','numbertitle','off')
            success = Calibrate();
            % Keep trying if they didn't click properly.
            while ~success
                success = Calibrate();
            end
            % If they get to here, they clicked properly
            % Change to something else so it will ask them
            % for the task on the next time through the loop.
            button = 99;
        case 2
            close all;
            tampilsemua();
        case 3
            close all;
            Tampilsatu();
        otherwise
            close all;
            break;
    end
end



end


function success = Calibrate()
global lastDrawnHandle;
global calibration;
global jarak;
global unit;
try
    success = false;
```

```matlab
    instructions = sprintf('klik kiri untuk menentukan titik
awal\nKlik kanan atau dobel klik untuk menentukan titik
kedua\n\nSetelah itu anda akan ditanya ukuran sebenarnya');
    title(instructions);
    msgboxw(instructions);

    [cx, cy, rgbValues, xi,yi] = improfile(1000);
    % rgbValues is 1000x1x3.  Call Squeeze to get rid of the
singleton dimension and make it 1000x3.
    rgbValues = squeeze(rgbValues);
    distanceInPiksels = sqrt( (xi(2)-xi(1)).^2 + (yi(2)-
yi(1)).^2);
    if length(xi) < 2
        return;
    end
    % Plot the line.
    hold on;
    lastDrawnHandle = plot(xi, yi, 'y-', 'LineWidth', 2);

    % Ask the user for the real-world distance.
    userPrompt = {'Masukkan Unit (contohnya: meter):','Masukkan
jarak dalam unit:'};
    dialogTitle = 'Spesifikasi Unit dan Jarak';
    numberOfLines = 1;
    def = {'microns', '500'};
    answer = inputdlg(userPrompt, dialogTitle, numberOfLines,
def);
    if isempty(answer)
        return;
    end
    calibration.units = answer{1};
    calibration.distanceInPiksels = distanceInPiksels;
    calibration.distanceInUnits = str2double(answer{2});
    calibration.distancePerPiksel = calibration.distanceInUnits /
distanceInPiksels;
    success = true;

    jarak=calibration.distancePerPiksel;
    unit=calibration.units;

    message = sprintf('Jarak yang anda gambar adalah %.2f piksels
= %f %s.\nJumlah dari %s per piksel adalah %f.\nJumlah dari
piksels per %s adalah %f',...
        distanceInPiksels, calibration.distanceInUnits,
calibration.units, ...
        calibration.units, calibration.distancePerPiksel, ...
        calibration.units, 1/calibration.distancePerPiksel);
    uiwait(msgbox(message));
catch ME
    errorMessage = sprintf('Error in function DrawLine().\nDid you
first left click and then right click?\n\nError Message:\n%s',
ME.message);
    fprintf(1, '%s\n', errorMessage);
    WarnUser(errorMessage);
end
```

```matlab
    return; % from Calibrate()
end


function tampilsemua()

global FileName;
global ARAL1;
global jarak;
global unit;

try

figure('Name','File Citra Satelit','numbertitle','off');
    set(gcf, 'units','normalized','outerposition',[0 0 1 1]);
%maximize tampilan figure
fontSize = 16;

numfiles=size(FileName,2); %menghitung jumlah elemen dalam array
FileName


for i=1:numfiles
    subplot(3,5,i)
    imshow(FileName{i});
    tahun=1999+i;
    title(tahun);
end
    h2=subplot(3,5,13)
    judul='Citra danau Aral Tahun 2000-2010';
    xl=xlim(h2);
    xPos=xl(1)+diff(xl)/2;
    yl=ylim(h2);
    yPos=yl(1)+diff(yl)/2;
    t=text(xPos,yPos,sprintf('%s\n',judul),'Parent',h2);
    set(t,'HorizontalAlignment','center');
    set(h2,'Visible','off');
    set(t,'fontSize',18);



message = sprintf('Gambar akan di ubah menjadi binary');
reply = questdlg(message, 'Jalankan program?', 'OK','Cancel',
'OK');
if strcmpi(reply, 'Cancel')
    % User canceled so exit.
    return;
end


figure('Name','Hasil Thresold gambar','numbertitle','off');
set(gcf, 'units','normalized','outerposition',[0 0 1 1]);
```

```matlab
%TRESHOLDING FILE ARAL 1
        channel1Min = 0.200;
        channel1Max = 0.583;

        channel2Min = 0.308;
        channel2Max = 0.780;

        channel3Min = 0.141;
        channel3Max = 0.608;

        rgbImage = imread(FileName{1});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);

            ARAL1=nnz(ARAL);


            subplot(3,5,1)
            imshow(ARAL);
            title('2000', 'FontSize', fontSize);


%TRESHOLDING FILE ARAL 2
        channel1Min = 0.217;
        channel1Max = 0.583;

        channel2Min = 0.132;
        channel2Max = 0.667;

        channel3Min = 0.141;
        channel3Max = 0.608;

        rgbImage = imread(FileName{2});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);

    ARAL2=nnz(ARAL);
    subplot(3,5,2)
    imshow(ARAL);
    title('2001', 'FontSize', fontSize);



%TRESHOLDING FILE ARAL KE 3
        channel1Min = 0.246;
        channel1Max = 0.549;

        channel2Min = 0.133;
```

```matlab
        channel2Max = 0.707;

        channel3Min = 0.145;
        channel3Max = 0.604;

        rgbImage = imread(FileName{3});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);

    ARAL3=nnz(ARAL);
    subplot(3,5,3)
    imshow(ARAL);
    title('2002', 'FontSize', fontSize);


%TRESHOLDING FILE ARAL 4

        channel1Min = 0.250;
        channel1Max = 0.581;

        channel2Min = 0.122;
        channel2Max = 0.716;

        channel3Min = 0.196;
        channel3Max = 0.663;

        rgbImage = imread(FileName{4});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);

    ARAL4=nnz(ARAL);
    subplot(3,5,4)
    imshow(ARAL);
    title('2003', 'FontSize', fontSize);



%TRESHOLDING FILE ARAL 5

        channel1Min = 0.233;
        channel1Max = 0.549;

        channel2Min = 0.092;
        channel2Max = 0.635;

        channel3Min = 0.141;
        channel3Max = 0.741;

        rgbImage = imread(FileName{5});
```

```matlab
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


    ARAL5=nnz(ARAL);
    subplot(3,5,5)
    imshow(ARAL);
    title('2004', 'FontSize', fontSize);



    %TRESHOLDING FILE ARAL 6

        channel1Min = 15.903;
        channel1Max = 59.097;

        channel2Min = -22.468;
        channel2Max = -4.317;

        channel3Min = -5.034;
        channel3Max = 18.651;


        rgbImage = imread(FileName{6});
        I=rgb2lab(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


    ARAL6=nnz(ARAL);
    subplot(3,5,6)
    imshow(ARAL);
    title('2005', 'FontSize', fontSize);



    %TRESHOLDING FILE ARAL 7

        channel1Min = 0.215;
        channel1Max = 0.543;

        channel2Min = 0.138;
        channel2Max = 0.761;

        channel3Min = 0.165;
        channel3Max = 0.561;

        rgbImage = imread(FileName{7});
```

```matlab
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
     (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
     (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);

    ARAL7=nnz(ARAL);
    subplot(3,5,7)
    imshow(ARAL);
    title('2006', 'FontSize', fontSize);




    %TRESHOLDING FILE ARAL 8

        channel1Min = 0.256;
        channel1Max = 0.457;

        channel2Min = 0.099;
        channel2Max = 0.690;

        channel3Min = 0.184;
        channel3Max = 0.608;

        rgbImage = imread(FileName{8});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
     (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
     (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


    ARAL8=nnz(ARAL);
    subplot(3,5,8)
    imshow(ARAL);
    title('2007', 'FontSize', fontSize);




    %TRESHOLDING FILE ARAL 9

        channel1Min = 0.205;
        channel1Max = 0.517;

        channel2Min = 0.111;
        channel2Max = 0.658;

        channel3Min = 0.133;
        channel3Max = 0.592;

        rgbImage = imread(FileName{9});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
     (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
```

```matlab
        (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);




    ARAL9=nnz(ARAL);
    subplot(3,5,9)
    imshow(ARAL);
    title('2008', 'FontSize', fontSize);




    %TRESHOLDING FILE ARAL 10

        channel1Min = 0.303;
        channel1Max = 0.500;

        channel2Min = 0.322;
        channel2Max = 0.745;

        channel3Min = 0.086;
        channel3Max = 0.471;


        rgbImage = imread(FileName{10});
        I = rgb2hsv(rgbImage);
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


    ARAL10=nnz(ARAL);
    subplot(3,5,10)
    imshow(ARAL);
    title('2009', 'FontSize', fontSize);




    %TRESHOLDING FILE ARAL 11

        channel1Min = 0.266;
        channel1Max = 0.508;

        channel2Min = 0.271;
        channel2Max = 0.816;

        channel3Min = 0.090;
        channel3Max = 0.541;

        rgbImage = imread(FileName{11});
        I = rgb2hsv(rgbImage);
```

```matlab
ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


    ARAL11=nnz(ARAL);
    subplot(3,5,11)
    imshow(ARAL);
    title('2010', 'FontSize', fontSize);

    h2=subplot(3,5,13)
    judul='Hasil Treshold Citra danau Aral Tahun 2000-2010';
    xl=xlim(h2);
    xPos=xl(1)+diff(xl)/2;
    yl=ylim(h2);
    yPos=yl(1)+diff(yl)/2;
    t=text(xPos,yPos,sprintf('%s\n',judul),'Parent',h2);
    set(t,'HorizontalAlignment','center');
    set(h2,'Visible','off');
    set(t,'fontSize',18);

message = sprintf('Akan ditampilkan masing-masing luas per
tahun');
reply = questdlg(message, 'Lanjut?', 'OK','Cancel', 'OK');
if strcmpi(reply, 'Cancel')
    % User canceled so exit.
    return;
end


figure('Name','Hasil Thresold gambar','numbertitle','off');
set(gcf, 'units','normalized','outerposition',[0 0 1 1]);

%membuat array luas dari file gambar ARAL1 sampai ARAL11
disp= {ARAL1*jarak^2;
    ARAL2*jarak^2;
    ARAL3*jarak^2;
    ARAL4*jarak^2;
    ARAL5*jarak^2;
    ARAL6*jarak^2;
    ARAL7*jarak^2;
    ARAL8*jarak^2;
    ARAL9*jarak^2;
    ARAL10*jarak^2;
    ARAL11*jarak^2;}

h1=subplot(1,2,1);
t=text(0,0.5,sprintf('%s%.2f%s%s\n\n%s%.2f%s%s\n\n%s%.2f%s%s\n\n%s
%.2f%s%s\n\n%s%.2f%s%s\n\n%s%.2f%s%s\n\n%s%.2f%s%s\n\n%s%.2f%s%s\n
\n%s%.2f%s%s\n\n%s%.2f%s%s\n\n%s%.2f%s%s\n',...
    'Tahun 2000= ',disp{1},unit,' persegi',...
    'Tahun 2001= ',disp{2},unit,' persegi',...
    'Tahun 2002= ',disp{3},unit,' persegi',...
    'Tahun 2003= ',disp{4},unit,' persegi',...
    'Tahun 2004= ',disp{5},unit,' persegi',...
```

```matlab
        'Tahun 2005= ',disp{6},unit,' persegi',...
        'Tahun 2006= ',disp{7},unit,' persegi',...
        'Tahun 2007= ',disp{8},unit,' persegi',...
        'Tahun 2008= ',disp{9},unit,' persegi',...
        'Tahun 2009= ',disp{10},unit,' persegi',...
        'Tahun 2010= ',disp{11},unit,' persegi'),'Parent',h1);

h2=subplot(1,2,2);
t1=text(0,0.5,sprintf('%.2f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2
f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2f%s\n\n%.2f%s\n\
n',...
    ARAL1,' Piksel',...
    ARAL2,' Piksel',...
    ARAL3,' Piksel',...
    ARAL4,' Piksel',...
    ARAL5,' Piksel',...
    ARAL6,' Piksel',...
    ARAL7,' Piksel',...
    ARAL8,' Piksel',...
    ARAL9,' Piksel',...
    ARAL10,' Piksel',...
    ARAL11,' Piksel'),'Parent',h2);

set(h2,'Visible','off');
set(t1,'fontSize',12);

set(h1,'Visible','off');
set(t,'fontSize',12);




%JIKA ERROR MAKA TAMPILKAN PESAN ERROR
catch ME
    errorMessage = sprintf('Error in function %s() at line
%d.\n\nError Message:\n%s', ...
        ME.stack(1).name, ME.stack(1).line, ME.message);
    fprintf(1, '%s\n', errorMessage);
    uiwait(warndlg(errorMessage));

end
return;
end


function Tampilsatu()

global FileName;
global jarak;
global unit;
try

            channel1Min = 0.200;
            channel1Max = 0.583;
```

```matlab
            channel2Min = 0.308;
            channel2Max = 0.780;

            channel3Min = 0.141;
            channel3Max = 0.608;


gambar=imread(FileName{1});
set(gcf, 'units','normalized','outerposition',[0 0 1 1]);
h1=subplot(2,2,1);
imshow(gambar);

                    rgbImage = imread(FileName{1});

                    I = rgb2hsv(rgbImage);


ARAL =(I(:,:,1) >= channel1Min ) & (I(:,:,1) <= channel1Max) & ...
      (I(:,:,2) >= channel2Min ) & (I(:,:,2) <= channel2Max) & ...
      (I(:,:,3) >= channel3Min ) & (I(:,:,3) <= channel3Max);


                    subplot(2,2,2);
                    imshow(ARAL);

            ARAL1=nnz(ARAL);


luas= ARAL1 * jarak^2;

desc={'Citra Satelit Danau Aral tahun 2000';
    'luas wilayah (dalam piksel): ';
    'luas wilayah (dalam Kilometer): '};


    h2=subplot(2,2,3);


    xl=xlim(h2);
    xPos=xl(1)+diff(xl)/2;
    yl=ylim(h2);
    yPos=yl(1)+diff(yl)/2;
    t=text(xPos,yPos,sprintf('%s\n%s%.2f%s\n\n%s%.2f
%s%s',desc{1},desc{2},real(ARAL1),' piksel',desc{3},real(luas),
unit,' persegi'),'Parent',h2);
    set(t,'HorizontalAlignment','center');
    set(h2,'Visible','off');
    set(t,'fontSize',12);


catch ME
```

```matlab
    errorMessage = sprintf('Error in function %s() at line
%d.\n\nError Message:\n%s', ...
        ME.stack(1).name, ME.stack(1).line, ME.message);
    fprintf(1, '%s\n', errorMessage);
    uiwait(warndlg(errorMessage));

end
end


function msgboxw(message)
    uiwait(msgbox(message));
end
%================================================================
====


function WarnUser(message)
    uiwait(msgbox(message));
end
```