Coastline Extraction Using Support Vector Machine from Remote Sensing Image

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Abstract—In recent years, support vector machine (SVM) has been widely applied in remote sensing image classification, since its experience can also minimize errors and maximize the geometric characteristics of the edge area. In this article SVM classification algorithm will be introduced the remote sensing extraction coastline. Fujian Province Landsat7 ETM + image will be a test region to be classified the image and extract the shoreline. Then based on the coastline formula calculate modified the shoreline in the ArcGIS and completed the extraction of coastline.

Index Terms—SVM, Landsat7 ETM +, GIS, Coastline

I. INTRODUCTION

With abundant natural resources and great location, coastal zone has become an important area where human develop and utilize. The coastline is the boundary between land and sea, one important indicator of the coastal zone, and also an important basis for delimiting the range of coastal zone. Due to tides, waves and impact of human activities, the coastline is changing constantly, which leads to the instability of coastal zone, and affects the environmental protection, coastal zone management and marine construction of coastal zone directly. Therefore, countries have always attached great importance to coastline change for a long time. How to determine the coastline fast and accurately has great practical significance. In view of this, with the development of medium spatial resolution remote sensing images, the coastline extraction technology with higher accuracy and lower cost is necessary.

Conventional oceanographic observations are difficult and high-cost, and the data obtained is not easy to statistics. However remote sensing technology with the advantage of large area and simultaneous observation can overcome various restrictions on ground surveys macroscopically, fast, comprehensively, dynamically and low-cost, which provides a convenient and important way to determine the coastline. The general concept of coastline is the dividing line between land and sea: including the mainland coastline and island coastline. Due to the different study and application purposes of different disciplines, its definitions are different, which can be divided into three kinds: 1. low-water line; 2. high tide line or trace line of tide over years; 3. the position where storm surge or maximum storm surge reaching land. The coastline of remote sensing images extraction discussed uses high tide line over years.

Support Vector Machine (SVM) theory is a machine learning method based on statistical learning theory. By learning algorithm, SVM can automatically find the support vectors which have great distinguishing ability of classification, thus to construct a classifier which can maximize the interval between classes, so it has better promotion and higher accuracy of classification [1]. SVM classification algorithm is introduced into coastline remote sensing extraction, the Landsat7 ETM + images of Fujian Province coast as test area, the images are classified and coastline is extracted.

II. RESEARCH METHOD

Support vector machine [2-10] is a classification technique proposed by Vapnik et al. It is built on the VC-dimensional theory and structural risk minimization principle of statistical learning theory, and meaningful characterization of function complexity having nothing to do with the problem dimension. It exhibits many unique advantages in solving problems of small sample, nonlinear and high dimension. When applying SVM to research classification of remote sensing images, it does not need to reduce data dimensionality, and has higher performance in terms of convergence of the algorithm, training speed and classification accuracy. SVM is becoming a new hotspot following neural network research.

SVM is developed from the optimal classification surface in case of linearly separable, given a sample set $S = (x_1, y_1), (x_2, y_2), \ldots, (x_m, y_m)$ of which $x_i \in \mathbb{R}^d$, $y_j \in \{+1, -1\}$, its basic idea is to find the optimal
classification surface between the two types of.

\[ w \cdot x + b = 0 \] (Figure 1):

Figure 1. optimal classification surface [7]

Wherein, \( W \) is the weight vector of this classification surface. In figure 1, the solid point and hollow point are on behalf of the two kinds of samples, \( H \) for the classification surface, \( H_1 \) and \( H_2 \) respectively the planes over the samples with the shortest distance from the classification surface in various kinds of classifications and paralleling to the classification surface, the distance between them is equal to \( 2 \| w \| \), called class interval, optimal classification surface requires the classification surface not only to separate the two types properly (training error rate of 0), and make the classification interval largest. The classification surface meeting the condition \( y_i(w \cdot x + b) \geq 1 - \xi_i \), \( i = 1,\ldots,m \) and making \( \frac{1}{2} \| w \|^2 \) smallest is called optimal classification surface, training sample points on \( H_1 \), \( H_2 \) are called support vector.

The phenomenon figure 1 described belongs to linearly separable. If linear inseparable, positive slack variables can be introduced to achieve the balance between empirical risk and promotion performance, allowing the presence of misclassified samples. Thus SVM looking for optimal classification surface is equivalent to solve the convex quadratic optimization problem as following:

\[
\min \frac{1}{2} \| w \|^2 + C \sum_{i=1}^{m} \xi_i
\]
subject \( y_i(w \cdot x + b) \geq 1 - \xi_i, \xi_i \geq 0 \) \( i = 1,2,\ldots,m \)

Wherein \( C \) is the penalty coefficient, is used to control the boundary balance of error \( \xi \) (slack variable). Lagrange optimization method is used to change the optimal classification surface problem into its dual problem (1.2), in the constraints

\[
\sum_{i=1}^{m} y_i a_i = 0 \quad \text{and} \quad 0 \leq a_i \leq C \quad i = 1,\ldots,m
\]

Solving the maximum of following function for \( a_i \):

\[
\max Q(a) = \sum_{i=1}^{m} a_i - \frac{1}{2} \sum_{i=1}^{m} \sum_{j=1}^{m} a_i a_j y_i y_j K(x_i, x_j) \quad (2)
\]

\( a_i \) is the Lagrange multiplier corresponding with each constraint (1.2) in original problem. This is the optimization problem of secondary function in inequality constraint, uniqueness of solution existing. It is easy to show that in solutions there will only be a part of \( a_i \) (usually the small portion) are not zero, the corresponding sample is support vector. Got the optimal classification function after solving the problems above

\[
f(x) = \text{sgn}\{w \cdot x + b\} = \text{sgn}\left(\sum_{i=1}^{m} a_i^* y_i K(x_i, x) + b^*\right) \quad (3)
\]

\( b^* \) is the classification threshold.

Nonlinear problems can be transformed to linear problem of some high-dimensional space through nonlinear transformation; solving optimal classification surface in transform space is as shown in Figure 2.

Figure 2. nonlinear mapping [7]

Therefore, using appropriate inner product function \( K(x_i, x_j) \) in optimal classification surface can achieve linear classification after nonlinear transformation, while the computational complexity does not increase, then the classification function becomes

\[
f(x) = \text{sgn}\left(\sum_{i=1}^{m} a_i^* y_i K(x_i, x) + b^*\right) \quad (4)
\]

SVM needs kernel function \( K(x_i, x_j) = \Phi(x_i) \cdot \Phi(x_j) \) to mapping from the original space to feature space, any symmetric function satisfying condition of Mercer can be used as the kernel function, frequently-used kernel function are:

1) Polynomial kernel function (POLY):

\[
K(x_i, x_j) = (x_i \cdot x_j + b)^d \quad d = 1,2,\ldots \quad (5)
\]

2) Radial basis function (RBF) kernel function:

\[
K(x_i, x_j) = \exp(-\gamma ||x_i - x_j||^2) \quad (6)
\]

3) Sigmoid kernel function:

\[
K(x_i, x_j) = \tanh(\gamma(x_i \cdot x_j) + b) \quad (7)
\]

Wherein \( \gamma, b, d \) are the parameters of kernel function, there is no theoretical guidance for choosing kernel function, which can only be selected empirically.

### III. COASTLINE EXTRACTION TEST BASED SVM

#### A. General Situation of Test Area

Fujian Province is located in the southeast coast of China, 23°30’N—28°22’N, 115°50’ to 120°40’E, next to the Zhejiang Province in north, next to Guangdong Province in south, only water apart with Taiwan. Seas of Fujian Province are vast, harbors are numerous and marine resources are very rich. The terrain is northwest high, southeast low; there are lot of mountains and hills. The macro geological structure of Fujian Province determines the general trend and distribution of the
province's mountains, basins, estuaries, bays and shoreline. Based on this, various topographies have been developed in the coastal area of Fujian.

B. Coastline Types and Interpretation Signs

(1) Coastline types

1) Bedrock coast

The bedrock coast is made of hard rock. Some coast uplifts constantly due to the crustal tectonic movement, making some bedrock structure encroach upon the coastal boundary and forming the bedrock coast and bench. Bedrock coast region is steep, so tides change little on the horizontal position of the coastline, at the same time due to the resolution limit of satellite images, it is generally considered that coastline is the water and land dividing line of sea water and sea cliff shot when satellite transiting.

2) Sandy coast

Sandy coast is the coast made of gravel (particle greater than 2mm) or sand (particle 0.2-2mm). The accumulation of plains is transported to the coast, and deposited by waves or wind, sandy coast is formed. Sandy coast can be divided into three types: general sandy coast, sandy coast with cliffs, barrier - lagoon coast.

General sandy shoreline: silt accumulates in the surf zone, forming the coast. Beach ridge which is parallel to the shore often develops on its beaches, these beach ridges can be higher than mean high tide level of spring tide 1-2m, the landward side of beach ridges is bedrock terraces or coastal plain sometimes. Therefore, we determine the coastline as the seaward side of the modern beach ridge top.

Sandy shoreline with cliffs: beach with cliffs do not develop beach ridge generally, which connects to bedrock steep bank directly. Because of its steep terrain, the sea water cannot diffuse, the ebb and flow of the tides have little effect on coastline, the position of coastline is loud and clear, which is the base of the escarpment.

Barrier - lagoon shoreline: the bay of original hills and mountains is head off by sandbank or spit of land, and forming the coast, generally has a very narrow tidal channel. Seawater of lagoon has a direct relationship with ocean tide changing, so as a part of the ocean, it needs to consider the influence of lagoon when determining the shoreline of barrier - lagoon.

The entrance of lagoon is narrow, small waves in the bay, but sandbank facing open waters is influenced by stormy waves significantly, so the inner shoreline of lagoon is not consistent with the shoreline elevation of sandbank’s off-shore side. The general lagoon inner shoreline is the mean high tide line of spring tide, while the trace lines of sandbank’s off-shore side is much higher than high tide line. This article identifies the coastline as the mean high tide line of spring tide which landward lagoon contacts with non-sandy surface.

3) Muddy coast

Muddy Coast is also known as tidal flat coast, which is mainly piled up by sediment grain and organic matter such as sand, silt, clay, shells, debris and plant humus, so it is organic-rich, gray or blue black. The muddy coast is usually found in places of weak hydraulic power, adequate sediment supply, between flat terrain estuaries, bays, castle Islands and the land. Its tidal flats are divided into supralittoral zone, mesolittoral zone and sublittoral zone, slope is gentle, mesolittoral zone is wide, tidal creek develops generally, some upper end of tidal creeks even extend to the river estuary.

The land side of mesolittoral zone has a growth boundary of alt-tolerant plants which changes obviously, in the landward side the plants flourish, while in the seaward side the plants are sparse and dwarf. The plant debris, shell fragments, garbage and other substances brought by seawater tide are often held up here, forming a typical “trace line”, where is the coastline of muddy beach.

4) Mangrove coast

Coast of mangrove plant communities. Mangrove plants are distributed in tropical and subtropical coastal mudflats, are salt-tolerant plant communities growing in the seawater immersion environment, have trees also shrubs, mostly the bark and wood are red-brown. The mass propagation of mangrove blocks the impact of storms on the coast significantly, and is also conducive to the deposition of suspended solids, has positive implications for coast protection. Same time the nutrition water zone around the mangrove provides an excellent environment for fish and shrimp farming, having important economic significance in coastal fisheries, aquaculture and agriculture.

5) Artificial Coast

Artificial coastline is artificial constructed, changed the original natural coastline, it is mainly built of stone, concrete, etc. The main types are ports, salt pan, and dams of aquaculture ponds.

In order to block the intrusion of sea water, dams of artificial coast is required to ensure that the high tides cannot diffuse the embankment in the design, and therefore it is influenced little by the tides. The dam of artificial coast can be determined as the coastline directly.

(2) Interpretation signs of coastline

1) Bedrock shoreline

Bedrock coast vegetation is generally divided into two kinds of vegetation cover and rock bare soil in remote sensing images. Bedrock coast with vegetation cover has high degree of greening, low spectral reflectance, as plaque; bedrock coast with rocks and bare soil has obvious mountains texture, and the rock body has marked concave-convex. The boundary bedrock coast connecting with the sea water is very obvious; its interpretation signs are the junction of cape, vertical cliff and sea water.

2) Sandy shoreline

The high reflectance of sand displays a high luminance on the image, while brightness of surface feature connecting with beach sand is much lower, the texture feature of sand is relatively obvious on the image. Due to be submerged by sea water, the beach below the mean high tide line has different tidal flat compositions, with its different exposed time of over the sea it has high water content, and the beach on the image when the water receded is darker than that not submerged by water, have
different grayscale at infrared wavelengths, forming the interpret signs of sandy coastline.

3) Muddy shoreline

Based on interpretation signs of remote sensing image, muddy coast can be divided into two types: one is the muddy coast of natural state, tidal flat area is relatively large, has rich organic matter, is gray or blue black in the image, and the tidal creek develops. Another is the muddy coast developed and utilized by human, shrimp, salt ponds and other culture zones are built in high tide level of tidal flat and geographic area nearby, at the edge of these culture zones, the breakwater is constructed generally, because sea water cannot get past the breakwater, it is identified as the coastline. There are grid images of pools or evaporation pools, and these dams have higher reflectivity, therefore it is easy to be identified in the image.

4) Mangrove shoreline

Mangroves grow in high tide level of tidal flat, show plaque characteristics on images because it is divided by small tidal creeks, have low reflectance, show plaques even sheet of dark gray - dark gray tone in full-color images. However, in color infrared images, mangroves characterizes as the bright red image.

5) Artificial shoreline

Artificial coast is constructed from rocks, concrete, has a higher reflectivity on the image, while seawater has low reflectance, therefore, it is easy to determine its coastline on the image.

This paper summarizes some distributions of various types of Fujian Province coast and Interpretation signs, as shown in Table 1.

<table>
<thead>
<tr>
<th>Coast types</th>
<th>Distribution</th>
<th>Interpretation signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedrock coast</td>
<td>northern Fujian as well as the windward side of island</td>
<td>Border of land and sea, marine foreland strip</td>
</tr>
<tr>
<td>Sandy coast</td>
<td>Within open bay between bedrock Cape in south of Minjiang Estuary</td>
<td>Ladder-like and white and delicate texture, headland bay strip</td>
</tr>
<tr>
<td>Muddy Coast</td>
<td>Hidden top of bay, such as Zhaoan Bay, Xiamen Harbor and Xinghua Bay</td>
<td>Boundary of onshore vegetation and intertidal zone, breakwater dam like shrimp ponds, salt pan</td>
</tr>
<tr>
<td>Mangrove coast</td>
<td>Distributes Widely in Fujian, but scattering.</td>
<td>Top of intertidal zone, ditch and tide en plaque, vegetation texture</td>
</tr>
</tbody>
</table>

C. Data Preprocessing

(1) Selection of images

The basic data for research is Landsat7ETM + image of a typical area of Fujian Province, China, December 24th, 2001. The image quality is good, almost no cloud cover, by atmospheric radiation correction and geometric correction. In the ERDAS IMAGINE9.1 software environment, fuse data of multispectral images of Landsat7ETM +30 meters resolution and the 15-meter resolution panchromatic images, and then cut out 5 types of coast areas for the experimental area on fused image, and do different image enhancement processing for different shoreline types, finally after image preprocessing, do experimental study of the coastline extraction method.

(2) Image pre-processing

1) Band combination

Different bands express different surface features information, so different band combinations often have different display effect for target objects. The extraction of coastline mainly selects TM741, TM743, TM432 and TM543. By comparison test, because TM741 band combination is sensitive to vegetation and water bodies, so coastal areas images of Fujian which are synthesized by it, the land surface features is easy to identify, boundary of land and water are also clearly visible. This article uses the images which are synthesized by these three bands.

2) Image fusion

ETM + image contains panchromatic band, which has high spatial resolution and better texture features, fusing it with multi-spectral band can integrate the details of high-resolution images and also retain the spectral information of multi-spectral band, significantly improve image clarity and classification accuracy. In order to give full play the high geometric resolution information of
ETM + data panchromatic band, improve the reflection of surface details in the image, this study do PCA transform, Brovey transform, wavelet transform and HIS transform fusion to ETM + image of Fujian coast. The fusion results are shown in Figure 3 - Figure 7.

As fusion results, comparing with the original images, spatial resolution of images transformed and fused by 4 types of transform methods, has been improved significantly, texture features of image has been enhanced, the details are more prominent. The clarity of image which is transformed and fused by HIS is significantly improved; images transformed and fused by Brovey have great contrast, obvious spectral distortion; images transformed and fused by PCA is brighter, that by Brovey is greenish, hue of the vegetation part changes significantly. The spectral characteristics of the wavelet transform fusion image is closer to the original image, spatial resolution improves, but a lot of noise, image fusion results is not as effective as other space conversion method. The transform fusion effect of HIS is clearer than the rest, less loss of spectral information, border of land and sea is obvious, suitable for the extraction of coastline, this paper use HIS transform fusion method.

IV. IMAGE ENHANCEMENT

Different types of coastline have different geomorphological features and different spectral characteristics in remote sensing images, so they have different interpretation signs. Therefore it is necessary to take different image enhancement processing methods for remote sensing images of different types of shoreline.

(1) Bedrock coast: two types of bedrock coast are vegetation cover and rock cover, the common feature is that the boundary between land and water is clear, bedrock coast with lush vegetation presents a velvet-like texture, rock-covered bedrock coast with sparse vegetation presents point, cluster and rough rock texture, these have great contrast with uniform texture of water, convolution filtering can be used to sharpening the image, that is edge enhancement processing, which can strengthen the border of land and sea. Bedrock coast image processed by edge enhancement is shown in Figure 8.

(2) Sandy coast: sandy coast has high brightness on satellite image, the surface features connecting with the beach has much lower brightness, due to be submerged by water, the beach below the mean high tide line have different tidal flat material composition, and due to different exposition time above the sea surface it has a high water content, when the water recedes, brightness of the beach on the image is lower than that not submerged by water, at the same time, texture feature of sand leads to the obvious noise of coast image, in order to remove

Figure 5. Fusion image by Brovey transform

Figure 6. Fusion image by wavelet transform

Figure 7. Fusion image by HIS transform

Figure 8. Enhanced bedrock coast image

Figure 9. Enhanced sandy shore image
these noise interference, the method of adaptive filtering is used, maintaining good image details. Image of sandy shore treated by adaptive filtering is as shown in Figure 9.

(3) Muddy coast: it’s divided into two types: one is the developed and utilized by human, the other is the natural state. For muddy coast developed and utilized by human, a large number of shrimp ponds, salt pans are constructed near the coast generally, in order to prevent the influx of seawater, breakwaters are built at the sea-side of these areas, which is the coastline of muddy coast. Generally, these shrimp ponds and salt pans present regular massive distribution on the image, which have great brightness contrast with the sea, with clear boundary. For muddy coast in the state of nature, due to rich in organic matter, the image is gray, also has great contrast with sea water, sharpening can be used to enhance the boundary of the land and sea. As shown in Figure 10.

(4) Artificial coast: artificial coast is built by stones and concrete, have higher reflectance in the image, while the reflectance of seawater is low. Therefore it is easy to determine on the image, edge enhancement processing can be used to strengthen the boundary of land and sea. The results are shown in Figure 11.

![Figure 10. Enhanced muddy coast](Image)

![Figure 11. Enhanced artificial coast](Image)

The base data for researching uses Landsat7ETM + images of a typical area of Fujian Province on December 24, 2001, image quality is good, little cloud covers basically, and processed by atmospheric radiation and geometric correction. In the software environment of ERDAS IMAGINE9.1, through comparative analysis of PCA transform, Brovey transform, wavelet transform and HIS transform fusion method, this paper uses the HIS transform method to do data fusion of multispectral images of Landsat7ETM +30-meter resolution and panchromatic image of 15-meter resolution, and selects TM741 band combination which is sensitive with vegetation and water. Compared with the original image, spatial resolution of the fused image has been improved obviously, image texture feature is enhanced, details are more prominent. Then cut 5 coast types on the fused image for the experimental areas, and process them with different image enhancements according to different types of shoreline, the finally study the coastline extraction method after image pretreatment.

### 3.4 coastline extraction

On the five kinds of remote sensing images of typical coastal types of Fujian Province after pretreatment, select representative surface features (ie, the interpretation symbols of the coastal zone)as the training samples, by a kernel function to mapping them to the high-dimensional space [11]. At the same time, set the parameters of the classifier based on SVM training sample, then determine the optimal classification surface in the feature space and get the support vector machine of training samples. According to the research of Vanpik, the performance of support vector machine has little relationship with the type of kernel function chosen, the parameters of kernel function and the penalty coefficient C is the main factor affecting the performance of SVM [12-14]. Statistical theory gives some suggestions and explanations for parameter selection of support vector machine in the practical application, but does not give a practical solution, experimental method is used to determine the optimum parameters generally.

<table>
<thead>
<tr>
<th>Coast types</th>
<th>SVM Kernel function</th>
<th>Classification accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedrock coast</td>
<td>$K(x, x) = (\gamma x \cdot x + b)^d$</td>
<td>80.86%</td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \exp \left[ \frac{-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \tanh [\gamma(x \cdot x) + b]$</td>
<td>81.06%</td>
</tr>
<tr>
<td>Sandy coast</td>
<td>$K(x, x) = (\gamma x \cdot x + b)^d$</td>
<td>78.32%</td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \exp \left[ \frac{-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \tanh [\gamma(x \cdot x) + b]$</td>
<td>78.94%</td>
</tr>
<tr>
<td>Muddy Coast</td>
<td>$K(x, x) = (\gamma x \cdot x + b)^d$</td>
<td>72.17%</td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \exp \left[ \frac{-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \tanh [\gamma(x \cdot x) + b]$</td>
<td>72.83%</td>
</tr>
<tr>
<td>Mangrove coast</td>
<td>$K(x, x) = (\gamma x \cdot x + b)^d$</td>
<td>74.54%</td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \exp \left[ \frac{-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \tanh [\gamma(x \cdot x) + b]$</td>
<td>74.91%</td>
</tr>
<tr>
<td>Artificial coast</td>
<td>$K(x, x) = (\gamma x \cdot x + b)^d$</td>
<td>96.83%</td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \exp \left[ \frac{-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$K(x, x) = \tanh [\gamma(x \cdot x) + b]$</td>
<td>97.65%</td>
</tr>
</tbody>
</table>
This paper determines the best classifier parameters suitable for the study area by contrasting the classification results of the three kernel functions as polynomial, radial basis function (RBF) and Sigmoid, SVM classification accuracy are shown in Table 2. After comparative tests, Sigmoid kernel function is selected as the best classifier to extract the coast image information of Fujian. Original images are shown in Figure 12, coastline extraction results are shown in Figure 13.

For bedrock coast, artificial coast and mangrove coast, it is easy to determine the coastline by combining classification processing of remote sensing images and visual interpretation, and often does not require amendment. The muddy coast for example, using the high tide line method generally [15] in the ArcGIS software environment, combines with ArcGIS spatial analysis techniques to correct the position of coastline [16].

First, determine the distribution curve of coast tidal level and forecast the tidal by computer, plot the tide level process curve of each tide gauge, investigate the tide-bit (the yellow sea level) when satellite imaging [17-18]. Then inquire into high-water line by the coast slope and tidal level value. Ascertain the high tide line, seek water-head of sea level when the high tide imaging with the satellite, using slope angle to calculate extrapolation distance, extrapolate the coastline on the water sideline. Its shoreline correction results are in Figure 14.

For bedrock coast, artificial coast and mangrove coast, it is easy to determine the coastline by combining classification processing of remote sensing images and visual interpretation, and often does not require amendment. The muddy coast for example, using the high tide line method generally [12] in the ArcGIS software environment, combines with ArcGIS spatial analysis techniques to correct the position of coastline. Its shoreline correction results are in Figure 15.

V. CONCLUSION

Using remote sensing technology to extract the information of coastal zone macroscopically, fast, and accurately, the advantages are more preeminent than other observation methods. This paper uses SVM algorithm to do the extraction test for coastline of Fujian province. For complex coastal landforms, the Fujian coast is divided into five typical coasts and researched, and use
different data preprocessing methods in accordance with the characteristics of each coastal type, makes image of land and maritime’s border clearer, improve accuracy of the water sideline extraction follow-up effectively.

The introduction of SVM classification algorithm to coastline remote sensing extraction, is different from the previous edge detection, obtains a large number of coastal zone information, SVM classification algorithm is also a classification method of artificial intelligence, which is considered the best method for small sample classification and regression problems currently. It solves the common difficulties of artificial neural networks and other methods, such as difficult to determine the network structure, over-learning and less learning as well as local minima. In this paper, the SVM algorithm is used to extract the coastline, after comparison test, chooses the Sigmoid kernel function as the optimal classifier to obtain higher classification accuracy, wherein the artificial coast has the best result, extraction accuracy of 96.83%.

REFERENCES


