

The application of time serious change detection by full pixel image matching

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Abstract: Dealing and analyze with digital photogrammetric difference, no matter aerial triangulation, orthophoto produce and stereo map survey operation procedure all needs highly technology and instrument. RealScape software has ability of Distributed Computing, can improve the aerial survey image and processing efficiency. Improving the reliability of matching by full pixel matches and can support single systematic digitizing; reduce the doubt produced and tedious procedure during operation. RealScape can be dealt image source includes satellite, LiDAR, UAV and aerial photo. Import camera inter-orientation information and aerial triangulation achievement (or produces by RealScape), it can generate high-accuracy and high-precision DSM (1:1) and fine ortho image automatically via full pixel process system. This system can apply to basic territory investigation, land use variation, analysis the environment change before and after disaster, building unusual fluctuation change analyze etc., offer the more perfect digital topographical data by improving analyzing process efficiency and accuracy.

This research utilize RealScape to carry on the change detection of the road, landuse variation, city expanded and subsidence by aerial triangulation and aerial orthophoto in 2005 and 2010 in DaKeng Taichung area.

1. INTRODUCTION

RealScap, which is widespread application software in Japan since the first edition announce and improvement in 2005, is applied extensively in the base map generation, new construction, demolition, rebuild, land slide, subsidence, etc. The data sets are also application in the disaster prevention strategy like tsunami, tide region, air flight path shelter, safety management for the railroad, felling plan of woods under electric wire.

The DSM with full pixel matching accuracy assessment is using the RTK-GPS field survey with ground solution 21 centimeters (1200dpi image); the stratified sampling area includes plain, hill and mountainous region. The plane accuracy of clear point is 0.91 meter, building is 1.03meters, and Z direction is smaller than 50 centimeter. The accuracy is better than the topography map of 1 to 2500 requirements. This reach utilize RealScape to carry on the change detection of the roads, buildings, landuse variation, city expanded and subsidence by aerial triangulation, aerial orthophoto and DEM/DSM in DaKeng area, Taichung.

According to the lectures research, land slide and collapse detection can be indicated by the terrain slope and image ratio from satellite image (liu, 2002). For Buildings change detection, the features of special information extracted from remote sensing by auto detection the object on the top of the building with high accuracy (Chang etc., 2005). Dealing with the building spatial information and updating the dataset is very much complicated. Not only collect the data of control points, base points, pile position, but also depend on the job content, experiments and knowledge arrange the suitable stuff for carrying on the operational procedure. It needs to check the errors from one building to another especially the data are fall short of ortho-photo overlay with digital building information, which is the massive time and massive manpower working. RealScape has generate DSM automatically, fine ortho image ability and change detection technologies for getting the variation data of buildings very fast and easy. These can reduce the needs of process time and mass manpower.

2. OPERATION

RealScape is UAV photo and aerial photo automatic processing system, it generate full pixel DSM (1 : 1) and fine ortho image with high resolution and high accuracy from stereo pair photo. It can calculate the difference in elevation high from temporal data. These can be associated or even integrated with digital map and GIS data, for improving decision efficiency and correction by sharing resource and updating information rapidly.

RealScape system requirement:

- Operation system: Windows Server 2003 SP1/Windows Server 2008, CPU Pentium4 3.0GHz minimum , ram, 3GB minimum (under UCD camera photo with 60% overlay condition) ◦
- Client or terminal OS is Windows XP SP2/Windows 7, CPU, Pentium4 2.6GHz minimum, ram 1GB minimum ◦
- Maximum 48 terminals.

3. STUDY AREA

The 14th zone urban land consolidation with major transportation network encirclement is located at Beitun district, Taichung County. It is the second large area about 403 hectares in Taichung, and will be the assembly place of cottage, mansion and edifice. Recently, there are intense changes for these building heights during this area, and it is the place of interesting for this research. Aerial photos were imported into the RealScape software to generate the change detection from ortho-photo, aerial triangular and aerial photogrammetry products, which were photo at 1995 and 2000. The major parameter, elements and area of photo were shown as figure 1 and table1.

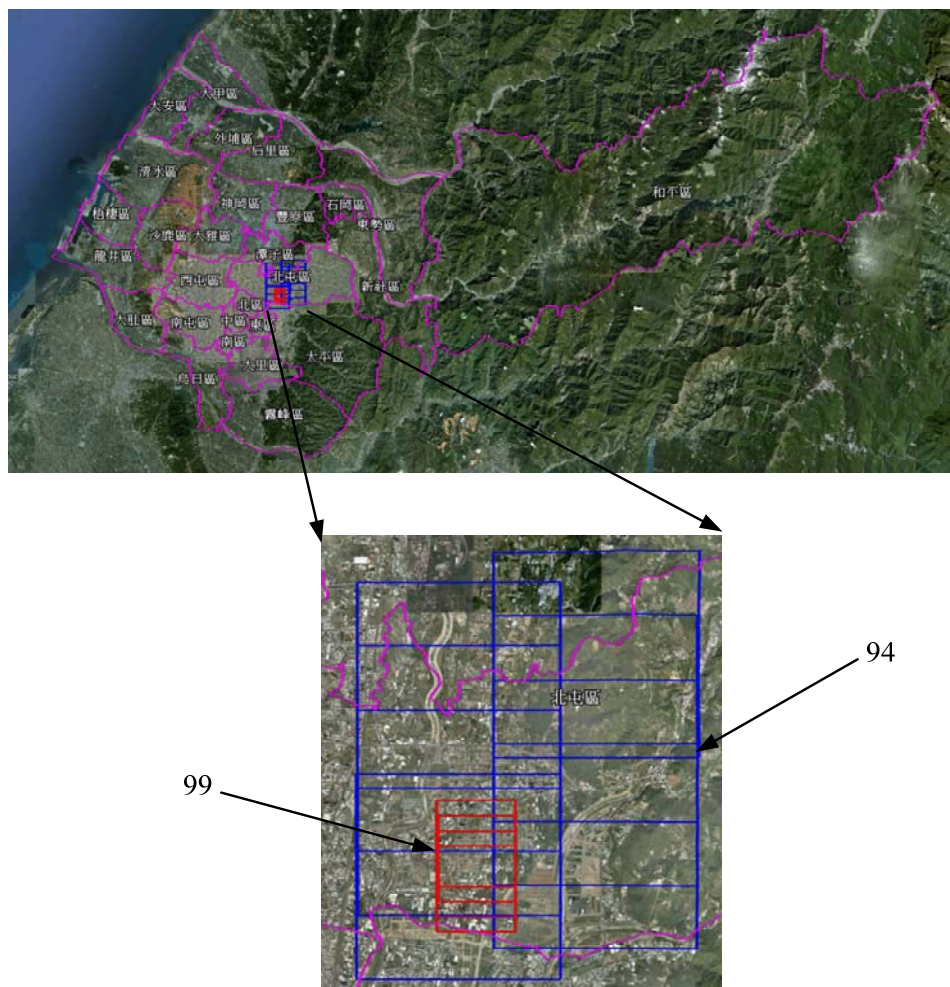


Figure 1 The photo of study area

Table 1 The information of aerial Photo 1995 and 2000

	1995	2000
Camera type	RMK TOP 15(film)	RMK TOP 15(digital)
Focus length	153.594mm	91.9817mm
Scale	1/12000	1/13000
Ground resolution	24cm	10cm
Flight Height	1770M~1950m	1190M~1511m

4. CHANGE DETECTION AND ANALYSIS

The camera calibration parameters, photo scale, internal/external orientation and other necessity reference data are import into the RealScape system for the process of photogrammetry. The RealScape system support the multi-processing and cloud top processing 48 terminals are the maximum.

The process of RealScape are divided into three parts :

- A. Orient Processing : After setting, each stereo pair as a processing unit for photogrammetry. Core image are preprocess of photogrammetry and make image matching more easily.
- B. Stereo Processing : DSM processing procedure base on Dynamic Programming image matching algorithm. DSM results can be modified by adjust parameters, manual check and add extra information, assistant elevation data and Y parallax.
- C. Ortho-Products : Ortho-rectification according to DSM, generate the ortho- photo and fine ortho-image.

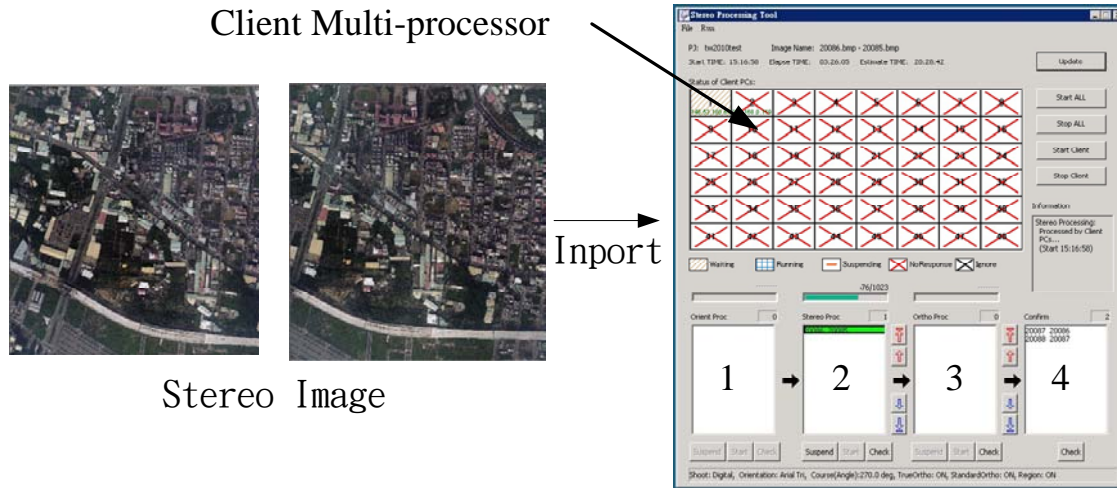


Figure 2. The process of aerial photogrammetry

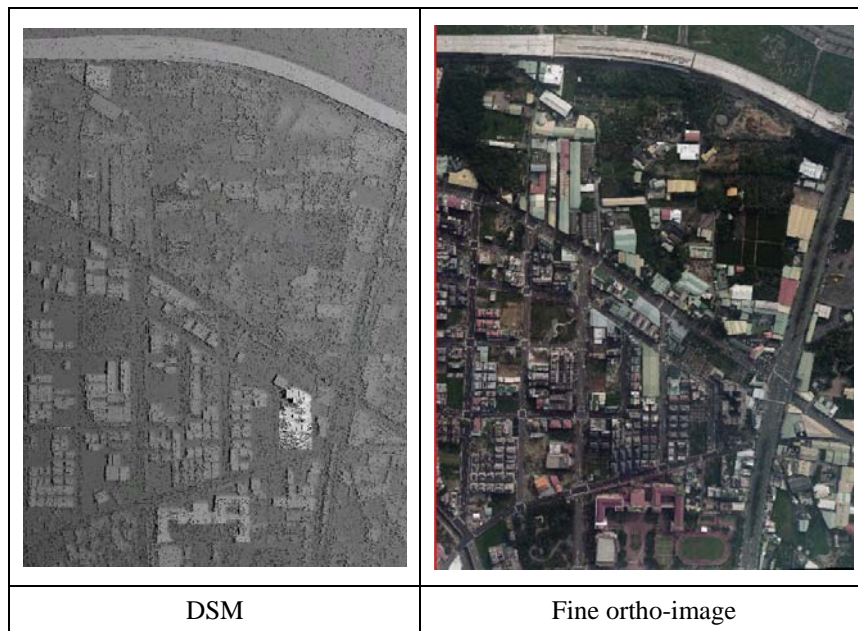


Fig. 3 Products of Stereo by photogrammetry

Change analysis calculates the differences according temporal DSM and fine ortho-image. The results of change detection present by image are shown as figure 4. The tolerance of DSM height can be adjustment according the characteristic of evaluation area. For example, 2m tolerance for urban area is not enough for eliminate the noise of vehicles, fine tolerance value is good help for reduce the noise signal from the background. The variation of DSM height is detected automatically and marked area as red region shown as figure 5.

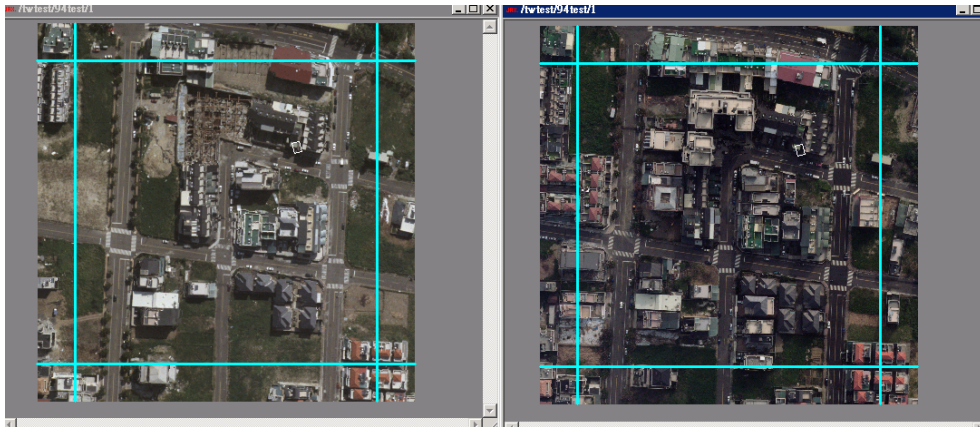


Fig. 4 The results of Change detection from 1995 and 2000 present by image.

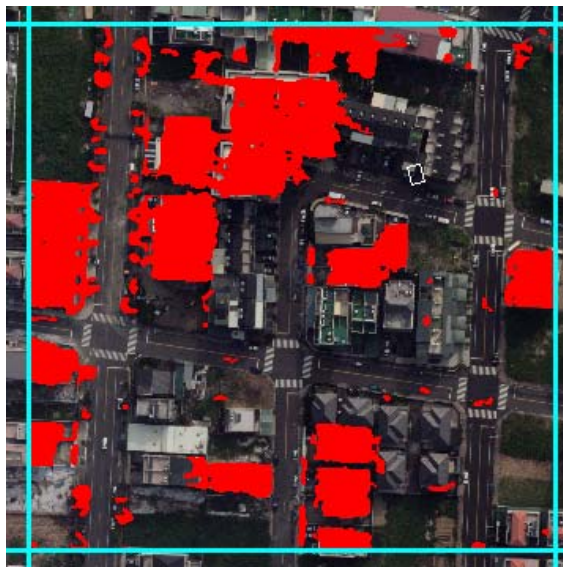


Fig. 5 The variation of DSM height area is mark as red region

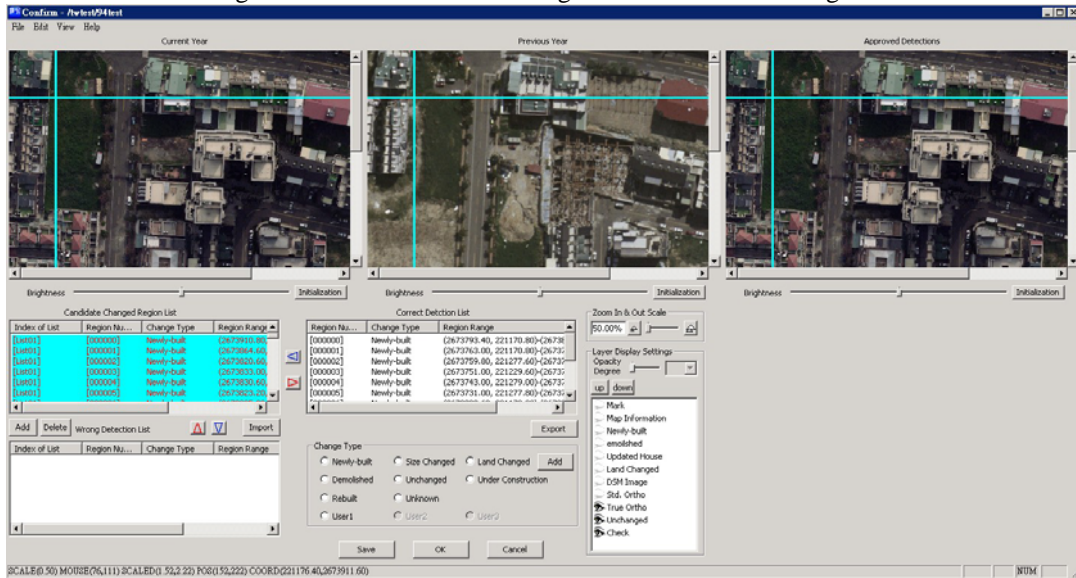


Fig. 6 the results of double check by manual

The count of variation results are 78 by manual double check from 1995 to 2000. Three types Include new construction, demolition and renovation of this area which are shown on figure 7. Land cover change presents not very

widespread and not the point of this study so there are not obviously around this urban. The count of new construction is 64 from 1995 to 2000. The detail of change is shown as table 4.

Table 4 The count of building height variance

new construction	64
demolition	12
renovation	2
Land cover change	0
Sum total	78

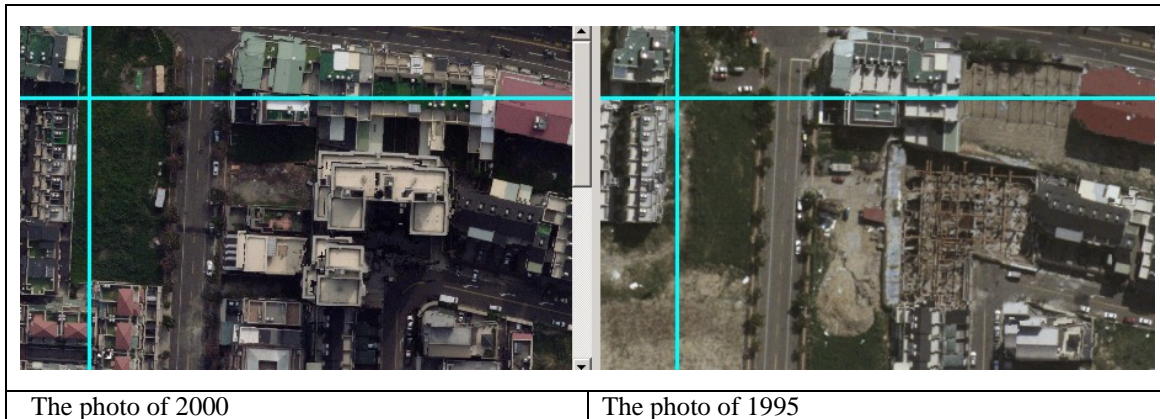


Fig. 7 the new construction from 1995 to 2000



Fig. 8 the demolition from 1995 to 2000

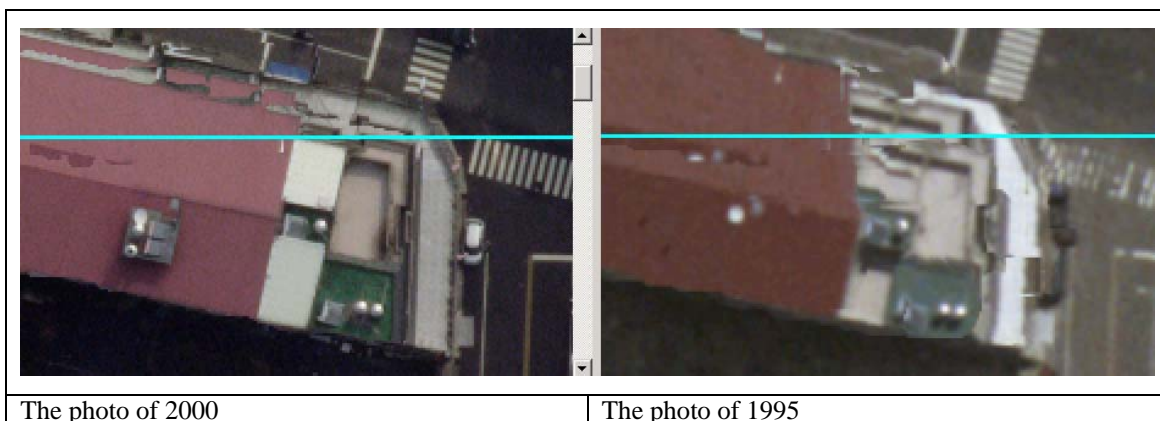


Fig. 9 the renovation from 1995 to 2000

5. RESULT AND CONCLUSION

This research shows the processing flow by using the RealScape system to dealing with the aerial photo from 1995 to 2000 in Beitun district, and accessing by artificial judgment. This processing of change detection achieving the goal of fast judgment and detect rapidly. RealScape not only manufacture fine ortho-image and DSM by image matching but also promote the accuracy of aerial photo products. This system also provides the fast examination and change detection of building height by according the aerial photo by temporal image. It also provides the pie chart and statistic table of these change area or union with the GIS data for more widespread application.

RealScape support system computes by one processor, multi-processor or even cloud computing according to different work content. The change analysis function of system may solve the work needs the massive manpower and more even support the correct and accuracy information of building change to the operator with more easy and rapid.

6. REFERENCE

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