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R2V for Windows

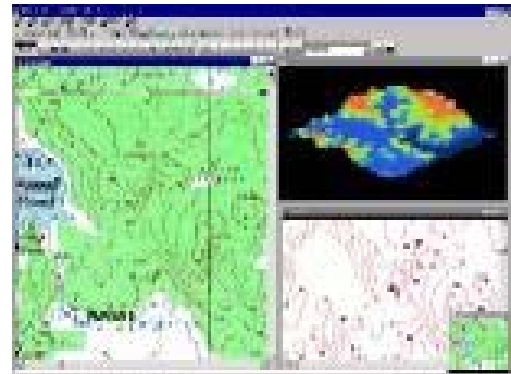
Raster to Vector conversion software
under Windows environment





R2V is an advanced, raster to vector conversion software used for automated map digitizing, GIS data capture, and CAD drawing conversion. Because R2V has many functions specially designed for mapping and GIS applications, the automated map digitizing feature is the main application that users in more than 60 countries are working with.

R2V supports both fully automated raster to vector conversion and interactive, semi-automatic tracing to handle a wide variety of map types. R2V provides a complete set of editing tools for vector editing, control point selection, and image and text editing. R2V allows vector geo-referencing for any projection system using GeoTIFF or control points and supports the most commonly used vector formats, such as DXF, ArcView Shapefiles, MapInfo MIF/MID, IGES, SVG (Scalable Vector Graphics) and many others.



R2V also provides many advanced image processing functions, such as unsupervised color classification, grayscale image background removal, image warp or rubber sheeting, image geo-referencing, image editing, and many more.

If you need to digitize maps or create vector data, the easiest way is to scan the hardcopy and let R2V vectorize it for you. You can then edit, label with attributes, select control points for geo-referencing, and export your data to the format you need.

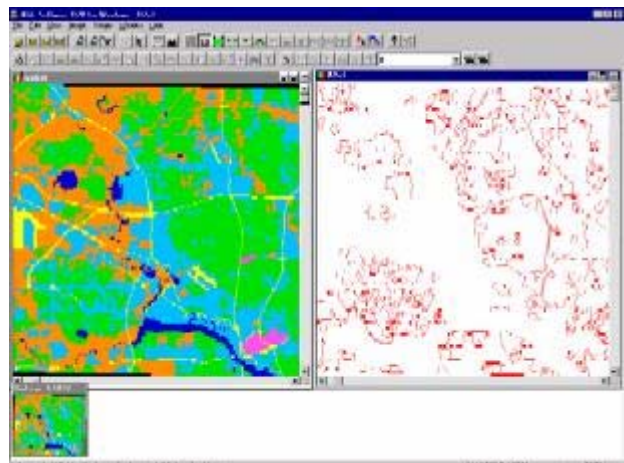
Applications:

- Contour Map Digitizing
- Parcel/Tax Map Digitizing
- Soil Map and Flood Map Digitizing
- Mapping from Aerial Photos & Satellite Imagery
- Create 3D DEM from Contour Maps
- CAD Drawing Conversion
- Image Geo-Referencing, Registration & Processing
- UTM, Lat/long and State Plane Projection Systems

Contour Map Digitizing - R2V Digitizes Contour/Topo Maps the Easy Way

Automatic Vectorization

If your contour maps are in color and scanned as color images, use R2V's Image/Classification to purify the colors into a smaller number of colors. The Image/Image Pixel Tool can be used to merge colors and convert one color to another. You can then vectorize the contours by specifying the brown color and other colors separately using R2V's Vector/Auto Vectorize function.



If your image is scanned as grayscale (this is recommended when map quality is not very high), use the Image/Set Image Thresholds command to select the best thresholds for contour lines, and then Vector/Auto Vectorize to trace all contours automatically.

If your image is 1-bit black and white, you can use Vector/Auto Vectorize to get all contour lines traced automatically.

Semi-Automatic Interactive Tracing

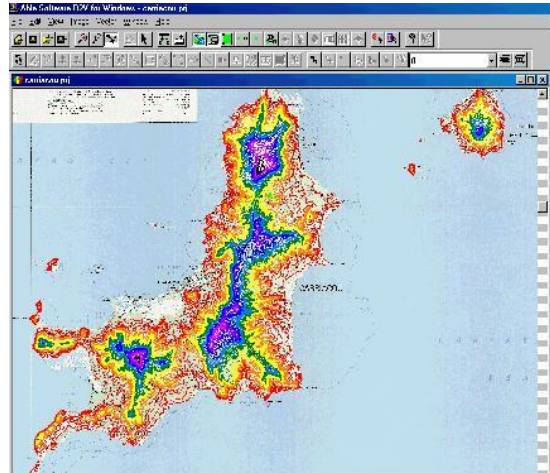
If you need to trace the contours selectively, then R2V's easy-to-use interactive tracing is the tool to use.

Start R2V's Line Editor (Edit/Line Editor) and turn on the Auto Tracing option. Click the starting point and click the next lead point and R2V will trace the entire line. It will stop for your further direction if there is a gap or intersection. You can trace color images, grayscale, or black and white images.

Contour Line Editing and Labeling

R2V provides the best Line Editor, designed for quick map editing. People around the world use it on a daily basis for large and small mapping projects. Contour labeling is made easy using the Label Contours option under Line Editor. Simply draw a line across the contours and enter the starting elevation and increment value, and it's done. All selected contours are labeled and ready to be used to create a DEM or by a mapping or GIS system.

An example of a topographic map in Grenada which has been vectorized and labeled using R2V. Different colors are used to show contours with different elevation (right image).



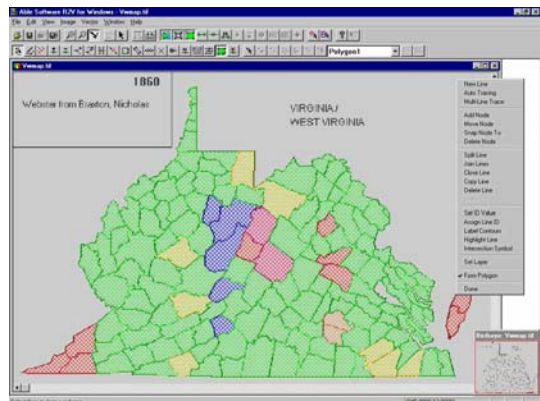
Parcel/Tax Map Digitizing

Automatic Vectorization

If your parcel map is scanned as a 1-bit black and white image, you can go ahead and use Auto Vectorize to get all parcel boundaries vectorized automatically.

Use R2V's Line Editor to clean up the vector lines and update broken boundaries.

Use Vector/Create Polygon Layer function to close all polygons



How To Vectorize A Parcel Map With A Lot of Text:

A parcel map normally includes parcel boundaries in the form of closed polygons, text for parcel ID, and other lines.

The following are some steps you can take to maximize automatic processing and minimize editing for digitizing parcel maps:

- Step 1. Assume the image is a 1-bit monochrome image. Check the resolution to make sure parcel boundary lines are connected. If not, you can use Image/Resize to downsample by 2 or more. You can also use Image/Despeckle a few times to remove noise.
- Step 2. Image/Conversion/Convert to Grayscale. Note: If you don't want to change the image to grayscale, you can skip Step 2 and at Step 3, define the color as the background color, and fill only lines you do not wish to vectorize. After the data is vectorized, you can save the vector lines and load the original image as the backdrop when doing editing.

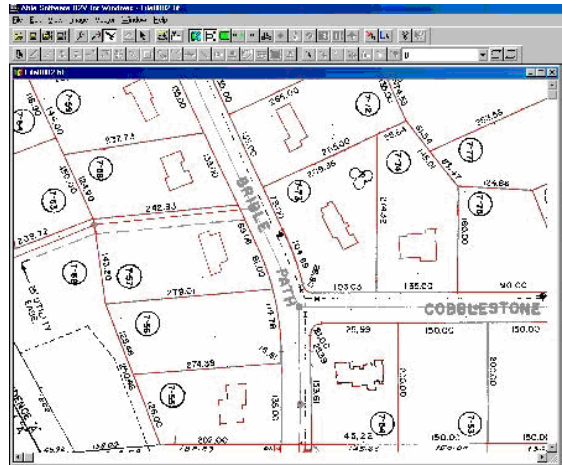
Step 3. Select Image/Image Pixel Tool On, then change to Fill Area mode. Define the color as 100, or something different from the background (255) or 0 (lines). Move the cursor to a parcel line and click the left mouse button to fill. You'll see all connected parcel lines will turn to the new color. Repeat this step to fill all parcels.

Step 4. Select Image/Set Image Threshold to adjust the threshold to include only the parcel lines (color around 100) to red and confirm this.

Step 5. Select Vector/Auto Vectorize to make sure the "Use Defined Image Thresholds" box is checked. Then start the process to vectorize only parcel boundaries.

Step 6. Edit the lines to remove non-boundary lines and any text that's vectorized.

Step 7. Use Vector/Create Polygon Layer to create polygons and use Edit/Line Editor/Form Polygon to close polygons if needed.



Step 8. Assign IDs to parcels if needed and export the vector data.

Soil Map and Flood Map Digitizing

Soil Map Vectorization

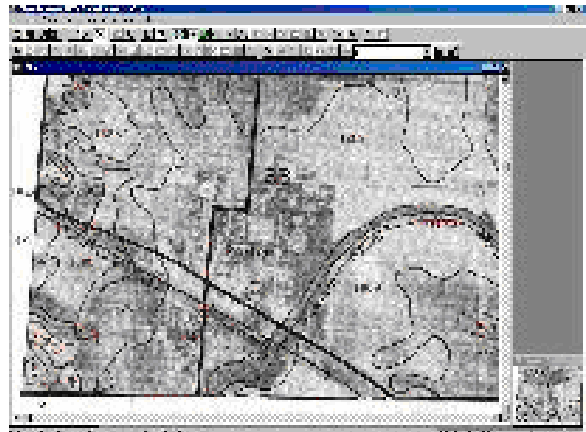
If your soil map is scanned as a 1-bit black and white image, you can Auto Vectorize to get all parcel boundaries vectorized automatically.

If your soil map is drawn on an aerial photo, scan the image as grayscale.

Use Image/Set Image Threshold to separate the lines from the background or use Image/Remove Background to clean up the background.

Select Vector/Auto Vectorize to trace all the boundary lines automatically.

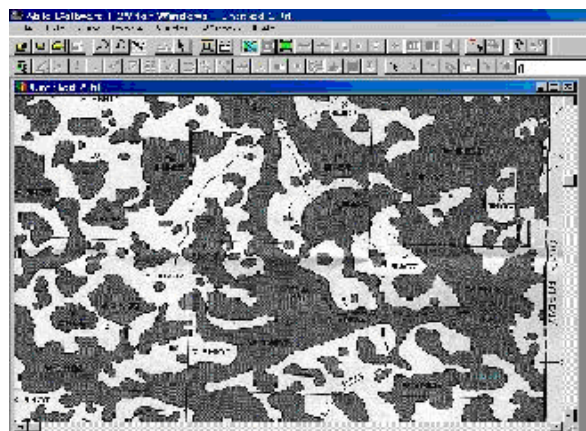
Use the Vector/Create Polygon Layer function to close all polygons



Flood Map Vectorization

If the flood regions are in different colors, you can scan the flood maps as color images and vectorize only the flood regions using the Boundary Line mode.

If you have a lot of maps, you can process the maps using R2V's batch processing mode to vectorize all the maps together with just a single processing script.



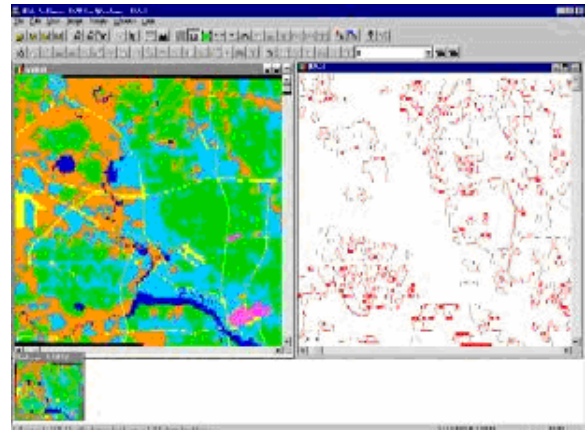


Mapping from Aerial Photos & Satellite Imagery

Create Maps

Aerial photos and satellite imagery provide the rich information source for computer mapping and map creation. You can use R2V to extract vector boundaries from aerial photos or satellite imagery or trace streets and roads.

If your image is classified, the Vector/Auto Vectorize command can create map layers for all classes with just a single command.



example of a map created from SPOT imagery

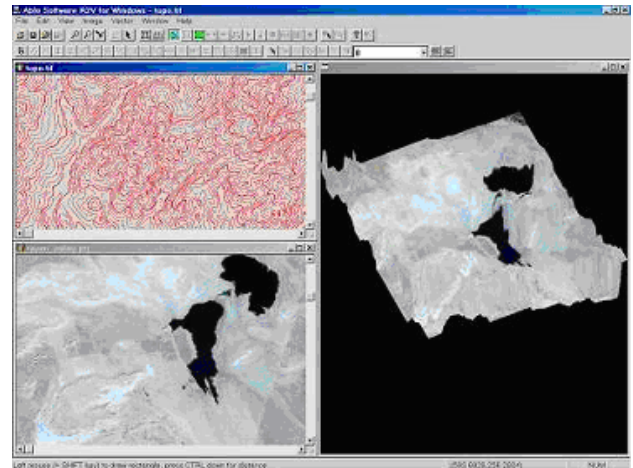
Update Existing Maps

R2V supports GeoTIFF, World File, and TAB file for image geo-referencing. To update your map, simply open the image and import your vector map layer into R2V and use R2V's easy-to-use line editor to update your maps.

Create 3D DEM from Contour Maps

Creating a 3D DEM Is Easy Using R2V

- ▶ Auto Vectorize your contour/topographic map using R2V.
- ▶ Label the contours.
- ▶ Select File/3D Data/Create 3D DEM or Grid to create the 3D file. R2V supports the standard USGS DEM format and the ASCII grid file format.



Drape An Image to 3D Surface

- ▶ Open the 3D DEM or Grid file to display in R2V.
- ▶ Open the image (any image, including a map, aerial photo, or satellite image) you want to drape on the 3D surface.
- ▶ You can use Image/Crop Region to select the proper image region to cover the 3D surface

CAD Drawing Conversion

R2V's powerful Auto Vectorize function converts CAD drawings to DXF, IGES, and other formats in just a few seconds. R2V supports multiple layers exactly the same way as CAD systems do.

R2V can handle very large size drawings. One major aircraft manufacturer has used R2V to vectorize a 180" by 48" drawing with just a single command. They tried other packages but R2V is the only one that does the job.

If you have a large number of drawings, you can use R2V's batch processing function to process them together with one command.

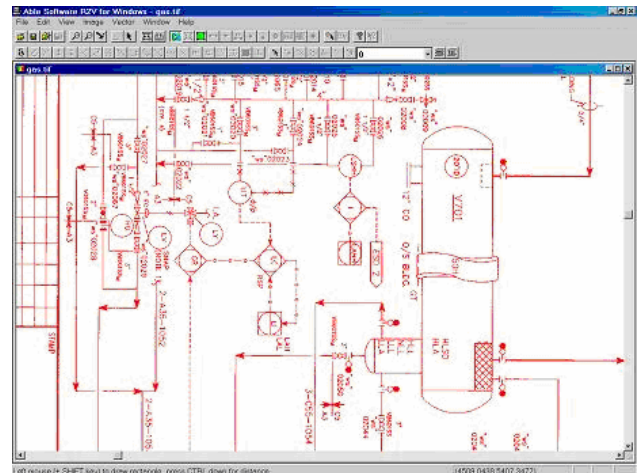
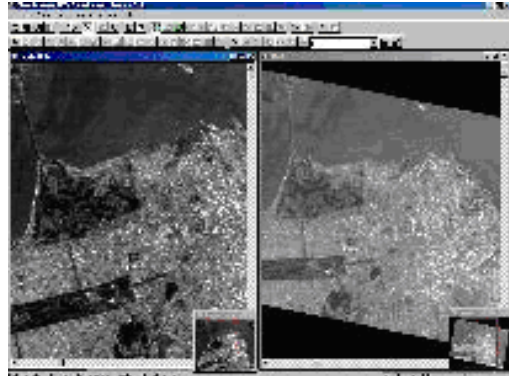


Image Geo-Referencing, Registration & Processing

Image Registration and Warp

R2V allows you to register one image against another image by using 4 or more control points. Image warp can correct map or image distortion so that two images can be overlaid on top of each other. R2V supports bi-linear or triangulation based methods for image registration.

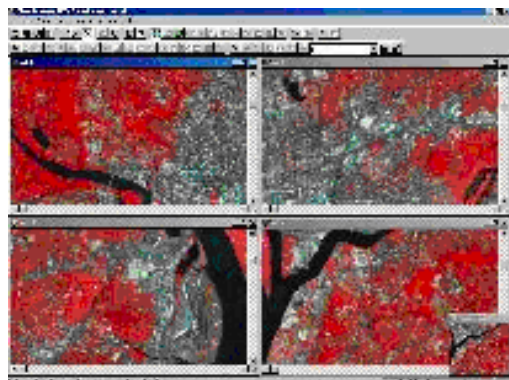


Geo-Referencing Images with R2V:

GeoTIFF: supported by many image processing and GIS packages
 World File: supported by all ESRI products and other packages.
 TAB File: supported by MapInfo and other products.
 R2V's own control points method.

Image Mosaic

R2V's Image/Mosaic function allows you to stitch a group of images together to create a mosaic image. Images with overlapped borders are correlated to create seamless image mosaic. This function can be used to merge small image sections together when using a small format scanner.



UTM, Lat/long and State Plane Projection Systems

R2V provides the Edit/Geo-Coord Convert/UTM and LL function to convert coordinates between UTM and geography coordinate system.

To convert a point from latitude/longitude to a UTM coordinate:

- Step 1. Select the reference ellipsoid from the geodetic datum list.
- Step 2. Enter the latitude and longitude values in the edit boxes. The latitude and longitude are in decimal degrees. East Longitudes are positive and west longitudes are negative. North latitudes are positive and south latitudes are negative.
- Step 3. Click the "LL to UTM" button to do the conversion. The calculated UTM coordinates are displayed in the Northing and Easting edit boxes. The UTM zone number is also displayed.
- Step 4. If your control points are defined using latitude and longitude and need to be converted to a UTM coordinate system, then click the "Convert Control Points to UTM" button to convert. Once the control points are converted, you can apply them when exporting your vector data.

To convert a point from a UTM coordinate to latitude/longitude:

- Step 1. Select the reference ellipsoid from the geodetic datum list.
- Step 2. Enter the UTM coordinate in the northing and easting edit box. UTM coordinates are in meters.



- Step 3. Enter the UTM zone number. If you are not sure about the UTM zone, one simple way to generate it is to enter an approximate latitude and longitude value and click "LL to UTM" to calculate.
- Step 4. Click the "UTM to LL" button to do the conversion. The calculated geography coordinates are displayed in the latitude and longitude edit boxes. Latitude and longitude are in decimal degrees.
- Step 5. If your control points are defined using a UTM coordinate system and need to be converted to latitude and longitude, then click the "Convert Control Points to LL" button to convert. Once the control points are converted, you can apply them when exporting your vector data.

To convert a point from latitude/longitude to a State Plane coordinate:

- Step 1. Select the correct state plane and the zone number. The state plane name is displayed in the list with the zone number following the name. Check NAD27 if you are using NAD1927 or NAD83 if using NAD1983.
- Step 2. Enter the latitude and longitude values in the edit boxes. The latitude and longitude are in decimal degrees. East Longitudes are positive and west longitudes are negative. North latitudes are positive and south latitudes are negative.
- Step 3. Click the "LL to SPL" button to do the conversion. The calculated State Plane coordinates are displayed in the Northing and Easting edit boxes.
- Step 4. If your control points are defined using latitude and longitude and need to be converted to a State Plane coordinate system, then click the "Convert Control Points to SPL" button to convert. Once the control points are converted, you can apply them when exporting your vector data.

To convert a point from a State Plane coordinate system to latitude/longitude:

- Step 1. Select the correct state plane and the zone number. The state plane name is displayed in the list with the zone number following the name. Check NAD27 if you are using NAD1927 or NAD83 if using NAD1983.
- Step 2. Enter your State Plane coordinates in the Northing and Easting boxes. State Plane coordinates are in meters.
- Step 3. Click the "SPL to LL" button to do the conversion. The calculated geography coordinates are displayed in the latitude and longitude boxes. Latitude and longitude are in decimal degrees.
- Step 4. If your control points are defined using a state plane coordinate system and need to be converted to latitude and longitude, then click the "Convert Control Points to LL" button to convert. Once the control points are converted, you can apply them when exporting your vector data.

Functions:

Image Formats: TIFF, GeoTIFF, JPEG, GIF, RLC, PNG and BMP formats. R2V supports most image types, including 1-bit bi-level, 8-bit grayscale, and color images (4-bit, 8-bit, and 24-bit). Most TIFF image compressions are supported. There is no software limit for image sizes. R2V also supports SPOT and other satellite raw image formats. Geo-reference your raster image in R2V and save to GeoTIFF format.



Vector Export/Import: ArcView (Shape file), Arc/Info Generate, AutoCAD DXF, MapInfo (MIF/MID), IGES, MapGuide SDL, 3D Grid file, 3D DEM (compatible with USGS DEM), VRML, and 3D XYZ vector file formats. More vector file formats are being added. Click here to get sample output files.

Advanced Vectorization: R2V supports three types of vectorization:

(1) Fully automatic vectorization. One command will vectorize your scanned map in seconds or minutes at high quality. Batch function allows vectorizing a number of maps without any user intervention. Write your own batch script to customize the processing steps for the images before vectorization and for vector line processing after the vectorization. **(2) Interactive line tracing.** You select two points on the image and let R2V trace the line for you. Easy, accurate and intelligent! For complex maps or drawings, use the interactive tracing to vectorize lines selectively. Or use the multiple line tracing function to vectorize a group of lines with only two clicks. **(3) Manual on-screen heads-up digitizing.** With R2V's easy to use vector editor, you simply draw the lines with your image as the backdrop, zoom in and out, and quickly create the data set for your specific applications.

Complete Vector Editing: A complete on-screen vector editor is provided using the image as a backdrop. Lines can be created, moved, joined, split, removed, colored, and labeled. Closed polygons are formed easily from existing lines with the polygon editing tool.

Vector Labeling and Contour Map Digitizing: Lines can be labeled with different ID values which are saved as attributes when exporting to a mapping or GIS package. Semi-automatic contour line labeling is supported for quick elevation assignments of contour lines.

Vector Rasterizing: Converts vector data to high resolution raster image for printing and processing.

Multiple Layers: Use R2V's layer manager to define as many layers as needed to organize vectorized data into layers. Layers created in R2V are fully compatible with the export vector file formats that support multi-layer structure. With multiple layers defined, vector data can be processed, edited, and displayed by layer and moved between layers. Layers can be turned on, off, or locked for flexible vector data editing and handling.

Point Feature Digitizing: Complete support for digitizing of point features. Points can be created, moved and labeled. Point data can be exported to all the vector file formats supported.

Automatic Polygon Layer Creation: Create polygon layers automatically from vectorized lines with just one command. The closed polygons can then be edited, and labeled using R2V's line editor. Polygons can be displayed in fill mode with a user defined hatch pattern and color for the layer.

Powerful Raster Image Editing: R2V provides a powerful raster drawing tool for easy image pixel editing and repairing. All image types, including 1-bit monochrome, grayscale, 8-bit color, and 24-bit color are supported by the Image Pixel Tool. Pixel mapping functions can easily map one pixel value to another for the entire image to remove noise pixels, clean up image background, or merge color layers.

Geo-Referencing Using GeoTIFF or Control Points: Vector data can be geo-coded or geo-referenced to a real world coordinate system (e.g., UTM, Latitude/Longitude) using GeoTIFF, user selected control points or a World file (TFW). Raster images can be geo-referenced as well with a generated World file supported by ESRI's Arc/Info, ArcView, or TAB file by MapInfo. Image rubber sheeting functions allow geometric correction or registration of an image to a new coordinate system. R2V supports both Bi-linear and Delaunay triangulation methods for geometric transformation. Geo-referenced raster images can be saved in GeoTIFF format, and are fully compatible with other packages that support GeoTIFF.

Conversion between Map Projection Systems: R2V supports conversion between UTM coordinate systems, latitude/longitude, State Plane NAD27 and State Plane NAD83 systems. You can convert one point or an entire set of control points automatically.



Automatic Text Detection and Recognition (OCR): Detects and recognizes text of different fonts, sizes, and languages automatically. Flexible editor for easy removal and manipulation. Other irregular intersection symbols can be detected and corrected as well.

Merge Multiple Maps: Use R2V to vectorize maps separately and then merge them into one set by specifying proper control points. The merged vector data set can then be edited within R2V and treated as a single map.

Flexible Region of Interest for Vectorization and Image Processing: R2V supports regions of interest in the form of circles, rectangles, free form polygons, and their combinations for vectorization and image cropping.

Powerful Image Processing: Vertical and horizontal flip, transpose, rotate, remove dark background, edge detection, image resample, crop a region, smoothing, segmentation, image mosaic, fusion, warping, and negate. Both supervised and unsupervised classification are built in to help process aerial photos or satellite imagery that are in color. Color separation, grayscale image enhancement, and image type conversions can all be done using R2V.

Image Mosaic: R2V's Image mosaic command makes it easy to create a mosaic image from a series of sub-sections. Simply start by selecting the Image/Mosaic option, and specify the layout matrix and image file names. The image mosaic will be created in a few seconds. Images with overlapped borders are correlated to create seamless image mosaic.

Image Merge and Overlay: The image merge function allows you to combine multiple images interactively to create image overlays or mosaics.

Colorize Grayscale Images using a Low Resolution Color Image: R2V's image fusion technology provides a powerful way to colorize a high resolution grayscale image using color information from a low resolution multi-spectral image. If you need to interpret a grayscale image at a higher accuracy, colorizing the image gives you the correct information about water, shadow, and vegetation, instead of just dark pixels.

3D Display With Image Draping: Create a 3D data set automatically from your labeled line data and display them using R2V's advanced 3D display and animation function. View your data with image draping in 3D at any angle and distance. Supports 3D DEM (compatible USGS DEM format) and Grid formats for both input and output. 3D models can be exported to DXF, VRML, and XYZ formats. Simply download a VRML plug-in for your web browser and then click here to see an example.

Technical:

System Requirements:

- ▶ Windows (9X/NT/2000/ME/XP/VISTA) are adequate for running R2V.
- ▶ 64MB is reasonable for processing regular sized images, but you may need more memory if you vectorize larger sized images, especially 24-bit color images regularly.
- ▶ Try to keep all your active data (project files, image files, vector files) on your local machine and move them to a network drive only when all processing is complete.

Image formats are supported:

R2V supports TIFF, GEOTIFF, BMP, JPEG, GIF, RLC, and other raw image formats used to store satellite imagery. Most scanners can generate images in TIFF format, if not, you can simply use an image utility to convert them to TIFF, or a format supported by R2V.

Image types support:

R2V can vectorize most image types, including 1-bit monochrome or bi-level, 4-bit and 8-bit grayscale, and 8-bit and 24-bit color images.

