Figure 3 Esther TM image (TM432)

DMSP (the Defense Meteorological Satellite Program) is a military weather satellite launched in 1976 by the United States. OLS, the sensor of DMSP, can detect the city lights at night including the low intensity light from the small-scale residents or the traffic stream. OLS consists of two channels: one is visible light (0.4~1.1μm), another one is thermal infrared (10.0-13.4μm), whose total width of the image is 3000km (Herao, 2012). In 1992, the department of defense (DOD) and the national oceanic and atmospheric administration (NOAA) started to use the digital documents. Since then, there were an increasing number of scholars begun to study nighttime light remote sensing data for urban studies, research areas include the urban population(Sutton, 1997) ,economy(Elvidge et al, 1997) ,energy(Amaral et al, 2005) and environment(Gallo et al, 1995) . The nighttime light remote sensing study in ours contrary is later than the United States and Europe countries, Jin Chen and other researchers used the nighttime light remote sensing data to analysis the change characteristics of China's urbanization (Jin, 2003); With the use of the nighttime light remote sensing data, Mengjie Xu and others studied on the Yangtze river delta urbanization process (Mengjie, 2011). Research shows that urban spatial information can basically reflect the actual situation of the development of urbanization in out country based on the nighttime light remote sensing data (Li, 2003).

The nighttime light remote sensing data we used in this paper is downloaded from the United States national geophysical data center web site (http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html). Since the coordinate system of original data is geographic coordinates, coordinate transformation is necessary to match it with the Landsat TM images. After that, we cut out the nighttime light remote sensing data and Landset-5 image to get the study area.

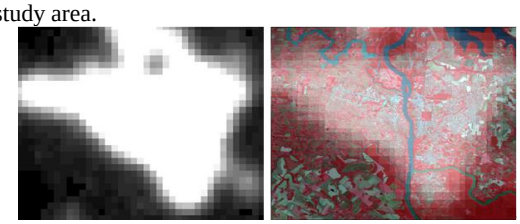

Figure 4 The nighttime image of Esther (left) and comparison chart of the nighttime image and TM image

3. EXTRACTION OF RESIDENTS

The flowchart of this paper:

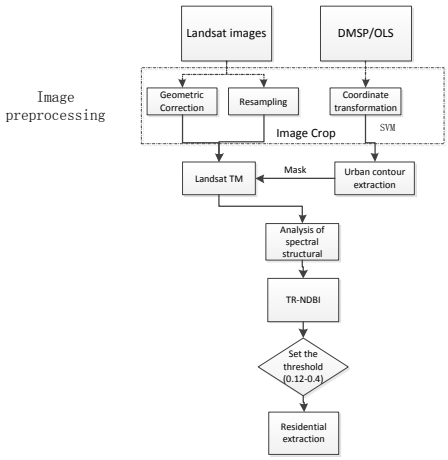

Figure 5 Flowchart of this paper

3.1 Research methods

3.1.1 Analysis of Esther residents and background feature characteristics: The nighttime light remote sensing data reflects the level of intensity of human activity, the higher value of the night lights is, the greater intensity of human activity is, and the area is more likely to be a developed city. In contrast, the region is more likely to be a village. According to this characteristic of nighttime light remote sensing data, this paper use the SVM to extract the contour of the study area. And then mask TM image to obtain the study area. Since the resolution of the nighttime light remote sensing data is very coarse and also exists the phenomenon of lighting overflow, the clipping area includes not only residents, but also water bodies, cultivated land, forest and other land types.

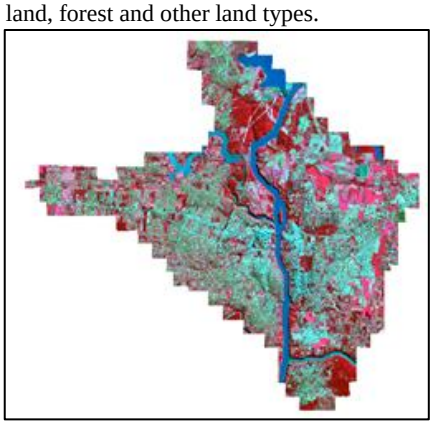

Figure 6 Cropping image (TM432)

In order to analyse the differences of characteristics of residents, water bodies, forest , cultivated land in Esther, we do statistical analysis separately to 7 TM bands by divided the TM images into four kinds of residents ,water bodies ,woodland and cultivated land，as shown in Table 7:

	water	forest	cultivated land	residents
B1	185	63	142	173
B2	196	47	195	183
B3	114	29	135	195
B4	9	169	206	128
B5	10	113	195	180
B6	110	99	191	217
B7	98	101	87	119

Table 7 Residents and other land type mean of different bands