DAFTAR PUSTAKA

Abdul Halim Hasugian, I. Z. (2018). Perancangan Sistem Restorasi Citra Dengan Metode Image Inpainting. *Ilmu Komputer dan Informatika*, 31-45.

Agus Prijono, M. C. (2007). *Pengolahan Citra Digital Menggunakan Matlab.* Bandung: Informatika.

Anharku. (2020, Agustus Selasa). Flowchar thttp://ilmukomputer.org. *2009*.

B Destyningtias, H. N. (2010). Segmentasi Citra Dengan Metode Pengembangan. *Elektrika*, 39-49.

Cahyono, B. (2013). Penggunaan Software Matrix Laboratory (MATLAB) dalam pembelajaran Aljabar Linier. *Phenomenon* , 45-62.

Cahyono, B. (2013). Penggunakan Software Matri Laboratory (MATLAB) dalam Pembelajaran Aljabar Linier. *Tadris Matematika*, 45-62.

Difla Yustisia Qur'ani, S. R. (2011). Jaringan Syaraf Tiruan Learning Vector Quantization Untuk Aplikasi Pengenalan Tanda Tangan. *Akademi Pengajian Islam, University Malaya Kuala Lumpur*, 6-10.

Dr. Makmur Abdullah Yusof, P. (2011). Manifestasi Khat Naskhi Sebagai Tulisan Asas Al-Qur'an. *Akademi Pengajian Islam, University Malaya Kuala Lumpur*, 1-16.

Haykin, S. (2009). *Neural Networks and Learning Machines.* United States of America: Pearson Education.

Imam Suderajad, T. A. (2015). Aplikasi Pengenalan Citra Chord Gitar Menggunakan Learning Vector Quantization (LVQ). *Teknologi Informasi dan Komunikasi Terapan*, 95-99.

Kusumadewi, S. (2003). *Artificial Intelligence (Teknik dan Aplikasinya).* Yogyakarta: Graha Ilmu.

Laurence, F. (1994). *Fundamentals of Neural Networks Architectures, Algorithms, Applications.* London: Prentice Hall, Inc.

Mhd. Furqan, S. S. (2020). Perbandingan Algoritma Contraharmonic Mean Filter dan Arithmetic Mean Filter Untuk Mereduksi Exponential Noise. *JISKA (Jurnal Informatika Sunan Kalijaga)*, 107-115.

Munir, R. (2004). *Pengolahan Citra Digital Dengan Pendekatan Algoritmik.* Bandung: Informatika.

Pujiati. (2016). Kaligrafi Arab Digital Ayat Al-Qur'an di Dunia Maya. *Ilmu Budaya*, 219-237.

RC Gonzales, R. W. (2002). *Digital Image Processing Second Edition.* New Jersey: Pearson Education.

RD Kusumanto, A. N. (2011). Pengolahan Citra Untuk Mendeteksi Obyek Menggunakan Pengolahan Model Normalisasi RGB. *Teknologi Informasi dan Komunikasi Terapan*, 1-7.

Santosa, B. (2007). *Data Mining Terapan Dengan Matlab.* Yogyakarta: Graha Ilmu.

Taufik. (2006). Sistem Komputerisasi Perpustakaan STMIK Banjar Baru. *Progresif*, 166-226.

Yahya, A. (2001). Pengembangan Kaligrafi untuk Optimalisasi Peranan Bahasa. *Universitas Gajah Mada*, 1.

LAMPIRAN-LAMPIRAN

LAMPIRAN
TOOLS MATLAB

Tools Matlab untuk Menjalankan Program Penerapan Metode *Learning Vector Quantization (LVQ)* Untuk Mengenali Jenis Teks Kaligrafi:

Tools	Fungsi
pushbutton1	Memasukkan File Citra Kaligrafi yang akan dikenalkan
pushbutton2	Proses pengenalan File Citra Kaligrafi
btnClear	Membersihkan riwayat proses pengenalan citra Kaligrafi
axes1	Menampilkan Citra Asli
axes2	Menampilkan Citra *Grayscale*
axes3	Menampilkan Citra Biner
axes4	Menampilkan Citra Dikenal
NamaFile	Menampilkan Posisi File Citra yang diinput
edit1	Menampilkan Hasil Pengenalan
txtUkuran	Menampilkan Ukuran Citra

LAMPIRAN

LISTING PROGRAM

```
function varargout = Menu(varargin)
% MENU MATLAB code for Menu.fig
%      MENU, by itself, creates a new MENU or raises the existing
%      singleton*.
%
%      H = MENU returns the handle to a new MENU or the handle to
%      the existing singleton*.
%
%      MENU('CALLBACK',hObject,eventData,handles,...) calls the local
%      function named CALLBACK in MENU.M with the given input arguments.
%
%      MENU('Property','Value',...) creates a new MENU or raises the
%      existing singleton*.  Starting from the left, property value pairs are
%      applied to the GUI before Menu_OpeningFcn gets called.  An
%      unrecognized property name or invalid value makes property application
%      stop.  All inputs are passed to Menu_OpeningFcn via varargin.
%
%      *See GUI Options on GUIDE's Tools menu.  Choose "GUI allows only one
%      instance to run (singleton)".
%
% See also: GUIDE, GUIDATA, GUIHANDLES

% Edit the above text to modify the response to help Menu

% Last Modified by GUIDE v2.5 13-Oct-2020 10:19:14

% Begin initialization code - DO NOT EDIT
```

```
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @Menu_OpeningFcn, ...
                   'gui_OutputFcn',  @Menu_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT


% --- Executes just before Menu is made visible.
function Menu_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to Menu (see VARARGIN)

% Choose default command line output for Menu
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);
```

```
% UIWAIT makes Menu wait for user response (see UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = Menu_OutputFcn(hObject, eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;
 axes(handles.axes1);
 imshow('LogoUIN.png');

% ------------------------------------------------------------------
    ----
function mnuPelatihan_Callback(hObject, eventdata, handles)
% hObject    handle to mnuPelatihan (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
%clc; clear; close all;
% image_folder = 'DataPelatihan';
% filenames = dir(fullfile(image_folder, '*.jpg'));
% total_images = numel(filenames);
% area = zeros(1,total_images);
% perimeter = zeros(1,total_images);
% metric = zeros(1,total_images);
% eccentricity = zeros(1,total_images);
%
% for n = 1:total_images
```

```
%     full_name= fullfile(image_folder, filenames(n).name);
%     I = imread(full_name);
%     J = I(:,:,1);
%     K = im2bw(J,.6);
%     L = imcomplement(K);
%     str = strel('disk',5);
%     M = imclose(L,str);
%     N = imfill(M,'holes');
%     %O = bwareaopen(N,5000);
%    O = bwareaopen(N,500);
%     stats = regionprops(O,'Area','Perimeter','Eccentricity');
%     area(n) = stats.Area;
%     perimeter(n) = stats.Perimeter;
%     metric(n) = 4*pi*area(n)/(perimeter(n)^2);
%     eccentricity(n) = stats.Eccentricity;
% end
%
% input = [metric;eccentricity];
% target = zeros(1,40);
% target(:,1:10) = 1;
% target(:,11:20) = 2;
% target(:,21:30) = 3;
% target(:,31:40) = 4;
% netLVQ = newff(input,target,[10
    5],{'logsig','logsig'},'trainlm');
% %netLVQ = lvqnet(input,target,[10
    5],{'logsig','logsig'},'trainlm');
% %netLVQ = lvqnet(40, 0.01, 'learnlv1');
% %netLVQ = lvqnet(input, 0.01, 'learnlv1');
% %netLVQ.trainParam.epochs = 200;
% netLVQ.trainParam.epochs = 1000;
% netLVQ.trainParam.goal = 1e-6;
% netLVQ = train(netLVQ,input,target);
% output = round(sim(netLVQ,input));
```

```
% save netLVQ.mat netLVQ;
% [m,n] = find(output==target);
% akurasi = (sum(m)/total_images)*100
% msgbox('Pelatihan selesai.....');
Pelatihan;
% --------------------------------------------------------------------
    ----
function mnuPengenalan_Callback(hObject, eventdata, handles)
% hObject    handle to mnuPengenalan (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
PengenalanKaligrafi;


% --------------------------------------------------------------------
    ----
function mnuKeluar_Callback(hObject, eventdata, handles)
% hObject    handle to mnuKeluar (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
close;
clc; clear; close all;
image_folder = 'DataPelatihan';
filenames = dir(fullfile(image_folder, '*.jpg'));
total_images = numel(filenames);


area = zeros(1,total_images);
perimeter = zeros(1,total_images);
metric = zeros(1,total_images);
eccentricity = zeros(1,total_images);


for n = 1:total_images
    full_name= fullfile(image_folder, filenames(n).name);
    I = imread(full_name);
```

```
    J = I(:,:,1);
    K = im2bw(J,.6);
    L = imcomplement(K);
    str = strel('disk',6);
    M = imclose(L,str);
    N = imfill(M,'holes');
    %O = bwareaopen(N,5000);
   O = bwareaopen(N,1000);
    stats = regionprops(O,'Area','Perimeter','Eccentricity');
    area(n) = stats.Area;
    perimeter(n) = stats.Perimeter;
    metric(n) = 4*pi*area(n)/(perimeter(n)^2);
    eccentricity(n) = stats.Eccentricity;
end

input = [metric;eccentricity];
target = zeros(1,60);
target(:,1:10) = 1;
target(:,11:20) = 2;
target(:,21:30) = 3;
target(:,31:40) = 4;
target(:,41:50) = 5;
target(:,51:60) = 6;

netLVQ = newff(input,target,[10 5],{'logsig','logsig'},'trainlm');
netLVQ.trainParam.epochs = 10000;
netLVQ.trainParam.goal = 1e-6;
netLVQ = train(netLVQ,input,target);
output = round(sim(netLVQ,input));
save netLVQ.mat netLVQ;

[m,n] = find(output==target);
% akurasi = sum(m)/total_images*100;
```

```
msgbox('Pelatihan selesai.....');
Menu;
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
    'gui_Singleton',  gui_Singleton, ...
    'gui_OpeningFcn', @PengenalanKaligrafi_OpeningFcn, ...
    'gui_OutputFcn',  @PengenalanKaligrafi_OutputFcn, ...
    'gui_LayoutFcn',  [] , ...
    'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(gui_State, varargin{:});
end
% End initialization code - DO NOT EDIT



% --- Executes just before PengenalanKaligrafi is made visible.
function PengenalanKaligrafi_OpeningFcn(hObject, eventdata,
    handles, varargin)
% This function has no output args, see OutputFcn.
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
% varargin   command line arguments to PengenalanKaligrafi (see
    VARARGIN)


% Choose default command line output for PengenalanKaligrafi
handles.output = hObject;
```

```
% Update handles structure
guidata(hObject, handles);
movegui(hObject,'center');

% UIWAIT makes PengenalanKaligrafi wait for user response (see
    UIRESUME)
% uiwait(handles.figure1);


% --- Outputs from this function are returned to the command line.
function varargout = PengenalanKaligrafi_OutputFcn(hObject,
    eventdata, handles)
% varargout  cell array for returning output args (see VARARGOUT);
% hObject    handle to figure
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)

% Get default command line output from handles structure
varargout{1} = handles.output;


% --- Executes on button press in pushbutton1.
function pushbutton1_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton1 (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
[nama_file,nama_path] = uigetfile({'*.*'});

if ~isequal(nama_file,0)
    I = imread(fullfile(nama_path,nama_file));
    axes(handles.axes1)
    imshow(I)
```

```
    handles.I = I;
    guidata(hObject,handles)
    lebar=size(I,2);
    tinggi=size(I,1);
    Dimensi=lebar*tinggi;
    set (handles.NamaFile,'string',fullfile(nama_path,nama_file));
    set (handles.txtUkuran,'string',num2str(Dimensi));
   else
    return
end


% --- Executes on button press in pushbutton2.
function pushbutton2_Callback(hObject, eventdata, handles)
% hObject    handle to pushbutton2 (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
I = handles.I;
CitraGray=rgb2gray(I);
axes(handles.axes4);
imshow(CitraGray);

J = I(:,:,1);
K = im2bw(J,.6);
L = imcomplement(K);
str = strel('disk',5);
M = imclose(L,str);
N = imfill(M,'holes');
%O = bwareaopen(N,5000);
O = bwareaopen(N,500);
stats = regionprops(O,'Area','Perimeter','Eccentricity');
area = stats.Area;
perimeter = stats.Perimeter;
```

```
metric = 4*pi*area/(perimeter^2);
eccentricity = stats.Eccentricity;

input = [metric;eccentricity];
load netLVQ
output = round(sim(netLVQ,input));

axes(handles.axes2)
imshow(O)

R = I(:,:,1);
G = I(:,:,2);
B = I(:,:,3);

R(~O) = 0;
G(~O) = 0;
B(~O) = 0;

RGB = cat(3,R,G,B);
axes(handles.axes3)
imshow(RGB)

if output == 1
    kelas = 'Khat Diwani';
elseif output == 2
    kelas = 'Khat Diwani Jali';
elseif output == 3
    kelas = 'Khat Farisi';
elseif output == 4
    kelas = 'Khat Naskh';
elseif output == 5
    kelas = 'Khat Riqah';
elseif output == 6
```

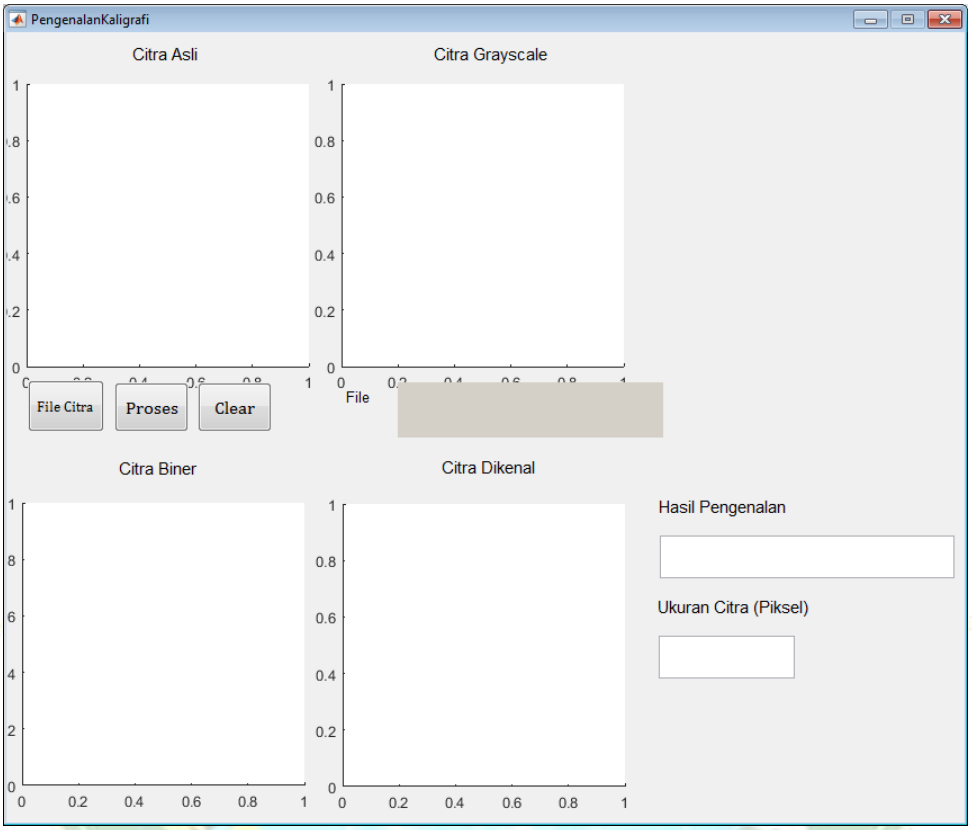
```
    kelas = 'Khat Tsuluts';
end
set(handles.edit1,'String',kelas)
function edit1_Callback(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of edit1 as text
%        str2double(get(hObject,'String')) returns contents of
    edit1 as a double


% --- Executes during object creation, after setting all
    properties.
function edit1_CreateFcn(hObject, eventdata, handles)
% hObject    handle to edit1 (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    empty - handles not created until after all
    CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
    get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


% --- Executes on button press in btnClear.
function btnClear_Callback(hObject, eventdata, handles)
% hObject    handle to btnClear (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)
set (handles.NamaFile,'string','');
```

```
set (handles.edit1,'string','');
set (handles.txtUkuran,'string','');
axes(handles.axes1);
cla('reset');
axes(handles.axes2);
cla('reset');
axes(handles.axes3);
cla('reset');
axes(handles.axes4);
cla('reset');
clc;
clc;
clc;
clc;
clear all;


function txtNmFile_Callback(hObject, eventdata, handles)
% hObject    handle to txtNmFile (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of txtNmFile as
    text
%        str2double(get(hObject,'String')) returns contents of
    txtNmFile as a double


% --- Executes during object creation, after setting all
    properties.
function txtNmFile_CreateFcn(hObject, eventdata, handles)
% hObject    handle to txtNmFile (see GCBO)
% eventdata  reserved - to be defined in a future version of
    MATLAB
% handles    empty - handles not created until after all
    CreateFcns called
```

```
% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
     get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end


function txtUkuran_Callback(hObject, eventdata, handles)
% hObject    handle to txtUkuran (see GCBO)
% eventdata  reserved - to be defined in a future version of
     MATLAB
% handles    structure with handles and user data (see GUIDATA)


% Hints: get(hObject,'String') returns contents of txtUkuran as
     text
%        str2double(get(hObject,'String')) returns contents of
     txtUkuran as a double


% --- Executes during object creation, after setting all
     properties.
function txtUkuran_CreateFcn(hObject, eventdata, handles)
% hObject    handle to txtUkuran (see GCBO)
% eventdata  reserved - to be defined in a future version of
     MATLAB
% handles    empty - handles not created until after all
     CreateFcns called


% Hint: edit controls usually have a white background on Windows.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
     get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

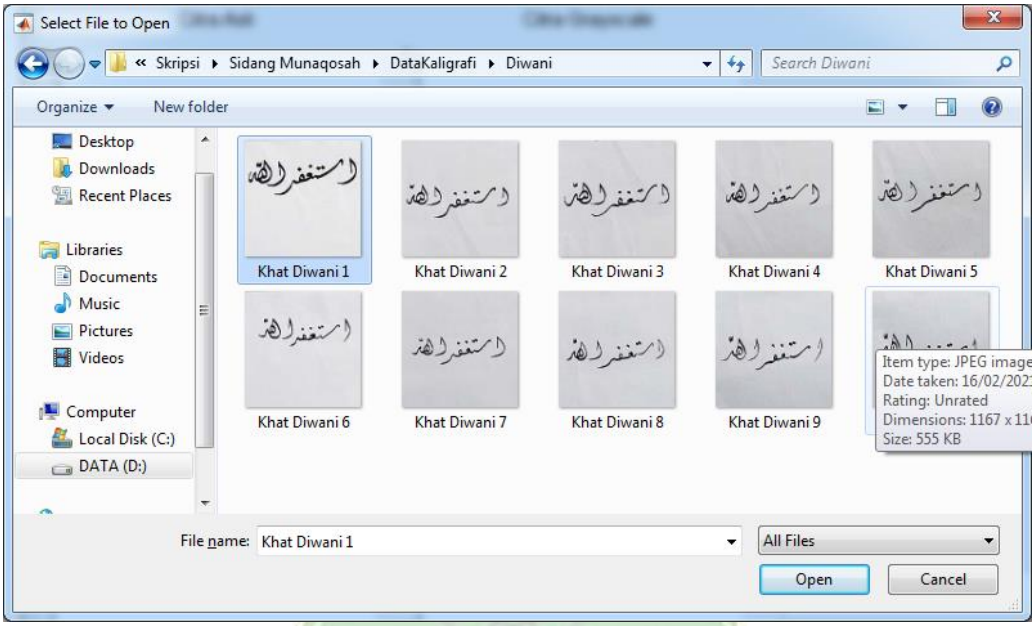
LAMPIRAN

UJI COBA TINGKAT KEBERHASILAN



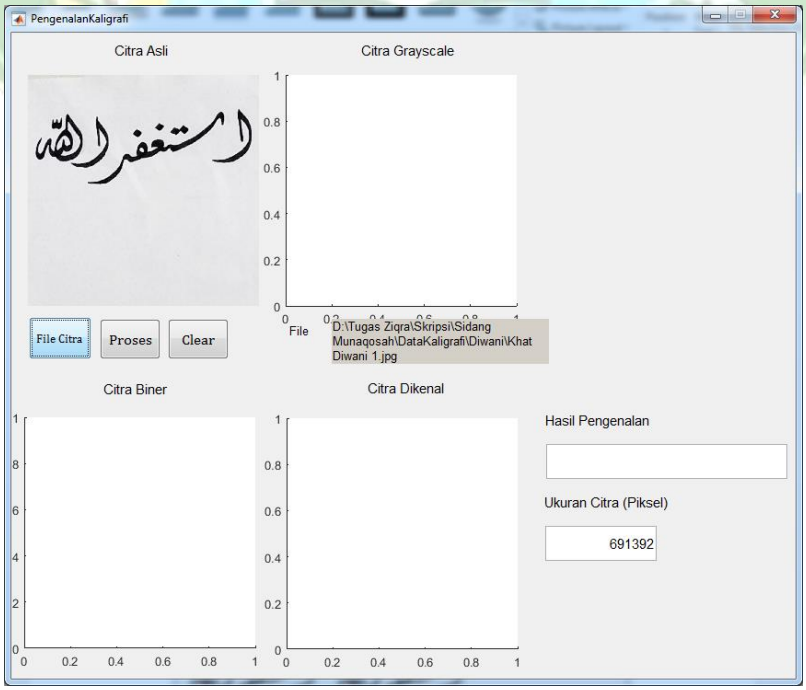
Gambar 1 Tampilan Aplikasi

Tampilan diatas adalah tampilan aplikasi Penerapan Metode *Learning Vector Quantization (LVQ)* Untuk Mengenali Jenis Teks Kaligrafi, dimana terdapat *Button* File Citra, *Button* Proses and *Button Clear*. Fungsi *Button* File Citra adalah memasukkan File citra/gambar kaligrafi yang akan di kenalkan, sedangkan *Button* Proses berfungsi sebagai mengenalkan File citra kaligrafi, apakah ia dikenal sebagai klas citra kaligrafi Diwani, Diwani Jali, Naskhi, dsbg. Dan *Button Clear* berfungsi sebagai untuk membersihkan riwayat proses pengenalan citra kaligrafi sebelumnya.



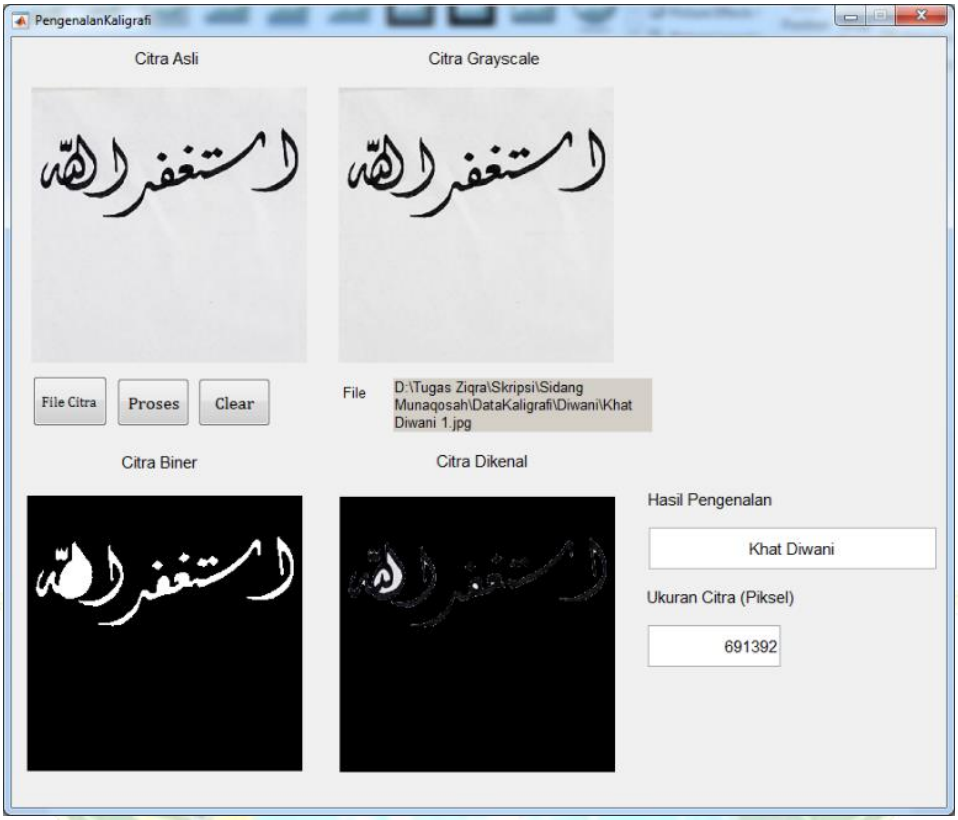
Gambar 2 Tampilan Input Citra

Setelah itu, klik *Button* File Citra. Pilih citra/gambar yang akan mau dikenalkan di aplikasi ini. Disini penulis mencoba menginput citra Khat Diwani yang akan diproses pengenalannya dengan menggunakan aplikasi ini.



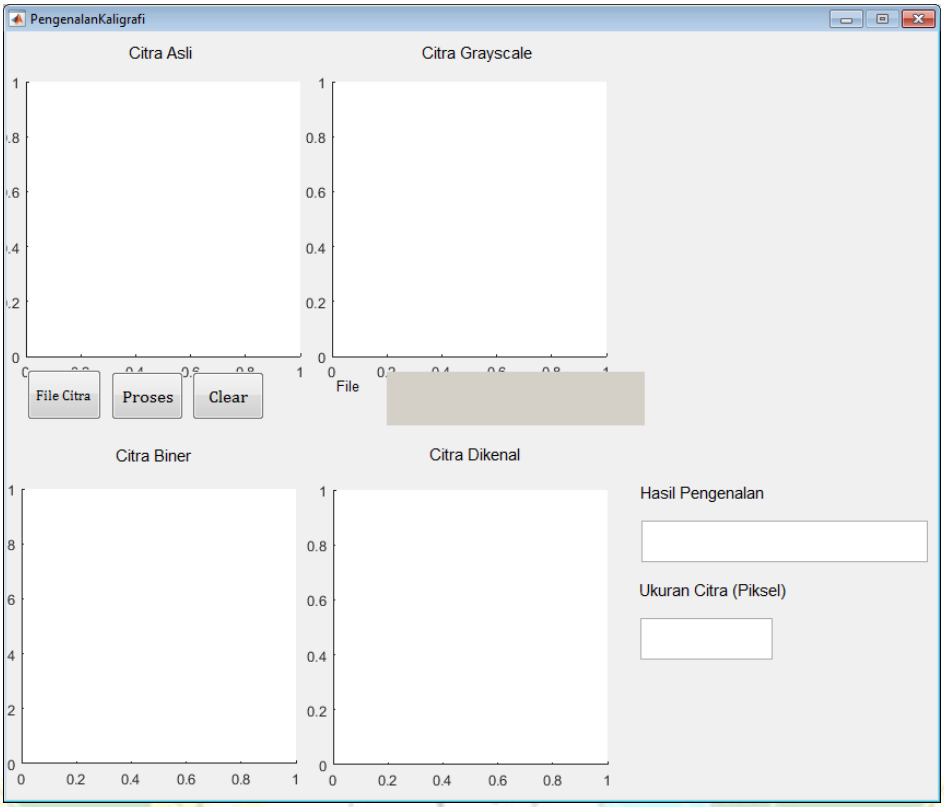
Gambar 3 Tampilan Aplikasi yang sudah di *Input* Citra

Setelah itu, tampilan diatas merupakan tampilan aplikasi LVQ yang sudah dipilih gambarnya dan akan diproses pengenalannya dengan menggunakan aplikasi ini.



Gambar 4 Tampilan Aplikasi Hasil Pengenalan

Berikut ini tampilan hasil proses pengenalan citra kaligrafi. Dapat disimpulkan bahwa, proses pengenalan ini sesuai dan berhasil dikenalkan oleh aplikasi ini. Citra Asli merupakan citra dari Khat Diwani yang diinput dari komputer, sedangkan Citra Dikenal merupakan citra Khat Diwani yang diproses pengenalannya menggunakan aplikasi. Sehingga proses pengenalan dengan *Metode Learning Vector Quantization* di aplikasi MATLAB hasilnya sesuai dan baik.



Gambar 5 Tampilan Aplikasi yang sudah dibersihkan

Tampilan ini merupakan tampilan aplikasi yang sudah dibersihkan riwayat hasil dari proses pengenalan sebelumnya dengan menggunakan *Button Clear*.

KARTU BIMBINGAN SKRIPSI

Semester Gasal/Genap Tahun Akademik 2019 / 2020

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Judul Skripsi : Penerapan Metode Learning Vector Quantization (LVQ) Untuk Mengenali Jenis Teks Kaligrafi

PERT	PEMBIMBING I			PEMBIMBING II		
	Tgl.	Materi Bimbingan	Tanda Tangan	Tgl.	Materi Bimbingan	Tanda Tangan
I	14 Oktober 2020	Pengecekan Proposal		27 Juli 2020	Perbaiki Bab I	
II	20 Oktober 2020	ACC seminar Proposal		14 Oktober 2020	ACC Bab 1	
III	8 Februari 2021	Revisi Proposal Skripsi		14 Oktober 2020	ACC Bab 2	
IV	15 Februari 2021	Revisi Bab III		14 Oktober 2020	ACC Bab 3	
V	22 Februari 2021	Revisi Bab IV		20 Oktober 2020	ACC seminar Proposal	

VI	23 Februari 2021	Revisi Bab V		9 Februari 2021	Revisi Proposal	
VII	1 maret 2021	Revisi ABSTRAK		16 Februari 2021	Revisi BAB III & IV	
VIII	9 maret 2021	Revisi kesimpulan		23 Februari 2021	REVISI ABSTRAK & DAFTAR PUSTAKA	
IX	10 maret 2021	ACC Semua Bab.		8 maret 2021	ACC SEMUA BAB.	
X	18 maret 2021	ACC Sidang		10 maret 2021.	ACC Sidang	

Medan, 25 maret 2021
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Catatan: *Pada saat bimbingan, kartu ini harus diisi dan ditandatangani oleh pembimbing*

DAFTAR RIWAYAT HIDUP

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Kelurahan	: Tegal Sari Mandala III
Kecamatan	: Medan Denai
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SMP	: SMP Swasta Nurul Islam Indonesia Medan
SMK	: SMK Swasta Eria Medan