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JIF = 1.500	SJIF (Morocco) = 2.031	

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SECTION 2. Applied mathematics. Mathematical modeling.

## SOME METHODS OF DIFFERENTIATION OF LAYERS IN DELPHI

**Abstract:** This article discusses some methods of isolation layers in Delphi, in relation to the geodetic satellite maps.

**Key words:** layer, maps, delphi.

**Language:** English

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### Introduction

In a separate geodetic tasks there is the problem of re-projection and allocation of separate cultures (layers) of a satellite map which shows several dozen of crops. [1-7]

- Load arbitrary map image (Fig.1)
- Re-projection and allocation of the common image block of 100x100 km
- Split into separate layers, and the allocation of each layer
- Save the obtained results

### Model

Let's will develop a program in Delphi which will work with large amounts of graphical information and will perform the following tasks:

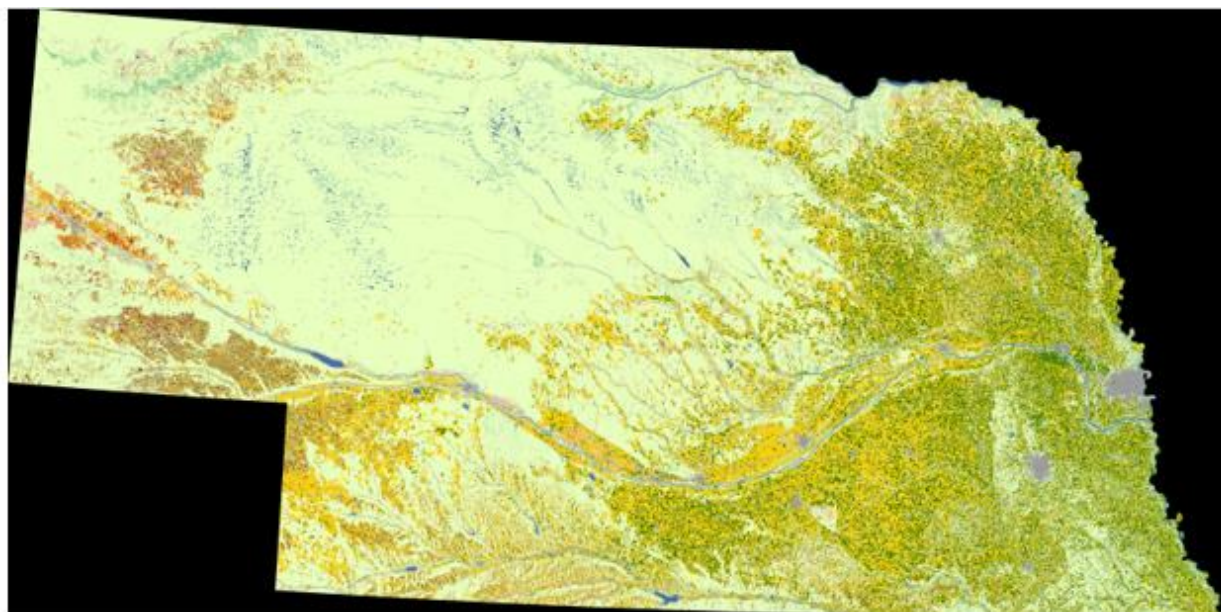


Figure 1 - Original image with all layers.

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<b>GIF (Australia)</b>	<b>= 0.564</b>	<b>ESJI (KZ)</b>	<b>= 1.042</b>	<b>IBI (India)</b>	<b>= 4.260</b>
<b>JIF</b>	<b>= 1.500</b>	<b>SJIF (Morocco)</b>	<b>= 2.031</b>		

## Materials and methods

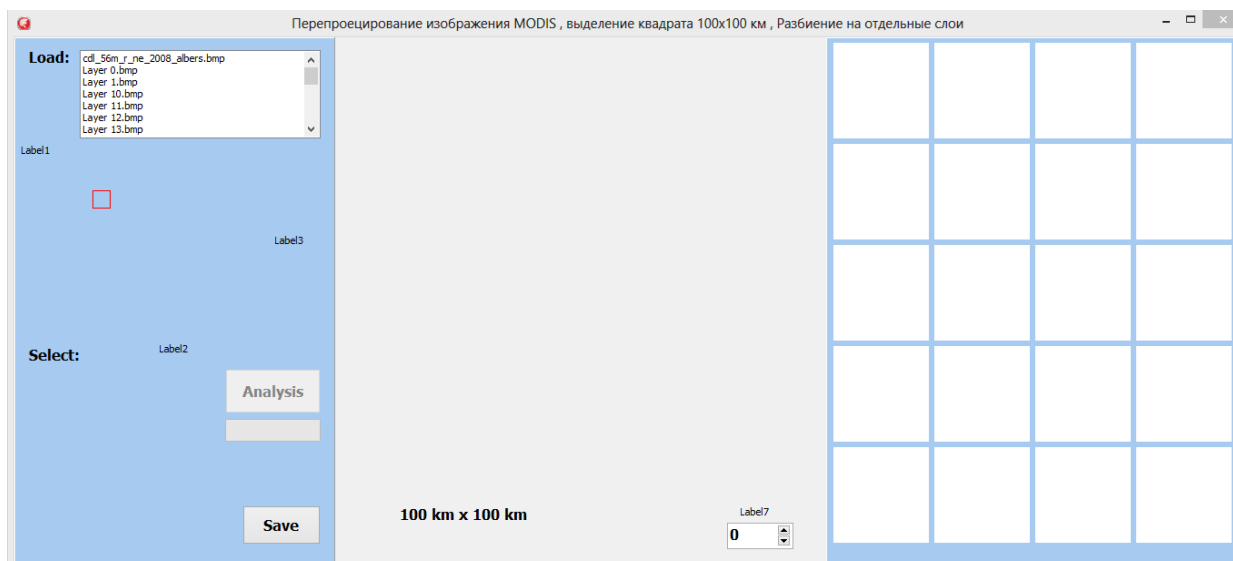


Figure 2 – The form of the program.

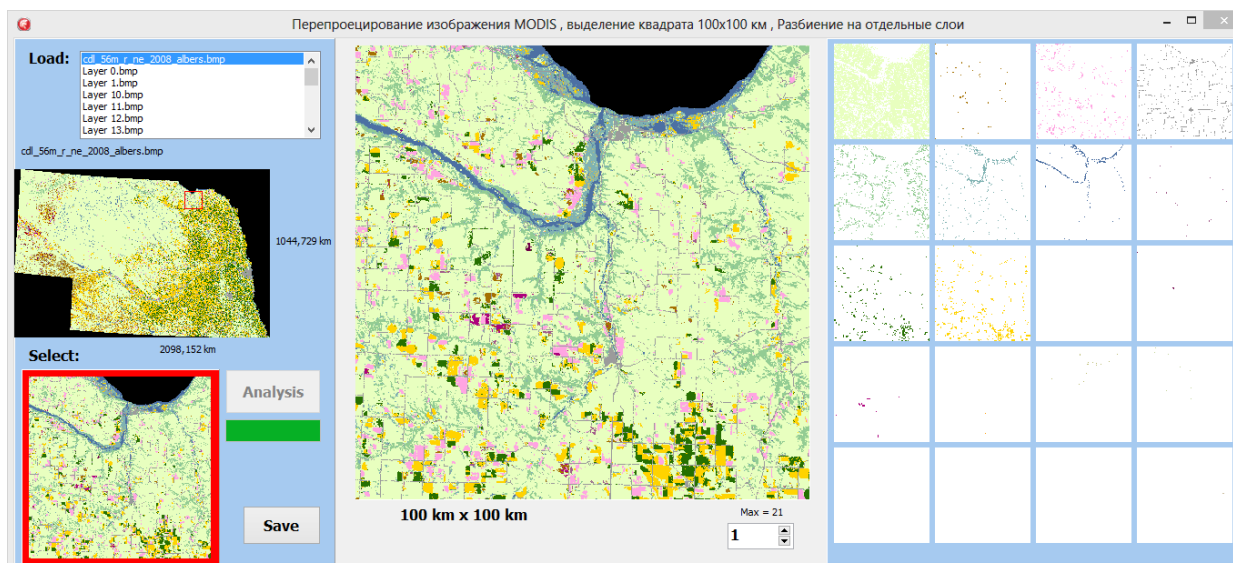


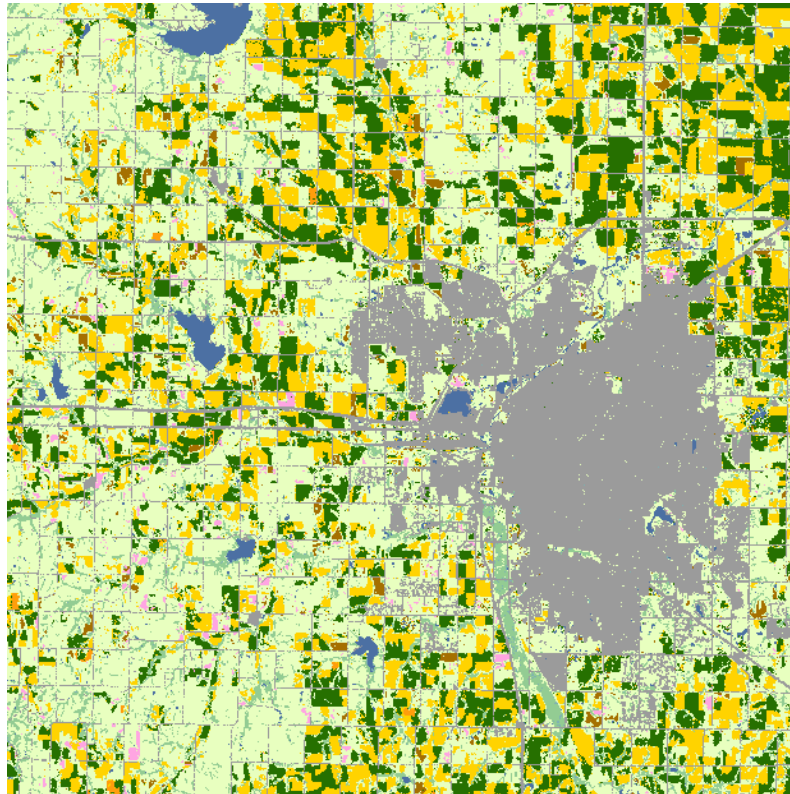
Figure 3 - The selection of layers.

In the program window (Fig. 3), it is possible to select a region on the map size of 100x100 km. Then, the obtained image becomes a separate and stored (Fig.4) Split it into layers occurs through the analysis

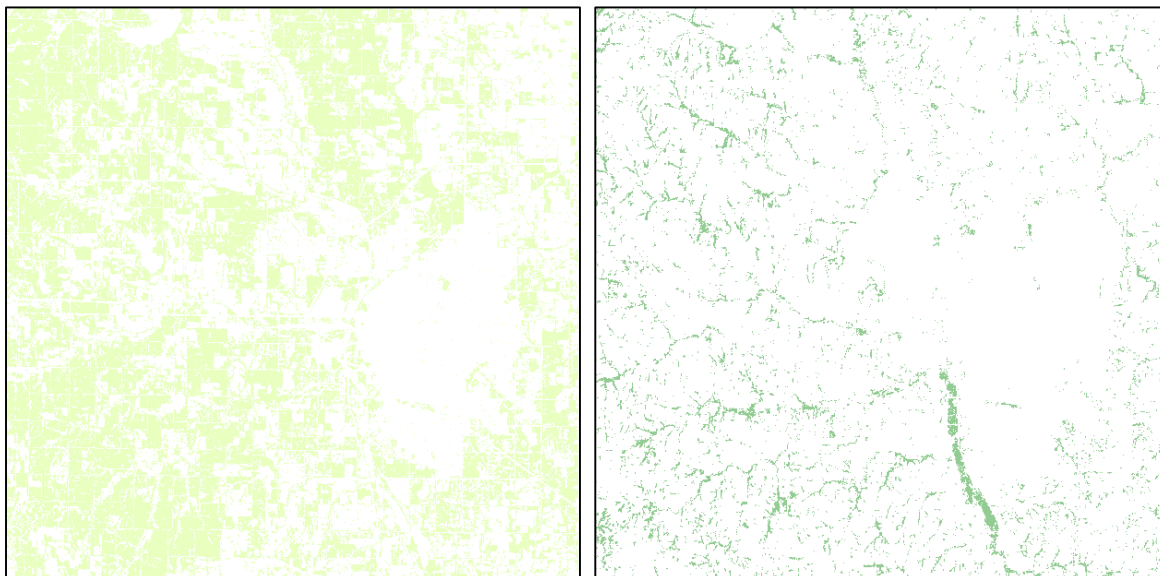
and selection of certain shades of color. Each individual layer is stored in an array and is displayed on the right panel of the window.

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**Figure 4 - The resulting image is 100x100 km.**



**Figure 5 - The resulting layers 1-2.**

The resulting layers characterize the crops grown in these areas.

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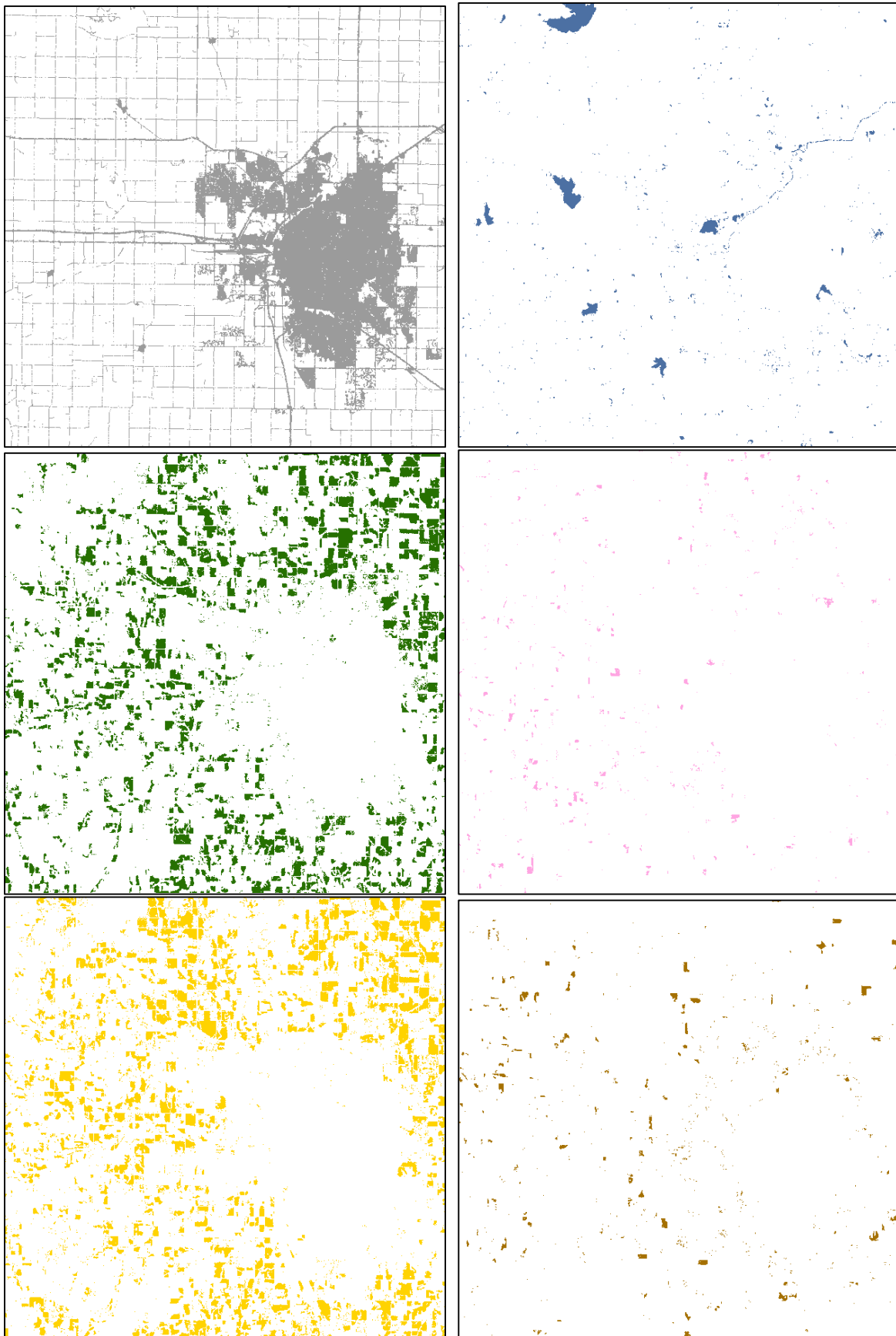


Figure 6 - The resulting layers 3-8.

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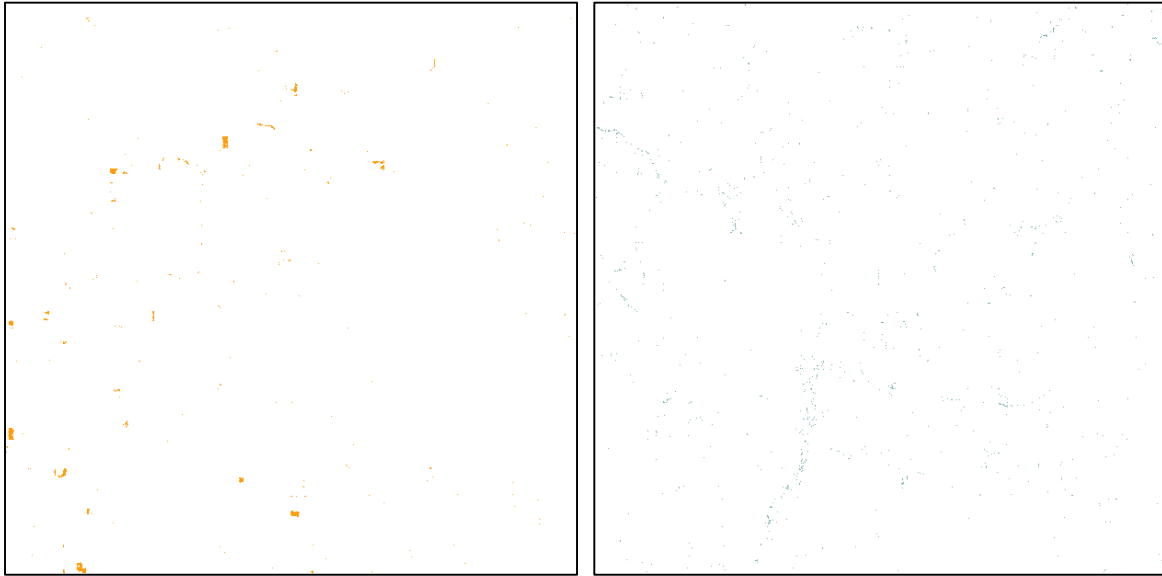


Figure 7 - The resulting layers 9-10.

### Results

The developed program allows to quickly and easily select from maps of the area, with a plot size of 100x100 km and divide it into separate layers. The

obtained layers can be used to create temporary maps of cultivation of agricultural crops.

### References:

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### Annex 1

#### The program in Delphi.

```
unit Unit1;  
interface  
uses  
  Winapi.Windows, Winapi.Messages, System.SysUtils, System.Variants, System.Classes, Vcl.Graphics,  
  Vcl.Controls, Vcl.Forms, Vcl.Dialogs, Vcl.StdCtrls, Vcl.FileCtrl, Vcl.ExtCtrls;
```

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Vcl.ComCtrls, Vcl.Samples.Spin;

type

```
TForm1 = class(TForm)
  Panel1: TPanel;
  Image1: TImage;
  FileListBox1: TFileListBox;
  Label1: TLabel;
  Image2: TImage;
  Image3: TImage;
  Label2: TLabel;
  Label3: TLabel;
  Memo1: TMemo;
  Panel2: TPanel;
  Image4: TImage;
  Image5: TImage;
  Image6: TImage;
  Image7: TImage;
  Image8: TImage;
  Image9: TImage;
  Image10: TImage;
  Image11: TImage;
  Image12: TImage;
  Image13: TImage;
  Label4: TLabel;
  Label5: TLabel;
  Label6: TLabel;
  Button1: TButton;
  Label7: TLabel;
  Image14: TImage;
  Image15: TImage;
  Image16: TImage;
  Image17: TImage;
  Image18: TImage;
  Image19: TImage;
  Image20: TImage;
  Image21: TImage;
  Image22: TImage;
  Image23: TImage;
  Image24: TImage;
  Panel3: TPanel;
  SpinEdit1: TSpinEdit;
  ProgressBar1: TProgressBar;
  Button2: TButton;
  procedure FileListBox1Click(Sender: TObject);
  procedure Image2MouseDown(Sender: TObject; Button: TMouseButton;
    Shift: TShiftState; X, Y: Integer);
  procedure Image2MouseMove(Sender: TObject; Shift: TShiftState; X,
    Y: Integer);
  procedure Image2MouseUp(Sender: TObject; Button: TMouseButton;
    Shift: TShiftState; X, Y: Integer);
  procedure FormCreate(Sender: TObject);
  procedure Button1Click(Sender: TObject);
  procedure FormDestroy(Sender: TObject);
  procedure Image14Click(Sender: TObject);
  procedure Image4Click(Sender: TObject);
  procedure Image5Click(Sender: TObject);
  procedure Image6Click(Sender: TObject);
  procedure Image7Click(Sender: TObject);
```



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```
procedure Image8Click(Sender: TObject);
procedure Image9Click(Sender: TObject);
procedure Image10Click(Sender: TObject);
procedure Image11Click(Sender: TObject);
procedure Image12Click(Sender: TObject);
procedure Image13Click(Sender: TObject);
procedure Image15Click(Sender: TObject);
procedure Image16Click(Sender: TObject);
procedure Image17Click(Sender: TObject);
procedure Image18Click(Sender: TObject);
procedure Image19Click(Sender: TObject);
procedure Image20Click(Sender: TObject);
procedure Image21Click(Sender: TObject);
procedure Image22Click(Sender: TObject);
procedure Image23Click(Sender: TObject);
procedure Image24Click(Sender: TObject);
procedure SpinEdit1Change(Sender: TObject);
procedure Button2Click(Sender: TObject);
private
  { Private declarations }
public
  { Public declarations }
end;

var
  Form1: TForm1;
  fname:string;
  d:boolean;
  i,x1,y1,maxi:integer;
  c:array[1..1000]of tcolor;
  b:array[0..1000] of tbitmap;
  implementation

  {$R *.dfm}

  procedure TForm1.Button1Click(Sender: TObject);
  var
    i,j,k:integer; cc:tcolor;
    pr:boolean;
  begin
    maxi:=0;
    for k := 1 to 1000 do
      b[k].Canvas.FillRect(rect(0,0,620,620));

    progressbar1.Max:=62;
    for I := 0 to 620 do
      begin
        for j := 0 to 620 do
          begin
            cc:=b[0].Canvas.Pixels[i,j];

            pr:=false;
            for k := 1 to maxi do
              if c[k]=cc then begin pr:=true;  b[k].Canvas.Pixels[i,j]:=cc;
            end;
            if not(pr) then begin inc(maxi);c[maxi]:=cc;
              end;
            end;
          end;
        end;
      end;
    end;
```



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```
if i mod 10 = 0 then progressbar1.Position:=trunc(i/10);
end;

label7.Caption:='Max = '+inttostr(maxi);

image4.Picture.Assign(b[1]);
image5.Picture.Assign(b[2]);
image6.Picture.Assign(b[3]);
image7.Picture.Assign(b[4]);
image8.Picture.Assign(b[5]);
image9.Picture.Assign(b[6]);
image10.Picture.Assign(b[7]);
image11.Picture.Assign(b[8]);
image12.Picture.Assign(b[9]);
image13.Picture.Assign(b[10]);
image15.Picture.Assign(b[11]);
image16.Picture.Assign(b[12]);
image17.Picture.Assign(b[13]);
image18.Picture.Assign(b[14]);
image19.Picture.Assign(b[15]);
image20.Picture.Assign(b[16]);
image21.Picture.Assign(b[17]);
image22.Picture.Assign(b[18]);
image23.Picture.Assign(b[19]);
image24.Picture.Assign(b[20]);

spinedit1.MinValue:=1;
spinedit1.MaxValue:=maxi;
spinedit1.Value:=1;
end;

procedure TForm1.Button2Click(Sender: TObject);
var k:integer;
begin
for k := 0 to maxi do
b[k].SaveToFile('Layer '+inttostr(k)+'.bmp');
end;

procedure TForm1.FileListBox1Click(Sender: TObject);
begin
fname:=FileListBox1.FileName;

label1.Caption:=extractfilename(fname);
image1.Picture.LoadFromFile(fname);

label2.Caption:=floattostr(image1.Picture.Width/10*1.61)+' km';
label3.Caption:=floattostr(image1.Picture.Height/10*1.61)+' km';
end;

procedure TForm1.FormCreate(Sender: TObject);
begin
for I := 0 to 1000 do
begin
b[i] := TBitmap.create;
b[i].Height:=621;
b[i].Width:=621;
b[i].Canvas.FillRect(rect(0,0,620,620));
end;
image4.Picture.Assign(b[1]);
```





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```
image5.Picture.Assign(b[2]);
image6.Picture.Assign(b[3]);
image7.Picture.Assign(b[4]);
image8.Picture.Assign(b[5]);
image9.Picture.Assign(b[6]);
image10.Picture.Assign(b[7]);
image11.Picture.Assign(b[8]);
image12.Picture.Assign(b[9]);
image13.Picture.Assign(b[10]);
image15.Picture.Assign(b[11]);
image16.Picture.Assign(b[12]);
image17.Picture.Assign(b[13]);
image18.Picture.Assign(b[14]);
image19.Picture.Assign(b[15]);
image20.Picture.Assign(b[16]);
image21.Picture.Assign(b[17]);
image22.Picture.Assign(b[18]);
image23.Picture.Assign(b[19]);
image24.Picture.Assign(b[20]);
end;

procedure TForm1.FormDestroy(Sender: TObject);
begin
for I := 0 to 1000 do
b[i].Free;
end;

procedure TForm1.Image10Click(Sender: TObject);
begin
image3.Picture.Assign(b[7]);
end;

procedure TForm1.Image11Click(Sender: TObject);
begin
image3.Picture.Assign(b[8]);
end;

procedure TForm1.Image12Click(Sender: TObject);
begin
image3.Picture.Assign(b[9]);

end;

procedure TForm1.Image13Click(Sender: TObject);
begin
image3.Picture.Assign(b[10]);
end;

procedure TForm1.Image14Click(Sender: TObject);
begin
image3.Picture.Assign(b[0]);
end;

procedure TForm1.Image15Click(Sender: TObject);
begin
image3.Picture.Assign(b[11]);
end;

procedure TForm1.Image16Click(Sender: TObject);
```

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```
begin
image3.Picture.Assign(b[12]);
end;

procedure TForm1.Image17Click(Sender: TObject);
begin
image3.Picture.Assign(b[13]);
end;

procedure TForm1.Image18Click(Sender: TObject);
begin
image3.Picture.Assign(b[14]);
end;

procedure TForm1.Image19Click(Sender: TObject);
begin
image3.Picture.Assign(b[15]);
end;

procedure TForm1.Image20Click(Sender: TObject);
begin
image3.Picture.Assign(b[16]);
end;

procedure TForm1.Image21Click(Sender: TObject);
begin
image3.Picture.Assign(b[17]);
end;

procedure TForm1.Image22Click(Sender: TObject);
begin
image3.Picture.Assign(b[18]);
end;

procedure TForm1.Image23Click(Sender: TObject);
begin
image3.Picture.Assign(b[19]);
end;

procedure TForm1.Image24Click(Sender: TObject);
begin
image3.Picture.Assign(b[20]);
end;

procedure TForm1.Image2MouseDown(Sender: TObject; Button: TMouseButton;
  Shift: TShiftState; X, Y: Integer);
begin
d:=true;
end;

procedure TForm1.Image2MouseMove(Sender: TObject; Shift: TShiftState; X,
  Y: Integer);
begin
if d then

begin
image2.Left:=image2.Left+X-10;
image2.Top:=image2.Top+Y-10;
x1:=trunc((image2.Left-image1.left)/image1.Width*image1.Picture.Width) ;
```

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```
y1:=trunc((image2.Top-image1.Top)/image1.Height*image1.Picture.Height);
memo1.Lines.Add('x = '+inttostr(x1));
memo1.Lines.Add('y = '+inttostr(y1));
b[0].Canvas.CopyRect(rect(0,0,620,620),image1.Canvas,rect(x1,y1,x1+621,y1+621));
  image3.Picture.Assign(b[0]);
  image14.Picture.Assign(b[0]);
end;
end;

procedure TForm1.Image2MouseUp(Sender: TObject; Button: TMouseButton;
  Shift: TShiftState; X, Y: Integer);
begin
d:=false;
panel3.Visible:=true;
application.ProcessMessages;
button1.Click;
end;

procedure TForm1.Image4Click(Sender: TObject);
begin
image3.Picture.Assign(b[1]);
end;

procedure TForm1.Image5Click(Sender: TObject);
begin
image3.Picture.Assign(b[2]);
end;

procedure TForm1.Image6Click(Sender: TObject);
begin
image3.Picture.Assign(b[3]);
end;

procedure TForm1.Image7Click(Sender: TObject);
begin
image3.Picture.Assign(b[4]);
end;

procedure TForm1.Image8Click(Sender: TObject);
begin
image3.Picture.Assign(b[5]);
end;

procedure TForm1.Image9Click(Sender: TObject);
begin
image3.Picture.Assign(b[6]);
end;

procedure TForm1.SpinEdit1Change(Sender: TObject);
var s:integer;
begin
s:= spinedit1.Value;
image3.Picture.Assign(b[s]);
end;

end.
```

