BANKNOTES RECONITION SYSTEM

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**Graphic User Interface**

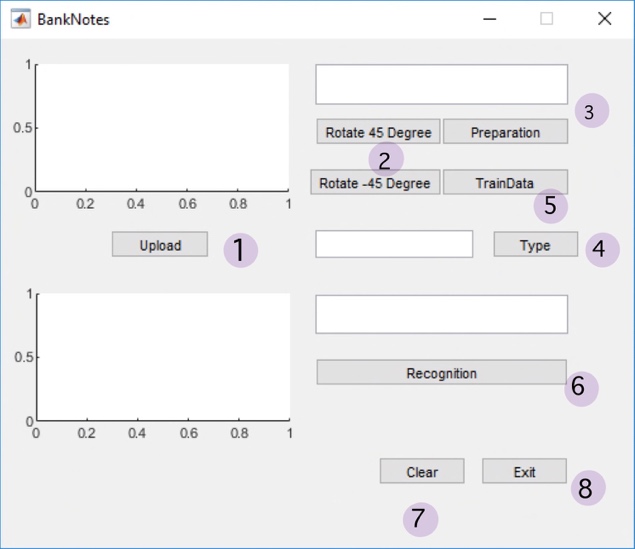


Figure 1: User Interface

**Implementation**

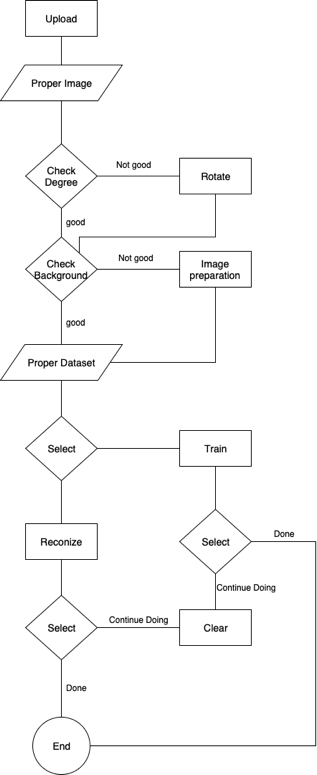


Figure 2: Flow chart of Implementation Process

1.Upload

global image;

global pic;

global filename;

[filename pathname]=uigetfile({'\*.bmp','\*.jpg'},'file select');

image = strcat(pathname,filename);

pic = imread(image);

axes(handles.axes1); imshow(pic);

axes(handles.axes2); cla;

set(handles.edit1,'string',filename);

2. Rorate 45 or -45 degree

global pic

pic = imrotate(pic,45);

% imrotate(pic,-45)%

axes(handles.axes1); imshow(pic);

3. Preparation [Crop an object]

global pic;

hsvImage = rgb2hsv(pic);

sImage = hsvImage(:, :, 2);

mask = sImage > 0.1;

mask = bwareafilt(mask,1);

mask = imfill(mask, 'holes');

props = regionprops(logical(mask),

'BoundingBox');

croppedImage = imcrop(pic, props.BoundingBox);

axes(handles.axes1);

imshow(croppedImage);

4. Color Recognition

global pic;

 r=mean(mean(pic(:,:,1)));

 g=mean(mean(pic(:,:,2)));

 b=mean(mean(pic(:,:,3)));

 Thou = abs(r-b);

 %Thou > 3 is not 1000%

 onethou = false;

 if Thou <=3

     onethou = true;

 end

 if (r > g) && (r > b)  && (onethou == false)

     set(handles.edit3,'string','100');

         elseif (b>r) && (b>g)&& (onethou == false)

     set(handles.edit3,'string','50');

 elseif (g>b) && (g>r)  && (onethou == false)

      set(handles.edit3,'string','20');

         else

     set(handles.edit3,'string','1000 or 500');

 end

5. Preparing data for Euclidean distance Recognition [Train]

global pic;

global filename;

global excel;

excel = 'E:\MATLAB\R2018\bin\Project\DB\_Train.xlsx';

tab=xlsread(excel);

[rr,cc]=size(tab);

% ............................ Calculate Features

 mred=mean(mean(pic(:,:,1)));

 mgreen=mean(mean(pic(:,:,2)));

 mblue=mean(mean(pic(:,:,3)));

 gray=rgb2gray(pic);

 mgray=mean(mean(gray));

 %energy

 gray=rgb2gray(pic);

 glcm = graycomatrix(gray, 'o', [0,1]);

 S = graycoprops(glcm);

 energy = S.Energy\*100;

 %entropy

 rngfil = rangefilt(pic);

 entro = entropy(rngfil)\*100;

 %homo

 Homo = S.Homogeneity\*100;

 %contrast

 Contrast = S.Contrast\*100;

 %Correlation

 correlation=S.Correlation\*100;

% ............................... calculate Excel Cell

 cell1=cat(2,'A',num2str(rr+2));

 cell2=cat(2,'B',num2str(rr+2));

 cell3=cat(2,'C',num2str(rr+2));

 cell4=cat(2,'D',num2str(rr+2));

 cell5=cat(2,'E',num2str(rr+2));

 cell6=cat(2,'F',num2str(rr+2));

 cell7=cat(2,'G',num2str(rr+2));

 cell8=cat(2,'H',num2str(rr+2));

 cell9=cat(2,'I',num2str(rr+2));

 cell10=cat(2,'J',num2str(rr+2));

% .................................. Write Excel Data

 xlswrite(excel,[{filename}],1,cell1);

 xlswrite(excel,[mred],1,cell2);

 xlswrite(excel,[mgreen],1,cell3);

 xlswrite(excel,[mblue],1,cell4);

 xlswrite(excel,[mgray],1,cell5);

 xlswrite(excel,[entro],1,cell6);

 xlswrite(excel,[energy],1,cell7);

 xlswrite(excel,[Homo],1,cell8);

 xlswrite(excel,[Contrast],1,cell9);

 xlswrite(excel,[correlation],1,cell10);

 system('taskkill /F /IM EXCEL.EXE');

6. Euclidean distance Recognition

global pic;

global excel;

excel = 'E:\MATLAB\R2018\bin\Project\DB\_Train.xlsx';

datasetpath ='E:\MATLAB\R2018\bin\Project\Dataset\';

tab=xlsread(excel);

[rr,cc]=size(tab);

% ............................ Calculate Features

 data(1)=mean(mean(pic(:,:,1)));

 data(2)=mean(mean(pic(:,:,2)));

 data(3)=mean(mean(pic(:,:,3)));

 gray=rgb2gray(pic);

 data(4)=mean(mean(gray));

 gray=rgb2gray(pic);

 glcm = graycomatrix(gray, 'o', [0,1]);

 S = graycoprops(glcm);

 rngfil = rangefilt(pic);

 data(5) = entropy(rngfil)\*100;

 data(6) = S.Energy\*100;

 data(7) = S.Homogeneity\*100;

 data(8) = S.Contrast\*100;

 data(9) =S.Correlation\*100;

% ............................ Matching

min=999;

rec=0;

for i=1 : rr

diff=0;

    for j=1 : cc

        diff=diff+sqrt(power(tab(i,j)-data(j),2));

    end

if (diff <=100)

    min=diff;

    rec=i;

end

end

if (rec ~= 0)

    %found

   cellx=cat(2,'A',num2str(rec+1));

    %cellx = A3

   [~,ff]=xlsread(excel,1,cellx);

   file=ff{1};

   imgfile = strcat(datasetpath,file);

   result=imread(imgfile);

   axes(handles.axes2); imshow(result);

file= strcat('Found : ',file);

   set (handles.edit2, 'string',file);

else

    % not found

   fig=zeros(250,300);

   axes(handles.axes2); imshow(fig);

   set (handles.edit2, 'string','NOT FOUND');

end

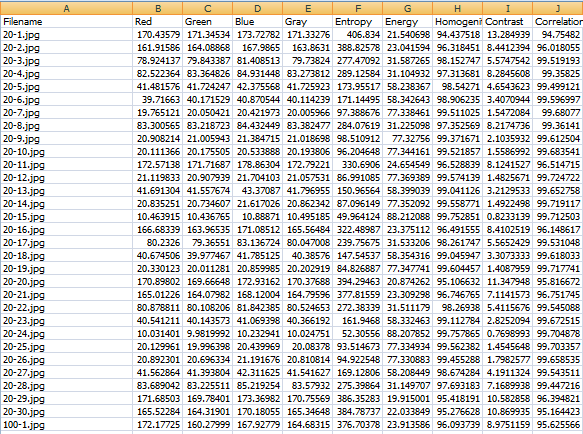


Figure 3: Data table from excel file

7. Clear a Data

axes(handles.axes1); cla;

axes(handles.axes2); cla;

set (handles.edit1, 'string','                         ');

set (handles.edit2, 'string','                         ');

8. Exit the System

close

**Experiment Result**

Thai Banknote Recognition System can recognize banknotes by 2 techniques which are Color Recognition and Euclidean distance Recognition. The experiment uses 12 pictures for each type of bank from the internet. For color recognition technique, it can recognize all pictures including both match and not match. Another technique which is Euclidean distance recognition can find only 1 match from all 60 banknotes.

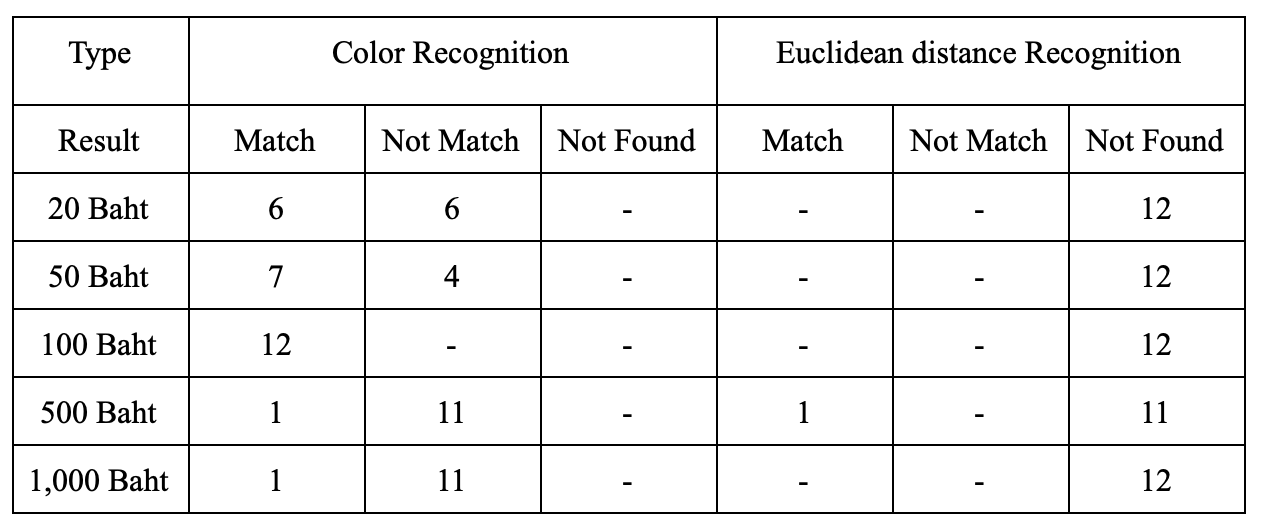


Figure 4: Result table from the experiment

**References**

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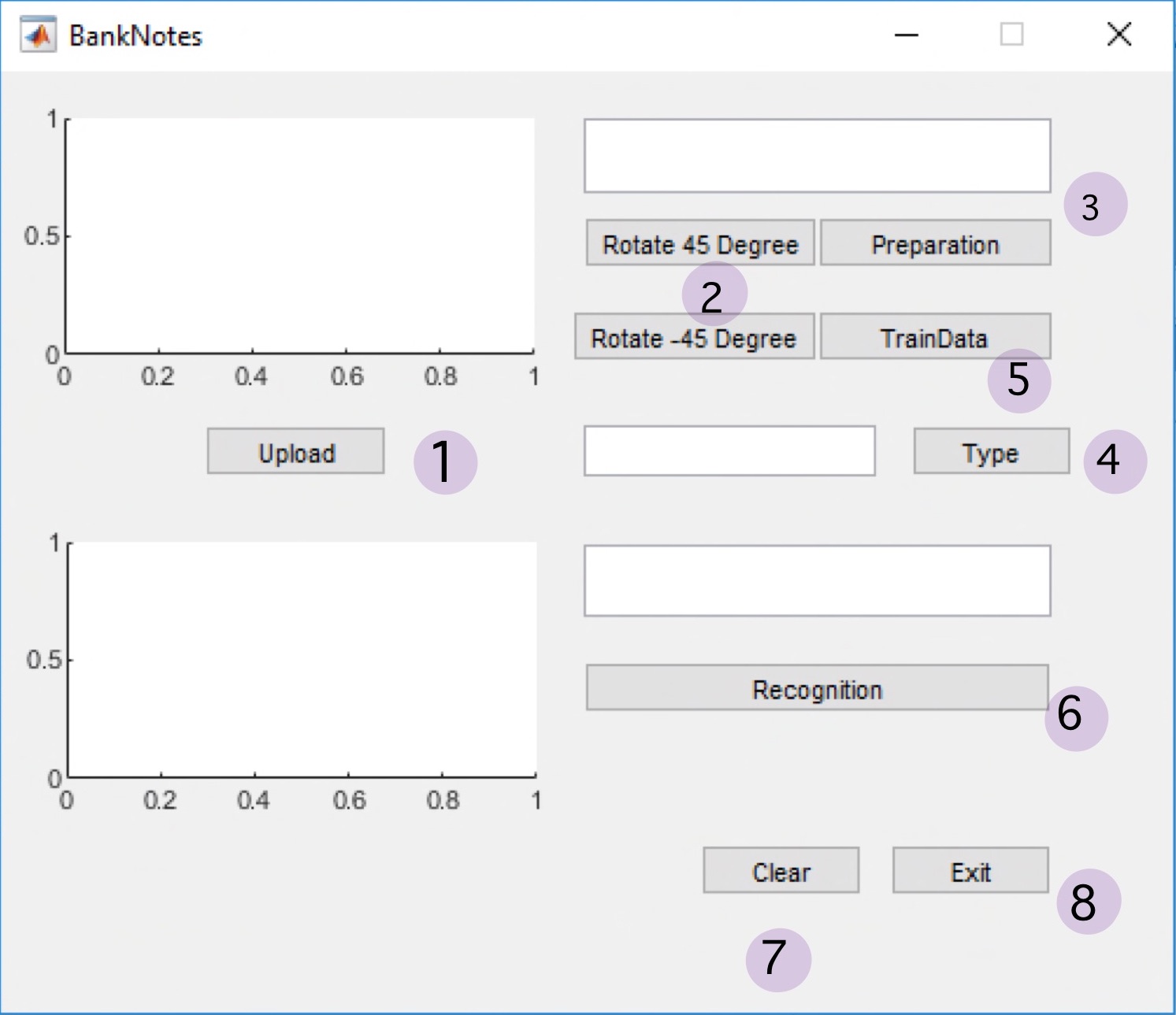


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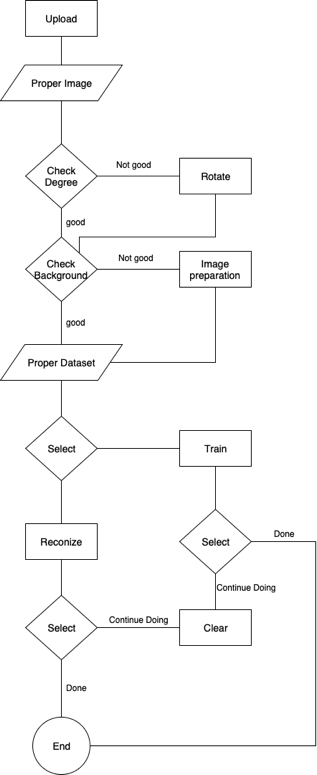


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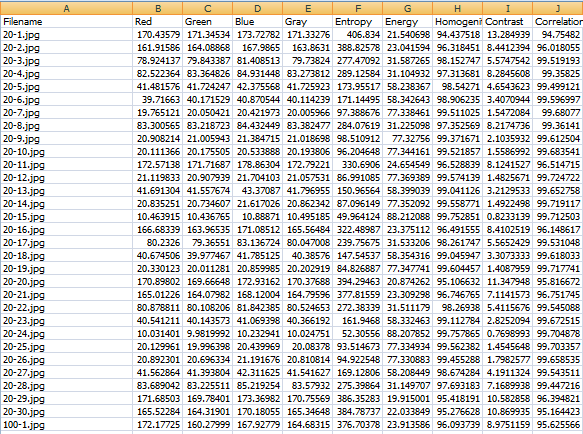


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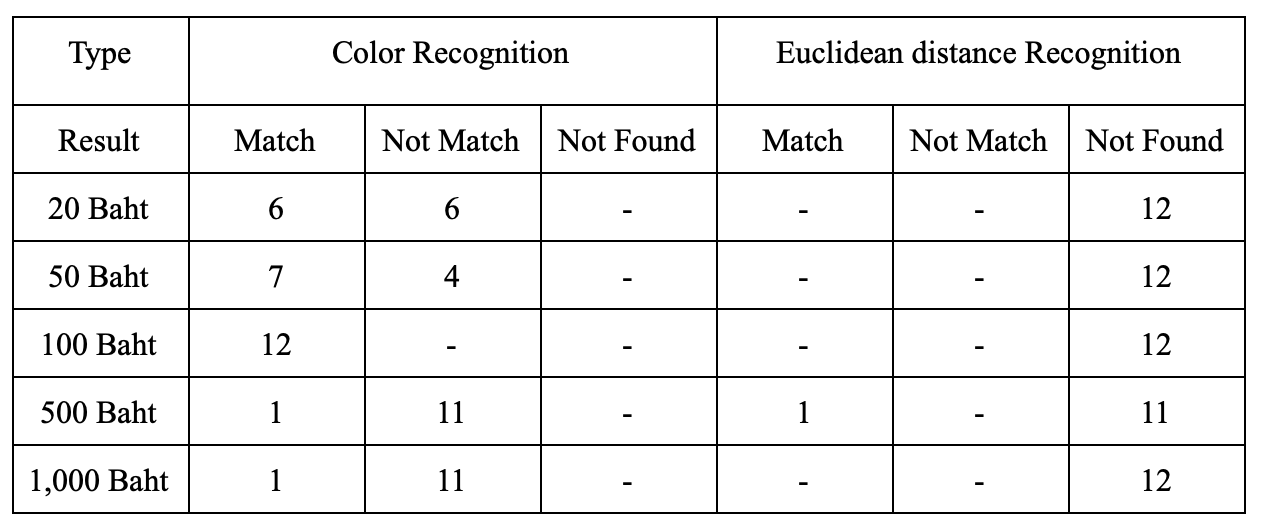


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