

How to digitise graphs?



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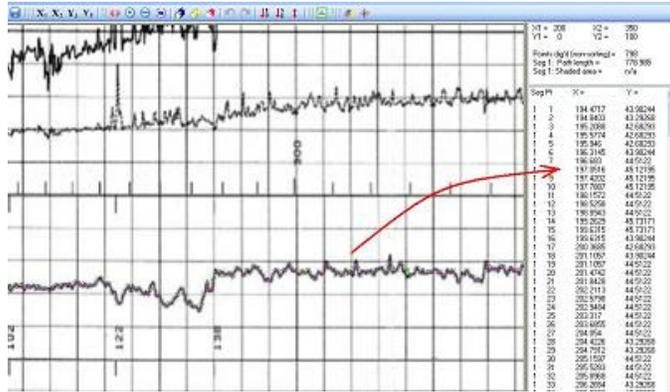
0) Your own notes of using VisualLab-dcsDigitiser:

You can write your own notes here and save this document for your own reference.

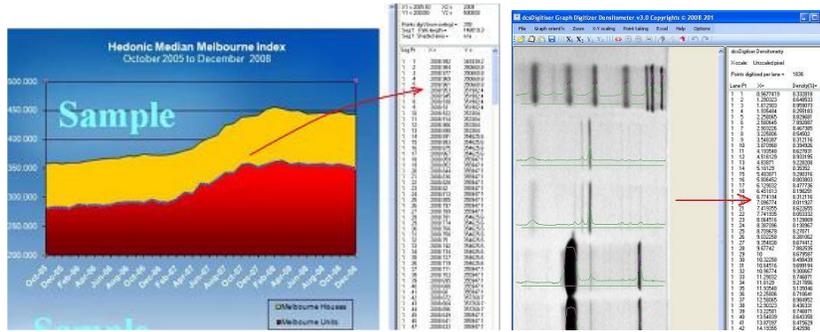
1) Overview of VisualLab-dcsDigitiser:

VisualLab-dcsDigitiser provides following functionalities:

1. automatically reads graphs into X-Y numerical numbers;
2. automatically reads gels into density numerical data;
3. calculate area size enclosed by a graph with at least 3 data points;
4. calculate area size of graphs in Excel (or any other programs).



A geographical record is digitised to obtain X-Y numbers (798 points).



A graph of house price is digitised (399 points)

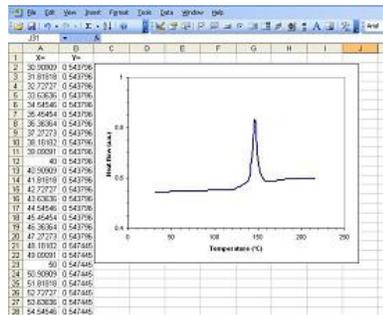
Gel stripes are digitised



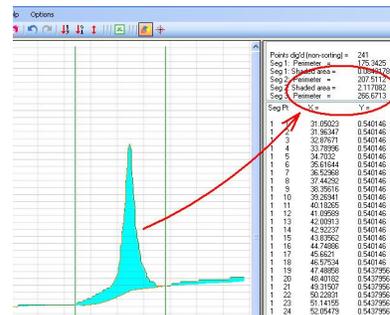
Digitising and area calculation

Digitising and area calculation

Measure Caspian Sea area size.



Graph and X-Y data in Excel



VisualLab-dcsDigitiser defines/calculates peak volume.

2) Graph preparation:

Scan your graph and save it in any one of the following formats:

Bitmap files:	bmp;
JPEG Files:	jpg
TIFF Files:	tif
Gif Files:	gif
PNG Files:	png
Enhanced Windows Meta Files:	emf
Exchangeable Image Files:	exif
Windows Meta Files:	wmf
Icons files:	ico

Any graphs on computer screen can be copied to **Clipboard** by pressing **Ctrl+PrtScr** keys simultaneously; and pasted to **VisualLab-dcsDigitiser** pressing **Ctrl+V** keys simultaneously or clicking **Tool Bar** .

The maximum pixel size of an image has been set 3000 x 3000. Extension can be made on request to fit special needs.

3) Graph prerequisites:

VisualLab-dcsDigitiser assumes X-Y axes orthogonal (**right angle**), and oriented either horizontal or vertical. If not oriented either horizontal or vertical, use **Orientation > Any angle** to rotate the graph until satisfaction. This makes it much easier because one can determine X-scale at any points with different Y value, and determine Y-scale at any points with different X-value.

Most graphs naturally meet this prerequisite, so there is no need for rotation.

4) Tool Bars:

Functions of tool bars are as follows:

-  to open an image file;
-  to paste an image in **Clipboard** to **VisualLab-dcsDigitiser**;
-  to paste numerical X-Y data in **Clipboard** to **VisualLab-dcsDigitiser**;
-  to save digitised X-Y numbers to a CSV Excel file;
-  to assign a point and value for X_1 ;
-  to assign a point and value for X_2 ;
-  to assign a point and value for Y_1 ;
-  to assign a point and value for Y_2 ;
-  to split a graph into two or more segments. If a graph is not segmented, the graph is dealt with as within one segment.
-  to digitise points manually, one click for one point.
-  to digitise points automatically from left to right: Click on a point of the curve to start.
-  to digitise points automatically from right to left: Click on a point of the curve to start.
-  to erase unwanted points one by one.
-  to erase all the points in a segment.



to erase all the points and curve segmentations to make a fresh start.

to undo previous moves;

to redo;

to sort data in ascending order according to X value;

to sort data in decending order according to X value;

to resotre data in order of digitisation;

to transfer data in the **List Box** of **VisualLab-dcsDigitiser** to **Excel**;

to calculate area size enclosed by a graph with at least 3 points;

to read X-Y values at the crosshair point.

5) Digitise a graph:

5.1 First practise:

Using the sample graph **VisualLab-dcsDigitiser** has provided, a user can practise digitising graph:

1. click **Tool Bar** , to digitise a graph automatically from left to right;
2. move the cross hair to a point on graph where you want to start;
3. click the mouse, digitising starts; you will see the X-Y numbers in the list boxes on the right hand side.
4. click **Tool Bar** **X₁**
5. move the cross hair to a point you know the value, and click;
6. type in the number for X₁, and press **Enter** or click button **OK**;
7. repeat 4~6 for X₂, Y₁ and Y₂;
8. click **Tool Bar**  to export digitised X-Y numbers to Microsoft **Excel**;

5.2 Procedures of graph digitization:

A typical process of digitising a graph is as follows:

- 1) Load the graph to **VisualLab-dcsDigitiser**; this can be done by:

Tool Bar  to load the graph file; or

Ctrl+V to paste the graph to **VisualLab-dcsDigitiser** if there is a graph in your clipboard already. Press **Ctrl+PrtScr** buttons on your keyboard simultaneously to capture any graph on **Screen** to **Clipboard**.

- 2) Align X-Y axes of the graph horizontally or vertically by:

Orientation → Any angle

Most graphs naturally meet the prerequisite and this step can indeed be skipped.

- 3) Digitise the graph

The simplest way to digitise a graph is to click on the graph you wish to digitise, **VisualLab-dcsDigitiser** then automatically digitises the graph. However following knowledge and skills, and a combination of these skills, are useful when a complex graph is digitised.

 to split a graph into two or more segments. If a graph is not segmented, the graph is dealt with as within one segment.

 to digitise points manually: one click for one point.

 to digitise points automatically from left to right: Click on a point of the curve to start.

 to digitise points automatically from right to left: Click on a point of the curve to start.

 to erase unwanted points one by one.

-  to erase all the points in a segment.
-  to erase all the points and curve segmentations to make a fresh start.

- 4) Determine the scales of X-Y axes;
 - X_1 to determine the point and its figure where X_1 reads
 - X_2 to determine the point and its figure where X_2 reads, $X_1 \neq X_2$
 - Y_1 to determine the point and its figure where Y_1 reads
 - Y_2 to determine the point and its figure where Y_2 reads, $Y_1 \neq Y_2$
- 5) Export data to, say, Excel. Simply click **Tool Bar**
 Or move the mouse to the **List Box**, make a selection, press **Ctrl+C** to copy it into Clipboard, and paste it by pressing **Ctrl+P** keys to anywhere you want.

6) Skilful use of the Tool Bars:

For low quality graphs or graphs with intersections, overlapping and/or grids, combination of different tools may be helpful.

To digitise the b curve in Figure 6.1, following procedures are taken:

- a) Click ; place cross hair on the starting point of curve b.
- b) Click ; erase bad points in a way of point by point on letter "b".
- c) Click  again; place cross hair to continue automatic digitising.
- d) Click ; place a segmentation mark on the intersection point of the curves.
- e) Click ; move the cursor hand over any digitised point of the right hand size segment, all the points in this segment are then erased.
- f) Click  again; place cross hair to continue automatic digitising.

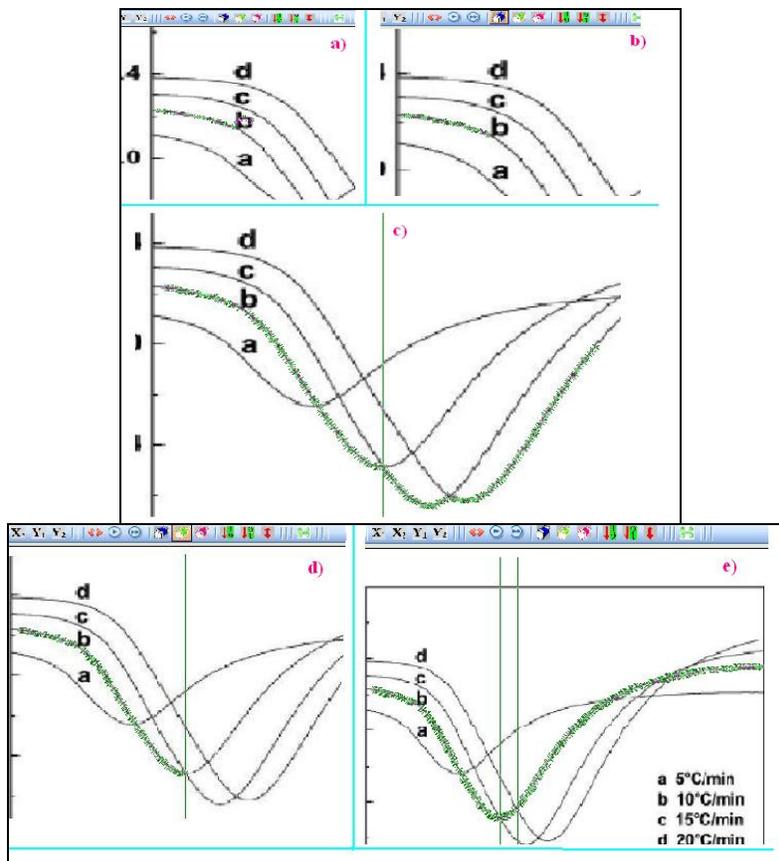


Figure 6.1

7) Calculate Area size of a graph:

Area size of a graph having more than 2 points can be calculated by clicking Tool Bar . It can be for an X-Y graph, map, SEM micrograph, photo or any drawing.

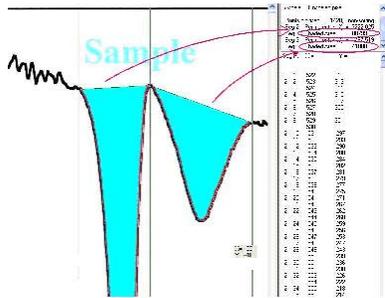


Figure 7.1

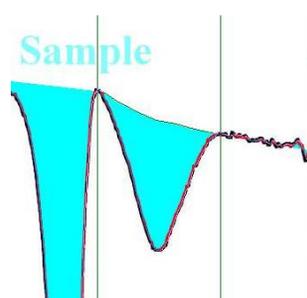


Figure 7.2



Figure 7.3

Procedures for Figure 7.1 to obtain the peak area are as follows:

1. Click the segmentation **Tool Bar** ; place the cross hair at where the peak starts and where it ends, and click;
2. Click Tool Bar  to digitise the graph;
3. Click Tool Bar  to calculate the area size.
4. If the baseline for the peak, e.g the one in the right hand side, is thought not a straight line, one can redefine as he/she likes so that the area value is more physically meaningful (Figure 7.2).

A Google satellite photo of Caspian Sea was copied and pasted to **VisualLab-dcsDigitiser**, with a scale bar being attached. The coast line of Caspian Sea was then manually clicked against the photo to obtain the area size for Caspian Sea.

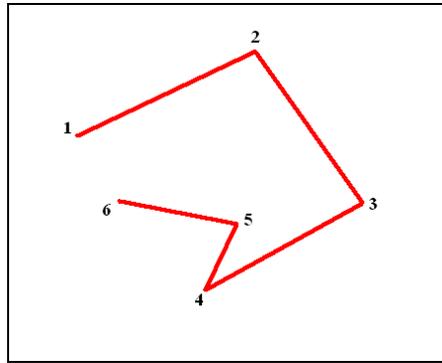
Note that no curvature of the Earth ground surface has been taken into consideration in **VisualLab-dcsDigitiser**. For maps with large distance, curvature compensation must be taken. For technical support, contact www.caotechnology.com.au.

8) Path length and perimeter of a graph:

Path length and perimeter of digitised points can be calculated and shown in the top left window. However, caution should be exercised in units. This is because the X-axis and Y-axis may not have the same unit. As shown in above figure, the definitions are:

Path length: Sum of the length of two successive points = $L_{12} + L_{23} + L_{34} + L_{45} + L_{56}$

Perimeter: Perimeter of the graph points = $L_{12} + L_{23} + L_{34} + L_{45} + L_{56} + L_{61}$



9) Densitometry:

9.1 Digitise a gel:

- 1) Load a gel to **VisualLab-dcsDigitiser**; this can be done by:

Tool Bar 

to open the gel file; or

Ctrl+V

to paste the gel to **VisualLab-dcsDigitiser** if there is a gel in **Clipboard** already.

Press **Ctrl+PrtScr** buttons on your keyboard simultaneously to capture any graph on **Screen** to **Clipboard**.

- 2) Align the gel horizontally or vertically by:

Orientation > Any angle to align the gel vertically or horizontally as you like. Most gels naturally meet the requirement and this step can be skipped.

- 3) Option selection

Options > Graph type to select either vertical or horizontal densitometry

- 4) Click the segmentation Tool Bar  to define the gel lanes;

a) move the cross hair to the top left of a gel strip and click;

b) move the cross hair to the bottom right of a gel strip and click;

Further lanes can be defined.

For vertical gels:

c) move the cross hair to the left of another gel strip and click;

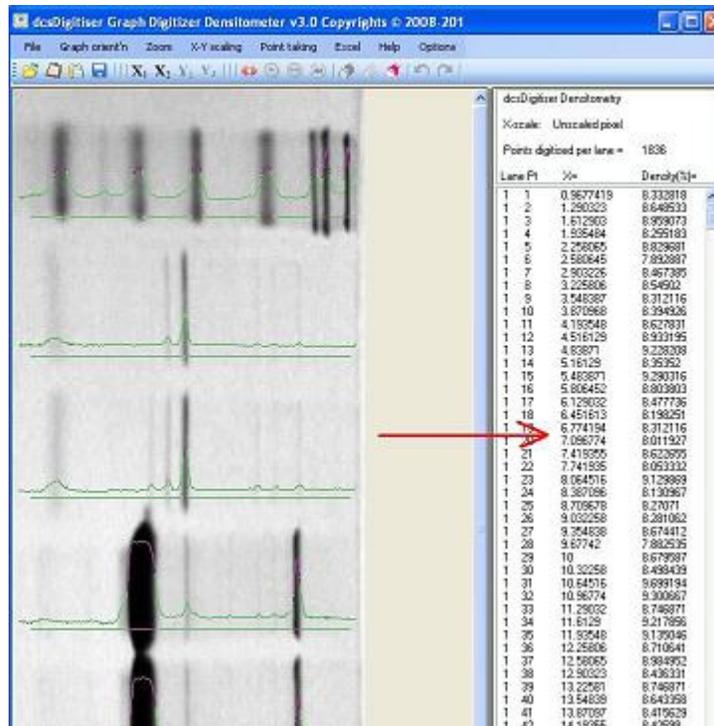
d) move the cross hair to the right of the gel strip and click;

For Horizontal gels:

c) move the cross hair to the top of another gel strip and click;

d) move the cross hair to the bottom of the gel strip and click;

- 5) Scaling the distance if necessary



9.2 Definition of the density in densitometry:

Lane number:

An automatic sorting processor is coded in **VisualLab-dcsDigitiser**, so that lanes are numbered from the left to the right for vertical gels and from top to bottom for horizontal gels regardless the order when lanes are defined.

Density (%)

Darkness (or brightness for negative gels) is averaged cross the width of a lane defined. The averaged darkness is then expressed as a percentage figure of the darkest (brightest for negative gels) spot of all the lanes defined.

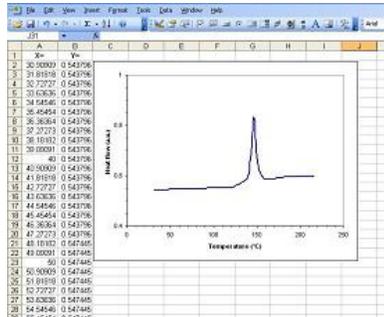
10) Input numerical data to VisualLab-dcsDigitiser:

In many cases, users have numerical numbers for their graphs, but simply want to take advantages of the unique functionalities of dcsDigitiser, e.g. calculation of the area size of a curve freely definable by users.

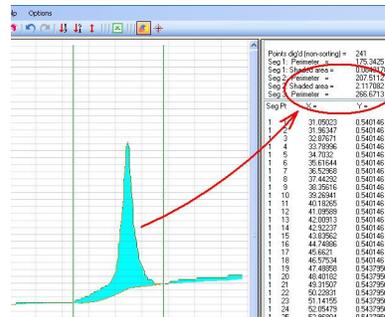
Simply: 1) Copy the data into your **Clipboard**

2) Paste the data to **VisualLab-dcsDigitiser** by pressing **Ctrl+P**

or by clicking **Tool Bar** 



Graph and X-Y data in Microsoft Excel



VisualLab-dcsDigitiser defines/calculates peak volume.

12) Further questions:

If you have any doubt regarding the use of VisualLab-dcsDigitiser, or any technical confusion requiring clarification, feel free to direct your further questions to: info@caotechnology.com.au