An Analysis of Different Resampling Methods in Coimbatore, District

Dr.S. Santhosh Baboo[1], M.Renuka Devi[2]

GJCST Classification I.4.6, I.3

***Abstract*-Image pre-processing of satellite Imagery. In order to actually geometrically correct the original distorted image, a procedure called resampling is used to determine the digital values to place in the new pixel locations of the corrected output image. The resampling Process calculate the new pixel values from the original digital pixel values in the uncorrected image. When remote sensing has been used to create an image, it needs to undergo some form of validation procedure using observational and/or sampling techniques. Failure to do so will reduce the confidence in the final product.This study describes the three methods applied in Coimbatore district. This study is used to evaluate the three resampling methods and how they are vary from their pixel calculation and accuracy.**

*Keywords:*Resampling,Satteliite imagery,pixel location

I. INTRODUCTION

When the first satellite, Sputnik, was launched in 1957 no one could have foreseen how its diverse its use would become. Today, we have Direct TV, On-Star, XM Radio and live up-to-the-second television coverage from every corner of the world. Today, satellite information is being relayed back to earth every second of every day. Before Sputnik had completed it first orbit it had relayed the first data back to earth. And it was not the "oldies" station on XM Radio. It was environmental data. More than forty years later, the use of satellite imaging continues as the most popular provider of environmental monitoring. With recent demands for new levels of data we are presented with the problem of how to manipulate our new raw satellite images so that these images can be integrated with pre-existing environmental observations and methods.In order to retrieve, manipulate and process raw satellite images we make use of commercial computer software, in particular ERDAS Imagine for Visualizing Images. ERDAS Imagine is used for data visualization and analysis of satellite images. With a full understanding the use of key components of the ERDAS, we are able to customize, compose and modify algorithms. This allows us to prompt and direct ERDAS to meet our specific needs and tailor, to our needs, the processing of the satellite data.Once the raw remote sensing digital data has been acquired, it is then processed into usable information. Analog film photographs are chemically processed in a darkroom whereas digital images are processed within a computer. Processing digital data involves changing the data to correct for certain types of distortions. Whenever data is changed to correct for one type of distortion, the possibility of the creating another type of distortion exists. The changes made to remote sensing data involve two major operations: *preprocessing* and *postprocessing*.The preprocessing steps of a remotely sensed image generally are performed before the postprocessing enhancement, extraction and analysis of information from the image. Typically, it will be the data provider who will preprocess the image data before delivery of the data to the customer or user. Preprocessing of image data often will include *radiometric correction* and *geometric correction*. lGeometric corrections are made to correct the inaccuracy between the location coordinates of the picture elements in the image data, and the actual location coordinates on the ground. Several types of geometric corrections include system, precision, and terrain corrections. Geometric correction contains two methods that is Parametric and Non-Parametric. Non-parametric method establishes mathematical relationships (mapping polynomials) between the coordinates of pixels in an image and the corresponding coordinates of those points on the ground (via a map). Two steps are involved in non-parametric corrections 1. Rectification 2. Resampling. Step one used to Calculate new output pixel locations (X, Y) and Relate image location to map location using a “mapping polynomial” function.Step two involves in the process of extrapolating data values to a new grid. Resampling is the step in rectifying an image that calculates pixel values from the original data grid. This also involves in determination of DN values to fill in the output matrix of the rectified or registered image.There are three methods in resampling:

- Nearest Neighbour
- Bilinear Interpolation
- Cubic convolution

II. NEAREST NEIGHBOUR

Nearest neighbor is a resampling method used in remote sensing. This resampling uses the digital value from the pixel in the original image, which is nearest to the new pixel location in the corrected image. This is the simplest method and does not alter the original values, but may result in some pixel values being duplicated while others are lost. This method also tends to result in a disjointed or blocky image appearance.The approach assigns a value to each "corrected" pixel from the nearest "uncorrected" pixel. The advantages of nearest neighbor include simplicity and the ability to preserve original values in the unaltered scene. The disadvantages include noticeable position errors, especially along linear features where the realignment of pixels is obvious.

About[1]- Lt.Dr.S.Santhosh Baboo, Reader, Postgraduate and Research department of Computer Science, Dwaraka Doss Goverdhan Doss Vaishnav College, Chennai E-mail id:santhosh2001@sify.com
About[2]- M.Renuka Devi,Asst.Prof, MCA Department, Sree Saraswathi Thayagaraja College, Pollachi, E-mail id:renuka_srk@yahoo.co.in

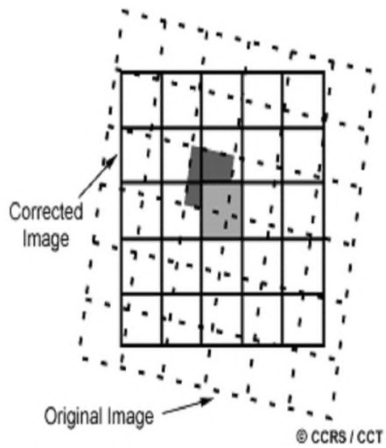

Figure 2.Nearest Neighbor pixel Calculation

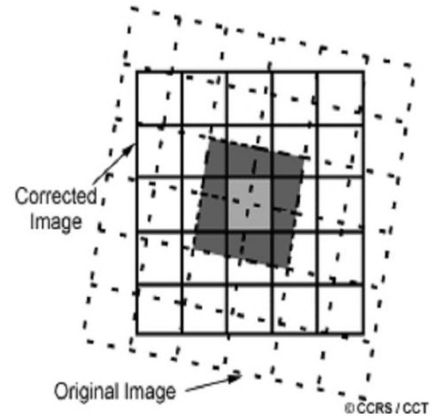

Figure3.Bilenear Interpolation

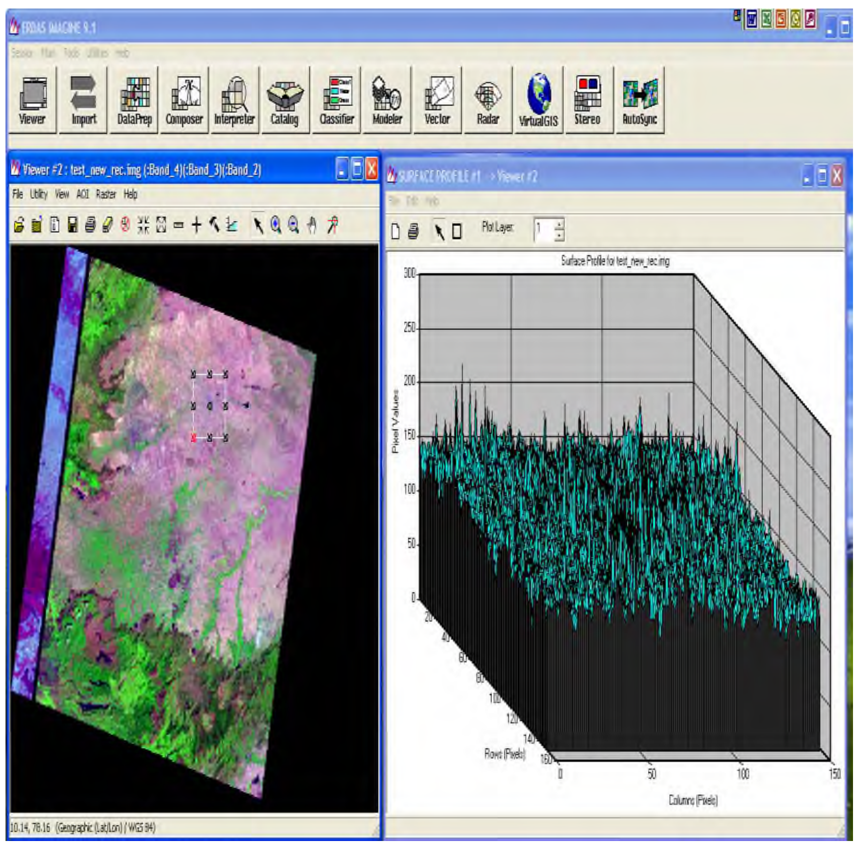

Figure.2.1 Surface profile of Nearest Neighbor resampling method

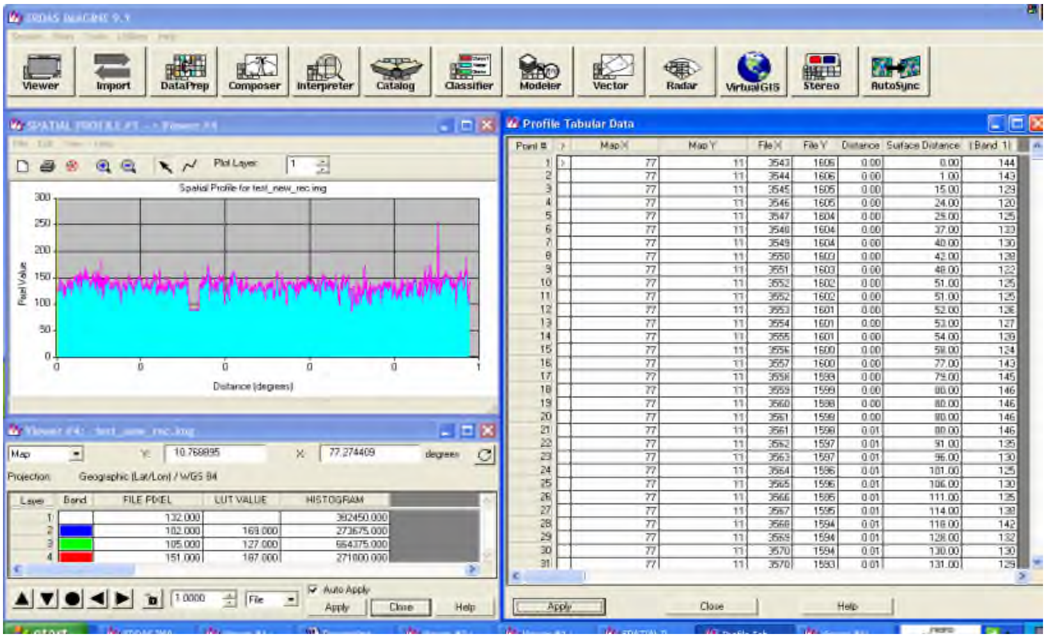

Figure. 2.2 pixel, histogram and spatial profile details of nearest neighbor

III. Bilinear Interpolation

Bilinear can refer to bilinear filtering or bilinear interpolation. Bilinear filtering is a method used to smooth out when they are displayed larger or smaller than they actually are. Bilinear filtering uses points to perform bilinear interpolation. This is done by interpolating between the four pixels nearest to the point that best represents that pixel (usually in the middle or upper left of the pixel). Bilinear interpolation resampling takes a weighted average of 4 pixels in the original image nearest to the new pixel location

The averaging process alters the original pixel values and creates entirely new digital values in the output image. This may be undesirable if further processing and analysis, such as classification based on spectral response is to be done. If this is the case,resampling may best be done after the classification process.It is shown figure 2.This resampling method assigns the average digital number (DN) of the four pixels closest to the input pixel (in a 2x2 window) to the corresponding output pixel. The mathematical function is bilinear.When apply this method in the coimbatore imagery we can get the following result in the figure 2.

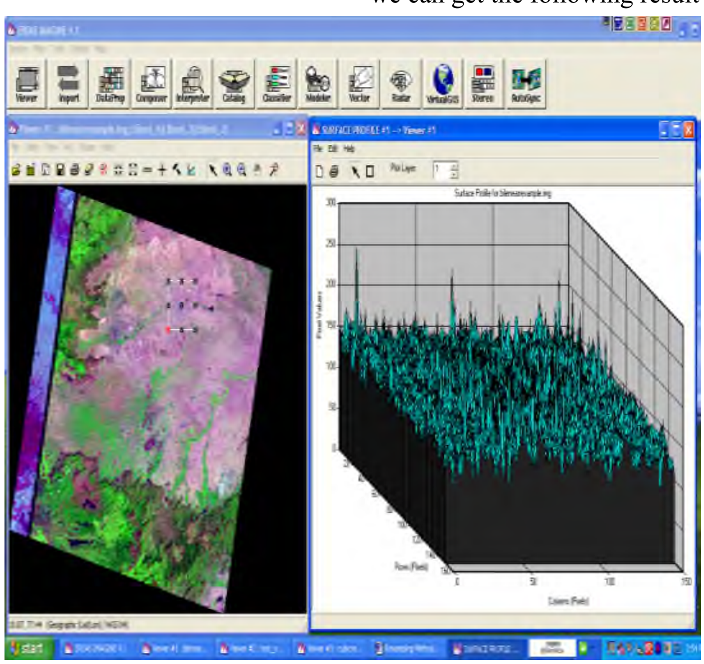

Figure 2.1Surface profile of bilinear resampling method

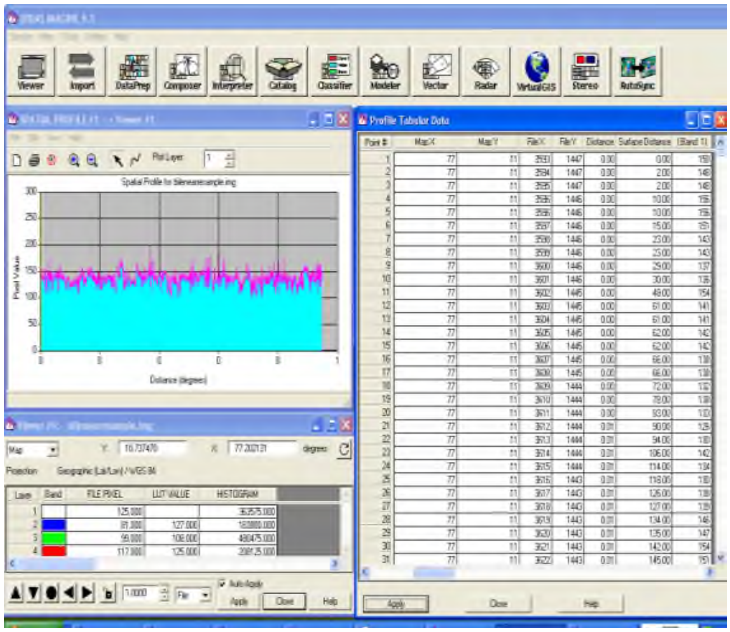

Figure 2.2.pixel,histogram and spatial profile details of bilinear resampling

IV. Cubic Convolution

Cubic convolution is a method used to determine the gray levels in an image. This is determined by the weighted average of the 16 closest pixels to the input coordinates. Then that value is assigned to the output coordinates. This method is slightly better than bilinear interpolation, and it does not have the disjointed appearance of nearest neighbor interpolation. Cubic convolution requires about 10 times the computation time required by the nearest neighbor method. This resampling calculates a distance weighted average of a block of sixteen pixel from the original image which surround the new output pixel location

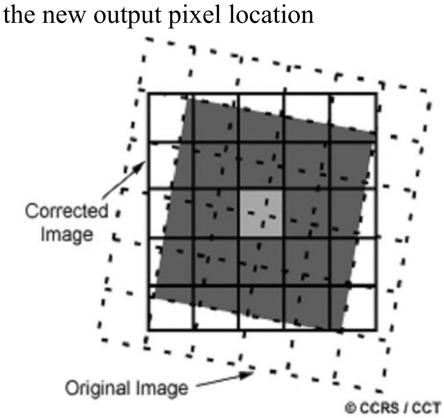

Figure 4 Cubic Convolution

This resampling method assigns the average DN of the sixteen pixels closest to the input pixel (in a 4x4 window) to the corresponding output pixel. The mathematical function is cubic.

V. Result and Discussion

Every one method has some advantage and disadvantage for some type of data,when compare result of surface and spatial profile of nearest neighbor resampling method the Cubic Convolution is gives the better result in coimbatore imagery.we can see the difference between these method in the following figures.Figure 5 shows the result of nearest neighbor and bilenear interpolation methods.In figure 5.1 we see the difference between Bilinear Interpolation and Cubic Convolution. The advantage of Nearest Neighboris extremes subtletie sare not lost and fast computation is possible. But the distadvantage of this method is "stairstepped".That is resampling to smaller gridsize effect around diagonallines and curves.This problem is solved by Bilenear Interplation.Its Result are smoother,accurate,without “stairstepped” effect. But it has some disadvantage that is edges are smoothed and some extremes of the data file valuesare lost. The most accurate resampling method is cubic convolution. It gives the effect of cubiccurve weighting can sharpen the image and smoothout noise. But the disadvantage is most computational is needed and it does n’t provide desired result.

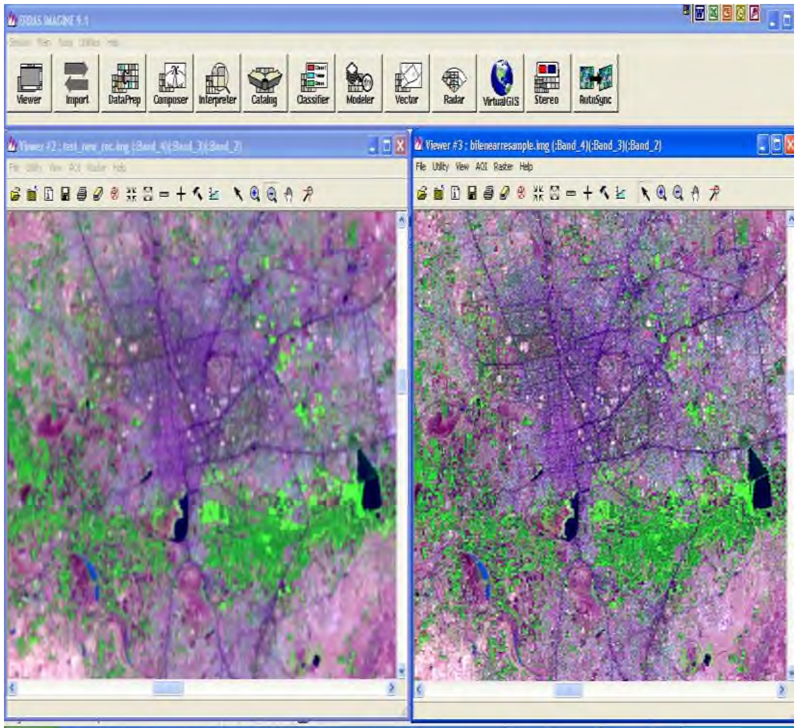

Figure 5.Result of nearest neighbor and Bilinear Interplation

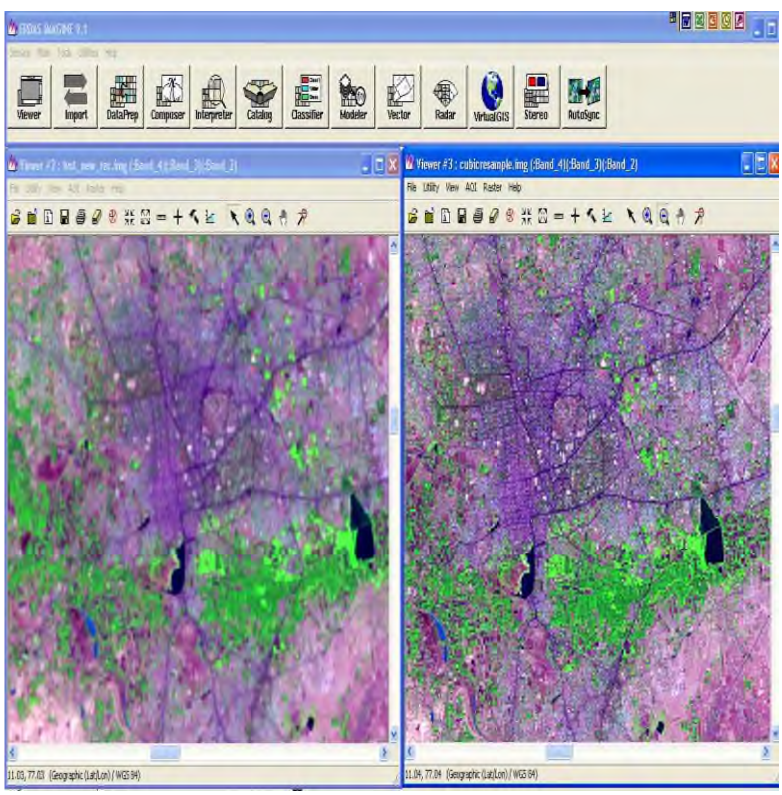

Figure 5.1.Result Bilinear Interpolation and Cubic Convolution

VI. CONCLUSION

The three resampling methods; Nearest Neighbor, Bilinear Interpolation and Cubic Convolution, determine how the cell values of an output raster are determined after a geometric operation is done. The method used depends upon the input data and its use after the operation is performed. Nearest Neighbor is best used for categorical data like land-use classification or slope classification. The values that go into the grid stay exactly the same, a 2 comes out as a 2 and 99 comes out as 99. The value of of the output cell is determined by the nearest cell center on the input grid. Nearest Neighbor can be used on Continuous data but the results can be blocky.Bilinear Interpolation uses a weighted average of the four nearest cell centers. The closer an input cell center is to the output cell center, the higher the influence of its value is on the output cell value. This means that the output value could be different than the nearest input, but is always within the same range of values as the input. Since the values can change, Bilinear is not recommended for categorical data. Instead, it should be used for continuous data like elevation and raw slope values. Cubic Convolution looks at the 16 nearest cell centers to the output and fits a smooth curve through the points to find the value. Not only does this change the values of the input but it could also cause the output value to be outside of the range of input values (imagine a sink or a peak occurring on a surface). This method is also not recommended for categorical data, but does an excellent job of smoothing continuous data.

VII. REFERENCES

1) Christensen, Albert H.J. (1996). The practice of piecewise fits with particular refer- ence to property mapping. Surveying and Land Information Systems, 56, 165-183.
2) Dowman,I., and Tao C.V.,2002.An update on the use of rational functions for Photogrammetric restitution,Highlights ISPRS,vol.7,No.3,pp.22-29.
3) Fraser,C.S.,Baltsavias, E.,Gruen, A.,2002.Processing of Ikonos imagery for submetre 3D positioning and building extraction,ISPRS Journal of photogrammetry & Remote Sensing 56 (2002) 177-194.
4) Fraser ,C., Hanley, H.,Yamakawa, T.2001.sub-Metre Geopositioning with Ikonos Geo imagery , ISPRS Joint Workshop on High Resolution Mapping from Space , Hanover,Germany ,2001.
5) Fritz,L.,1995.Recent Developments for Optical Earth Observation in the United states, Photogrammetric Week,pp75-84,Stuttgart ,1995.
6) Hanley,H.B. and Fraser,C.S.,2001.Geopositioning accuracy of Ikonos imagery : indications from 2D transformations,photogrammetric Record ,17(98) : 317-329.
7) Hattori,S.,one ,T., Fraser, C.S. and Hasegawa,H.,2000. Orientation of high-resolution satellite images based on affine Projection,International Archires of photogrammetry & Remote Sensing, Amsterdam,33(B3):59-366(on CD ROM).
8) Li, R., Zhou, G., Yang, S., Tuell, G., Schmidt, N. J. and Flower, C , 2000, Astudy of the potential attainable geometric accuracy of IKONOS satellite images, IAPRS, 33(B4), 587-595.
9) Jensen, John R. (1996). Introductory Digital Image Processing: A Remote Sensing Perspective (2nd ed.). Chapter 6, Image Preprocessing: Radiometric and Geometric Correction. Upper Saddle River, NJ: Prentice-Hall. pp. 107- 137.
10) ovak, Kurt (1992). Rectification of digital imagery. Photogrammetric Engineering & Remote Sensing, 58, 339-344.
11) Wolf, Paul. R. and Ghilani, Charles. D. (1997). Adjustment Computations: Statistics and Least Squares in Surveying and GIS. New York: John Wiley & Sons, 564 p.