

Feature Extraction

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1. Install Feature Extraction

1. Unzip the **Fe.zip**. It contains the following files: fe.avx, fe.doc, convolve.aml, gedit.aml and clean.aml.

Fe.avx: the main Feature Extraction extension file.

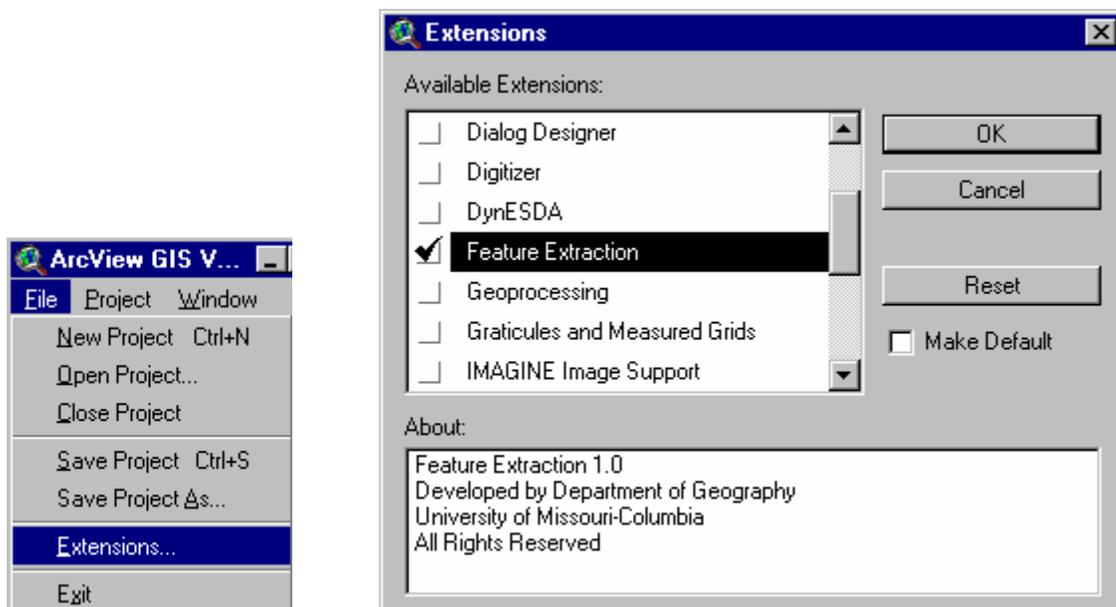
Fe.doc: the Feature Extraction help document.

Convolve.aml: Arc/Info AML program to convolve grid.

Gedit.aml: Arc/Info AML program to remove the small speckles of a grid.

Clean.aml: Arc/Info AML program to clean an Arc/Info coverage.

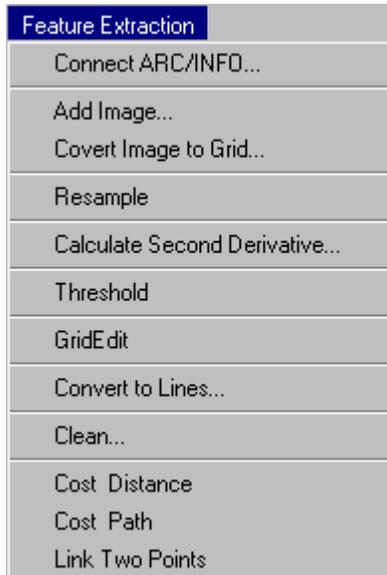
2. Copy the fe.avx and all AML file to **Arcview Ext32** directory. E.g. c:\esri\av_gis30\arcview\exe32\.
3. Start Arcview. From **project File** menu, choose **extensions** and then check the Feature Extraction extension and press ok.



3. The extension will place one new menu item on the View menu bar called **Feature Extraction**. Also two new tools  and  are added to tool bar.

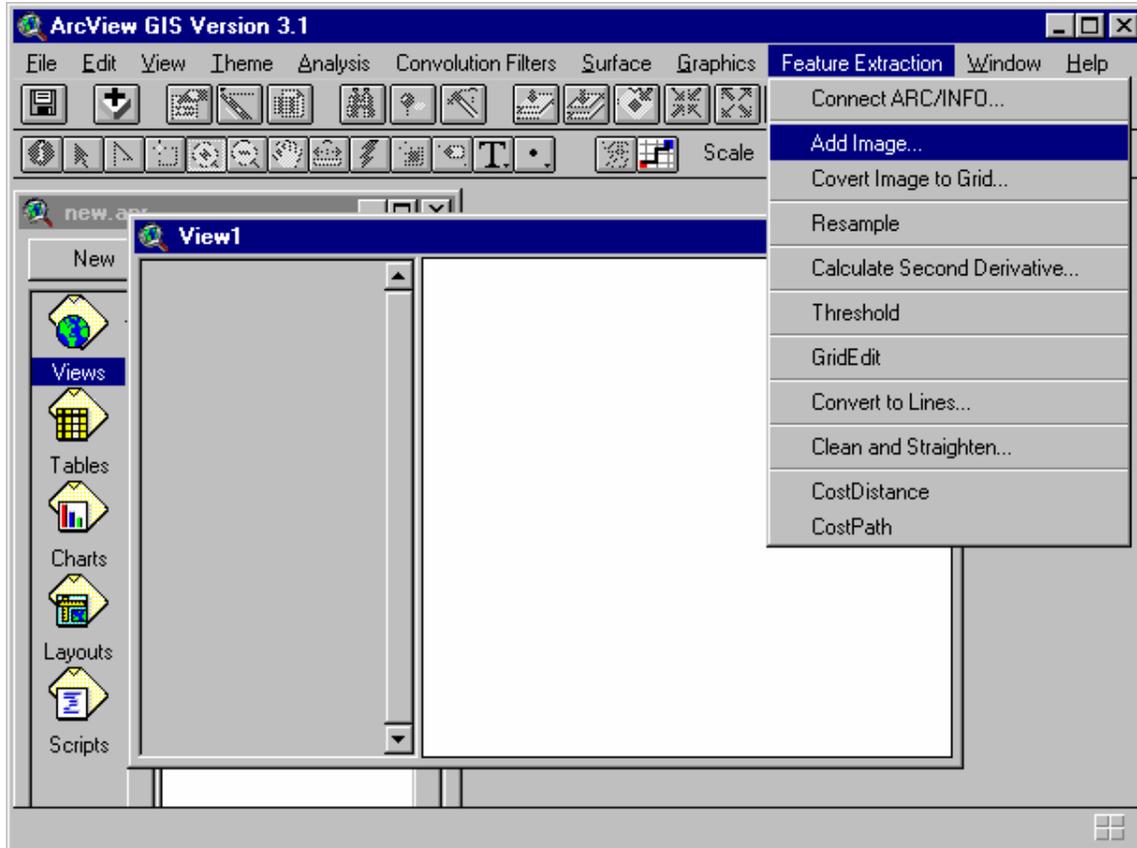
2. Using Feature Extraction

Feature Extraction is developed by Department of Geography/Geographic Resources Center (GRC) at University of Missouri-Columbia. Feature extraction can be used to automatically/semi-automatically extract roads from remotely sensed images. It's an extension to ARCVIEW and require Spatial Analysis. The main menu is added to View GUI. It has the following items:

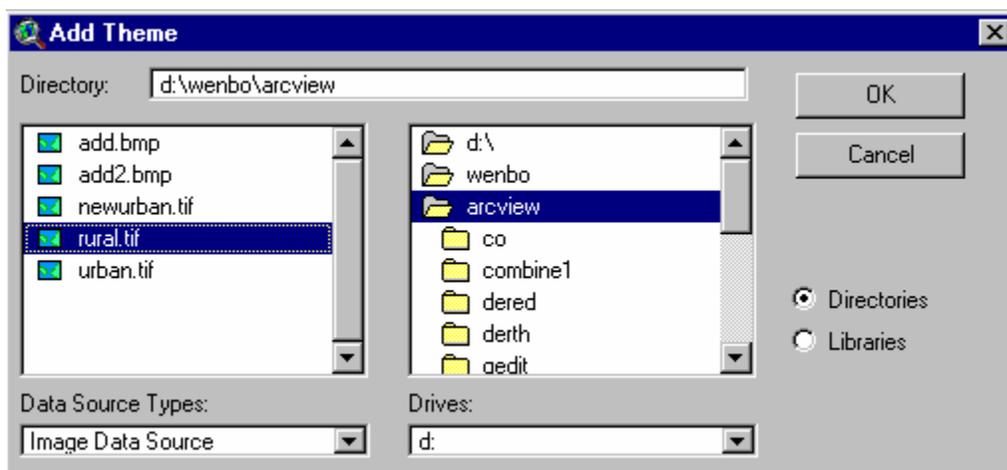


To add an image to a view

1. From menu **Feature Extraction** click **Add Image**.

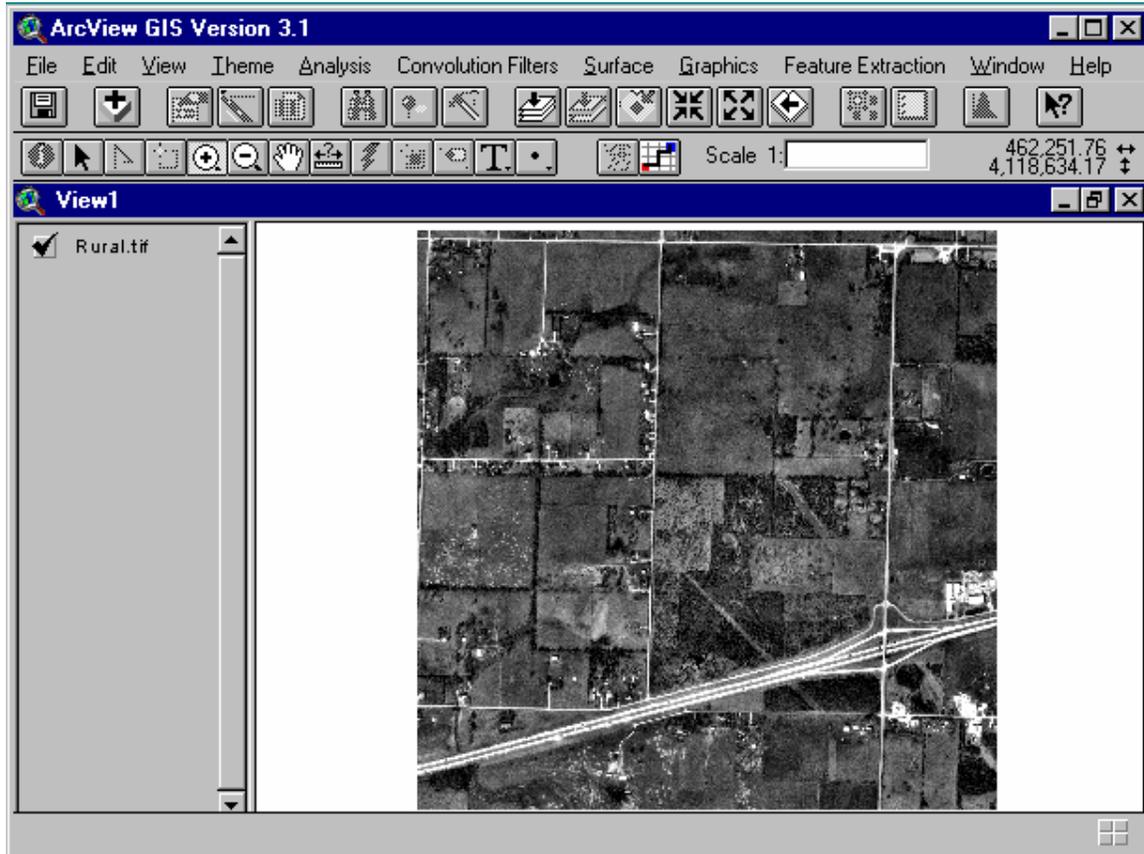


2. In the dialog that appears, choose **Image Data Source** from the **Data Source Types** list.



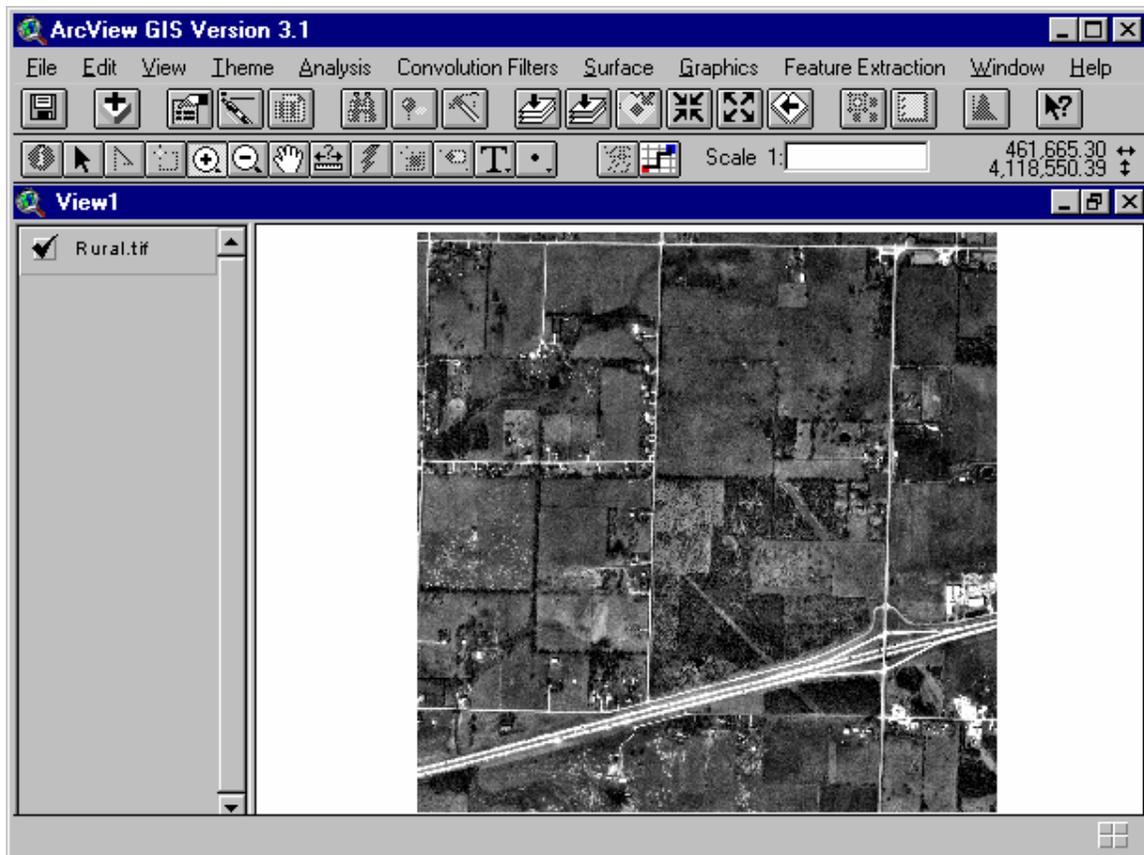
3. Navigate to the directory that contains the image you want to add. Double-click the directory name to list the image data sources it contains. Any images or ARC/INFO grids in this directory will be listed.
4. Double-click the image you wish to add. The image is added to the view.

5. Click the check box next to the theme's name in the view's table of contents to draw the image.

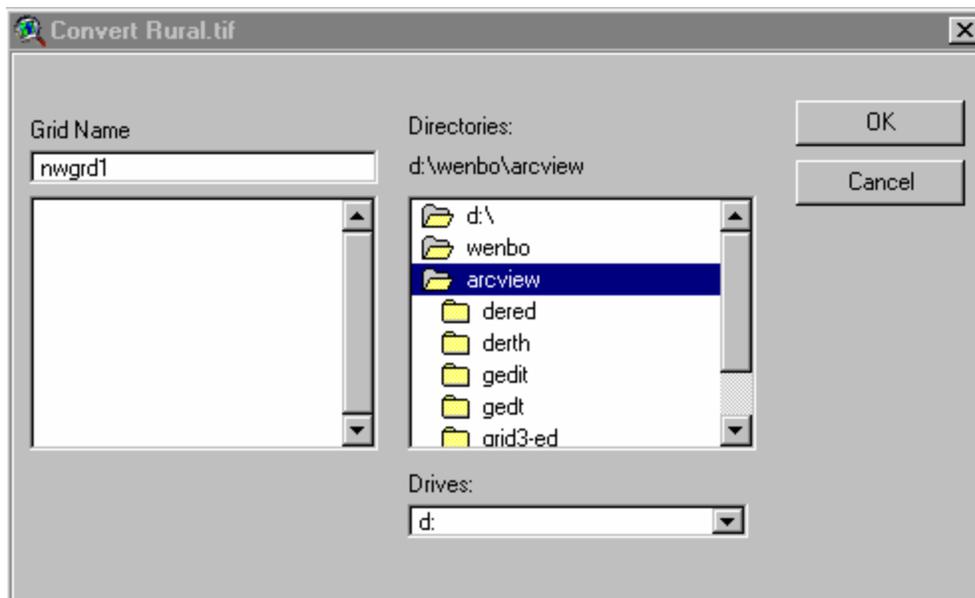


To Convert image to Grid

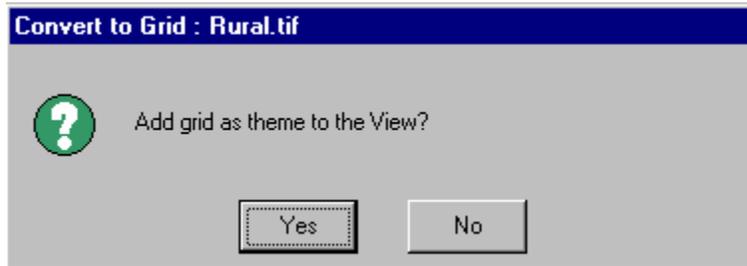
1. In the view's table of contents, click the image theme you wish to convert to make it active. The theme name will stand out.



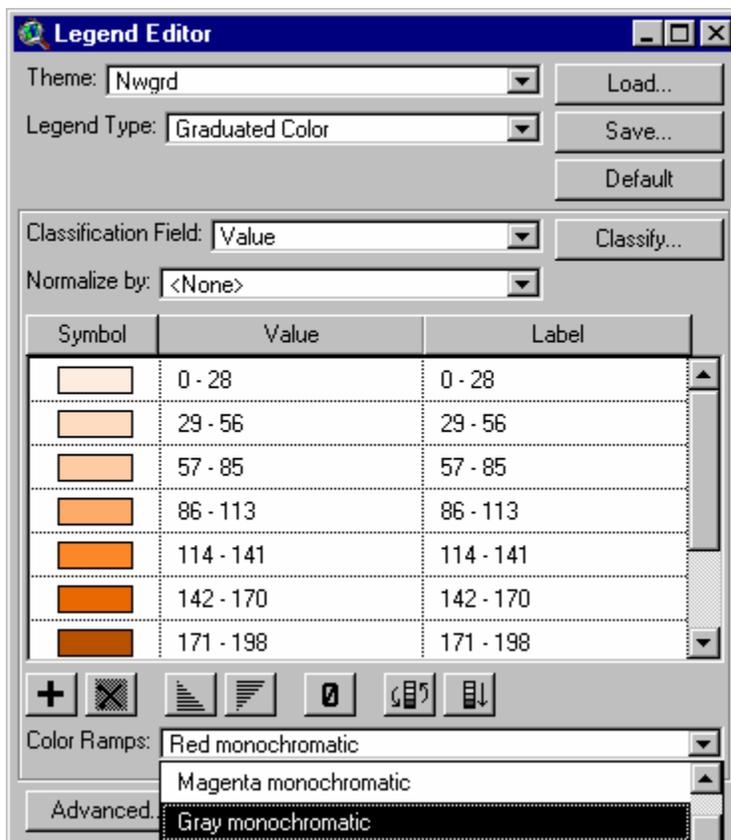
2. From the Feature Extraction menu, choose **Convert image to Grid**.
3. In the dialog that appears, specify the name and location for the new grid that will be created from the image. Press **OK** to start the converting.



4. You are prompted whether you want to add the new grid to current view. If you click **yes**, the new grid theme will be added to your view.



5. Optionally, you can change the way a grid is displayed. Double-click the theme's name in the view's table of contents, the Legend Editor will appear.

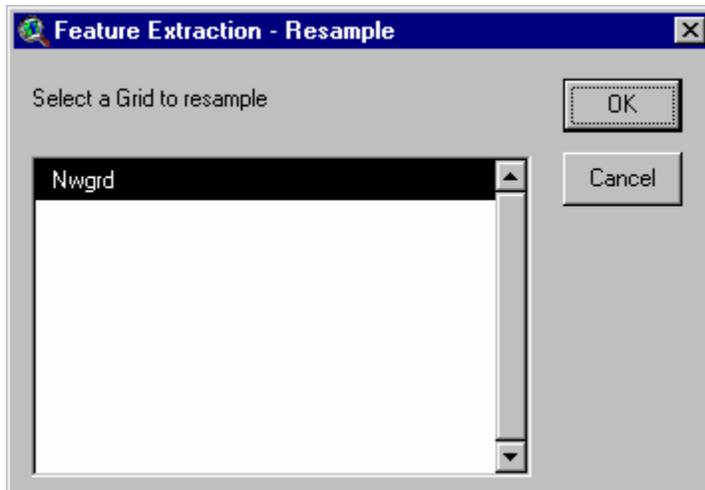


6. You can choose a pre-defined color scheme from the **Color Ramps** dropdown list or double-click the symbols to set them individually. Also you can select legend type, classification method, change labels etc. To know more about this, see ARCVIEW help.

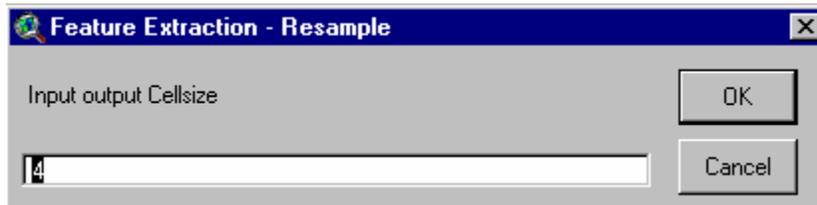
Resample

Sometimes you may need to change the cell size of a grid using resample.

1. From Feature Extraction menu, choose **Resample**.
2. A dialog will show all grid themes in current view. From the list, select a grid you want to resample. Press OK.



3. Another dialog will prompt you to enter the output grid cell size. Enter a **number** and press OK.



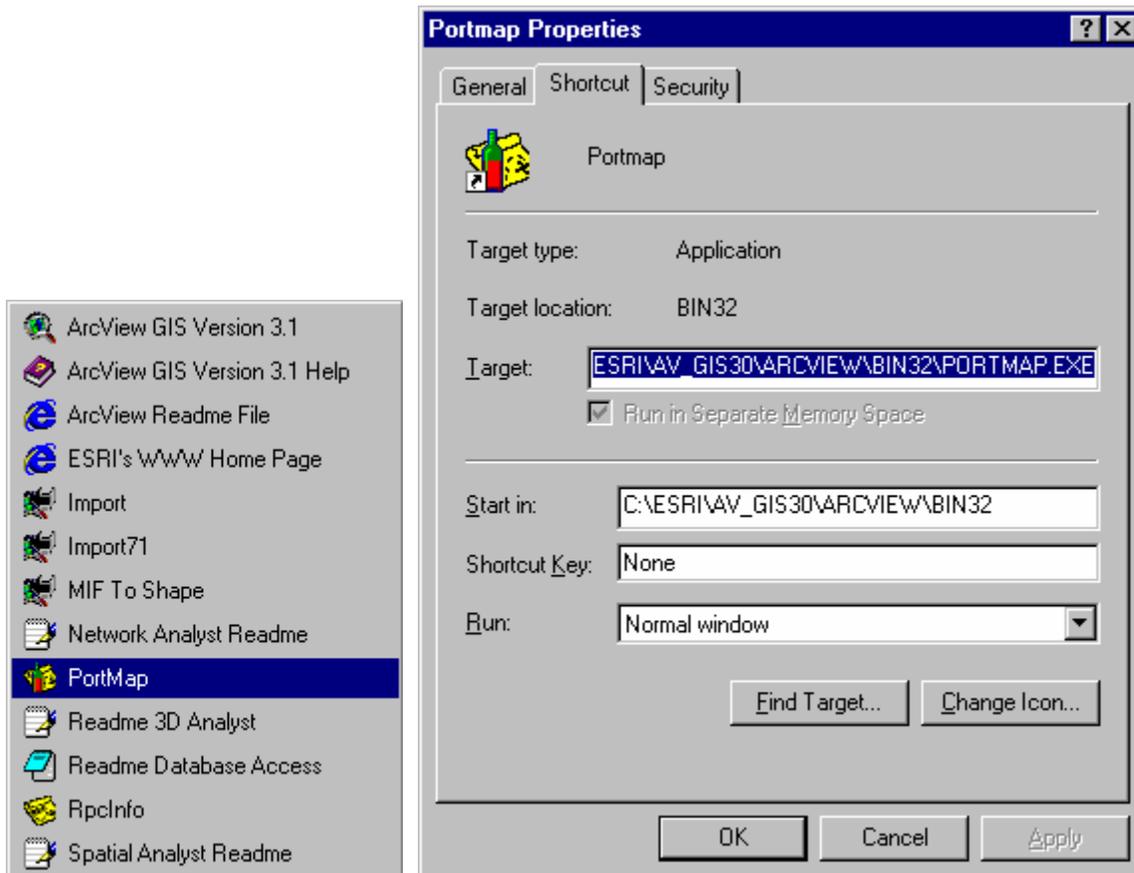
4. You are prompted if you want to add the resampled grid to current view.

Connect ARCVIEW to an ARC/INFO server

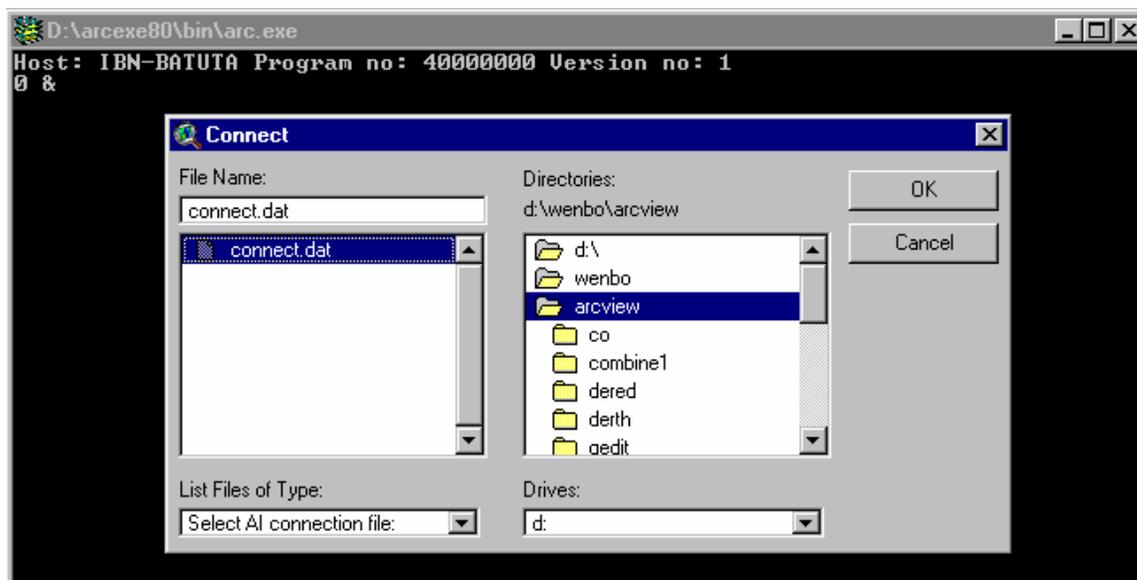
Some functions of Feature Extraction are performed on ARC/INFO server using Remote Procedure Call (RPC). RPC provides a standard protocol for implementing Client/Server relationships between applications. One application establishes itself as a server and then other applications become clients by connecting to the server. Clients request services

from the server application and the server performs those requested tasks. By making ARC/INFO as an RPC server, we can use ARC/INFO's functionality.

1. Make sure a **Portmap** is running before you start the RPC Server in ARCVIEW. To start Portmap, simply click on the portmap icon in the ARCVIEW program group. Portmap is an executable comes with ARCVIEW.

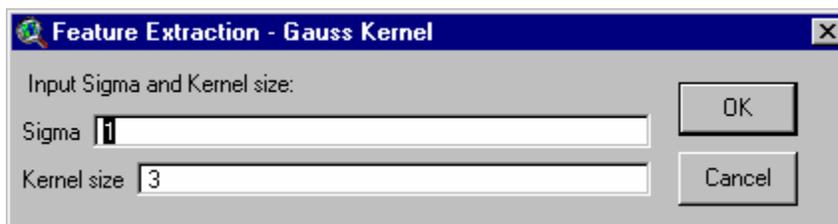


2. From Feature Extraction menu, choose **Connect ARC/INFO**. An ARC/INFO window and a dialog will appear. From the dialog, click the file name connect.dat and press OK. ARCVIEW will connect to an ARC/INFO server.

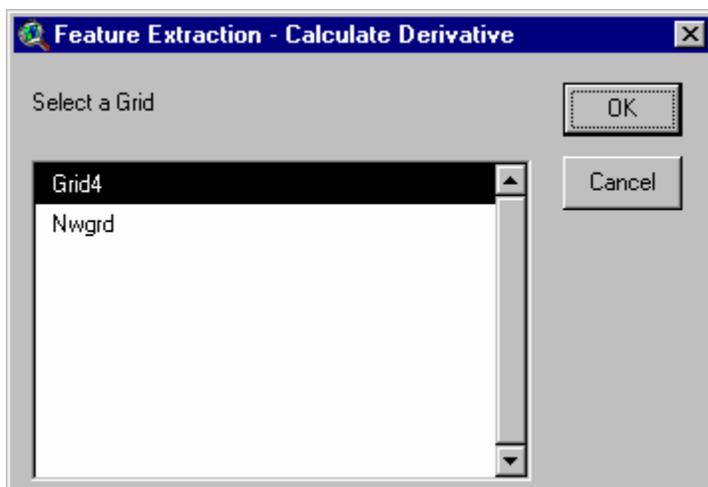


Calculate the second derivative of a grid

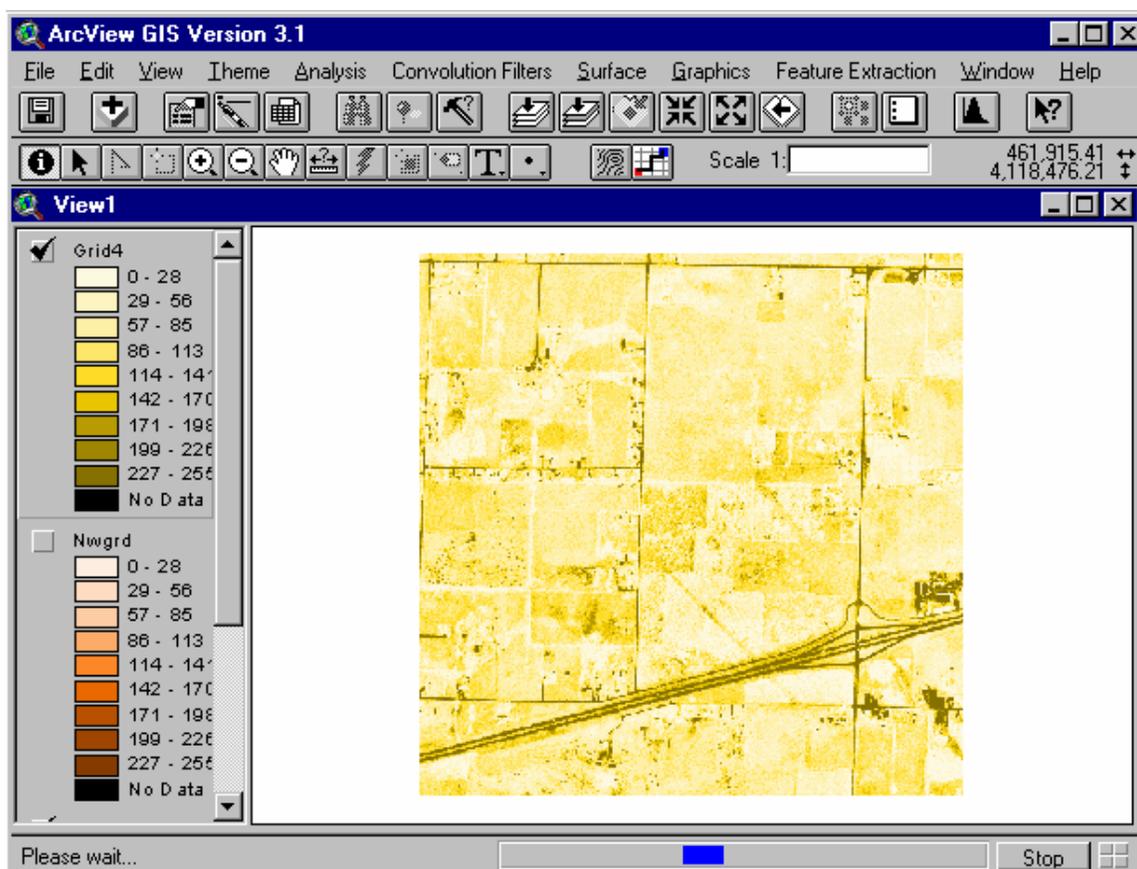
1. From Feature Extraction menu, choose **calculate second derivative**, a dialog will appear. Enter the parameters **sigma** and **kernel size**. Sigma determines the amount of smoothing to be performed. Larger sigma value lead to a larger smoothing of the image. Kernel size is the size of Gaussian kernels such as 3,5, 7 etc. Press OK.



2. A new dialog will prompt you to select a grid to calculate.



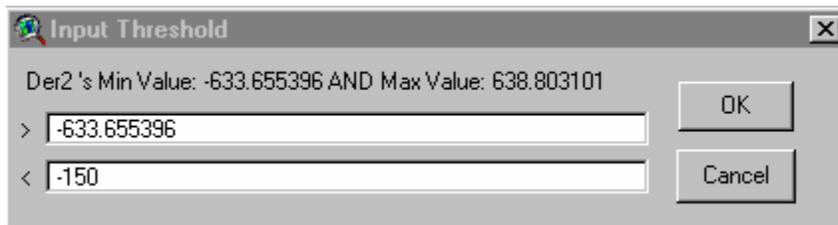
- An ARC/INFO server will run a program to calculate the second derivative. When program is running, a “Please wait...” message will appear on the bottom and a blue bar will bounce left and right until ARC/INFO complete the application.



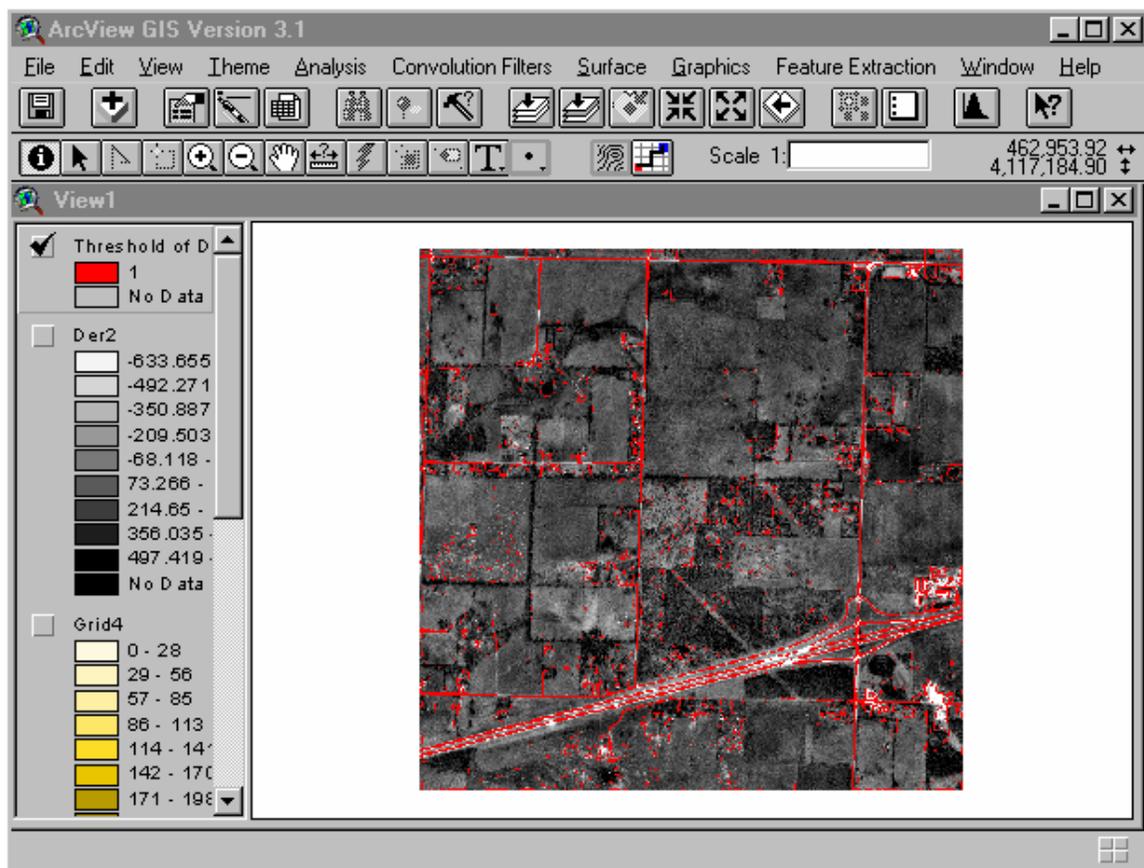
- When calculation completed, you will be prompted to add the second derivative grid to current view.

Threshold

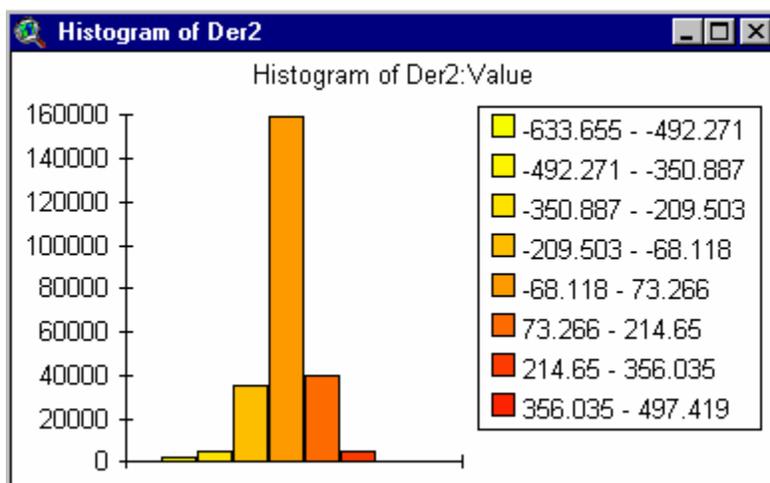
1. From Feature Extraction menu, choose **Threshold**. A dialog will list all the grids in the current view. Select a grid you wish to threshold.
2. Another dialog will let you input low threshold and high threshold value. In the output grid, any cell whose old value is between low threshold and high threshold will be assigned a value “1”, otherwise it will be assigned to “No Data”.



3. The threshold grid will be added to current view. You can try different threshold value to get a better result.



4. You may use the **histogram** tool  to chart your grid and help you decide the threshold.



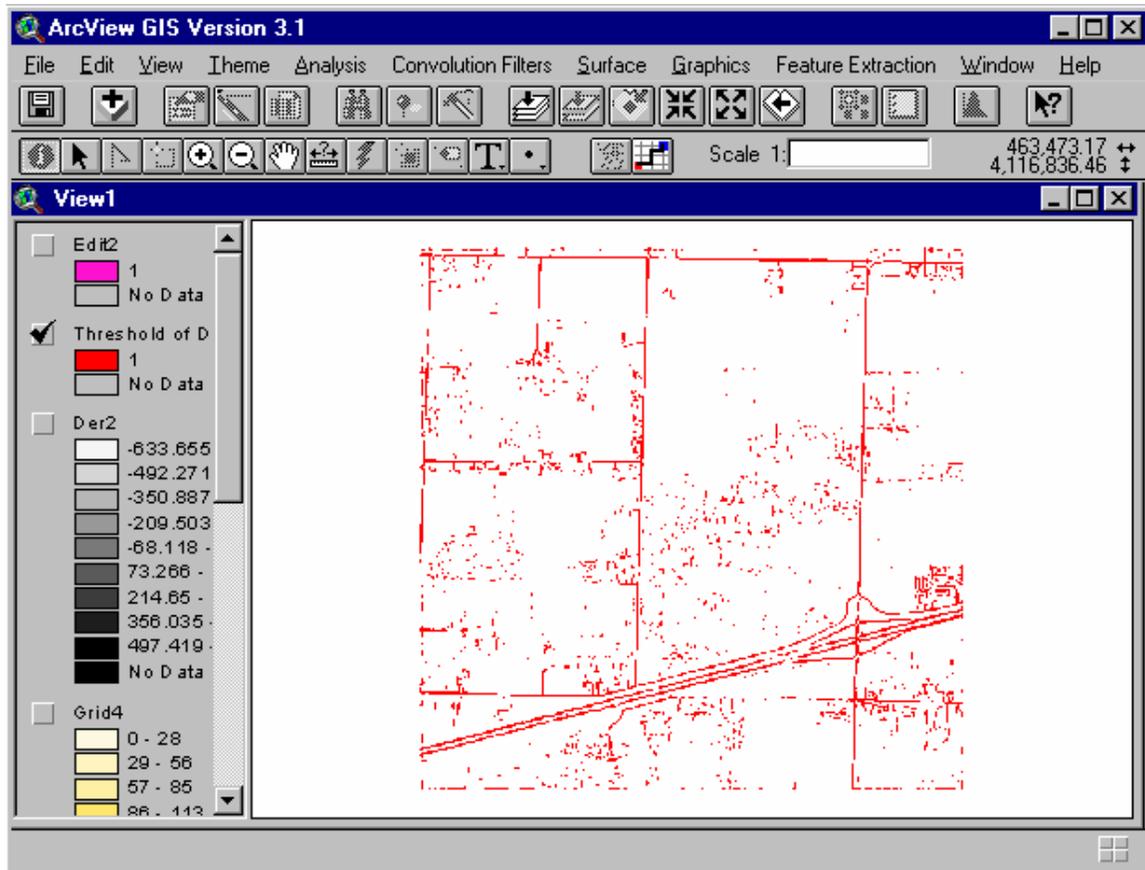
GridEdit

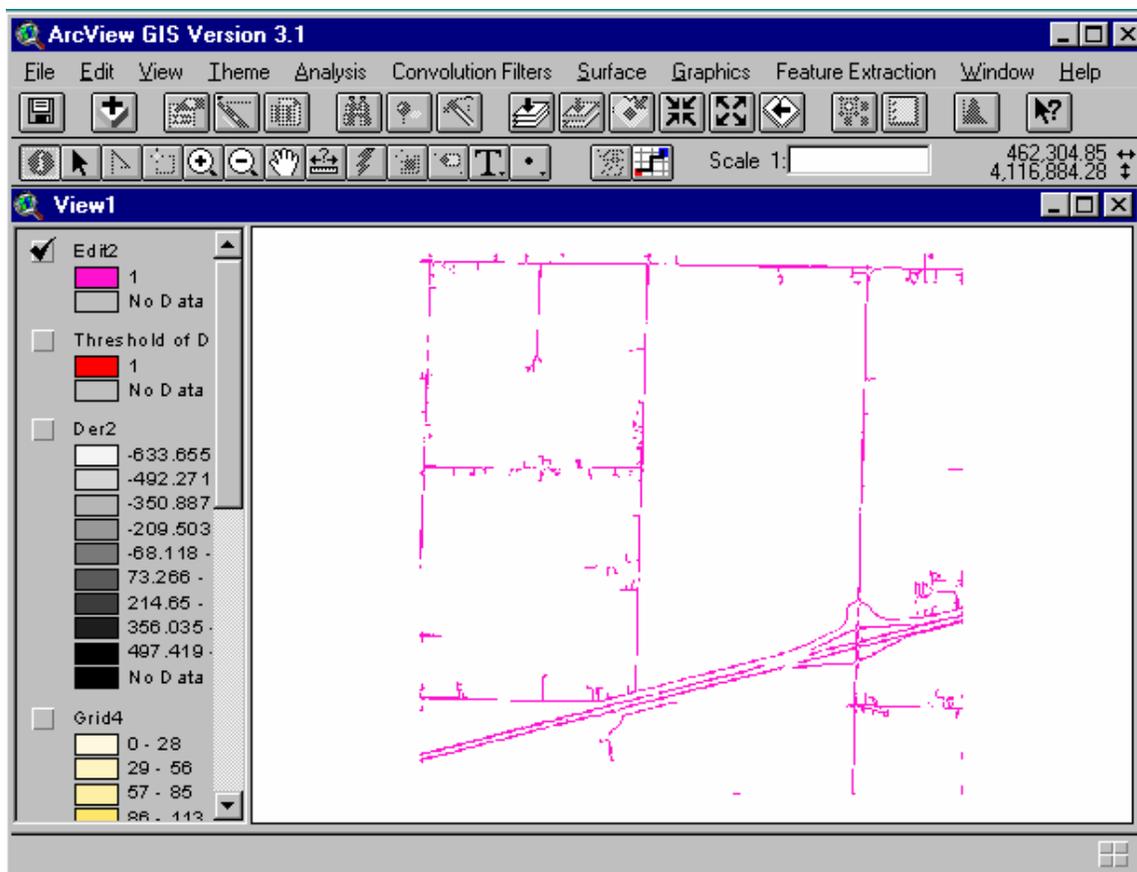
The thresholded grid may contain small speckles. Some editing is needed.

1. From Feature Extraction menu, select **GridEdit**. In the dialog that appears, choose the grid to be edited.
2. Enter maximum cell threshold (Region size). Given a connected set of cells with a value of one, if the total number of cells in the region is less than the threshold number, the region will be removed and the cells filled with value zero.



3. After GridEdit, the small speckles are removed automatically.

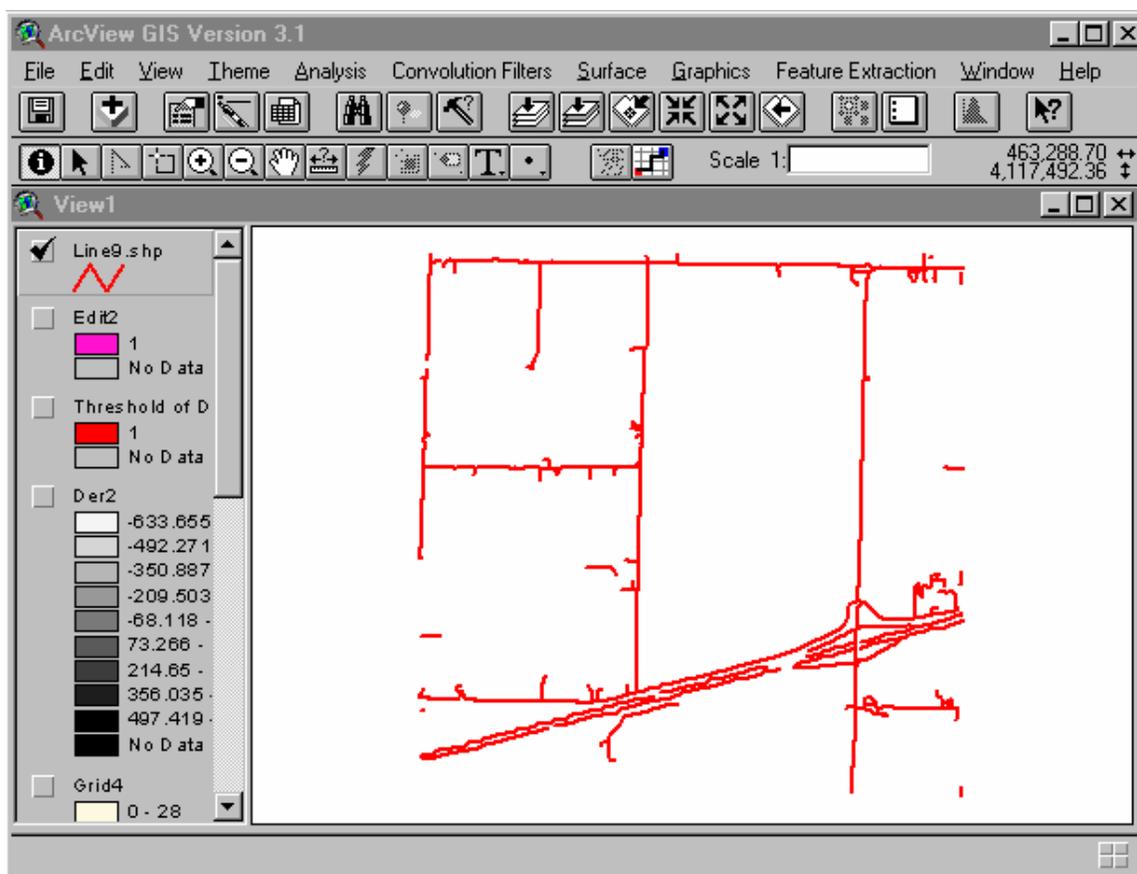




Convert Grid to Lines

The edited grid is in raster format. We can convert it into vector format.

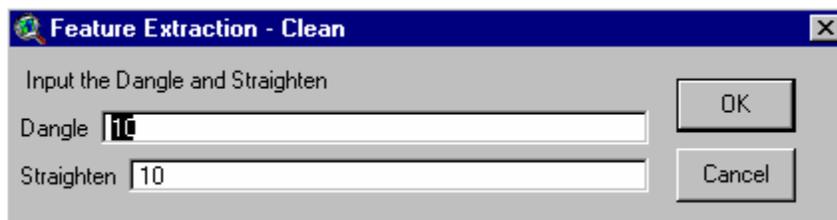
1. From Feature Extraction menu, choose **Convert to lines**. In dialog that appears, select a binary grid.
2. The grid will be converted into a line shape file. The line shape file is added to current view.



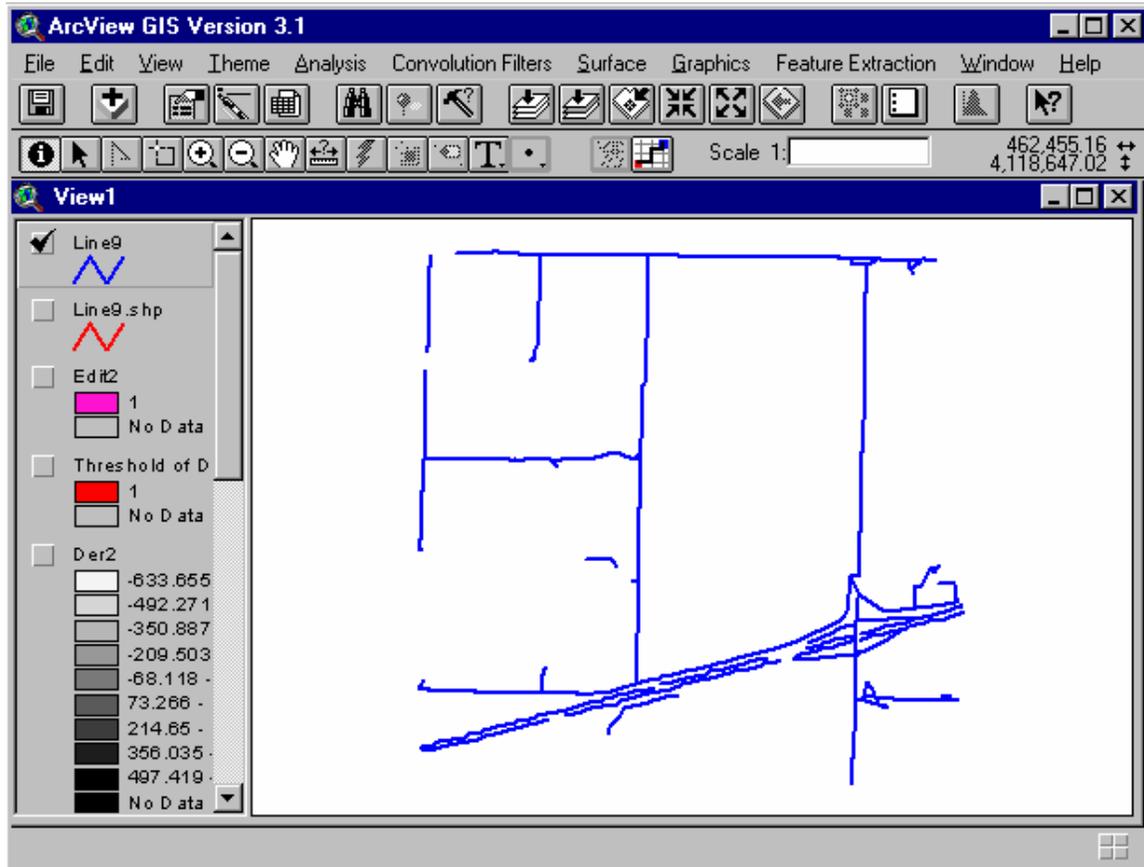
Clean the line shape file

The conversion of raster-vector may cause some problems such as zigzag shaped lines. You can run a program to clean the line shape file.

1. From Feature Extraction menu, choose **Clean**. In the dialog that appears, select a line theme to clean.
2. Enter some parameters in following dialog. The **dangle length** is the minimum length allowed for dangling arcs. The **straightening distance** is the maximum distance a node can move during line straightening.



- Clean will run ARC/INFO commands. Make sure ARCVIEW connected to an ARC/INFO server. The line features in cleaned theme look better.



Cost Distance

Cost Distance calculates for each cell the least-accumulative-cost distance over a cost surface, CostGrid, to cells with values other than No Data in Source Grid, optionally producing direction and allocation grid data sets. The inputs are a source theme (either points or grid) and a cost grid.

You can threshold the second derivative grid to get a cost grid. Remember to enter a lower threshold.

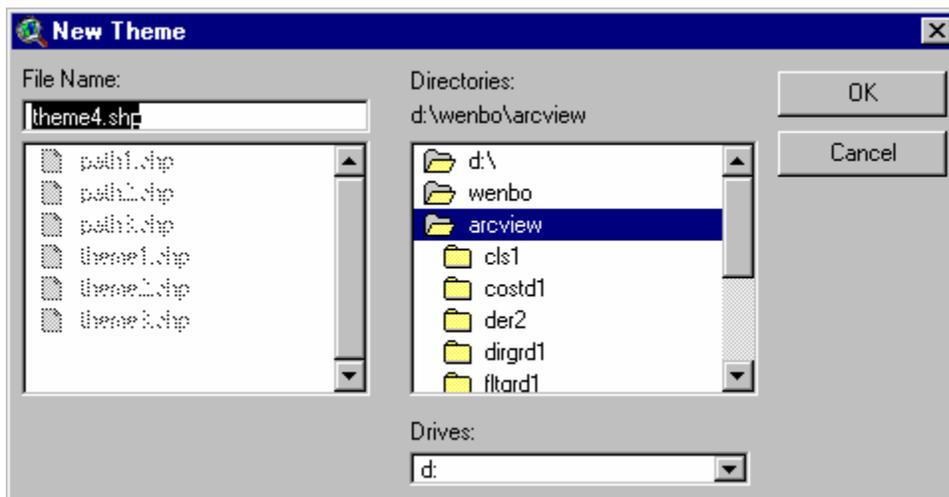
If you don't have a source theme, you can create a new point theme using ARCVIEW.

Creating a new point theme

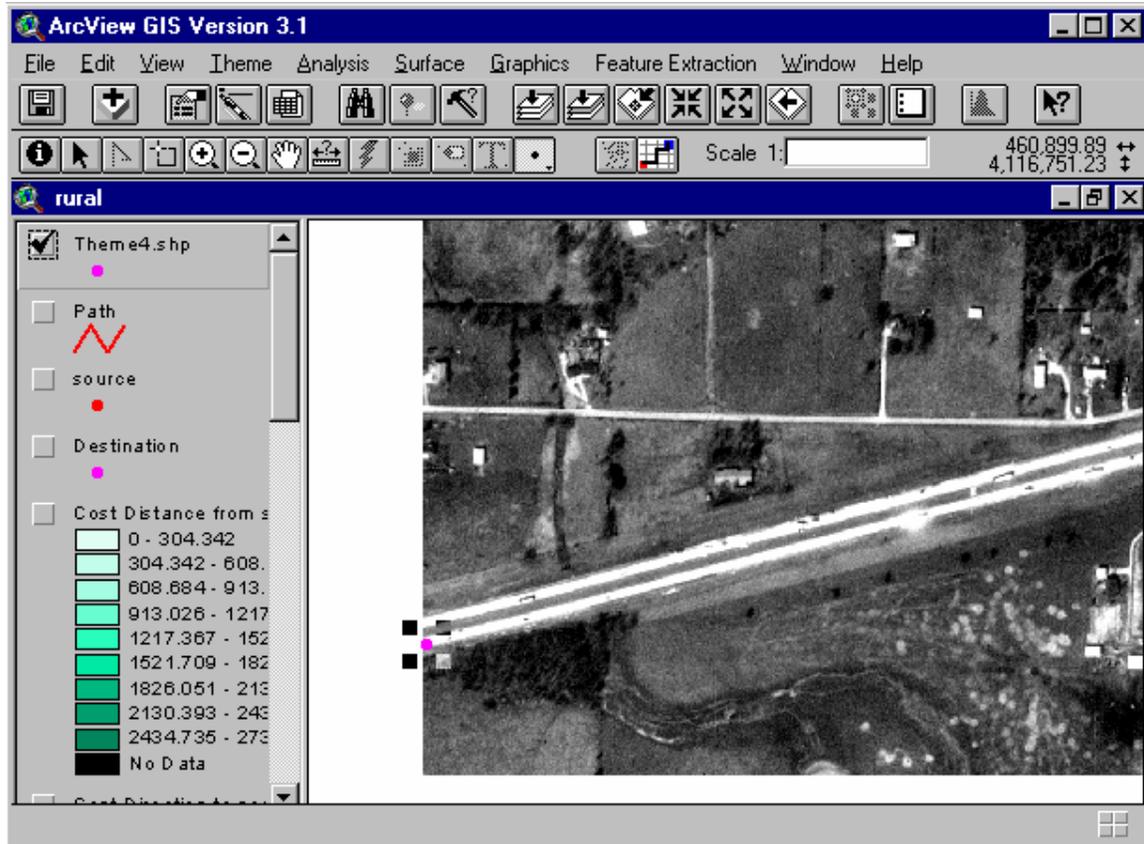
- From the view menu, choose **New Theme**. In the dialog that appears, select **Point** as the feature type from the dropdown list. Then, press OK.



2. In the dialog that appears next, specify the name and location of the new shape file in which ARCVIEW will store the data you add to your new theme. Press OK, a new empty theme is added to the view. Now you can add some points to this theme.



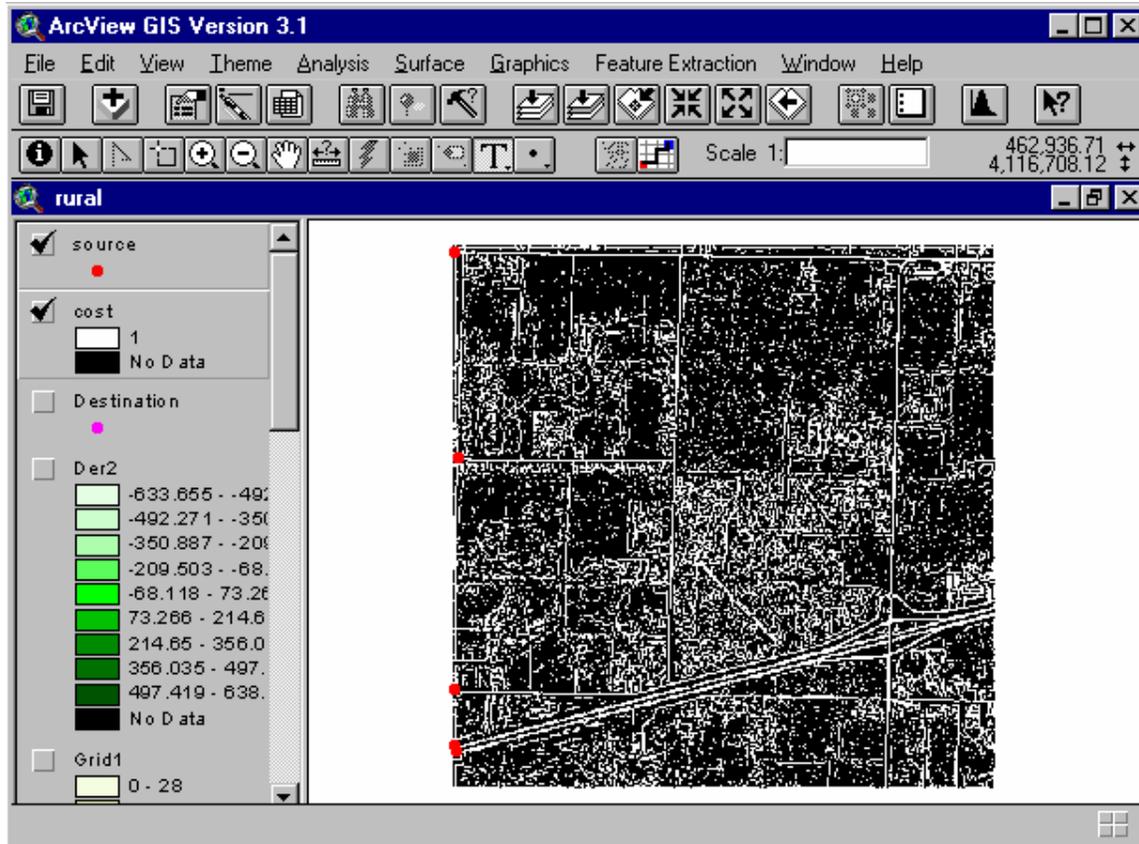
3. Click the **Draw point** tool . Add points to the theme by clicking the left mouse button at locations you like in the view.



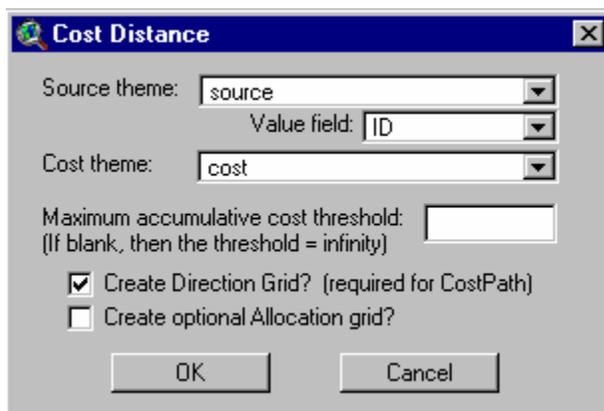
4. When you are finished adding new points, choose **Stop Editing** from the **Theme** menu. Choose **Yes** when you asked whether you want to save your changes.

To calculate Cost Distance

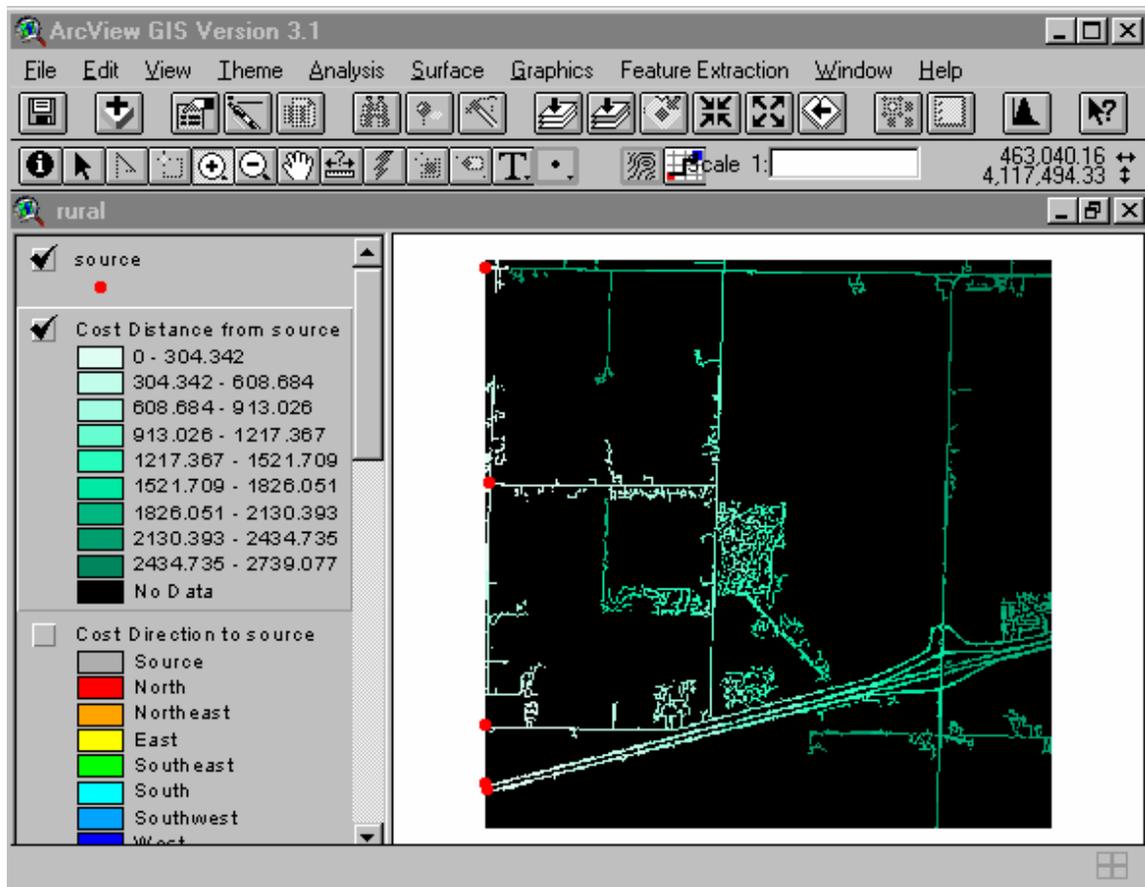
When your source theme and cost grid are ready, you can calculate the cost distance.



1. From Feature Extraction menu, choose **Cost Distance**. In the dialog that appears, select the Source theme and Cost theme, and check to create direction grid. Press OK.



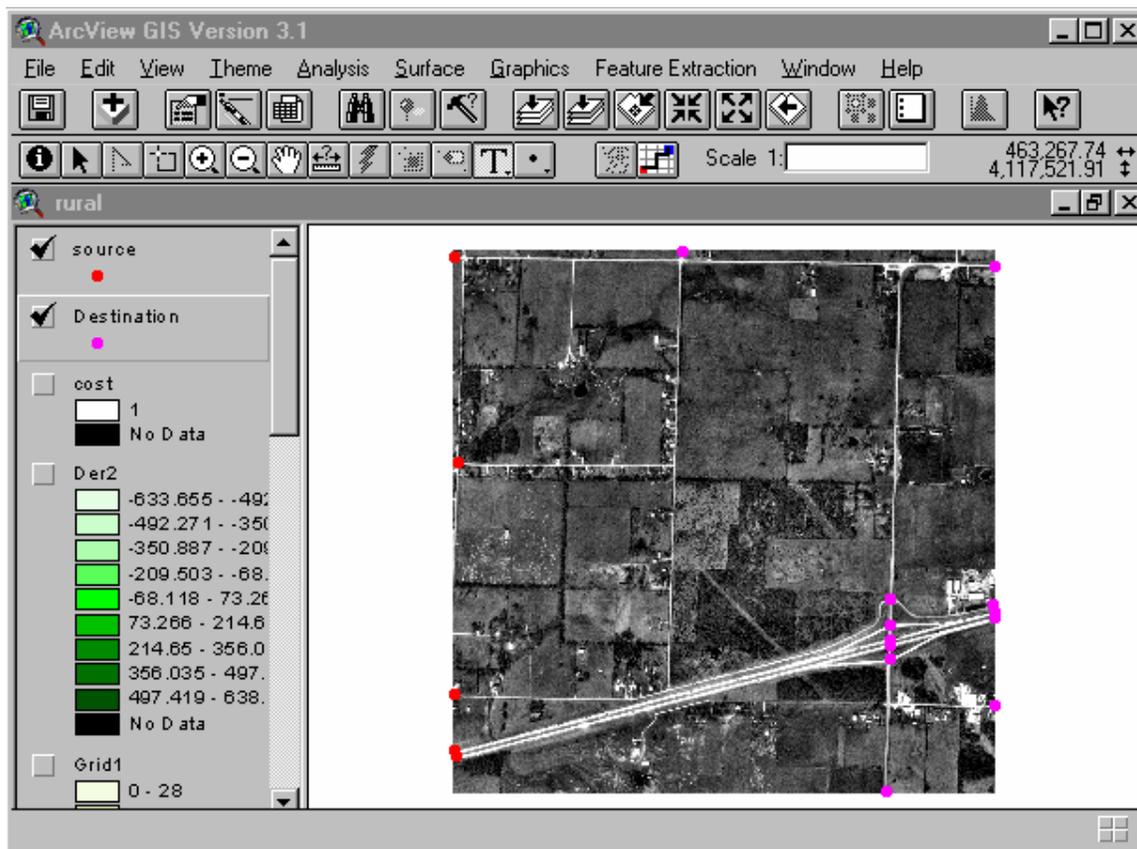
2. The cost distance and direction grids from source will be created and added to the view.



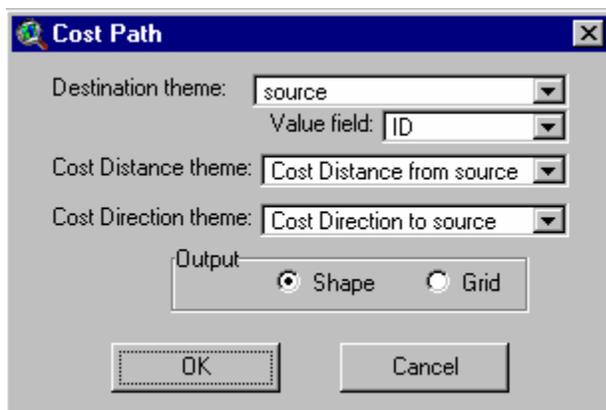
To Calculate Cost Path

Cost Path will calculate the shortest cost paths from a set of cells with values other than No Data in a destination theme. Distance and Direction grids are produced with the Cost Distance request.

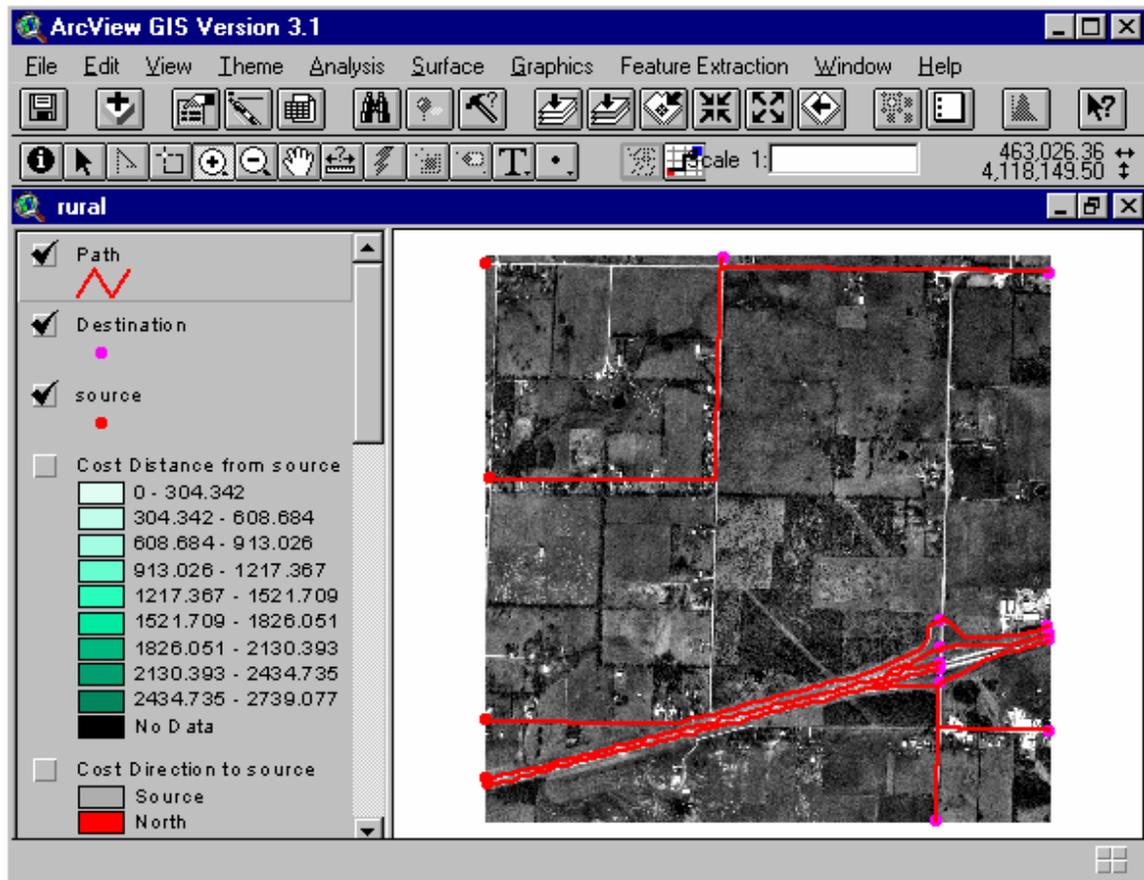
The destination theme can be a grid or point theme. You may create it using **ARCVIEW New Theme**.



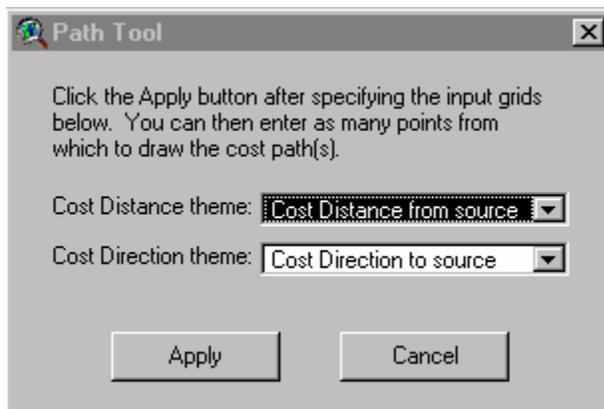
1. From Feature Extraction menu, choose **Cost Path**. In the dialog that appears, select the destination theme, value field, cost distance theme and cost direction theme. Press OK.



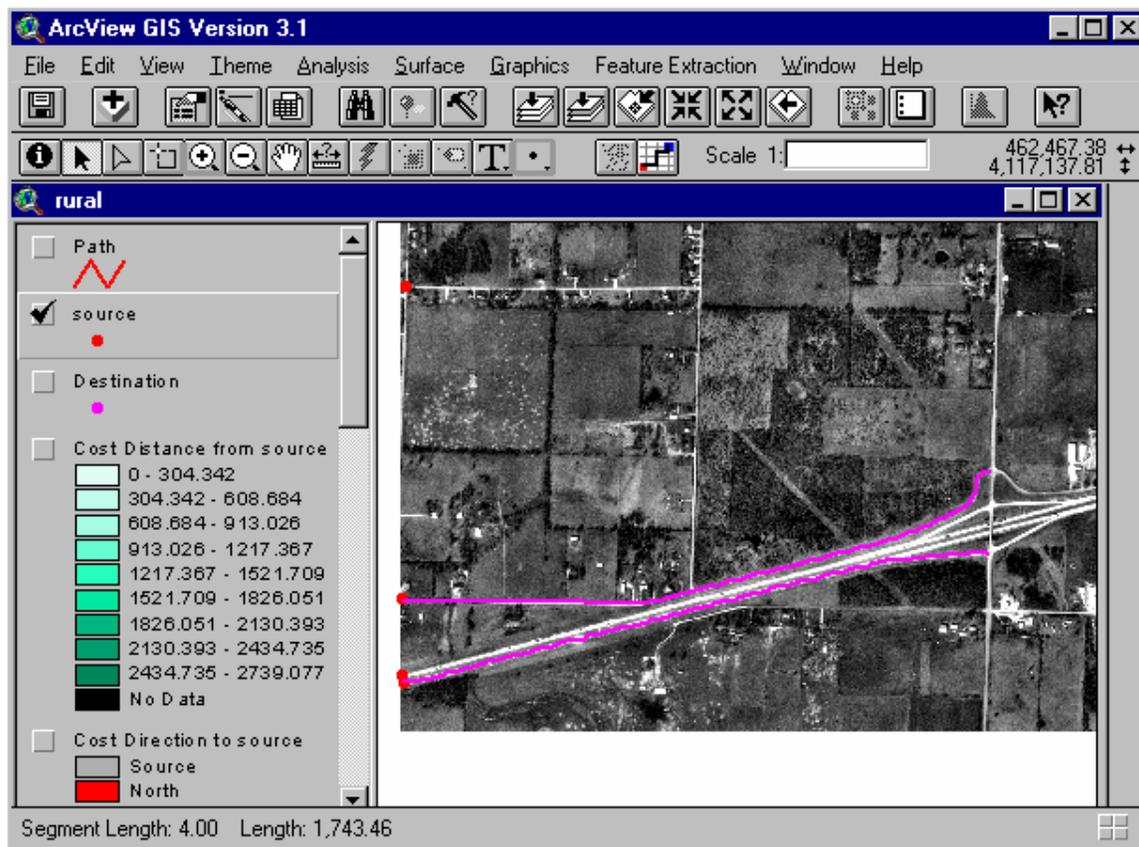
2. The shortest paths will be calculated. The new path theme will be added to the view.



3. You can also use **path** tool  to interactively enter points in view display. In the dialog that appears, choose the cost distance and cost direction themes.



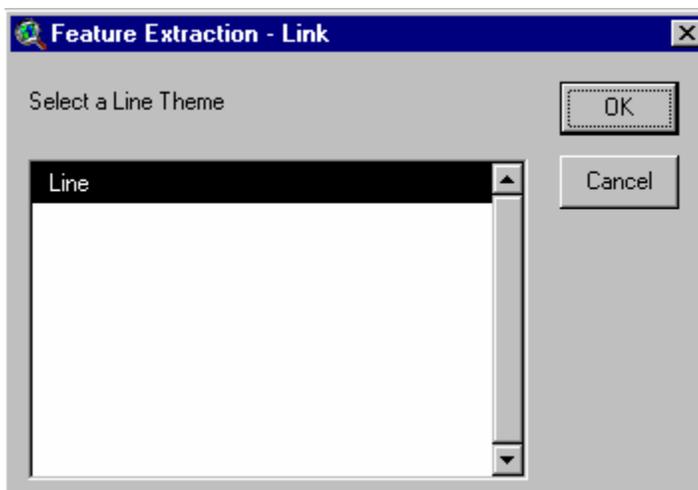
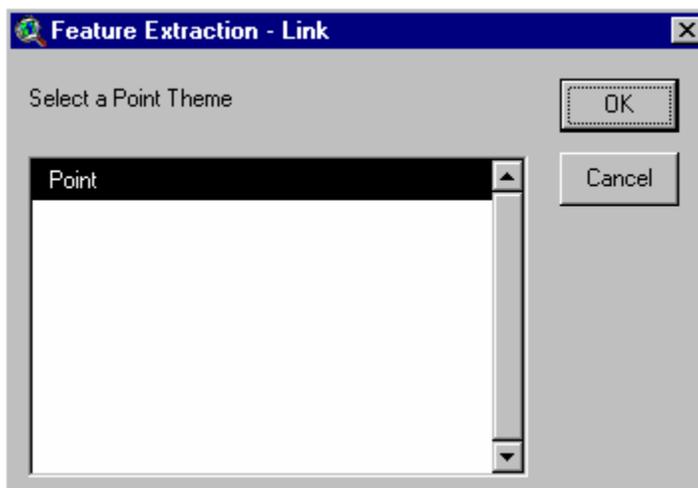
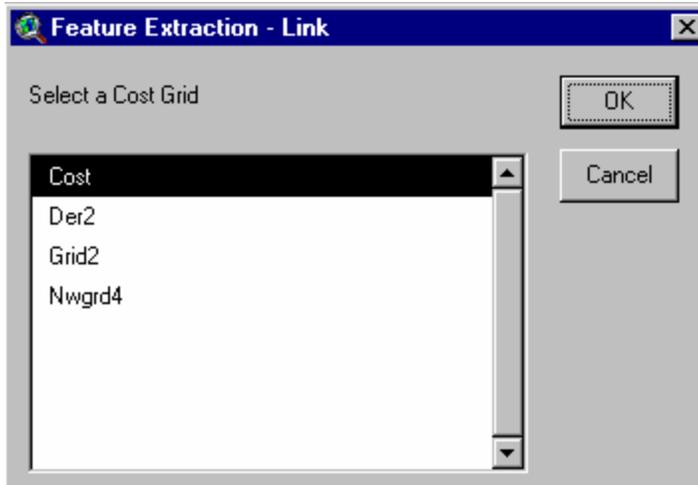
4. Enter points on-screen in view display by clicking the left button of mouse, the shortest paths between source theme and your points will be added to graphic list of view. Or if there is an editable line theme, then the graphics are added to the editable theme.



Link Two Points

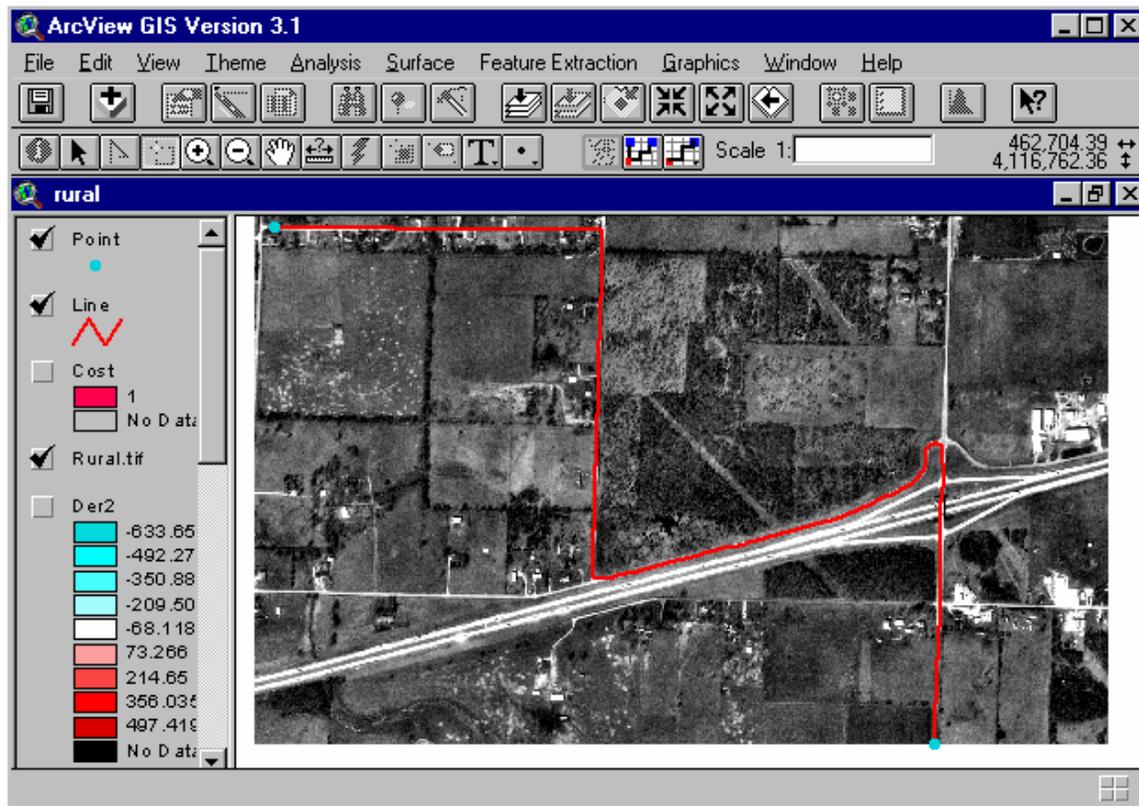
The Link two Points tool is a semi-automatic road extraction tool. It allows user to graphically enter the start point and end point of a road segment. The algorithm will trace the road by finding the shortest path over a cost grid between start point and end point.

1. From Feature Extraction menu, choose **Link Two Points**. Three dialogs will appear one by one. Select the Cost grid, a point theme that will store the start and end points and a line theme that will store the extracted lines. If current view do not have point or line theme, the program will create a new theme automatically.



2. Click the **Link Tool** . Then, Click the start point using the left button of mouse, keep the left button pressed and move to the end point, release the left button. When

you move the mouse, a line that connect the start point and current mouse location will appear. Make sure to release the left button only at the end point.



3. If a path between start point and end point can be found, it will be added to the line theme. If not, an error message will appear.

