

Comparison of Pixel Based and Object Oriented Classifications in Land Cover Mapping in the Red River Delta. Example of Duy Tien District, Ha Nam Province, Vietnam.



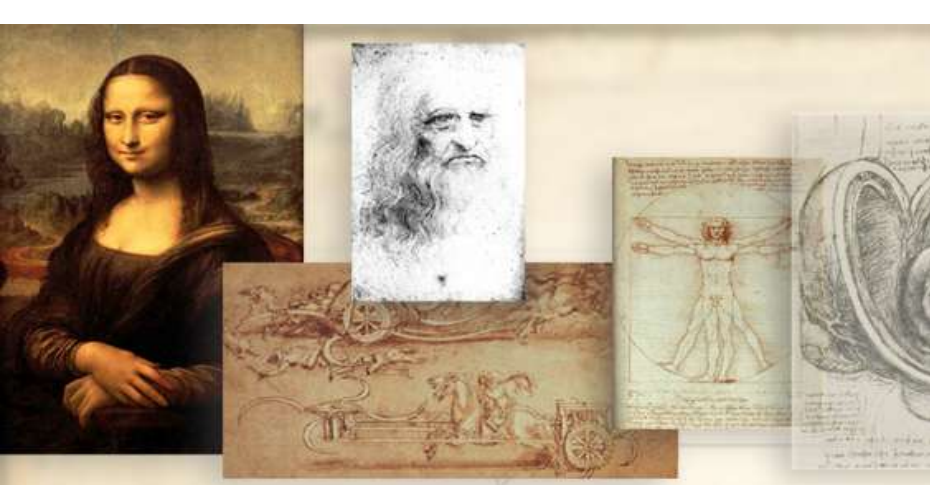
**Pham Van Cu, Nguyen Thuy Hang,
Nguyen Phan Dong, ICARGC, VNU,**



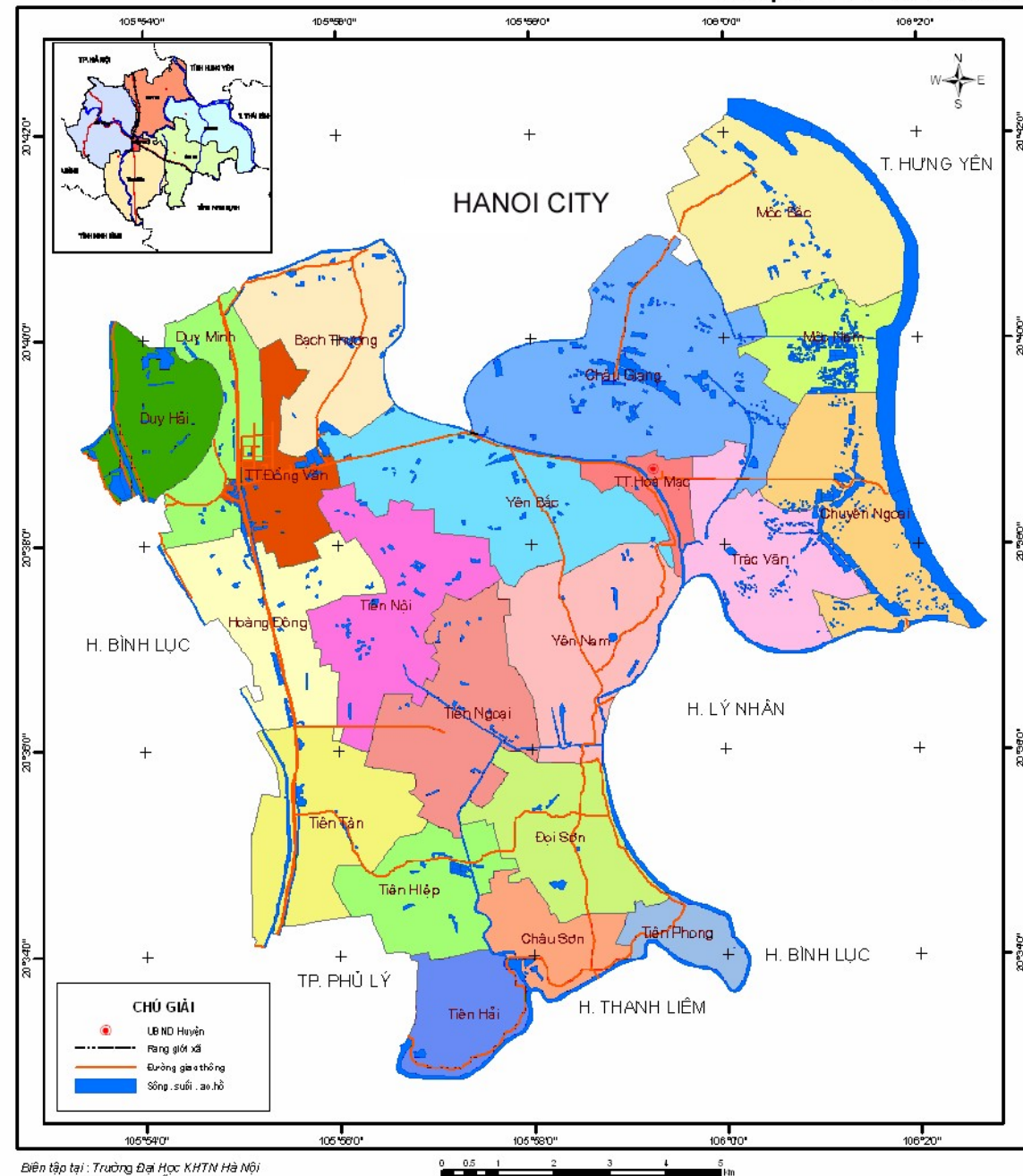


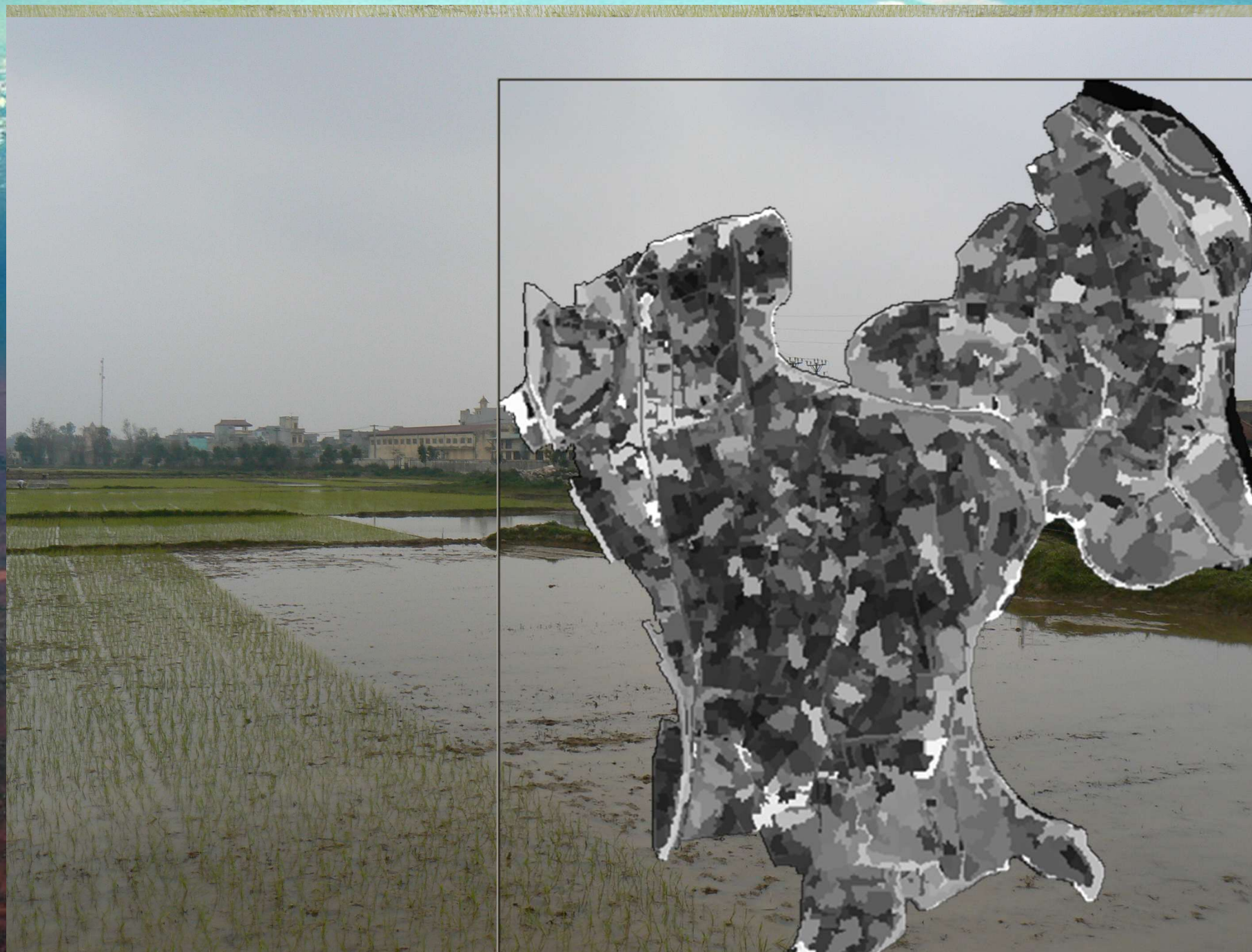
Content

- Land use management needs
- Land Use Patterns and Spectral Confusion in the Red River Delta
- Comparison of MCL and O-O methods
- Conclusion



- Rapid land use changes
- Rapid land transformation
- 5 year inventory seems to be unsufficient for daily operation





MLC Method Description



Maximum Likelihood (ML):

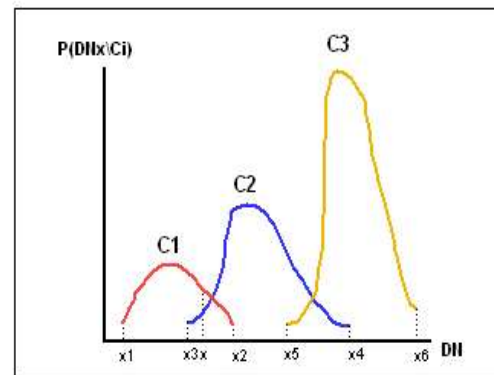
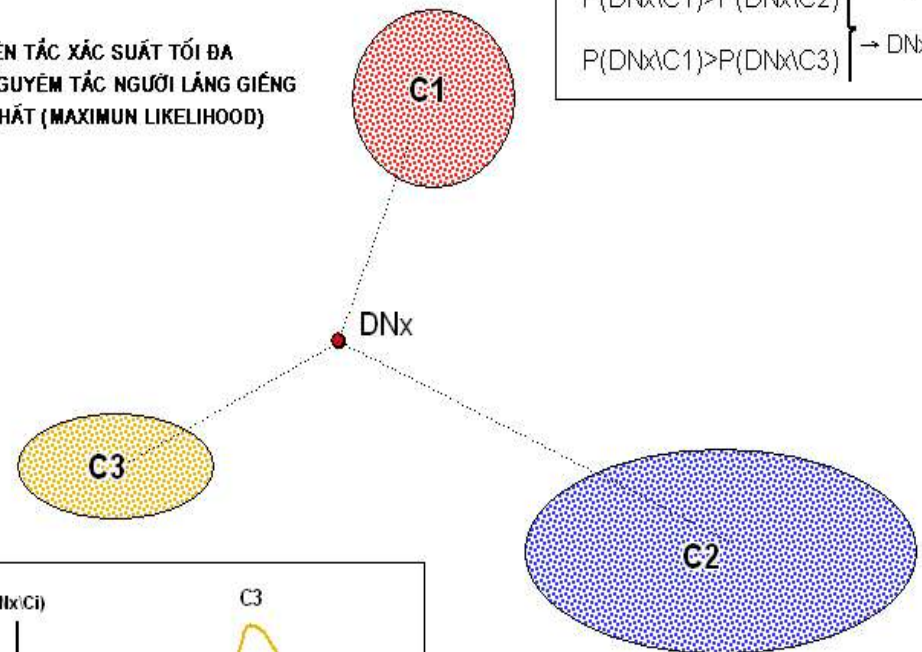
$$P(DN_x/C_i) = (P(DN_x) * P(C_i/DN_x)) / P(C_i)$$

***DN = Binarized Spectral Response
(Into Grey Level of 2^8)***

(Jensen 2001)

NGUYÊN TẮC XÁC SUẤT TỐI ĐA
HAY NGUYÊN TẮC NGƯỜI LÃNG GIỀNG
GẦN NHẤT (MAXIMUM LIKELIHOOD)

$$\left. \begin{array}{l} P(DN_x/C_1) > P(DN_x/C_2) \\ P(DN_x/C_1) > P(DN_x/C_3) \end{array} \right\} \rightarrow DN_x \in C_1$$

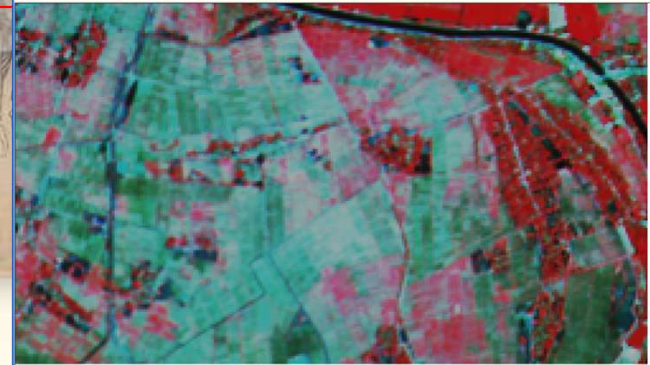


OO Method description

- Image is considered as a set of objects rather than that of pixels
- Segmentation is the first step of procedures rather than sampling
- Knowledge and cognitive perception are basic rather than spectral characteristics

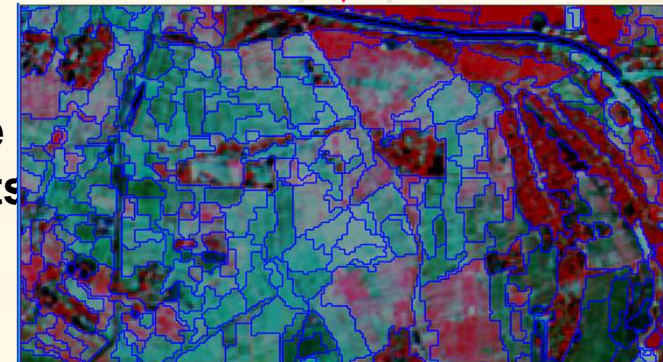
(Ursula C. Benz, Peter Hofmann et al. 2004; Denfinies 2007)

Image



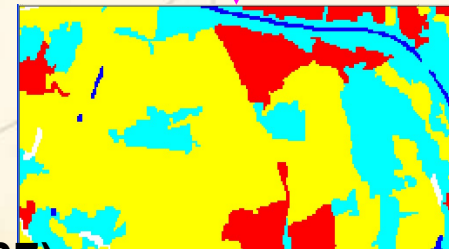
Segmentation

Image Objects



Rules (+parametrs)

Thematic Objects

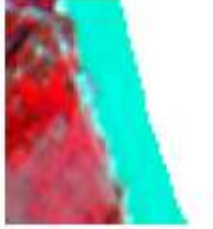
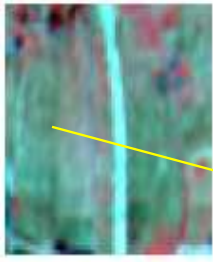


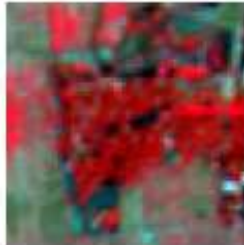
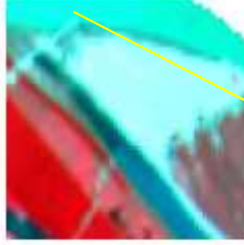
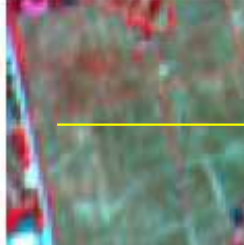


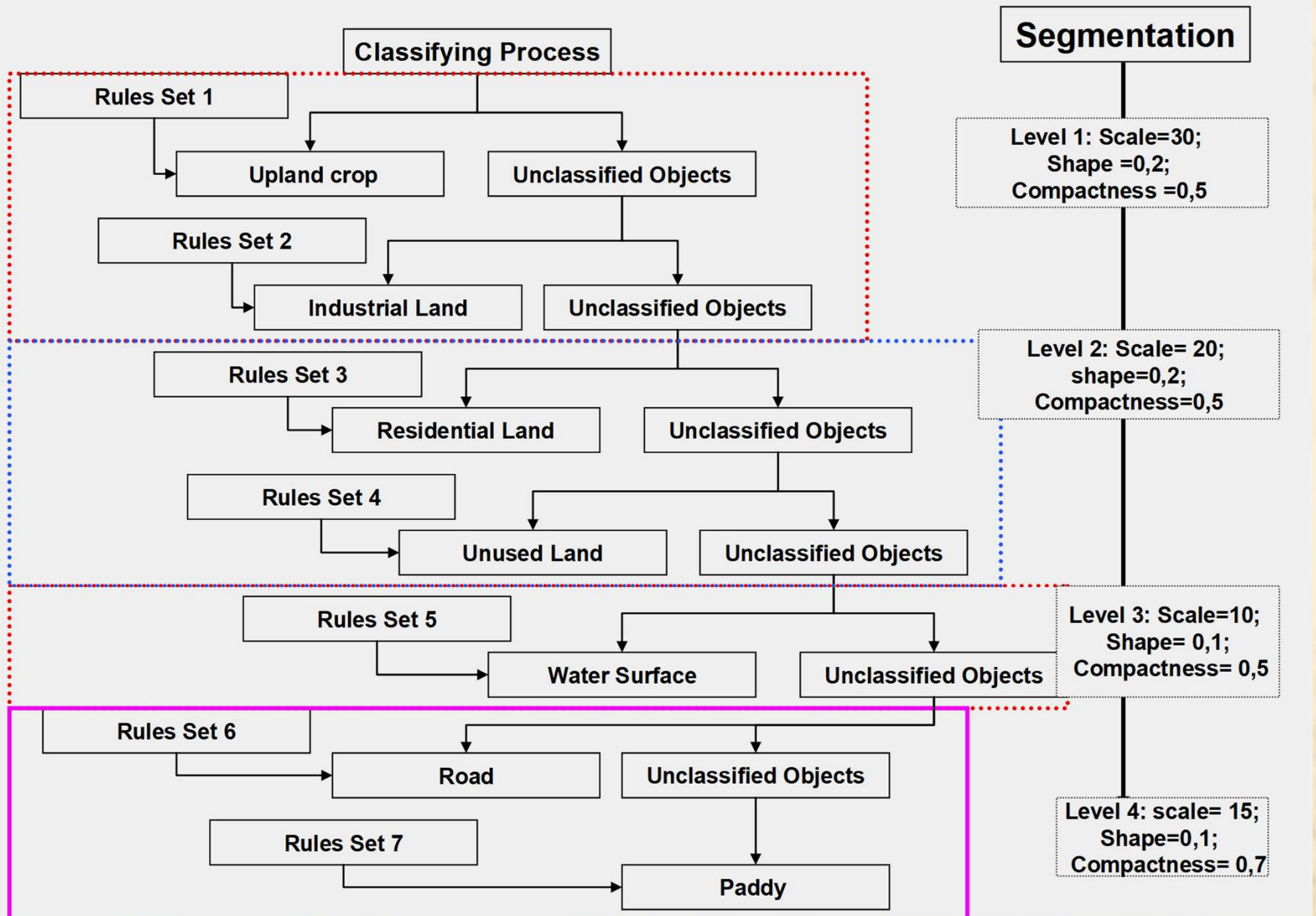
Bảng so sánh hai phương pháp phân loại: PLTK và ĐHĐT

	Color (Spectrum)	Shape	Area/ Size	Texture	Context
MLC	✓ ■	X	X	X	X
OO	✓ ■	✓ ■	✓ ■	✓ ■	✓ ■

Terrain Reference

STT	Đối tượng	Trên ảnh	Thực địa	Mô tả đối tượng
1	Sông			Có dạng uốn khúc điển hình, cấu trúc ảnh phẳng mịn,
2	Hồ, ao			Phân bố cạnh khu dân cư, có hình dạng nhân tạo, cấu trúc phẳng mịn.
3	Hoa màu			Có màu đỏ trên ảnh, cấu trúc mịn phẳng, thường phân bố ven sông, bên cạnh khu dân cư NT.(Ngô, đậu đỗ ...)
4	Đường giao thông			Có màu sáng xanh, phân bố dạng tuyến điển hình, nối các đối tượng khu dân cư với nhau.

5	Khu Công nghiệp			Có màu sáng xanh, có hình dạng theo quy hoạch, phân bố cạnh các đường giao thông lớn ...
6	Khu Dân cư			Có hình dạng không cố định, màu sắc phụ thuộc vào cây, nhà, mặt nước, phân bố ven sông, cạnh đường GT,
7	Đất Chưa sử dụng			Có màu sáng xanh, hoặc trắng, thường là bãi cát ven biển ven sông
8	Đất ảm (lúa sau khi thu hoạch)			Lúa sau khi đã thu hoạch xong màu sắc của đối tượng phụ thuộc độ ẩm. Hình dạng ô ruộng, bên cạnh là các khu dân cư NT





Segmentation parameters

level		(level 1)	(level 2)	(level 3)	(level 4)
(Scale parameter)		30	20	10	15
Weight	(color)	0,8	0,8	0,9	0,9
	(shape)	0,2	0,2	0,1	0,1
	(compactness)	0,5	0,5	0,5	0,7
	(smoothness)	0,5	0,5	0,5	0,3

Rules Sets

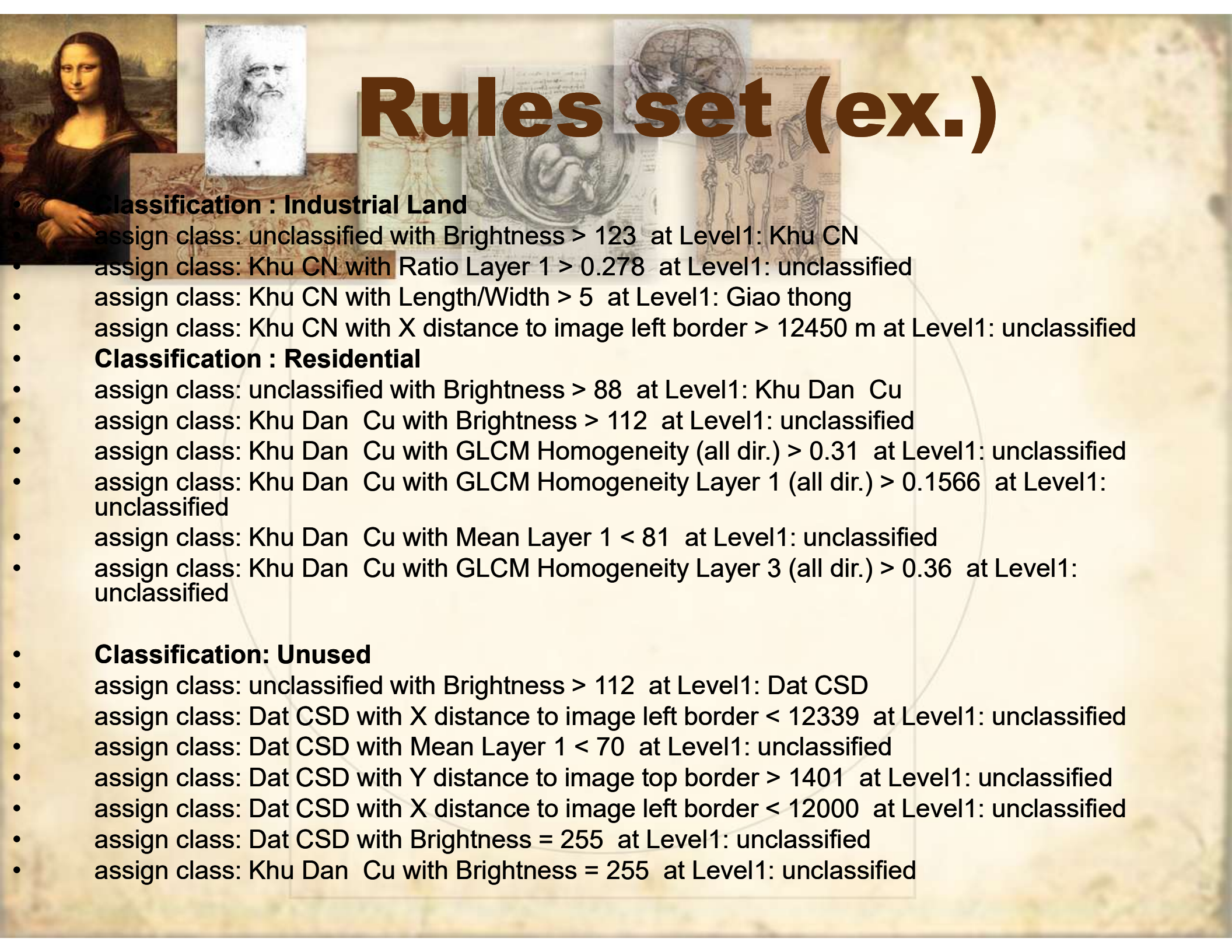
Mean

Standard Deviation

- Band Ratio
- Shape
- Location
- Homogeneity
- Contrast...

Image Object Information

Feature	Value
Layer Values	Mean
Brightness	115.64
Layer 1	112.76
Layer 2	118.62
Layer 3	115.54
Max. diff.	0.050680
Layer Values	Standard deviation
Layer 1	5.664
Layer 2	4.332
Layer 3	2.881
Pixel-based	Ratio
Layer 1	0.3250
Layer 2	0.3419
Layer 3	0.3331
Shape	Generic
Area	31600
Asymmetry	0.5755
Density	1.303
Length/Width	1.971
Rectangular Fit	0.5480
Rectangular Fit (legacy feature, up to V3.5)	0.5480
Shape index	2.363
Shape	Position
Distance to image border	6040
X Center	598833.9910506
X distance to image left border	6040
X distance to image right border	9940
Y distance to image bottom border	8700
Y distance to image top border	8500
GLCM Homogeneity	All directions
GLCM Homogeneity (all dir.)	0.2878
Layer 1	0.1462
Layer 2	0.1488
Layer 3	0.3022
GLCM Contrast	All directions
GLCM Contrast (all dir.)	13.94
Layer 1	57.39
GLDV Contrast	All directions
Layer 2	42.78
Layer 3	9.979



Rules set (ex.)

Classification : Industrial Land

- assign class: unclassified with Brightness > 123 at Level1: Khu CN
- assign class: Khu CN with Ratio Layer 1 > 0.278 at Level1: unclassified
- assign class: Khu CN with Length/Width > 5 at Level1: Giao thong
- assign class: Khu CN with X distance to image left border > 12450 m at Level1: unclassified

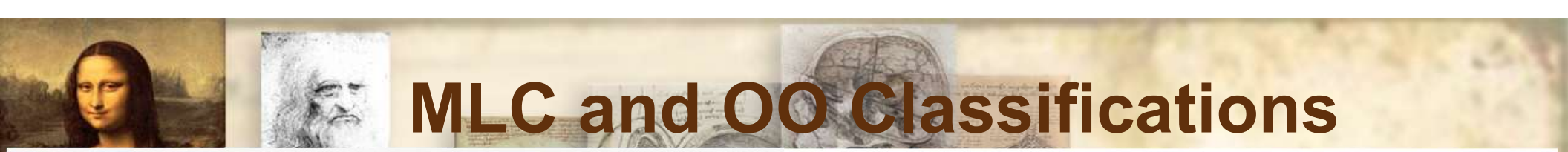
Classification : Residential

- assign class: unclassified with Brightness > 88 at Level1: Khu Dan Cu
- assign class: Khu Dan Cu with Brightness > 112 at Level1: unclassified
- assign class: Khu Dan Cu with GLCM Homogeneity (all dir.) > 0.31 at Level1: unclassified
- assign class: Khu Dan Cu with GLCM Homogeneity Layer 1 (all dir.) > 0.1566 at Level1: unclassified
- assign class: Khu Dan Cu with Mean Layer 1 < 81 at Level1: unclassified
- assign class: Khu Dan Cu with GLCM Homogeneity Layer 3 (all dir.) > 0.36 at Level1: unclassified

Classification: Unused

- assign class: unclassified with Brightness > 112 at Level1: Dat CSD
- assign class: Dat CSD with X distance to image left border < 12339 at Level1: unclassified
- assign class: Dat CSD with Mean Layer 1 < 70 at Level1: unclassified
- assign class: Dat CSD with Y distance to image top border > 1401 at Level1: unclassified
- assign class: Dat CSD with X distance to image left border < 12000 at Level1: unclassified
- assign class: Dat CSD with Brightness $= 255$ at Level1: unclassified
- assign class: Khu Dan Cu with Brightness $= 255$ at Level1: unclassified

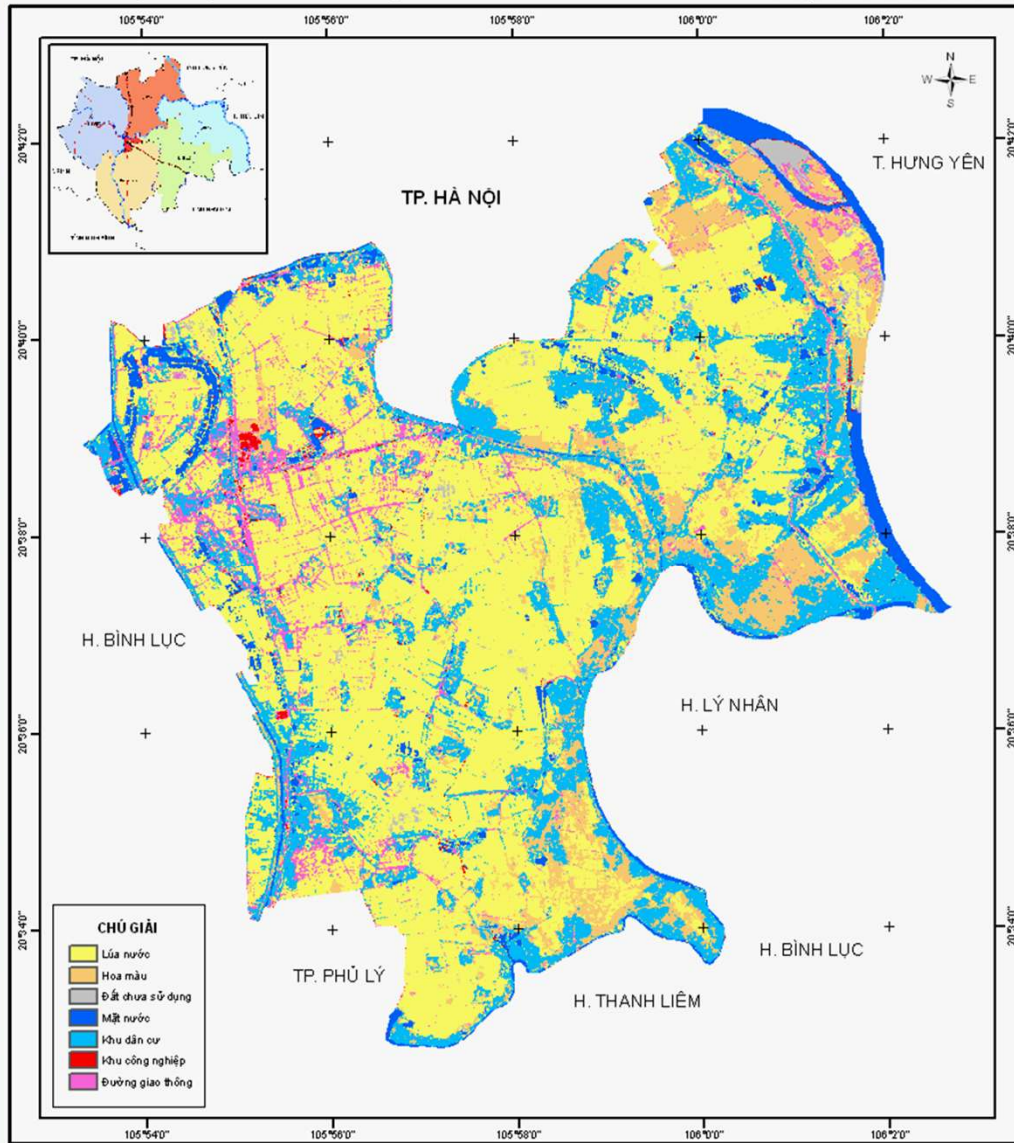




MLC and OO Classifications

BẢN ĐỒ HIỆN TRẠNG LỚP PHỦ MẶT ĐẤT NĂM 2003

HUYỆN DUY TIÊN - HÀ NAM

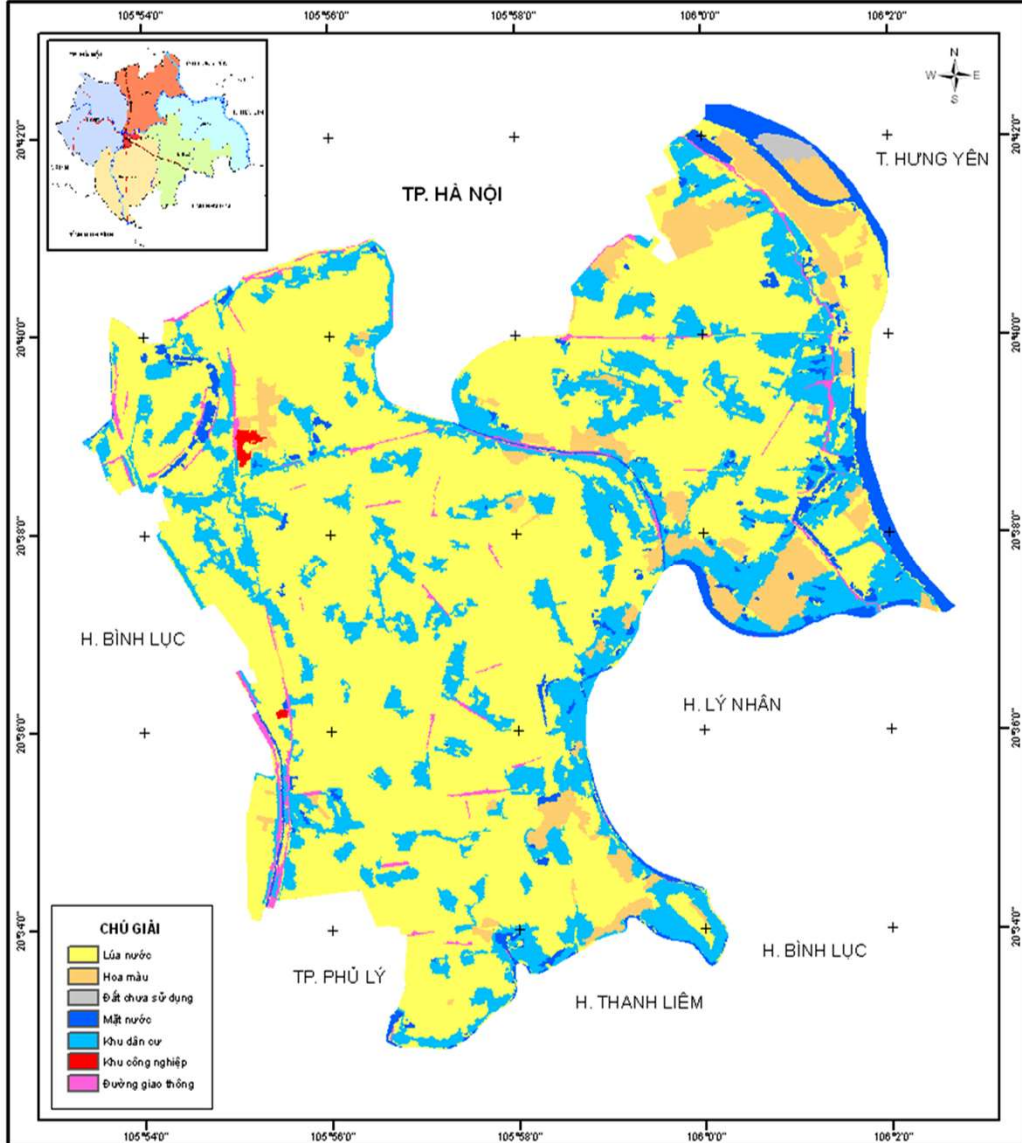


Bản tập tại : Trường Đại Học KHTN Hà Nội
Người biên tập : Nguyễn Phan Đồng

MLC

BẢN ĐỒ HIỆN TRẠNG LỚP PHỦ MẶT ĐẤT NĂM 2003

HUYỆN DUY TIÊN - HÀ NAM

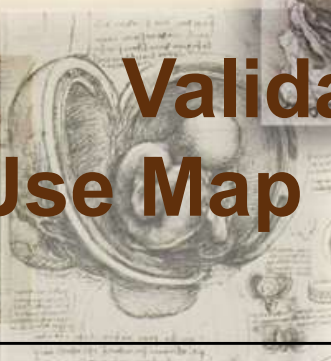


Bản tập tại : Trường Đại Học KHTN Hà Nội
Người biên tập : Nguyễn Phan Đồng

OO



	Paddy	Upland Crop	Unused Land	Water Surface	Residential Land	Industrial Land	Road
Paddy	37752000	1005600	31200	1254000	4560400	30800	659600
Upland Crop	14373200	19464800	2400	16000	8806400	25200	557200
Unused Land	1774800	57600	365200	738800	195200	142800	192800
Water Surface	229200	34800	38400	4497200	290400	1600	2000
Residential Land	4022000	1156800	400	552000	20877200	2400	128000
Industrial Land	989200	46000	70800	1431200	364000	1316000	68400
Road	4586400	477600	96800	62800	2536000	842800	1486800
Classified by OO	63726800	22243200	605200	8552000	37629600	2361600	3094800
MLC/OO	59%	87%	60%	52%	55%	56%	48%



Validation (with Land Use Map 1:10000 of Duy Tien)

	Pixel- based classification						
Land Use	Paddy	Upland Crop	Water Surface	Residential Land	Industrial Land	Road	Total (m2)
Residential Land on Land use Map (m2)	232000	440000	800	1902000	4800	108400	2688000

	Object- Oriented classification						
Land Use	Paddy	Upland Crop	Water Surface	Residential Land	Industrial Land	Road	Total (m2)
Residential Land on Land use Map (m2)	152800	11200	800	2519200	1600	2400	2688000



Conclusion

- MLC may reach high Kappa value but not necessarily high reliability.
- O-O is closer to cognitive thinking of image interpreter
- Ground truthing can complete the knowledge
- O-O can be used as interpretation tool rather than classification one in which we can use non remote sensing data as supplementary sources.