

## A COMPARISON OF SPOT 5 OBJECT-BASED CLASSIFICATION BASED ON SPECTRAL AND GLCM TEXTURE ANALYSIS

Penpan BOONDERM<sup>a</sup> and Assoc.Prof. Vichai YIENGVEERACHON<sup>b</sup>

Department of Survey engineering, Faculty of Engineering, Culalongkorn University, Phayathai Road, Pathumwan, Bangkok Thailand. 10330

<sup>a</sup>E-mail [penpan.b@gmail.com](mailto:penpan.b@gmail.com) <sup>b</sup>E-mail [vichai.y@eng.chula.ac.th](mailto:vichai.y@eng.chula.ac.th)

**KEY WORDS:** Satellite Image, Classification, Object-based classification, Spectral analysis, GLCM

**Abstract:** Presently, classification procedures of satellite images are developed including object-based classification. This method applies spectral analysis of satellite images. Result will increase accuracy and efficiency. However, similar spectral of corps will obtain mixed results that will be effect on accuracy. The texture algorithms method such as Gray Level Co-occurrence Matrix or GLCM is applied to classify the previous problem. The purpose of this study is comparison the results between object-based classification and texture algorithms on corps agriculture areas in Prachinburi province. The satellite images were taken from the SPOT 5 satellite. Then comparing the results what is a better method for the object-based classification. This study applied the segmentation technique with considered constant parameters consisting of scale parameter, color, shape, compactness and smoothness. All results were analyzed by spectral analysis. Besides, segmentation technique was used to GLCM, but the results were classified by using GLCM and were evaluated and accuracy. According to this study, the results indicated the GLCM more overall accuracy than the spectral analysis as 94.79% versus 81.09%. and compare per class, The classification of data using the GLCM contrast each direction, it's making accuracy better than using Spectral analysis

### 1. INTRODUCTION

Now mapping for land utilization of Land Development Department, Ministry of Agriculture and Cooperatives is applied by Remote Sensing Technology in order to improve and update the original data base of Ortho color image by using SPOT5 image as supplementary component to classify and analyze information of land utilization as well as database Ortho color image, then take it to conduct field survey and bring survey results to update the original database which is called land utilization plan (Operations Manual for the preparation of land use map of the state, 2011). According to the previous information, it is found that remote sensing survey is technology used to classify, analyze information and features of object without direct contact, the information acquired by remote sensing survey is used as significant source of Geographic Information System: GIS which is applied in other study such as water resource and forest, basic concept of analysis on satellite image data by pixel-based classification obtained by spectral analysis of different objects.

There are main economic crops in Thailand such as rice, sugarcane, cassava, Rubber tree and Eucalyptus, these crops can be planted in all regions of Thailand and highly generate national revenue for export. As using remote sensing technology and GIS system to classify satellite information, survey and inspection area of economic crops plantation can be conducted conveniently, rapidly and precisely but in case of areas planted these economic crops are nearby and plantation pattern is similar as agricultural plants as orange, pomelo and similar perennial plants as Eucalyptus and Rubber tree etc. which close spectral analysis value may cause problem of data mixture and precision obtained by satellite data classification consequently.

Most of satellite data classification that widely used is Pixel-based classification that relied on the same and different spectrum analysis value of each pixel for each object-based classification on satellite image in each area, most results are accurate approximately 69 – 84 % which error may occur due to close spectral analysis of pixel in some area that constituted inability to classify image of object correctly by using pixel area alone.

Now satellite data classification has been developed, object-based classification techniques of segmentation may help better classification of object on image by using property of visual object on image helps to classify object by considering size and shape of object, pixel resolution of image data, color and spectral analysis of pixel area as this method may include close spectral analysis value and the precision of this object-based classification method is approximately 78 – 97 %, besides there is also texture algorithms which is classification by texture algorithms of Gray Level Co-occurrence Matrix or GLCM all directions, it may classify better for complex object on image such as data with close spectral analysis value.

So, this research shall study comparison between classification of land utilization for economic crops data by using Object-based classification process from spectral analysis and Texture algorithms techniques of GLCM from SPOT5 satellite data in order to get precise and efficient data classification results.

## OBJECTIVE

To comparatively study results of Object-based classification process of economic crops planting area from Spectral analysis and Texture algorithms techniques from SPOT5 satellite data whether which method resulted more precision.

## SCOPE OF RESEARCH

1. Object-based classification from spectrum analysis.
2. Object-based classification from Texture analysis techniques by using GLCM Contrast.
- 3.3. This study may conduct data classification of economic crops planting areas such as rice, water resource, cassava, eucalyptus, sugarcane, forest areas, mix-orchard, bamboo plantation, buildings, mango orchards and Glass (empty areas) in Prachinburi Province.

## STUDY AREA

Study area of this research is located in Prachinburi Province where it is variety of economic crops and land utilizations, data of visual image used in this research was obtained from SPOT 5 satellite recorded on 13 January, 2006 and 14 January, 2006 which were 4 Bands of wavelength such as Green, Red, Near infrared, SWIR (short-wave infrared) with pixel resolution 10 X 10 meter



Figure 1: Displays study areas

## 2. METHODS AND EQUATION

### 1. Data preparation

1.1 Monitor data obtained from SPOT5 to cover provincial areas of Prachinburi and geometric modification into UTM zone 47 coordinate system based on WGS84 of proof to correct obtained image prior further processing.

1.2 Define Training Area with reference to land utilization map of Land Development Department, Ministry of Agricultural and Cooperatives by using Remote sensing technology to update original database of Ortho color from SPOT 5 image which is selected SPOT 5 image in the same year of database improvement.

1.3 Level of data is defined into 11 Classes such as paddy, water resource, cassava, eucalyptus, Sugarcane, forest areas, mix-orchards, bamboo garden, buildings, mango orchards and glass areas .

### 2. Object-based Classification

Process of object-based classification on SPOT 5 satellite image data is conducted by Deffinien 5.0 Program to analyze objet-based classification by using segmentation process and object-based analysis and spectral analysis value of different objects to proceed to data processing in the following significant steps:

2.1 Segmentation is the process of image data classification with close spectral analysis, categorized as group of the same object set by the parameters such as scale parameter, color, shape, smoothness and compactness

which spectral analysis of each segmentation can be obtained, examined and chosen appropriately and precisely for classification.

2.2 Data classification can be categorized by using nearest neighbor method:

- Spectral analysis consideration.
- Define Training Area for each group of Object which is obtained by setting the parameters then, proceeded to the program for data processing to get the most significant statistics result.

3. Object-base classification by using GLCM Contrast Texture analysis techniques

In the process of object-based classification on SPOT 5 data image, Deffinen 5.0 Program is used for object-based analysis to classify data image, segmentation process, spectral analysis of different objects and Contrast GLCM Texture analysis techniques are required to proceed to data processing in the following significant steps:

3.1 Segmentation is the process of image data classification with close value of spectral analysis, categorized as group of the same object set by the parameters such as scale parameter, color, shape, smoothness and compactness which spectral analysis of each segmentation can be obtained, examined and chosen appropriately and precisely for classification.

3.2 Data classification can be categorized by using nearest neighbor method:

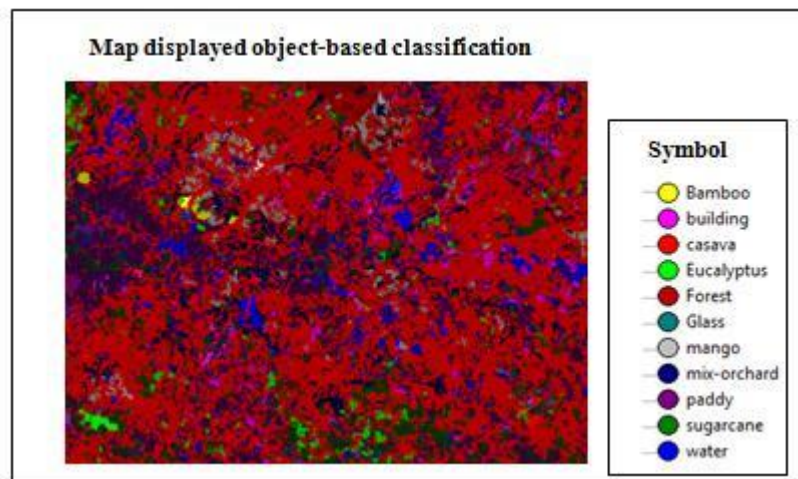
- Spectral analysis consideration.
- Define Training Area for each group of Object which is obtained by setting the parameters.
- Using 5 GLCM Contrast Texture analysis techniques such as all direction, 0°, 45°, 90° and 135° then, proceeded to the program for data processing to get the most significant statistics result.

### 3. RESULTS

1. Results of Object-based Classification

In studying, the most appropriate parameters for Segmentation that used to classify economic crops land utilization, such segmentation has been tested by 5 parameters such as scale parameter, Color, shape, compactness and smoothness in order to get the appropriate representative in object segmentation on 11 classes of representative image.

Experimental parameters results are: Scale parameter 60, Color 0.9, shape 0.1, compactness 0.5 and smoothness 0.5. The results that shown in Fig. 3 are calculated based on pixel in the following table:



**Figure 2:** Map displayed object-based classification

User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	Glass	mango	water	Eucalyptus	building	casava	Bamboo	Sum
<b>Confusion Matrix</b>												
Forest	34327	0	1921	0	0	1326	0	0	0	0	0	37574
sugarcane	0	2506	2790	0	0	0	0	5123	0	0	0	10419
mix-orchard	0	0	7646	0	0	0	0	0	0	0	5543	13189
paddy	0	0	0	75495	5869	0	0	0	0	0	0	81364
Glass	0	0	0	0	4940	0	0	0	0	0	0	4940
mango	3994	0	8057	0	0	3697	0	0	0	0	0	15748
water	0	0	0	0	0	0	30959	0	0	0	0	30959
Eucalyptus	0	0	0	0	0	0	0	22715	0	0	0	22715
building	0	0	0	689	2114	0	0	0	11907	0	0	14710
casava	0	7451	4677	0	0	0	0	0	0	13234	0	25362
Bamboo	0	0	0	0	0	0	0	0	0	0	5075	5075
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
Sum	38321	9957	25091	76184	12923	5023	30959	27838	11907	13234	10618	
<b>Accuracy</b>												
Producer	0.8958	0.2517	0.3047	0.9910	0.3823	0.736	1	0.8160	1	1	0.4780	
User	0.9136	0.2405	0.5797	0.9279	1	0.2348	1	1	0.8094	0.5218	1	
Hellden	0.9046	0.2460	0.3995	0.9584	0.553	0.3560	1	0.8987	0.8947	0.6898	0.6468	
Short	0.8258	0.1402	0.2496	0.92	0.3823	0.2165	1	0.8160	0.8094	0.5218	0.4780	
KIA Per Class	0.8783	0.2207	0.2679	0.9869	0.3704	0.7191	1	0.7985	1	1	0.4677	
<b>Totals</b>												
<b>Overall Accuracy</b>	<b>0.8109</b>											
<b>KIA</b>	<b>0.7773</b>											

Figure 3: Display significant statistics of object-based classification

From table of results displayed combination of pixel classification, it is found that *forest* has high accuracy value while most mixed class of mango and *sugarcane* has low accuracy value, much mixed class of cassava and *mix-orchard* has low accuracy value, much mixed class of mango, cassava, sugarcane and rice *paddy* has high accuracy value and little mixed class of building, *Glass* area has low accuracy value, there is most mixed class of paddy field and building, *Mango* has high accuracy value and other mixed class of forest, and *water* resource has accuracy value 100%, *eucalyptus* has high accuracy value with most mixed class of sugarcane, *Building* has accuracy value 100%, *cassava* also has accuracy value 100%, *Bamboo* has low accuracy value while most mixed class of mix-orchard has totally high accuracy value.

2. Results of object-based classification by GLCM Contrast Texture analysis techniques

2.1. GLCM Contrast all direction

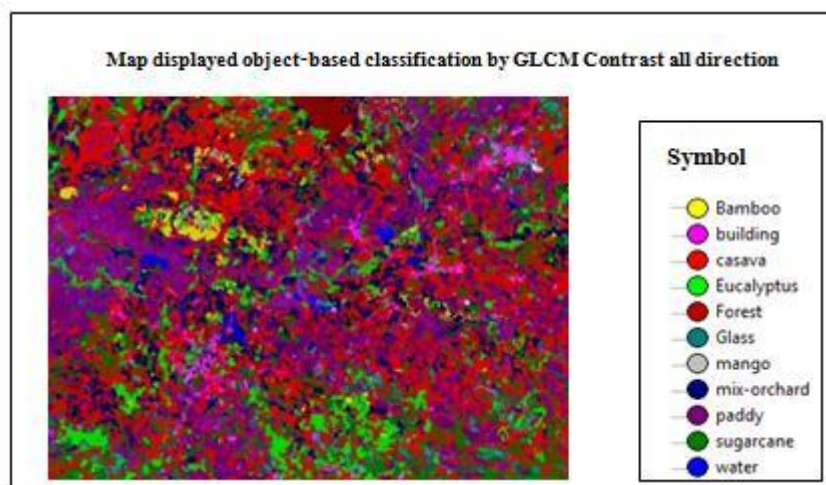


Figure 4: Map displayed object-based classification by GLCM Contrast all direction



Error Matrix based on: ITA.MSA

User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	Glass	mango	water	Eucalyptus	building	cassava	Bamboo	Sum
<b>Confusion Matrix</b>												
Forest	34327	0	5089	0	0	0	0	0	0	0	0	39416
sugarcane	0	8084	0	0	0	0	0	0	0	0	0	8084
mix-orchard	0	1853	20002	0	0	0	0	729	0	0	0	22584
paddy	0	0	0	75109	893	0	0	0	0	0	0	76001
Glass	0	0	0	1076	12090	0	0	0	0	0	0	13166
mango	3594	0	0	0	0	5023	0	0	0	0	0	8617
water	0	0	0	0	0	0	30959	0	0	0	0	30959
Eucalyptus	0	0	0	0	0	0	0	27109	0	0	0	27109
building	0	0	0	0	0	0	0	0	11507	0	0	11507
cassava	0	0	0	0	0	0	0	0	0	13234	0	13234
Bamboo	0	0	0	0	0	0	0	0	0	0	10618	10618
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
Sum	35321	8557	25091	76184	12923	5023	30959	27109	11507	13234	10618	
<b>Accuracy</b>												
Producer	0.8958	0.8129	0.7972	0.9859	0.9309	1	1	0.9738	1	1	1	
User	0.9709	1	0.8853	0.9893	0.9179	0.557	1	1	1	1	1	
Hitler	0.8832	0.8958	0.8389	0.987	0.9244	0.7155	1	0.9867	1	1	1	
Shat	0.7908	0.8129	0.7225	0.9745	0.8593	0.557	1	0.9738	1	1	1	
KIA Per Class	0.9773	0.8069	0.728	0.9801	0.9273	1	1	0.9708	1	1	1	
<b>Totals</b>												
Overall Accuracy	0.9479											
KIA	0.9387											

Figure 5: Display significant statistics of object-based classification by GLCM Contrast all direction

According to classified results by using object-based classification, GLCM Contrast all direction, it is found that *forest* has high accuracy value with little mixed class of mango, *sugarcane* has high accuracy value with much mixed class of mix-orchard, *mix-orchard* has rather high accuracy value with mixed class of forest, *paddy field* has very high accuracy value with little mixed class of Glass area, *Glass* area has very high accuracy value with little mixed class of paddy field, *eucalyptus* has very high accuracy value with little mixed class of mix-orchard, *Mango, water, Building, cassava, and Bamboo* have high accuracy value without other mixed class

2.2. GLCM Contrast 0°

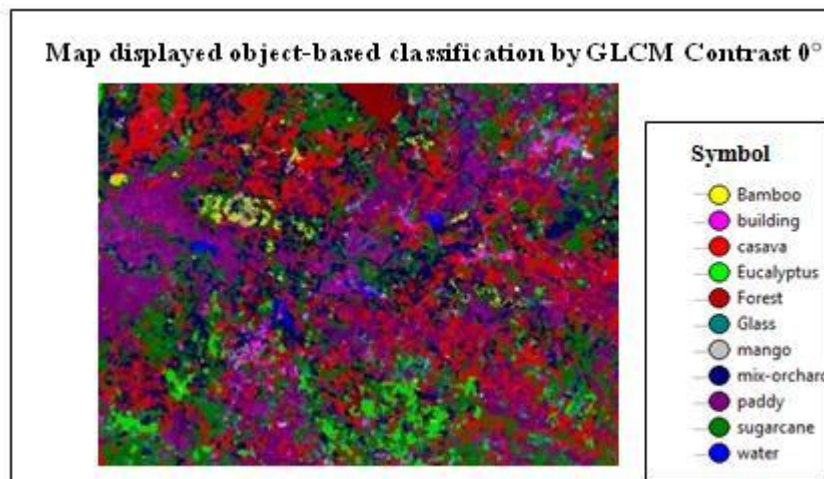


Figure 6: Map displayed object-based classification by GLCM Contrast 0°

Error Matrix based on TTA Mask

User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	glass	mango	water	Eucalyptus	building	cassava	Bamboo	Sum
<b>Confusion Matrix</b>												
Forest	34327	0	5089	0	0	1326	0	0	0	0	0	40742
sugarcane	0	8064	1774	0	0	0	0	0	0	0	0	9838
mix-orchard	0	1863	18228	0	0	0	0	0	0	0	0	20091
paddy	0	0	0	25108	893	0	0	0	0	0	0	26001
Glass	0	0	0	1076	12030	0	0	0	0	0	0	13106
mango	3684	0	0	0	0	3687	0	0	0	0	0	7371
water	0	0	0	0	0	0	30959	0	0	0	0	30959
Eucalyptus	0	0	0	0	0	0	0	27838	0	0	0	27838
building	0	0	0	0	0	0	0	0	11507	0	0	11507
cassava	0	0	0	0	0	0	0	0	0	13234	0	13234
Bamboo	0	0	0	0	0	0	0	0	0	0	10618	10618
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
Sum	36321	8967	25091	26184	12823	5023	30959	27838	11507	13234	10618	
<b>Accuracy</b>												
Producer	0.8958	0.8129	0.7285	0.9659	0.9309	0.736	1	1	1	1	1	
User	0.8425	0.8202	0.9073	0.9883	0.9175	0.4807	1	1	1	1	1	
Hidden	0.8683	0.8165	0.8068	0.987	0.9244	0.5816	1	1	1	1	1	
Shot	0.7673	0.6300	0.6763	0.9745	0.8593	0.41	1	1	1	1	1	
KIA Per Class	0.8766	0.8066	0.7038	0.9601	0.9273	0.728	1	1	1	1	1	
<b>Totals</b>												
Overall Accuracy	0.9389											
KIA	0.928											

Figure 7: Display significant statistics of object-based classification by GLCM Contrast 0°

According to object-based classification by GLCM Contrast 0°, it is found that *forest* has high accuracy value with mixed class of mango, *sugarcane* has high accuracy value with much mixed class of mix-orchard, *mix-orchard* has rather high accuracy value with mixed class of forest, *paddy* has very high accuracy value with little mixed class of glass area, *Glass* has very high accuracy value with little mixed class of paddy, *Mango* has high accuracy value with little mixed class of forest, *eucalyptus*, *water*, *Building*, *cassava* and *Bamboo* have high accuracy value without other mixed class.

2.3. GLCM Contrast 45°

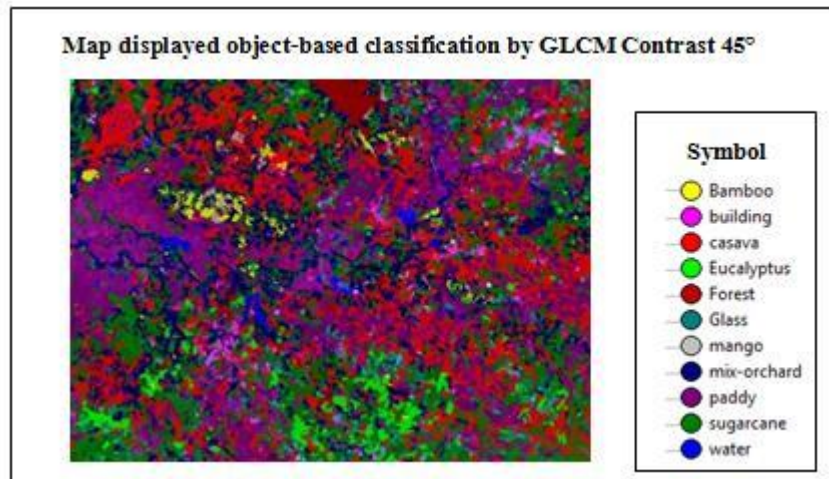


Figure 8: Map displayed object-based classification by GLCM Contrast 45°

Error Matrix based on TTA Mask

User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	Glass	mango	water	Eucalyptus	building	cassava	Bamboo	Sum
<b>Confusion Matrix</b>												
Forest	34327	0	5059	0	0	0	0	0	0	0	0	39416
sugarcane	0	8034	0	0	0	0	0	0	0	0	0	8034
mix-orchard	0	1863	20002	0	0	0	0	729	0	0	0	22594
paddy	0	0	0	75108	853	0	0	0	0	0	0	76001
Glass	0	0	0	1076	12000	0	0	0	0	0	0	13106
mango	3994	0	0	0	0	3687	0	0	0	0	0	7681
water	0	0	0	0	0	0	30959	0	0	0	0	30959
Eucalyptus	0	0	0	0	0	0	0	27108	0	0	0	27108
building	0	0	0	0	0	0	0	0	11907	0	0	11907
cassava	0	0	0	0	0	0	0	0	0	13234	0	13234
Bamboo	0	0	0	0	0	1326	0	0	0	0	10616	11944
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
Sum	38321	8957	25081	76184	12923	5023	30959	27838	11907	13234	10616	
<b>Accuracy</b>												
Producer	0.8958	0.6129	0.7972	0.9659	0.9009	0.736	1	0.5738	1	1	1	
User	0.6209	1	0.6885	0.9823	0.9179	0.4807	1	1	1	1	0.8930	
Median	0.8832	0.8968	0.8388	0.987	0.9244	0.5816	1	0.9867	1	1	0.9412	
Spot	0.7909	0.6129	0.7225	0.9745	0.8953	0.41	1	0.5738	1	1	0.8930	
KIA Per Class	0.6273	0.8869	0.778	0.9801	0.9273	0.728	1	0.5208	1	1	1	
<b>Totals</b>												
Overall Accuracy	0.9429											
KIA	0.9328											

Figure 9: Display significant statistics of object-based classification by GLCM Contrast 45°

According to object-based classification by GLCM Contrast all direction, it is found that *forest* has high accuracy value with little mixed class of mango, *sugarcane* has high accuracy value with much mixed class of mix-orchard, *mix-orchard* has rather high accuracy value with mixed class of forest, *paddy* has very high accuracy value with little mixed class of glass area, *Glass* has very high accuracy value with little mixed class of paddy, *eucalyptus* has very high accuracy value with little mixed class of mix-orchard, *Mango* has high accuracy value with little mixed class of forest, *water*, *Building*, *cassava* and *Bamboo* have high accuracy value without other mixed class.

2.4. GLCM Contrast 90°

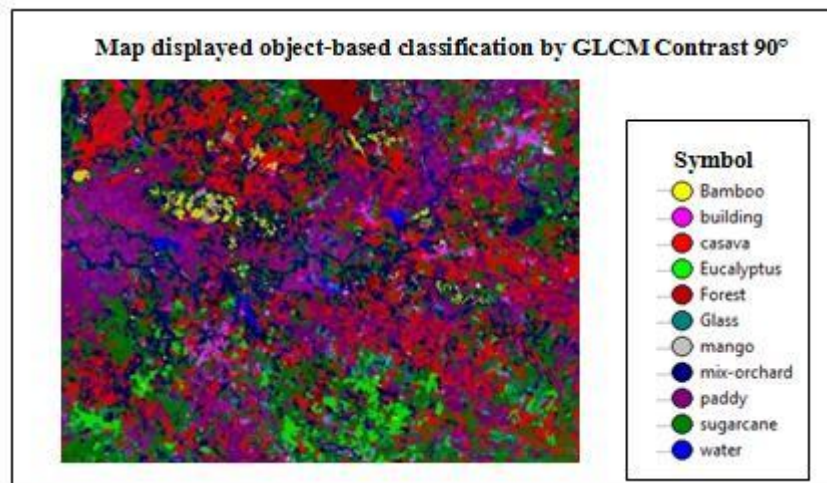


Figure 10: Map displayed object-based classification by GLCM Contrast 90°



Error Matrix based on TTA Mask

User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	Glass	mango	water	Eucalyptus	building	cassava	Bamboo	Sun
<b>Confusion Matrix</b>												
Forest	34327	0	1921	0	0	0	0	0	0	0	0	36248
sugarcane	0	8034	0	0	0	0	0	0	0	0	0	8034
mix-orchard	0	0	20002	0	0	0	0	729	0	0	0	20731
paddy	0	0	0	75108	853	0	0	0	0	0	0	76001
Glass	0	0	0	1076	12030	0	0	0	0	0	0	13106
mango	3994	0	3168	0	0	1326	0	0	0	0	0	8488
water	0	0	0	0	0	0	30859	0	0	0	0	30859
Eucalyptus	0	0	0	0	0	0	0	27108	0	0	0	27108
building	0	0	0	0	0	0	0	0	11507	0	0	11507
cassava	0	1863	0	0	0	0	0	0	0	1324	0	15087
Bamboo	0	0	0	0	0	3687	0	0	0	0	10518	14375
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sun</b>	<b>38321</b>	<b>9557</b>	<b>25091</b>	<b>76184</b>	<b>12523</b>	<b>5023</b>	<b>30859</b>	<b>27838</b>	<b>11507</b>	<b>1324</b>	<b>10518</b>	
<b>Accuracy</b>												
Producer	0.8959	0.8129	0.7972	0.9859	0.9309	0.2640	1	0.9738	1	1	1	
User	0.947	1	0.9649	0.9893	0.9179	0.1562	1	1	1	0.8766	0.7417	
Hitden	0.9207	0.8968	0.873	0.987	0.9244	0.1963	1	0.9867	1	0.9342	0.8517	
Shot	0.883	0.8129	0.7747	0.9745	0.8953	0.1088	1	0.9738	1	0.8766	0.7417	
KIA Per Class	0.878	0.8063	0.7798	0.9801	0.9273	0.2393	1	0.9708	1	1	1	
<b>Totals</b>												
<b>Overall Accuracy</b>	<b>0.9338</b>											
<b>KIA</b>	<b>0.9223</b>											

Figure 11: Display significant statistics of object-based classification by GLCM Contrast 90°

According to object-based classification by GLCM Contrast all direction, it is found that *forest* has high accuracy value with little mixed class of mango, *sugarcane* has high accuracy value with much mixed class of mix-orchard, *mix-orchard* has rather high accuracy with mixed class of forest, *paddy* has very high accuracy value with little of glass empty, *Glass* has very high accuracy value with little mixed class of paddy, *eucalyptus* has very high accuracy value with little mixed class of mix-orchard, *Mango*) has high accuracy value with little mixed class of forest, *water*, *Building*, *cassava* and *Bamboo* have high accuracy value with other mixed class.

2.5. GLCM Contrast 135°

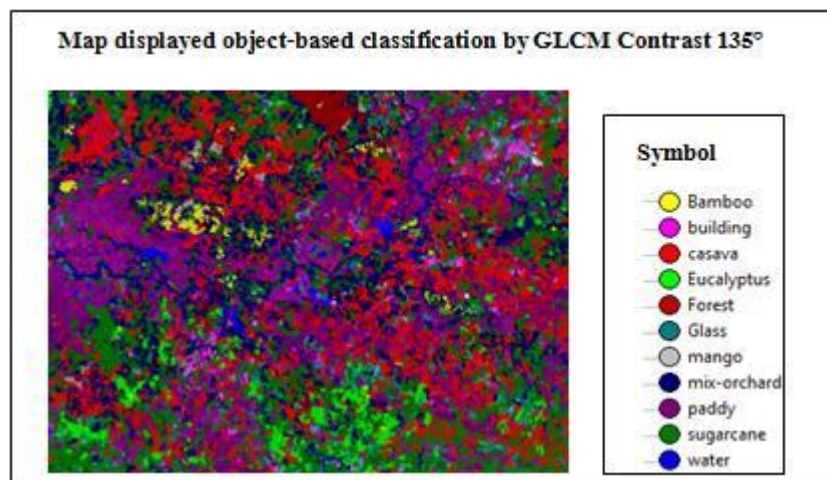


Figure 12: Map displayed object-based classification by GLCM Contrast 135°



User \ Reference Class	Forest	sugarcane	mix-orchard	paddy	Glass	mango	water	Eucalyptus	building	cassava	Bamboo	Sum
<b>Confusion Matrix</b>												
Forest	34327	0	1521	0	0	0	0	0	0	0	0	36248
sugarcane	0	8094	0	0	0	0	0	0	0	0	0	8094
mix-orchard	0	1863	20002	0	0	0	0	729	0	0	0	22594
paddy	0	0	0	75108	890	0	0	0	0	0	0	76001
Glass	0	0	0	1076	12030	0	0	0	0	0	0	13106
mango	3994	0	3188	0	0	1328	0	0	0	0	0	8488
water	0	0	0	0	0	0	30659	0	0	0	0	30659
Eucalyptus	0	0	0	0	0	0	0	27109	0	0	0	27109
building	0	0	0	0	0	0	0	0	11907	0	0	11907
cassava	0	0	0	0	0	0	0	0	0	13234	0	13234
Bamboo	0	0	0	0	0	3697	0	0	0	0	10618	14315
unclassified	0	0	0	0	0	0	0	0	0	0	0	0
Sum	38321	9957	25091	76184	12923	5023	30659	27808	11907	13234	10618	
<b>Accuracy</b>												
Producer	0.8998	0.8129	0.7972	0.9859	0.9309	0.2640	1	0.9738	1	1	1	
User	0.947	1	0.8853	0.9883	0.9179	0.1562	1	1	1	1	0.7417	
Median	0.9207	0.8968	0.8389	0.987	0.9244	0.1983	1	0.9867	1	1	0.8517	
Short	0.853	0.8129	0.7225	0.9745	0.8593	0.1068	1	0.9738	1	1	0.7417	
KIA Per Class	0.879	0.9069	0.779	0.9801	0.9273	0.2393	1	0.9708	1	1	1	
<b>Totals</b>												
Overall Accuracy												0.9338
KIA												0.9223

Figure 13: Display significant statistics of object-based classification by GLCM Contrast 135°

According to object-based classification by GLCM Contrast all direction, it is found that *forest* has high accuracy value with little mixed class of mango, *sugarcane* has high accuracy value with much mixed class of mix-orchard, *mix-orchard* has rather high accuracy value with mixed class of forest, *paddy* has very high accuracy value with little of glass empty, *Glass* has very high accuracy value with little mixed class of paddy, *eucalyptus* has very high accuracy value with little mixed class of mix-orchard, *Mango* has high with little mixed class of forest, *water*, *Building*, *cassava* and *Bamboo* have high accuracy value with other mixed class.

### 3. Comparison of data classification results

Table 1 Display comparison results between object-based classification by using spectral analysis and GLCM contrast (%)

Class \ contrast	spectral	all direction	0°	45°	90°	135°
Forest	87.83	87.73	87.66	87.73	87.73	87.90
sugarcane	22.07	80.69	80.56	80.69	80.69	80.69
mix-orchard	26.79	77.80	70.38	77.80	77.80	77.80
paddy	98.69	98.01	98.01	98.01	98.01	98.01
Glass	37.04	92.73	92.73	92.73	92.73	92.73
mango	71.91	100.00	72.80	72.80	72.80	23.93
water	100.00	100.00	100.00	100.00	100.00	100.00
Eucalyptus	79.85	97.08	100.00	97.08	97.08	97.08
building	100.00	100.00	100.00	100.00	100.00	100.00
cassava	100.00	100.00	100.00	100.00	100.00	100.00
Bamboo	46.77	100.00	100.00	100.00	100.00	100.00
Overall accuracy	81.09	94.79	93.89	94.29	94.29	93.38
KIA	77.73	93.87	92.81	93.28	93.28	92.23

In table 1, it is found that object-based classification by both spectral analysis and GLCM Contrast methods; the precision of object based classification is 92-94% and 81.09%.

If it is considered by class, it is found that object-based classification by GLCM Contrast and it is found that object-based classification by spectral analysis, *forest* and *paddy* obtain accuracy value little better than by GLCM Contrast while both methods can obtain 100% accuracy in the class of *water*, *building* and *Cassava*, the object-based classification by GLCM Contrast obtains accuracy value much better than by spectral analysis in the rest 6 classes as shown in the table.

#### 4. CONCLUSIONS & RECOMMENDATIONS

According to studying comparison results obtained from Object-based classification process of plantation area of economic crops by using Spectral analysis and Texture algorithms techniques from SPOT5 satellite data, it is found that Texture algorithms techniques obtains results of accuracy better than Spectral analysis at 94.79% and 81.09% respectively, when it is compared separately by class, it is found that object-based classification by using GLCM can obtain accuracy better than spectral analysis and it is also found that 5 Contrasts can classify accuracy in each class differently, so it should select to use appropriately.

#### 5. REFERENCES

References from Books:

Definiens Cognition Network Technology. Definiens professional 5.0 User Guide , 2006.

Operations Manual for the preparation of land use map of the state. (2011) Land Development Department Ministry of Agriculture and Cooperatives. <sup>T</sup>

Suthinee Dontre . (2006). Remote Sensing. Department of Geography, Faculty of Social science, Chiangmai university ,Thailand. <sup>T</sup>

References from Other Literature:

Ehles ,M. et al.(2006). Decision based data fusion techniques for the analysis of settlement Areas from multisensory satellite data. ASPRS 2006 Annual Conference to be held in Reno. Nevada , 2006 May 1-5. <sup>T</sup>

Hall-Beyer,M. (2008). The GLCM Tutorial Home Page . from: URL <http://www.fp.ucalgary.ca/mhallbey/>

Kressler, F.P, Kim,Y.S. , Steinnocher, K.T.( 2003). Object-oriented land cover classification of panchromatic KOMPSAT-1 and SPOT-5 data. Geoscience and Remote Sensing Symposium, 2003. IGARSS '03. Proceedings. 2003 IEEE International.

[1] Monphol Thanaboonkarn and Assoc.Prof. Vichai Yiengveerachon.(2009). Comparison Classification Procedure by Pixel-based and Object-based Methods Using ALOS AVNIR-2 Satellite Image. Geoinfotech 2009, IMPACT Convention Centre, Muang Thong Thani, Thailand. 2009, 21-23 January. <sup>T</sup>

Patcharavadee Thamarux and Vichai Yiengveerachon (2010). Color-orthophoto classification by object-based analysis. Geoinfotech, IMPACT Convention Centre, Muang Thong Thani, Thailand.2010, 15-17 December. <sup>T</sup>

Prachinburi province.(2009). Recapitulate of year 2008 . from: URL <http://www.prachinburi.go.th>.

Puetz, A.M. , Olsen, R.C. (2006). Haralick Texture Features Expand Into The Spectral Domain. 2006 Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XII edited by Sylvia S. Shen, Paul E. Lewis, Proc. Vol. 6233,623311.

Whiteside,T., Ahmad, W. A comparison of object-oriented and pixel-based classification methods for mapping land cover in Northern Australia. The national biennial Conference of the Spatial Sciences Institute September 2005.