UNB Image Processing Technologies

Moving Target Detection
 Image Matching
 Image Segmentation

Dr. Yun Zhang Canada Research Chair in Advanced Geomatics Image Processing

> Department of Geodesy and Geomatics Engineering University of New Brunswick (UNB) Fredericton, NB, Canada, E3B 5A3 Tel. (506) 453-5140, Fax. (506) 453-4943 YunZhang@UNB.ca

> > August 2009

CRC-AGIP

8/21/2009

© CRC-Laboratory in Advanced Geomatics Image Processing, UNB, Canada

1

1. Moving Target Detection

8/21/2009

QuickBird Pan



QuickBird MS



Parallax

QuickBird Pan-MS arrays alignment





P -> parallax Hae -> ellipsoidal height D -> focal plane distance F -> focal length

θ -> off nadir angle



Reference:

Padwick, C., 2004. Pan Sharpening of High Resolution Satellite Imagery, ASPRS Annual Conference, June 8, 2004

















Table 5: Coordinates, speed, and azimuth angle of moving targets

			Pan				
	No	X(m)	Y(m)	H(m)	Speed(km/h)	Azimuth(degree)	
I	1	694447.8621	5079066.252	29.539007	118.522133	133.830994	
	2	694485.7676	5079025.978	30.392731	109.926338	150.191025	On alour land
	3	694524.2158	5079028.594	30.532267	68.152657	323.130402	- On slow lane
	4	694021.1658	5079358.151	18.099633	133.697861	126.339523	2.2 2 1 2 2 2 2
	5	693929.825	5079424.877	15.421739	93.154297	306.870209	
I	6	693917.1496	5079406.324	15.740675	23.862312	◆ 74.054672	- On road side
	7	695493.5569	5077424.519	30.564808	135.721359	317.726593	7
I	8	695349.1159	5077532.095	30.622373	113.871544	152.488144	
	9	695370.0456	5077506.848	30.630486	149.73671	134.356384	
I	10	695185.9368	5077759.267	30.330296	107.45369	150.191025	
I	11	695206.4002	5077792.369	30.298069	145.642273	337.50769	On high speed lane,
	12	695203.0379	5077735.757	30.372644	145.450485	146.192184	will pass over 13
	13	695209.0495	5077724.515	30.388153	83.820351	164.745041	Longvahiele
	14	698168.0609	5077339.579	37.840326	71.232735	52.957577	Long venicle
I	15	698551.6409	5077532.603	43.529508	120.406052	254.578079	
	16	69 <mark>8525.3102</mark>	5077484.445	43.616787	162.604324	74.188698	vill pass over 17
I	17	698553.9627	5077496.88	44.048217	127.154083	75.379196	
I	18	698465.6076	5077497.859	42.224455	150.211761	249.145782	Just passed over 15
	19	699557.0058	5078000.132	42.423995	144.731583	243.904816	
I	20	699597.5814	5077989.308	42.318242	143.545547	68.198654	
	21	700452.3905	5079682.306	27.973226	96.366844	4.39871	20200
	22	700445.0516	5079628.63	28.158358	138.395966	11.228902	
	23	700441.445	5079599.551	28.268832	100.277542	10.35333	
	24	700404.1849	5079558.529	28.569551	77.596268	183.252106	
1							





Speed and direction of moving target:



8/21/2009





Speed and direction of moving target:



8/21/2009

2. Image Matching

8/21/2009

Problem with the Existing Solutions

Ambiguity in smooth (low texture) areas, such as forest, grass, water, highway surfaces, building roofs, etc.



QuickBird Image Pair

8/21/2009

UNB Image Matching



QuickBird Image Pair

8/21/2009



UNB Image Matching

Right image rotates 315



8/21/2009

© CRC-Laboratory in Ac



UNB Image Matching



8/21/2009

© CRC-Laboratory in Ao

3. Image Segmentation

8/21/2009

3.1. Problem in object-oriented classification

Segmentation in eCognition[™]





The operator must use his/her experience and a trial-and-error method to find the appropriate segmentation parameters:

- Scale = ?
- Shape weight (factor) = ?
- Smoothness = ?

8/21/2009

3.2. Existing object-oriented classification (eCognition)

Step 1: Segmentation at various scales

Step 2: Classification of image objects



3.3. UNB Supervised Segmentation

- Perform Preliminary Segmentation
- Parameters used:
 Scale = 25
 Shape weight = 0.1
 Smoothness = 0.1
 weight

(1) Initial Segmentation



8/21/2009

3.3. UNB Supervised Segmentation

• Train the system by selecting appropriate subobjects that comprise the object of interest

• Start iterative process to determine appropriate segmentation parameters

(2) Segmentation Training



3.3. UNB Supervised Segmentation

- Convergence in 4
 iterations
- Solution parameters:
 Scale = 120
 Shape weight = 0.410

Smoothness = 0.868 weight

(3) Automatically finding optimal segmentation parameters



8/21/2009

Re-segmentation Results and Comparison





Trial and error approach (State-of-the-art) UNB approach (UNB solution)

8/21/2009

Re-segmentation Results and Comparison



Trial and error approach

UNB approach

8/21/2009

Re-segmentation Results

(UNB result)



Some examples of international research awards:

• John I. Davidson President's Award for Practical Paper of ASPRS, 2009, with my PhD student Zhen Xiong

• One of 9 Canadian successful research achievements for the "Technology Transfer Works: 100 Cases from Research to Realization", by the Association of University Technology Managers 2006 (an international association)

• Talbert Abrams Grand Award of ASPRS, 2005, Yun Zhang, C. Vincent Tao, and J. Bryan Mercer



(CRC-Laboratory in Advanced Geomatics Image Processing) Agip

(Azienda Generale Italiana Petroli) established in 1926.

© CRC-Laboratory in Advanced Geomatics Image Processing, UNB, Canada

Ŧ

Questions?

8/21/2009