MATH590: C3examples, topological clustering of blood cells

In this module the problem of identifying individual cells in a blood smear is revisited. Individual cells are isolated by combining clustering (set partition methods, SET module) with topological methods, in particular the use of simplicial complexes and convexity.

Read data and carry out visual examination of images

Isolate erythrocytes

Modify the function used to isolate leukocytes from the C2examples.nb to return a mask for the erythrocytes (RBCs).

In[39]:=
```
LeukocyteMask[im_, t_] := Module[{imR, imG, imB, mask,
   MaxCells, MinPixels, cellsB, Lmask, FLmask, Bmask, Rmask, FRmask},
  {imR, imG, imB} = Map[ImageAdjust[#] &, ColorSeparate[im]];
  mask = ColorNegate[Binarize[imG]];
  MaxCells = 100;
  MinPixels = Floor[Apply[Times, ImageDimensions[mask]] / MaxCells];
  cellsB = ImageMultiply[mask, imB];
  Lmask = FillingTransform[Binarize[cellsB, t]];
  FLmask = Binarize[ColorConvert[
     Colorize[SelectComponents[Lmask, #Count > MinPixels &]], "Grayscale"]];
  Bmask = FillingTransform[Binarize[ColorConvert[
      Colorize[SelectComponents[mask, #Count > MinPixels &]], "Grayscale"]]];
  Rmask = ImageMultiply[Bmask, ColorNegate[FLmask]];
  FRmask = FillingTransform[Binarize[ColorConvert[
      Colorize[SelectComponents[Rmask, #Count > MinPixels &]], "Grayscale"]]];
  Return[FRmask];
 ]
```

Here is an example of a mask isolating erythrocytes in the image

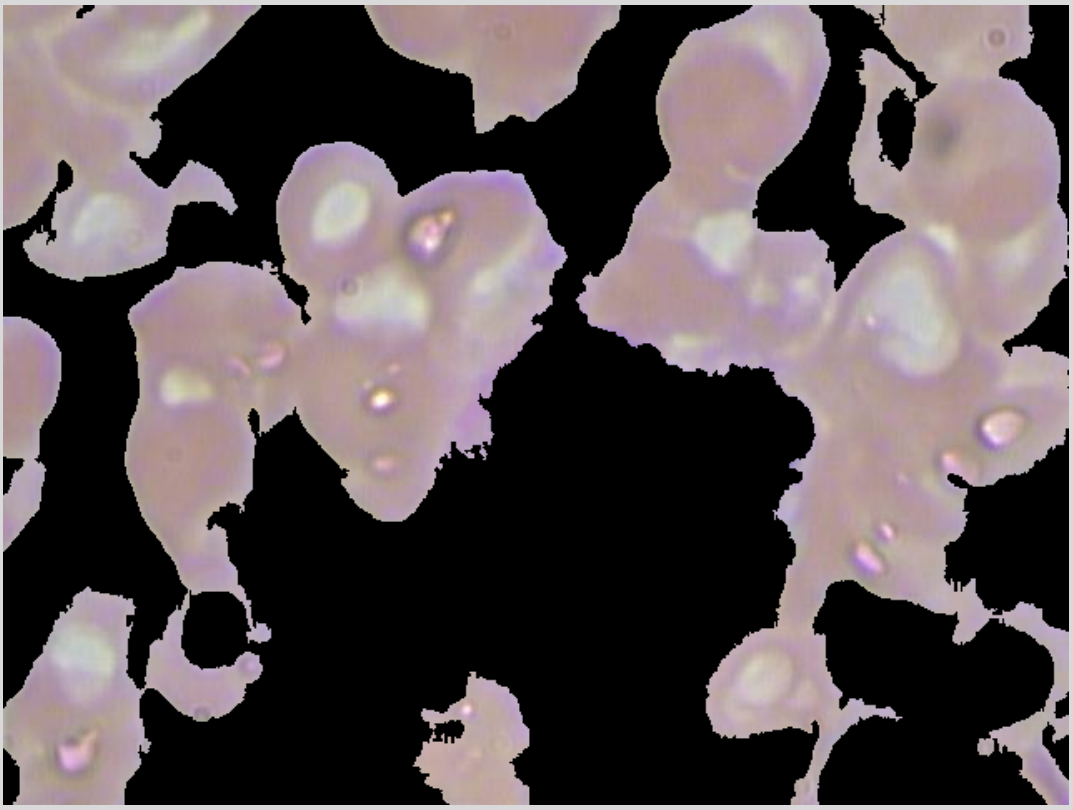
In[40]:=
```
im = Import[f[[1]]];
Rmask = LeukocyteMask[im, 0.6]
```

Out[41]=

And these are the erythrocytes

In[42]:=
```
rbc = ImageMultiply[Rmask, im]
```

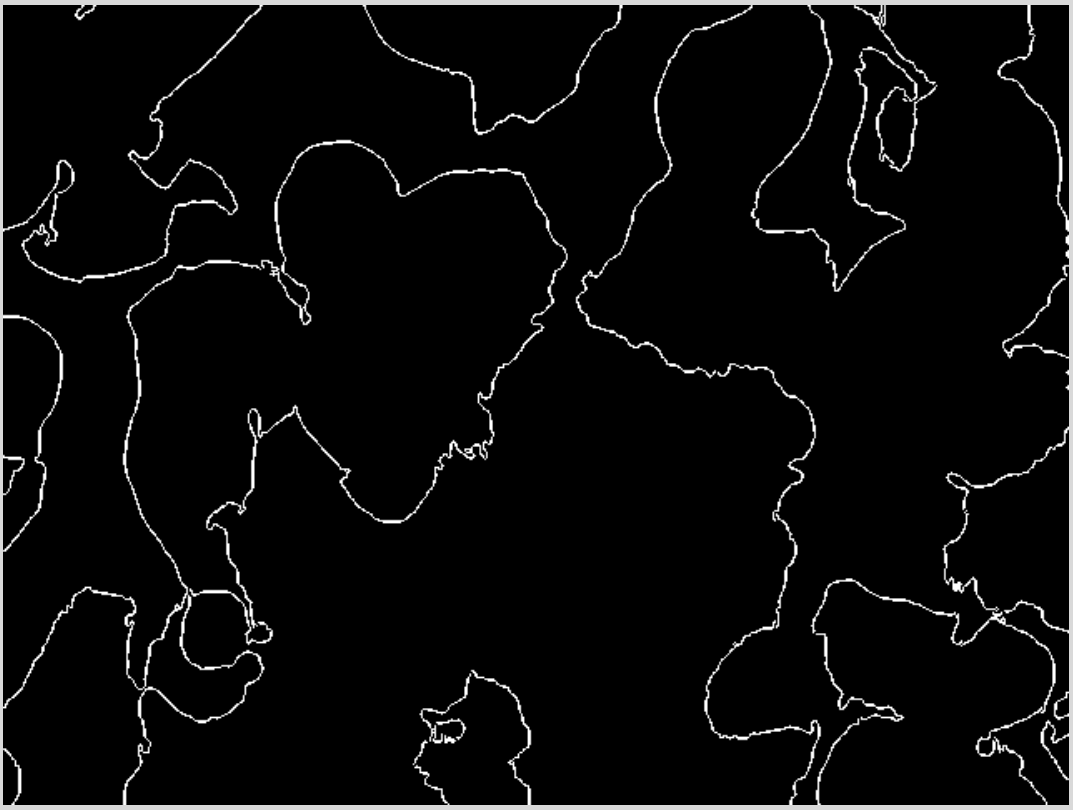
Out[42]=



Revisit the problem of isolating individual erythrocytes by introducing a simplicial complex to represent the image data, and then isolating convex parts of dimension 2.

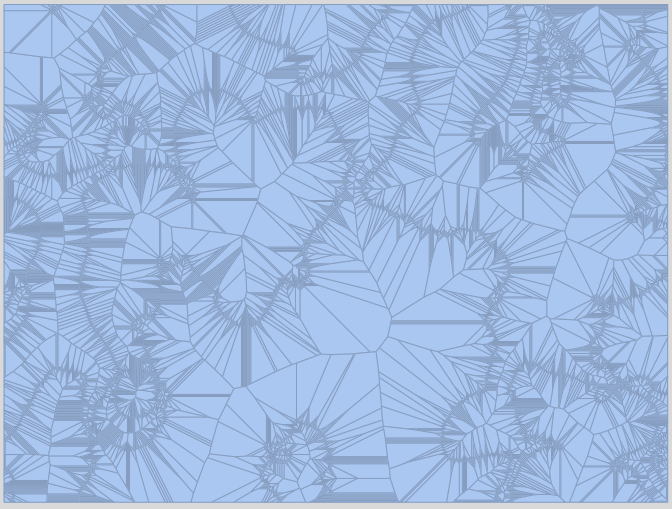
In[43]:=
```
edges = EdgeDetect[Rmask, 1]
```

Out[43]=



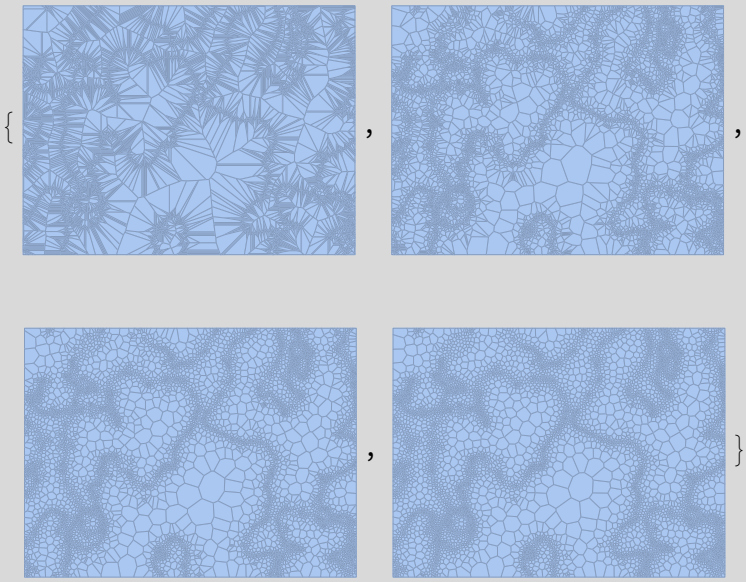
In[44]:=
```
imgBounds = Transpose[{{0, 0}, ImageDimensions[Rmask]}];
vm = VoronoiMesh[ImageValuePositions[edges, White], imgBounds]
```

Out[45]=



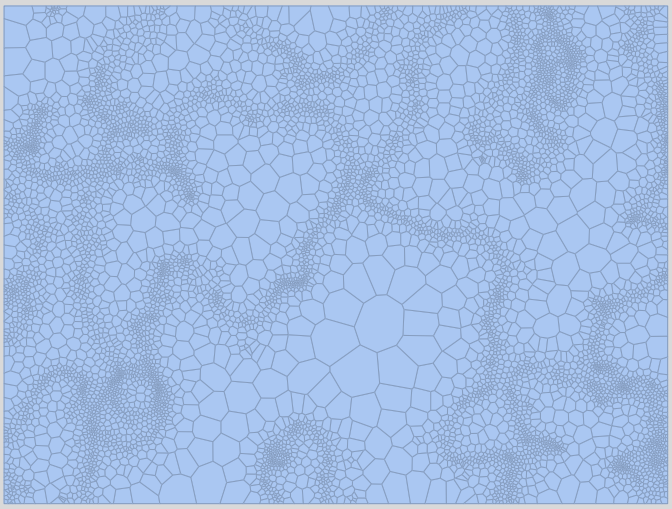
In[46]:=
```
vml = NestList[VoronoiMesh[Mean @@@ MeshPrimitives[#, 2], imgBounds] &, vm, 3]
```

Out[46]=



In[48]:=
```
vml[[4]]
```

Out[48]=



In[47]:=
```
Graphics[Table[{RGBColor[ImageValue[im, Mean @@ p]], p},
  {p, MeshPrimitives[Last[vml], 2]}]]
```

Out[47]=