COASTLINE EXTRACTION FROM AERIAL IMAGES BASED ON EDGE DETECTION

Presented By:

Poornima Manjunath

OUTLINE

- **Motivation**
- **Overview of Methodology**
  - Pre-processing
  - Region Segmentation
  - Post-processing
  - Coastline modelling
- **Conclusion**

MOTIVATION

- **Significance of Coastline Extraction**
  - Geographical exploration
  - Autonomous navigation
  - Coastal resource inventory and management
  - Coastal erosion monitoring and modelling

BLOCK DIAGRAM OF PROPOSED METHODOLOGY

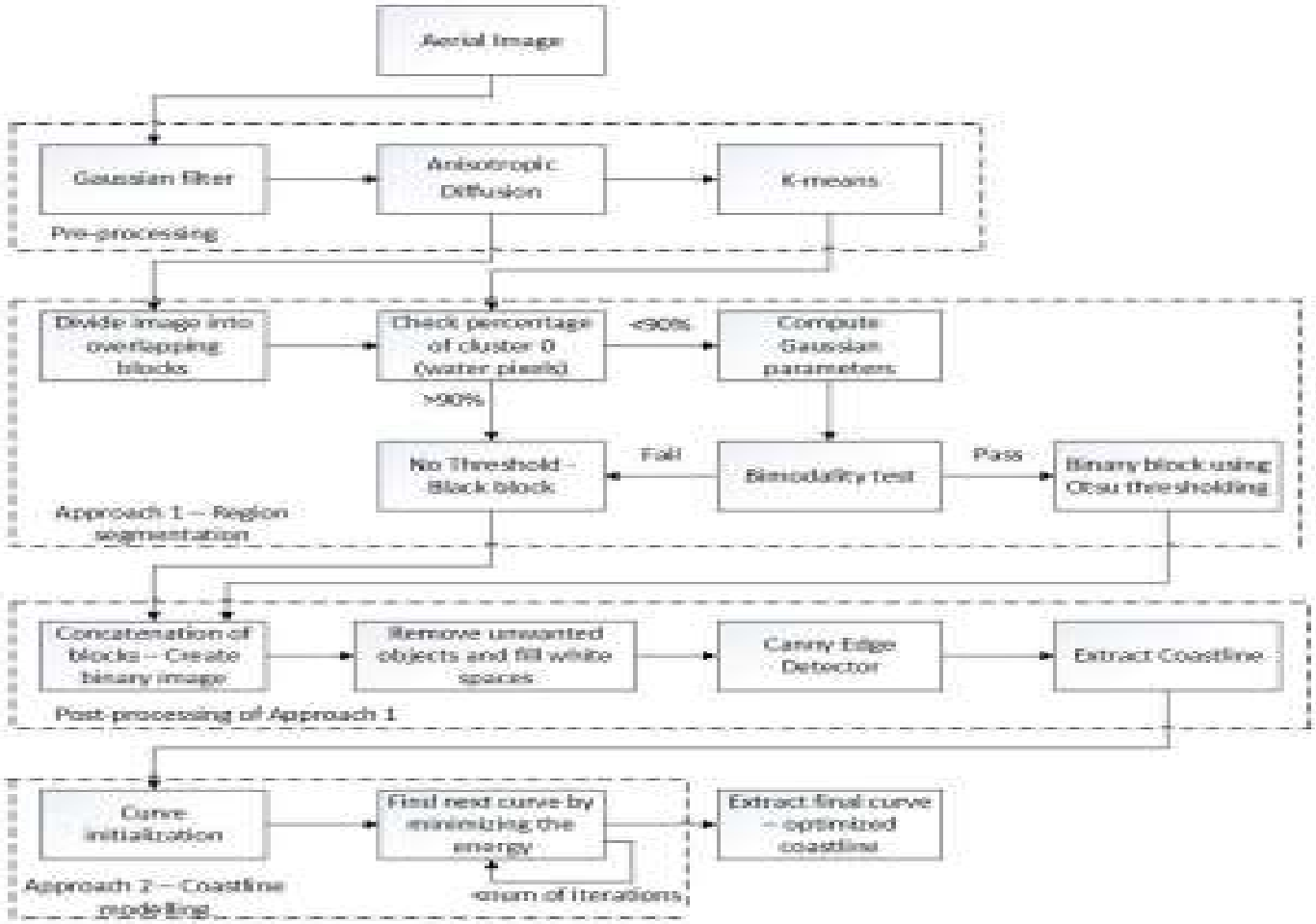

Figure.1 Block Diagram [Ref.1]

PRE-PROCESSING

- Step 1: Apply a Gaussian filter
- Step 2 : Apply Anisotropic Diffusion Algorithm

RESULT OF PRE-PROCESSING

Figure.2 a)Initial Image b)Image after Pre-processing[Ref.1]

REGION SEGMENTATION

- Step 1: Clustering of the image using K-means
- Step 2: Divide the image into square overlapping blocks of width ‘w’
- Step 3:Examine the percentage of zero value pixels.
- Step 4: Examine the bimodality.
- Step 5: A threshold ‘T’ is calculated by using the Otsu’s method.

OTSU'S ALGORITHM

- Assumption: The block contains two classes of pixels (land, sea) through bimodal histogram.
- The weighted between-class variance is:

$$\sigma_b^2(t) = q_1(t)q_2(t)[\mu_1(t) - \mu_2(t)]$$

q_i are the probabilities of the two classes separated by a threshold t and μ_i denote the means of these classes.

- The class probabilities estimated from the class histograms are:

$$q_1(t) = \sum_{i=1}^{t} p(i) \quad q_2(t) = \sum_{i=t+1}^{I} p(i)$$

OTSU'S ALGORITHM CONTD..

- The class means are given by:

$$\mu_1(t) = \sum_{i=1}^{t} \frac{p(i)x(i)}{q_1(t)} \qquad \mu_2(t) = \sum_{i=t+1}^{I} \frac{p(i)x(i)}{q_2(t)}$$

- Compute the threshold that maximizes the between class variance.

- Apply the threshold on each block.

$$b(x,y) = \begin{cases} 0, \text{ if } I(x,y) < T \\ 1, \text{ if } I(x,y) > T \end{cases}$$

POST-PROCESSING

- Concatenate the blocks in order to recreate the image in a binary form.
- Apply the morphological operations of erosion and dilation.
- An erosion procedure followed by a dilation.
- Further, apply a closing operation, which is a dilation followed by an erosion.

POST-PROCESSING CONTD..

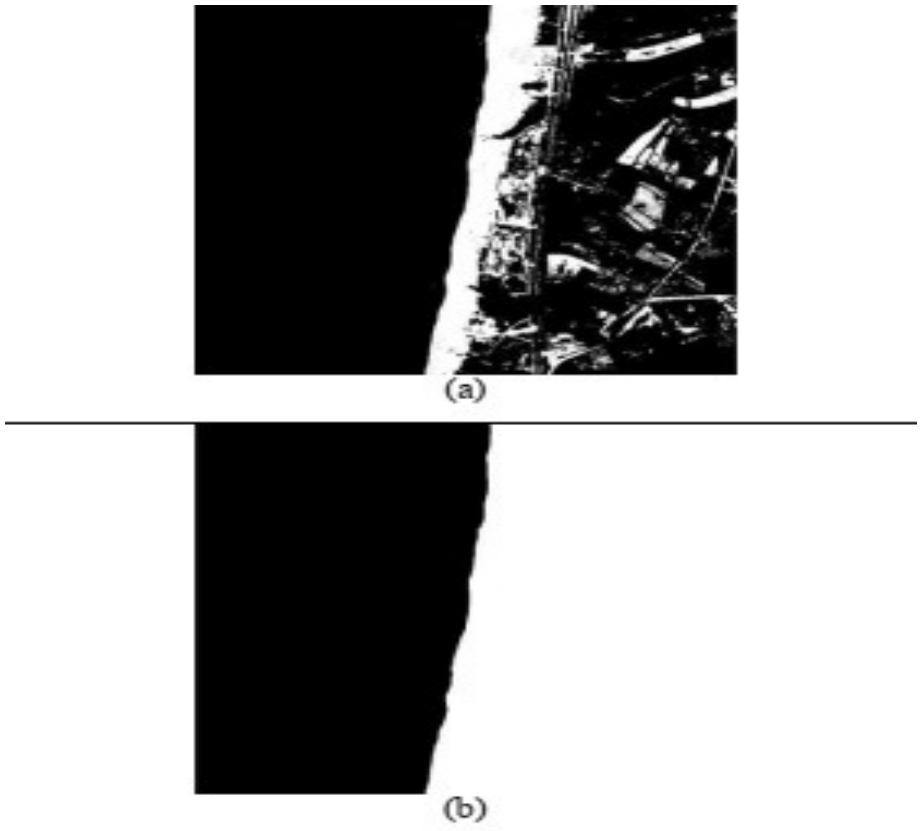

Figure.3 (a) Image after concatenation of binary blocks (b) Image after morphological operations[Ref. 1]

POST-PROCESSING CONTD..

- **Canny edge detection method.**

- Find the intensity gradient of the image.
- Apply non-maximum suppression.
- Hysteresis is applied to eliminate gaps

COASTLINE MODELLING

- **Open active contour method:**

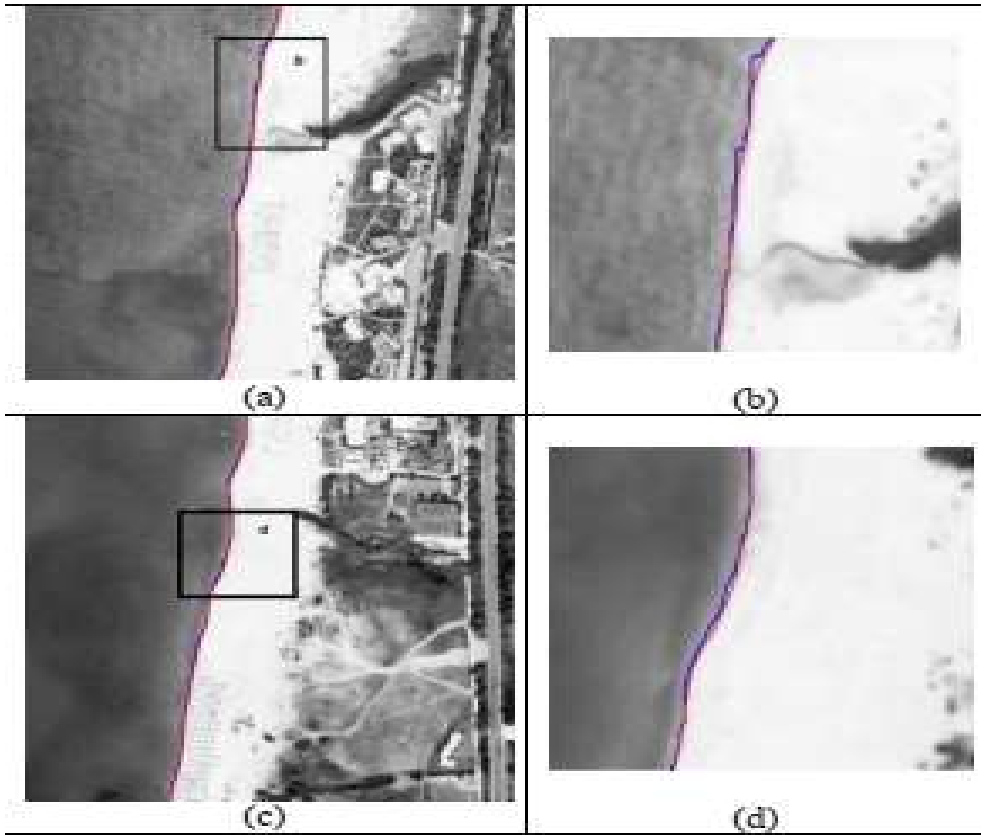

Figure.4 Estimation of coastline modelling approach [Ref.1]

CONCLUSION

- Provides coastline extraction using aerial images through image processing techniques.
- Local Thresholding Method, Canny edge detection and Active Contour Fitting improve the accuracy.
- **Future Scope:**
  - Implementing the transform for moving from image coordinates to real-world coordinates.
  - Basis for post processing and computations of real-world measures

REFERENCES

[1] V. Paravolidakis, K. Moirogiorgou, L. Ragia , M. Zervakis, C. Synolakis,

”Coastline Extraction From Aerial Images Based On Edge Detection”, ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume III-8, 2016,XXIII ISPRS Congress, 12–19 July 2016.

[2] H. LIU , K. C. JEZEK, “Automated extraction of coastline from satellite imagery by integrating Canny edge detection and locally adaptive thresholding methods”, INT. J. REMOTE SENSING, 10MARCH, 2004, VOL. 25, NO. 5, 937–958.

[3] John Canny, “A Computational Approach To Edge Detection”, IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. Pami-8, No. 6, November 1986.

[4] DongjuLiu, JianYu,” Otsu method and K-means “ Ninth International Conference on Hybrid Intelligent Systems,2009

[5] Muhammet Baştan , Syed Saqib Bukhari, Thomas Breuel, “Active Canny: edge detection and recovery with open active contour models”, IET Image Processing,2017

THANK YOU