Experimental Study on Satellite Image Restoration for Vanished Area by Dam Construction

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Abstract: It will be a real good news for the people who were lost their hometown by the construction of a large dam to be restored to the former state. Focused on Cheung-Pyung around where most part were flooded by the Chungju large Dam founded in early 1980s, we used Remote Sensing Technique in this study in order to restore topographical features before the flood with 3 dimensional effects. We gathered comparatively good satellite photos and remotely sensed digital images, then we made a new color image from these and the topographical map which had been made before the flood. This task was putting together two kinds of different timed images. And then, we generated DEM including the outskirts of that area as harmonizing current contour lines with the map. That could be a perfect 3D image of Cheung-Pyung around before when it had been flood by making perspective images from all directions, north, south, east and west, for showing there in three dimensions. Also, flying simulation we made for close visiting can bring us to experience their real space at that time.
Keywords: Image Reconstruction, DEM, Perspective Image, Cheung-pyung Myung-wol, Chungju Dam.

1. Introduction

Today we can see the great lake and wonderful scenery in Cheung-Pyung lake around. We can realize that this area has become a major tourist attraction in there are already built Cheung-Pyung Culture Center, hotels, drama studios, the biggest fountain in Korea, seaplanes and condominiums. If we, however, remind this area had been a very meaningful place with many cultural inheritances as a hart of "Cheung-Pyung-Myung-Wol" for a long time, and also this place often pierces one's heart who knows the former state. As It was started to fill water by the completion of Chungju-Dam in 1985, and it caused 25 villages, 1,665 houses, to get in to water. About 9,500 people who lived there at that time should move to near other towns or some else where, so now they can only see their hometown in a dream. Therefore, reconstructing the past life spatial to the present computer environment would be a meaningful task. To do that, first, we visited relative authorities, Water resource cooperation, construction companies and regional culture centers in order to have relative documents and pictures of when it was flood, and organized it, and then got cadastral map and topographical map made before 1985, and searched satellite photos and digital images related with remote sensing after looking them up. To restore topographical features vanished in the past , we set up the target and than we had to make the flying simulation from the reconstructed color images and 3D images as we could as possible. We are trying to write the each process in this report.

2. Object Area Analysis and Preparation

The target area is Cheung-Pyung area in Jecheon. Here was a part of Cheung-Pyung town at the past, included 9 villages, and later has been became today's Cheung-pyung by the policy of integrating cities and counties in 1995. The whole watered area was about 5,643,000 pyeong that was connected 25 towns included agricultural fields, farms, forest lands and others. It was 50% that was water filled area in Cheung-Pyung area of the whole watered 5 myeon towns in Jecheon.

I tried to get the topographical map, town pictures and relative data, and I asked remotely sensed air photos, satellite photos and satellite digital images to the relative authorities. we visited the Chungju Korea Water Resources Development Corporation which has managed Chungju Dam for some information about there. There was not any information without some pictures and data only about the dam. Also there was only some part of "Watered Towns' History", so we could not get any document, topographical map and photo in detail. Our basic task in this project was started by the model of the towns that we found it in a museum in the center, and by the topographical map drawn on a scale of 1 to 50,000 that National Geography Institute issued this in 1984.

First, I arranged the available photos in order flooded before and after in each town by comparing with the topographical maps. Then, I scanned it with small scanner. I could see the towns in computer. I considered to be to integrate and edit it with satellite photos and image data that would be done later.

To gain remotely sensed image data, I asked 7 bands digital image of Landsat-3 TM managed in NASA to Seoul national university's Spatial information lab. That

is the only remained data taken in February 1984. Fortunately I could have Corona satellite photos taken in 1969, so I decided to use this. Also I decided to use some image of Landsat-4 TM taken after flood and of Ikonos-1 lately taken as a reference information.

3. Fusion Image Generation and Optimum Composite Image Selection

I decided to separate contour lines between 80M to 150M above mean sea level from the topographical map. I scanned the map that is a copy of the original map in National Geography Institute for the work of separating the contour lines. There was, however, nothing to use, because it was hard to see the lines, and more couldn't edit in any graphic software. I gained the original one to them, and scanned it several times with the small color scanner, and then I tried to separate the contour lines from the scanned small raster maps. I decided to adjust the other information such like building data and roads data separated from other maps.

The Corona satellite photos in 1969 were black and white scanned photos and could have up to ground resolution of 5m to 10m. And Landsat TM could have up to ground resolution of 28.5m for multi-band images. If I could have a fusion image from them, then it could have visible resolution of 10-15m at least. Therefore it changed to make a data format for a fusion image from two kinds of different timed image data. In doing this, matter was the uncorrected distortion images. Precision geometric correction that had the images had minimum position error should be ahead to solve this matter. Especially, there wasn't any satellite information about the Corona satellite photos, therefore it was impossible that mutual positioning about satellite posture and atmospheric condition. Further correction processes were not handled in this report. This study was tried to handle the fusion images produced from precision geometric corrected Corona images and TM images. It was very exciting that creating a new image from the different two kinds of images and from the different pixel resolutions and from the different times about 15 years. It did some experiments to do this. Here is the results.

Fig. 1. Fusion 1 is a Composite Image of Corona 69 and TM 1/2/3 Band

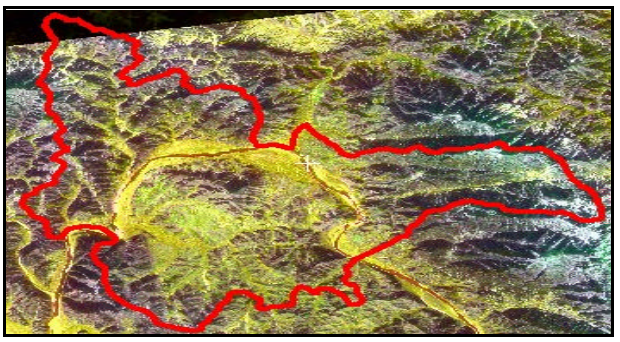

Fig. 2. Fusion 2 is a Composite Image of Corona 69 and TM 1/3/5 Band

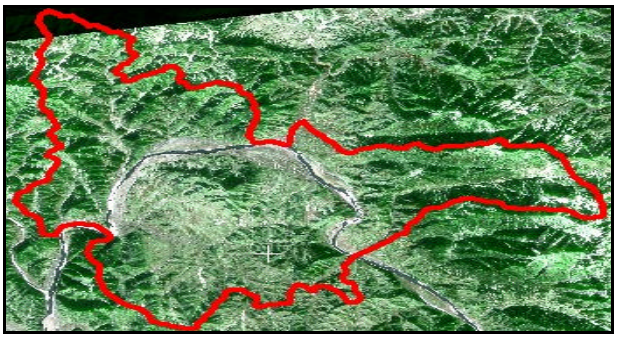

Fig. 3. Fusion 3 is a Composite Image of Corona 69 and TM 1/2/7 Band

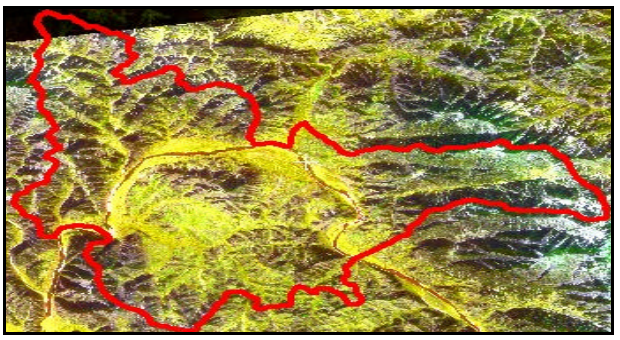

Fig. 4. Fusion 4 is a Composite Image of Corona 69 and TM 1/3/7 Band

In this papers, It decided the Fusion 3 could show the terrain and villages in detail. That would be help the next 3D work as a optimum image.

4. 3D Perspective Image Generation and Simulation

If you want to have 3 dimensional perspective image, then you have to prepare the good optimum images and DEM data, and choose the best. In the task of applying DEM data to the fusion image, both of pixel resolutions must be in a relative same degree and I can not have good 3-D perspective image when a relative elevation of a view-point elevation is too big or not. In this research, I decided a ratio of horizon to verticality had to be five to one(5:1) by some experiments. That ratio should be decided by the topographical conditions. I had to decide proper angles and directions, and proper conditions that

a standard projection would be different in target places, and far or near angles and slop angles. After these, I could work 3D rendering. I made 3D perspective images in each direction north, south, east and west.

Fig. 5. Perspective Image 1 Penetrated It form East to West with Far or Near Angle of about 60 and Slop Angle of 30

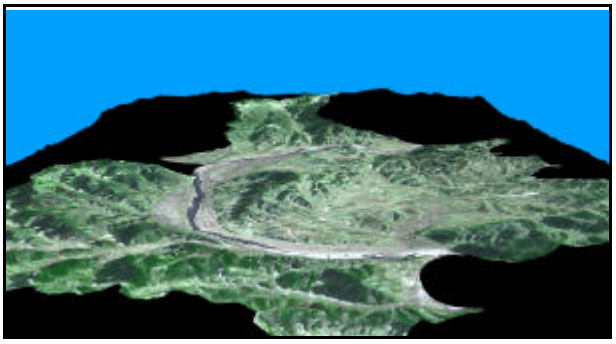

Fig. 6. Perspective Image 2 Penetrated It form West to East with Far or Near Angle of about 60 and Slop Angle of 25

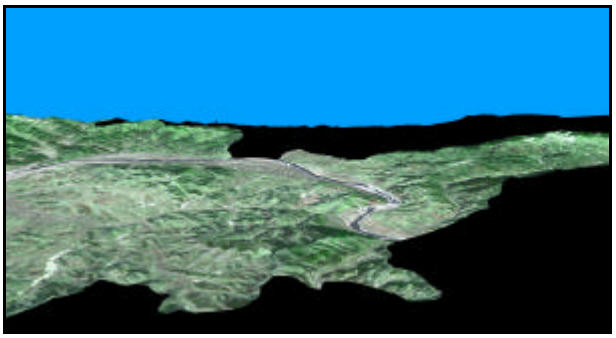

Fig. 7. Perspective Image 3 Penetrated It form South to North with Far or Near Angle of about 60 and Slop Angle of 35

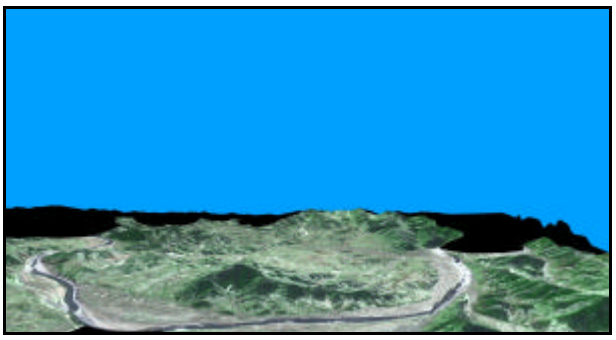

Fig. 8. Perspective Image 4 Penetrated It form North to South with Far or Near Angle of about 60 and Slop Angle of 30

Nest, for 3-D aviation simulation, I used the DEM data and the best fusion image used in the 3-D perspective image task. I had to add speed change, elevation change and slop change to flying condition with the data and image, and decide flying paths. In this report, the courses Ire decided along each town forced on watered area. I made the flying could show whole Cheung-Pyung around vanished by the dam with free speed, elevation, direction and slop.

5. Impression and Conclusion

I greatly satisfied with the experimental research that restored the towns vanished in the past to 3-D digital image by using remote sensing technique. I could have confidence in a new trip of back to the past to see the vanished world in an infrared channel by finding new information that couldn't dream at first. This trip can be a very meaningful trip to the past in a point that it may make people who lost their hometown to reduce their own grief by restoring water filled area disappeared in the real world to computer image. Here is some important something known by this research.

Second, It must know that how much land information and data about our land spatial have been saved and that how I can do that. we must make an effort to find the information about our national geo-spatial in every part. Secondly, the remotely sensed data must make into not only photos and digital images, but a new image by analysing it. All of the past data include culture and life style, so we must analysis the data and make a new image connected it.

Third, It would better make 3D images from 2D information to express the real geo-space information and to bring us where I want to visit. To do this is need an effort of all college and research support actively.

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