

To accurately extract buildings from remote sensing operations

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Abstract: In recent years, Domestic and foreign scholars have proposed a variety of shadow based building extraction side Law. H. Liu, and so on [3] uses the shaded area in the HIS in the model I value Changes small, Value large attribute, the creates an exponent for detecting shadows, and successfully detect shaded areas with histogram thresholds; D. Mehmet, and so on [4] on image segmentation based on shaded area Tint / Brightness (h/i) high value and detect shaded area; C. Jaynes, and so on [5] and G. D. Finlayson, and so on [6] the observes shaded areas like The element has a low brightness feature, present the corresponding shadow detection party law. Most of the above methods pass the threshold after extracting the corresponding spectral features Values the precision of the extracted Shadow area is mainly the result of, depend on thresholds and extract building directly from Shadow area, instead of to consider the height of the building. when encountering more tidy tree shadows can be to create shape features similar to building shadows, some special material When the roof can be mistakenly divided into shadows, will result in a building target. False check for information. In view of this, This article combines DSMData, The presents the A Color Remote sensing image based on DSM and Shadow law, In order to reduce the false inspection of the building area brought by the non shaded area, Extract the outline of the Building more accurately.

Keywords: Technical Route; Experimental results and analysis; Epilogue

1. Technical Route

by setting the vegetation segmentation threshold, Eliminate vegetation. takes the mean - shift split algorithm split image, on this basis extract building Shadow area. According to the space of the building and its shaded area relationship, the approximate location of a building by light direction, and then combining to DSM data processing get actual height NDSM Chart like. its specific process see figure 1.

diagram 1 Is based on the DSM Color Remote sensing image of and Shadow

Building Extraction Flow Chart

1.1 vegetation Detection

True Color images contain rich information, to go directly to row Shadow extraction, interference factor very large, in the shaded area extracted by the may contain vegetation information. so, Remove vegetation information before over split, final extraction of building shadows, to effectively avoid dry vegetation harass. in RGB image on, to intercept multiple implants on an image by Sample point diagram, and on a sample point graph RGB component histogram to divide analyze. by parsing Multiple sample point diagrams RGB Histogram of the component, Final Draw vegetation RGB distribution range. To determine the vegetation segmentation threshold value, for vegetation extraction.

1.2 Building Shadow extraction

Shadow extraction is done on a segmented basis, takes the meamhif Algorithms Implementing remote Sensing Image segmentation. based on remote sensing imagefeatures low shading and chroma

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enhancement, with h/i value to mention Draw Shadows. The primary implementation procedure for IS: gets

the for color remote sensing images RGB value , calculated from the conversion formula His The value of , Set Parameters , generates a threshold image . The detects the building by its phase with the original image object Shadow area .

RGB color space and His conversion Relationships between spaces and ; : all normalized to 0,1] for values in the range H , I , The component calculates the formula as follows .

Here it is worth noting that , when S =0 , represents a colorless , at this time , H is meaningless , is defined as 0. also , when I = 0 or 1 , to S discussion is meaningless .

1.3 Shadow area boundary extraction

Sets the shadow binary image $I(x, y)$ is at a pixel with a value of $I(x, y) \in \{0,1\}$, Shaded area boundary image I^* can be represented as

$$I^*(x, y) = I(x, y) \text{ and } I(x, y) = 1$$

otherwise

is the of a pixel. 4 the values for adjacent pixel points are 1, will The pixel's value is set to 0; Otherwise the value of the pixel remains Unchanged .

1.4 Building target information extraction

between a building and its shadow is a _ A deterministic space phase neighbor , when building shadow exists , buildings must also exist ,

and must appear in the sunny direction of its shadow . so , can based on the relationship between the building and its shadow , the building's large to position , determine appropriate seed point , Use the region growth method to

get to approximate buildings area . first track and vectorization building Yin Shadow binary image shaded area border , take P . Kovesi the bounds of tracking algorithm to shadow area bounds tracking , vector number According to compression . in a possible candidate area for a building RoI , Select a type of Child points for region growth , Get the approximate outline of a building - Chart , then light direction , Find Right angle inflection , to determine candidate area . To determine the candidate area diagram 2 shows , based on the seed point area growth map as shown 3 Show.

After the candidate area is determined , first in the Geometry center of the candidate area Select seed Point start area growth , Expand parallel expansion area Get two value image , get a general outline of the building . Is based on the candidate areas and seed points get the building outline as shown 4 show .

compared to traditional building extraction methods , Use Shadow extraction method of building avoids interference effect , Raising construction Extract accuracy of object information , But when encountering trees shade more

Rule , There will be a false leak detection in the above method . for top issues , This article takes a DSM data vs. Shading method for building extraction research .

General Building Contour comparison rules and has a certain high degree , so on DSM the corresponding area on the image is more than the surrounding background light, with clear rule edge lines . Chang ? from DSM Data automatically extract buildings , and refine it Mark control watershed ' split , finally get the building object you want . butWhen you split , thresholds are difficult to control , Subsequent filtering work Miscellaneous tedious . in the literature 9] to DSM based on data processing , this to extract a building by using the DSM and shadowing method , based on Building shadow area combined with illumination direction to determine the building about the square bit, and then combine DSM data for building extraction . First , from DSM using morphological operators ' Opening and closing operations Extract Digital ground model (DTM) ,and then DSM image and DTM Image Subtraction , on Get the actual height of the object, NDSM Images , vs Shaded Area The growth method extracted from the building of the rough extraction results combined to build the construction extract . because the building has a _ Height , and research area

The path is a closed bar , There is no high letter ,, through setting One threshold for Set height information , Add building to Mark Information extraction error detection in the result of road filtering . This method can solve both To determine the existence of a false check when a tree is shaded more than the rule , also solved the road Road effects , And the error caused by the threshold determination .

finally uses the morphological algorithm M , to extract the results of a building into Line Final optimization , Main elimination image total pixels below set threshold speckles . First expand Operation , Select the appropriate structure element , fill hole ; based on building size , to select the appropriate thresholds to perform morphological closing operations on images ; and then to the image Line corrosion operation , Finally get the exact building area .

2. Experimental results and analysis

The experimental data used in this paper is a single optical remote sensing image and a Single DSM data . where optical data is color Quick Bird Guardian Star Image ,resolution to 0. m xO. m . DSM Data Height resolution to 1 m (actual precision is 2 m). Image Main Building type residential and office buildings , Building distribution density comparison large . diagram 5 is by RGB 3 Band synthetic True Color Remote sensing image .

Remote Sensing image culling vegetation information , Is based on the His image Shadow attribute , extract shadow results as shown in the diagram 6 shows , containing 00 hashes The scatter spots are not the desired building shadows . based on morphology Open and close operation set threshold elimination spots , final extracted buildings overcast Shadow area results as shown in Figure 7 . use shading to detect building areas , use boundary tracking algorithm for shaded area boundary tracking , line vector data compression Delete redundant data . The is based on the lighting direction and The relationship between a building and its shadow , Looking for a building's weather Select area . Select the seed point you want for region growth , using seed points The area grows to get the outline of the building as shown in the diagram 8 show .extract Knot fruit vs. artwork (Chart 5) compared to , The building extraction results include Yan color similar to building roof section road , respectively is diagram 8 , 1, 2, at .

This article uses the DSM Digital Surface model as shown in figure 9 shows , consists of the Lower resolution , Building Display not very clear , only can be processed and combined with other information for building extraction . DSM data processed by NDSM Image results as shown in figure Ten Show , and diagram 9 compared to , a building area with high information is significantly better than around area light , fit in shadow extraction results DSM number extracted building final results as shown All shows . and Figure 7 only according to Building Shadow Extraction results comparison , mistakenly extracted three road information no longer exists , Improved accuracy of building area extraction . optimizes the extraction results and is the most with the original image final results as illustrated , The building area that was extracted has not been optimized for dot , gap , becomes smooth and complete .

Traditional methods of using shadows only to extract buildings and this article method to extract the number of objects in the original image building see table 1.

consists of the table 1 Know , will DSM data is built in combination with shadows Building target Information extraction , Quick and efficient implementation of buildings fetchextract results High precision , closer to actual objects .

diagram 9 Digital Surface model DSM

diagram Ten NDSM Image

diagram One Is based on the DSM and color remote sensing images of shadow images

Building Extraction Results

diagram Optimized end result

Table 1 Two methods to extract the result comparison

Method	Correct extraction	extraction of false	The correct rate of visual interpretation/%
Based on Shadow	15 3 2		20 75
Is based on the DSM and Shadow	18 0 2		20 90

3. Epilogue

This article designed a method based on DSM Color Remote sensing with shadows Image Building Extraction method . with traditional only shadow extraction build The comparison test of the extraction method for the construction shows that , DSM data and Shadow combination of extraction , with higher extraction accuracy . But the method also exists _ Some questions and disadvantages , such as buildings by trees , Trees Shadow such tall objects part or full coverage , can cause shadow error sentence or cannot be judged as building shadow , It will cause the building to leak . check . So you also need to refer to the building for more information on the deep into research .

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