

*Geographic Information Technology Training Alliance (GITTA) presents:*

# **Derived sources and methods**

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# 1. Derived sources and methods

In this practical oriented lesson, you will

- how to digitize practically (points, lines and polygons).
- the functionality of digitizing in order to capture the data in GIS. The procedure is illustrated step by step through Animation.
- spatial data through scanned documents using onscreen digitizing, automated and semi-automated conversion methods.

## Learning Objectives

- Existing data could be commonly available as a map. Conversion of a paper map to digital features can be accomplished by the digitizing a paper map and the automated conversion of scanned map. You will learn both methods.
- The details of digitizing steps are software dependent. However, these are similar. You will learn step-by-step digitizing point, line and polygon features through the animation. It is recommended that the software manual of your digitizing software should be made available and your digitizing software installed on your system before starting reading the Map Digitizing Unit. Then relate the knowledge you gain from the Map Digitizing Unit to your digitizing software manual. As the nature of the unit is practical oriented study, you should follow digitizing tasks using your GIS software based on the knowledge gained. Otherwise, you will not learn this unit.
- You will learn automated conversion step-by-step through practical exercises. After reading the content of Map Scanning and Automated Conversion, download the PDF version of exercises and R2V software. As the nature of the unit is practical oriented study, you should follow step-by-step automated and semi automated conversion exercise using free R2V software based on the knowledge gained. Otherwise, you will not learn this unit.

# 1.1. Map Digitizing

## Objectives

This unit is exercise oriented, that will teach you how to digitize practically. You will learn the functionality of digitizing in order to capture the data in GIS. The general procedure is illustrated step-by-step through Animation. At the end of the unit, the students will understand how to capture the point, line and polygon features using digitizing capabilities of GIS. You need to digitize the provided map with your digitizing software or GIS software after learning the process. Otherwise, you will not be able to carry out digitizing practically.

### 1.1.1. Introduction to Digitizing

#### Introduction to Digitizing

**["Download the PDF version of the following pages here."](#)**

Digitizing is the process of converting geographic features on a paper map into digital format. The x, y coordinates of point, line and polygon features are recorded and stored as the spatial data. The feature attributes are also recorded during the digitizing process. It is the most common and labor intensive method to create a spatial database. The method is used especially when existing maps are available as the source of data. Coordinates of point features, line features and polygon features are recorded by manually pointing or tracing, using a digitizer table and cursor. The cursor position is accurately measured, by the device in order to generate the coordinate data in digital form. Although digitizing is substituted by scanning, digitizing tablets are still used to convert existing maps and drawings into GIS. Digitizing tablets typically support E-Size and larger drawings, with 0.001-foot resolution, 0.001-foot repeatability and 0.005-foot accuracy. Remember that, digitizing contributes to error.

#### Step-1 Setting Up The Digitizer

Go to the Step by Step Animation. See the Step 1.



*Click to view the animation of digitizing - Step 1.*

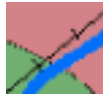
**Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed. [\[link\]](#)**

#### Step-2 Preparation of the Map for Digitizing

Go to the Step by Step Animation. See the Step 2.



*Click to view the animation of digitizing - Step 2.*



*Print this map for digitizing.*

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### 3. Create the Common TIC file

Go to the Step by Step Animation. See the Step 3.



*Click to view the animation of digitizing - Step 3.*

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### 4. Register the control points

Go to the Step by Step Animation. See the Step 4.



*Click to view the animation of digitizing - Step 4.*

TIC ID

*Click to view GUI for Control Point Register.*

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### 5. Digitizing Point Feature

Go to the Step by Step Animation. See the Step 5.



*Click to view the animation of digitizing - Step 5.*

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### 6. Digitizing Line Feature

Go to the Step by Step Animation. See the Step 6, 7 and 8.



*Click to view the animation of digitizing - Step 6, 7 and 8*

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### 7. Digitizing Polygon Features

Go to the Step by Step Animation. See the Step 9, 10 and 11.



*Click to view the animation of digitizing - Step 9, 10 and 11*

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## Step By Step Digitizing Animation

DigitizingAnimationText

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### Digitizing Exercise



1. Set up the digitizer with digitizing software or GIS software available at your GeoInformatics Lab.
- 2.



Print out the following map.

*Click to view the complete graphic. Then print the map.*

3. Digitize the point features. The file name should be given as Settlements. Build the attribute table of settlements.
4. Digitize the line features that represent roads. The file name should be given as Road. Correct all the dangle errors. Build the attribute table of Roads.
5. Digitize the line features that represent streams. The file name should be given as Stream. Correct all the dangle errors. Build the attribute table of Streams.
6. Digitize the polygon features that represent different landuses. The file name should be given as Landuse. Correct all the dangle errors and label errors. Build the attribute Table of Landuse.

### 1.1.2. Submit your result

1. Submit your digitizing results to the discussion group.
2. Submit your answer to questions 1 to 6 to the instructor by Email.

### 1.1.3. Questions

1. List the three most common methods of data capture.
2. List the steps for digitizing based on your experience.
3. Before digitizing the map, what information should be obtained or gathered about the map?
4. Why tic controls are necessary and explicitly marked before digitizing?
5. What is a User ID of features? Explain with examples.
6. What are dangle errors? Explain with examples.



## 1.2. Map scanning and automated conversion

### Objectives

This unit will introduce quick and less costly methods of data capture - map scanning and automated conversion. This unit will briefly discuss scanners. This unit will thoroughly discuss scanning of documents, vectorizing through on-screen digitizing, automated and semi automated conversion with practical exercises using R2V software. At the end of the unit, you will be able to carry out capture of spatial data through scanned documents using onscreen digitizing, automated and semi-automated conversion methods.

### 1.2.1. Map Scanning and Automatic Conversion

[Download the PDF version of the page here.](#)

Compared to manual digitizing, scanning is very quick and less costly. The result of scanning an existing document or map, is a raster image, recording a value of dark or light for each grid cell or pixel of the scan. Due to the raster format, scanned images are not directly useful in the vector GIS. However, the scanned image can be displayed as the background image after georeferencing.

The pattern recognition algorithms have been developed to recognize lines, symbols and annotations from the scanned image to the vector format. Moreover, editing and translation software, are available to convert to vector format.

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The following table illustrates the relationship between pixel scanning resolution or dpi; scale of document and pixel ground resolution.

Pixel Resolution or dpi	$\mu\text{m}$	Pixel Ground Resolution 1:40000	Pixel Ground Resolution 1:20000	Pixel Ground Resolution 1:5000
75	339	13.5 m	6.8 m	1.7 m
100	254	10.2 m	5.1 m	1.3 m
150	169	6.8 m	3.4 m	0.8 m
200	127	5.1 m	2.5 m	0.6 m
300	85	3.4 m	1.7 m	0.4 m
400	64	2.6 m	1.3 m	0.3 m
600	42	1.7 m	0.8 m	0.2 m
800	32	1.3 m	0.6 m	0.16 m
1000	25	1.0 m	0.5 m	0.13 m

1200	21	0.8 m	0.4 m	0.11 m
1500	17	0.7 m	0.3 m	0.07 m
2000	13	0.5	0.3	0.07 m
3000	9	0.4 m	0.2 m	0.05 m

### Scanned Documents Examples

The following image is 1 bit bi-level image. The image contains 0, 1 values. The source of the image is from:

[R2V software.](#)

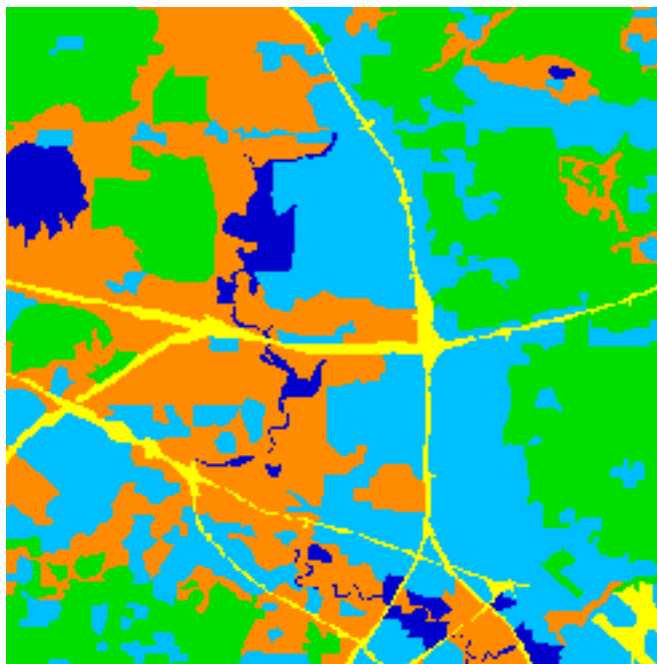
**This is an essential link, you have to visit the web site and download the software.**



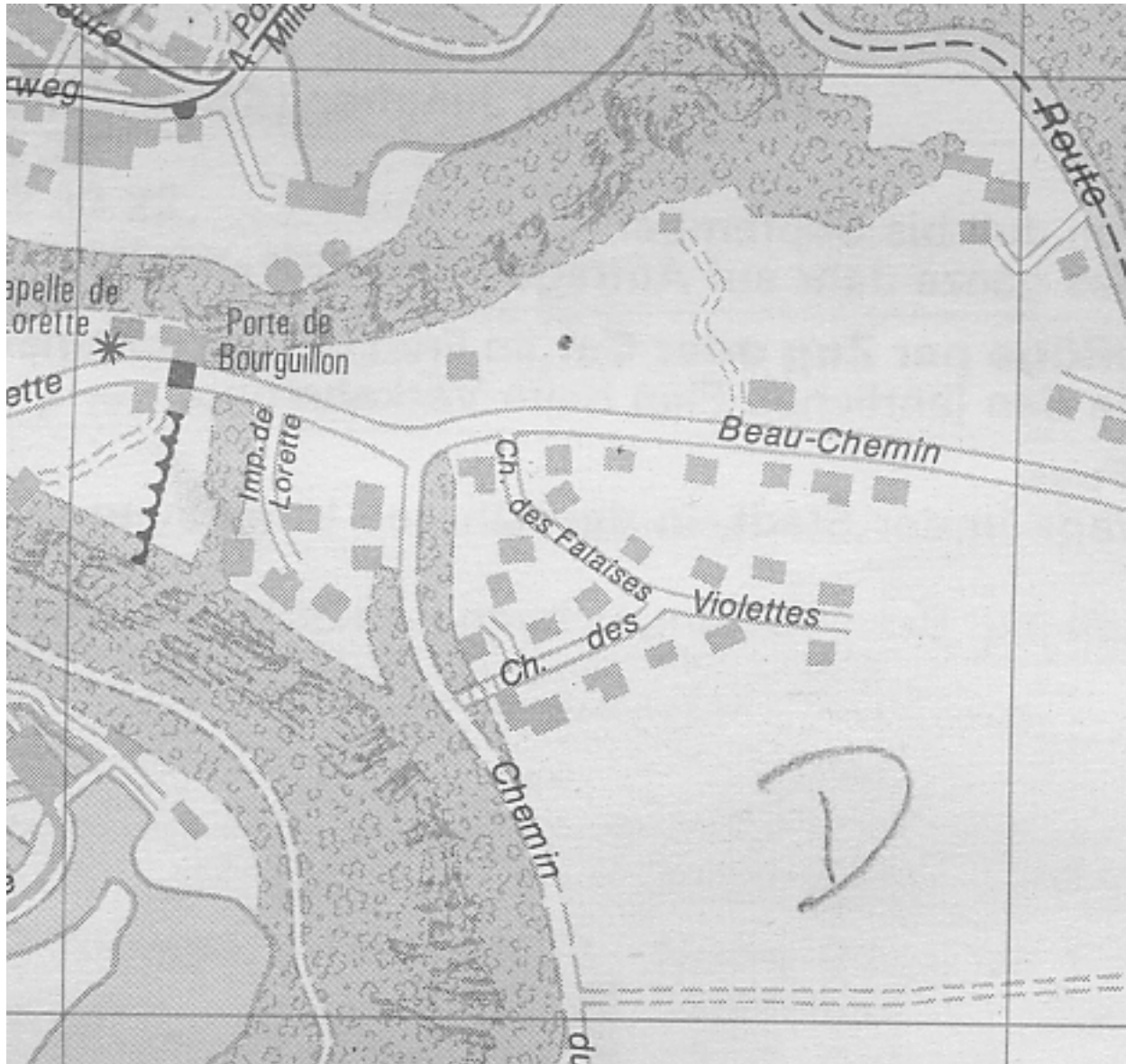
0 represents the pixels of contour which are dark in colour. 1 represents the pixel of non-contour which are white in colour. See the following enlarged image. The contour lines can be extracted from this scanned 1 bit bi-level image through semi-automated conversion.



The following image is an 8 bit (256 color) image. The polygon and line features can be extracted from this image through semi-automated conversion or onscreen digitizing.



The following image is an 8 bit grey scale scanned image. The polygon and line features can be extracted from this image through semi-automated conversion or onscreen digitizing.



### Practical exercises with R2V

Download the **PDF version of hands-on exercises** by clicking [here](#). The exercises will demonstrate the automated and semi-automated conversion process. --> Follow the step-by-step instructions.

### 1.2.2. Exercises

1. Describe the three basic types of scanner.
2. The scanned map is ready to use for analyses after scanning. Yes/No
3. The scanned aerial images of aerial photographs can be used directly for Digital Photogrammetry Stereo compilation; Digital Elevation Modelling from a stereo pair of scanned aerial photographs and Orthophoto Mapping. Yes/No
4. Explain the usefulness of scanned images

## 1.3. Bibliography

- **Antenucci, John C; Brown, Kay**, 1991. *Geographic Information Systems: A Guide to Technology*. New York, Van Nostrand Reinhold, cop.
- **Burrough, P. A. and R. A. McDonnell**, 1998. *Principles of Geographical Information Systems*. New York, Oxford University Press.
- **Minami, Michael**, 2001. *Using ArcMap*. ESRI.
- **Montgomery, Glenn E; Schuch, Harold C**, 1993. *GIS Data Conversion Handbook*. Fort Collins Colo: GIS World.
- **Shaner, Jeff ; Wrightsell, Jennifer**, 2001. *Editing in ArcMap*. ESRI.