

# Comparision of manual (visual) and digital classification of forest trees using images acquired by UAVs

Krzysztof Będkowski

Uniwersytet Łódzki

Paweł Szymański

SGGW w Warszawie

# Nalot 27-X-2011 r.

RGB Orthomosaic

# Nalot 27-X-2011 r.

RGB Orthomosaic  
with crown's  
segments

Sample plot no 4

# Nalot 27-X-2011 r.



Crowns clasified manually (visually) into 5 classes:

G – green

G/Y – green/yellow

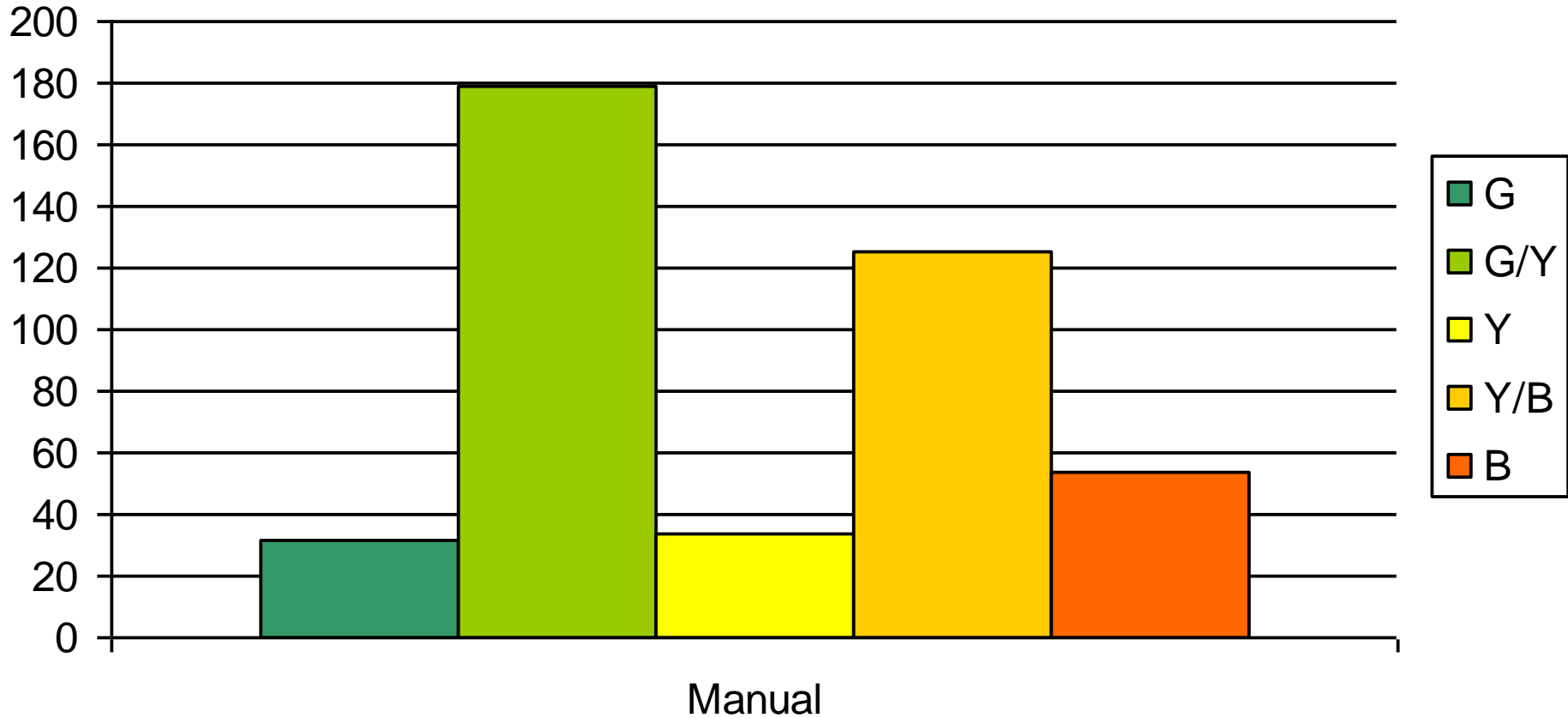
Y – yellow

Y/B – yellow/brown

B – brown

Black segments are unclassified trees

# Manual tree's classification



# Tested Procedures of Supervised Classification

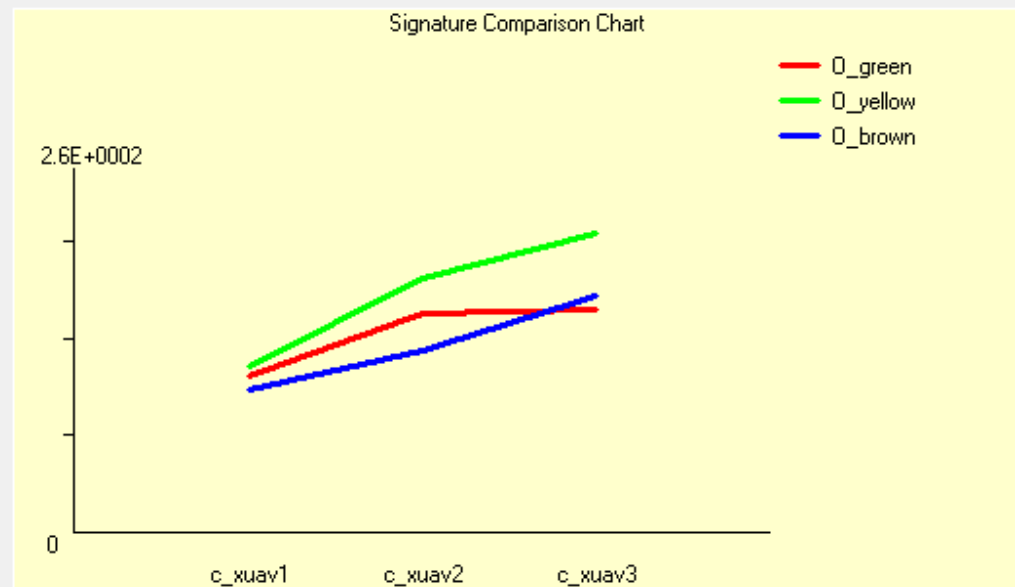
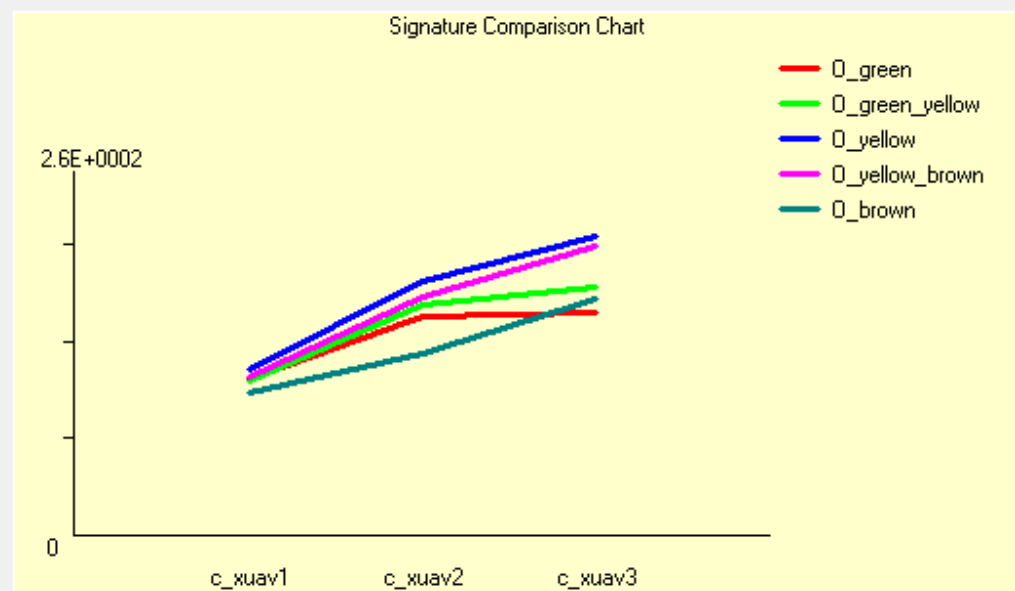
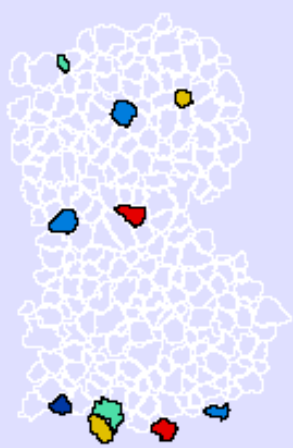
MINDIST – Minimum Distance

MAXLIKE – Maximum Likelihood

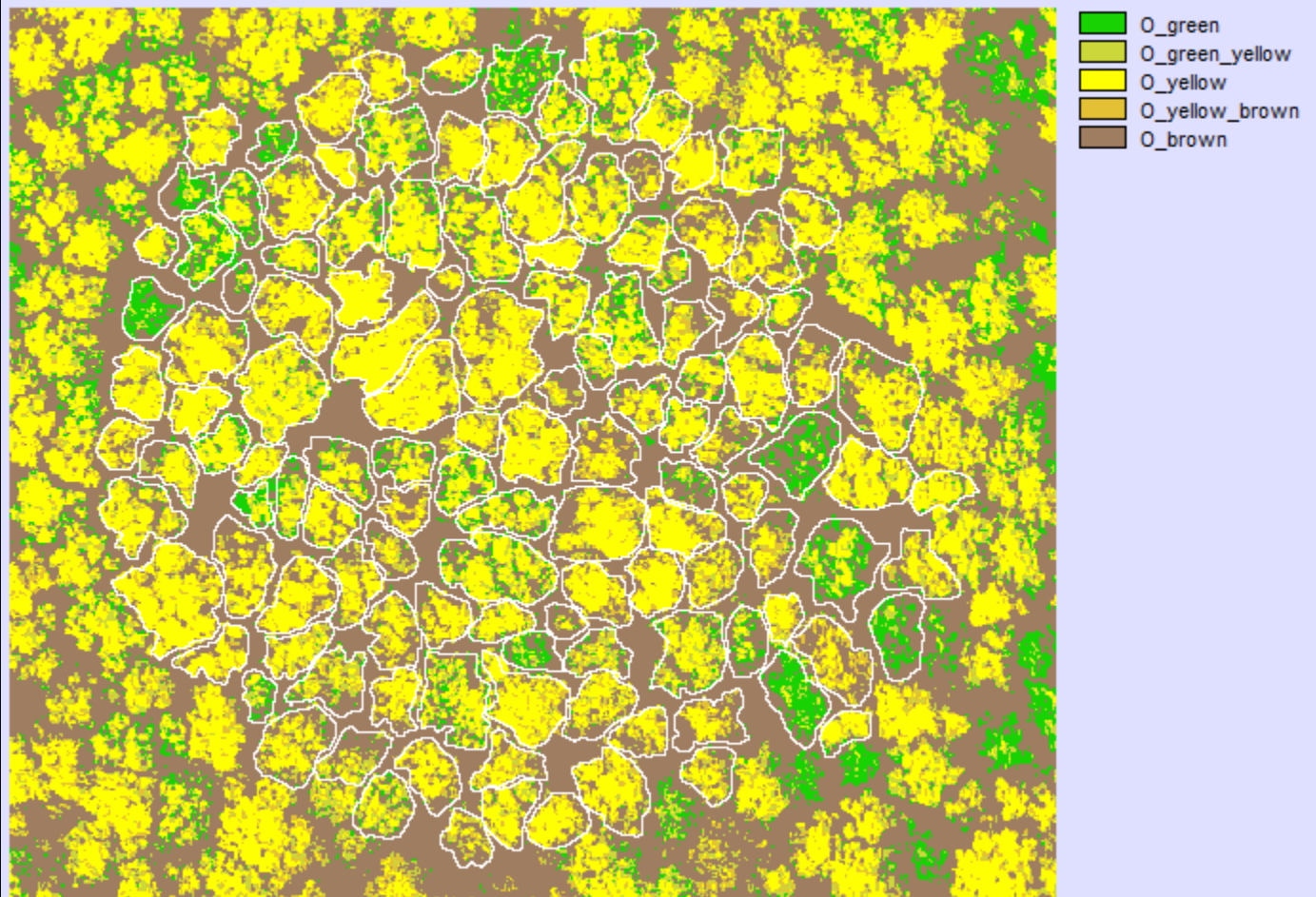
Fisher – Fisher Classification

kNN – k Nearest Neighbours

# 2011 Sessile Oak Gluchow



# Minimum Distance Classification

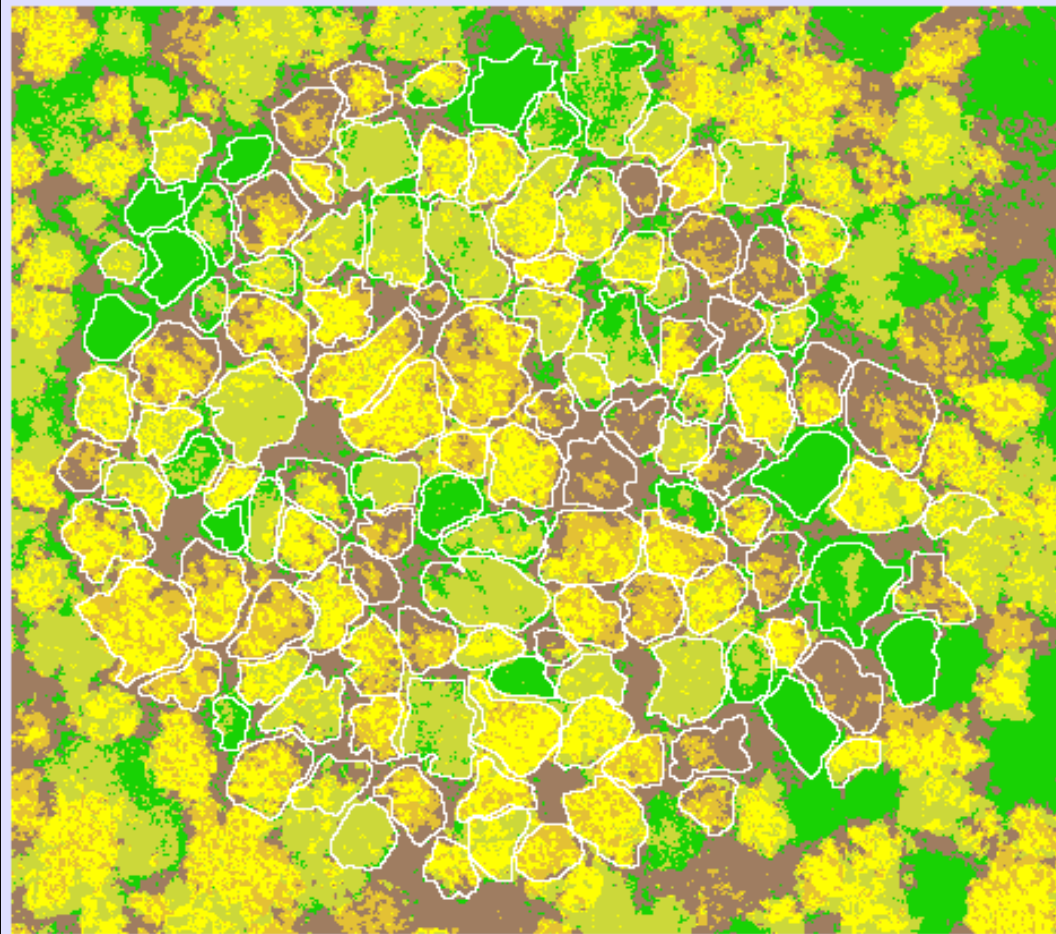


Ambiguous results of pixel-based classification

Within crowns are pixels classified into different classes



# Maximum Likelihood Classification

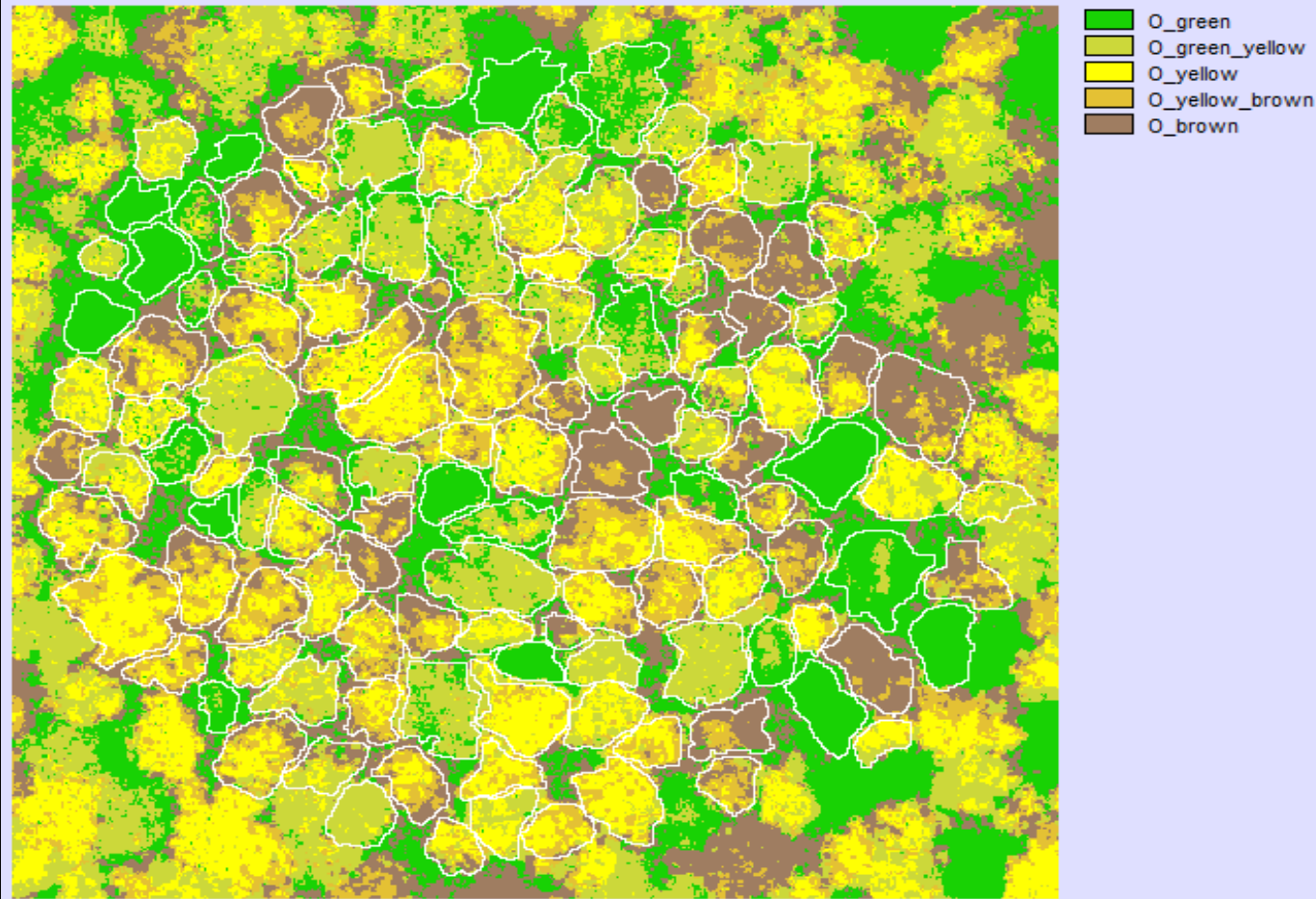


- O\_green
- O\_green\_yellow
- O\_yellow
- O\_yellow\_brown
- O\_brown

Ambiguous  
results of pixel-  
based  
classification

Within crowns  
are pixels  
classified into  
different  
classes

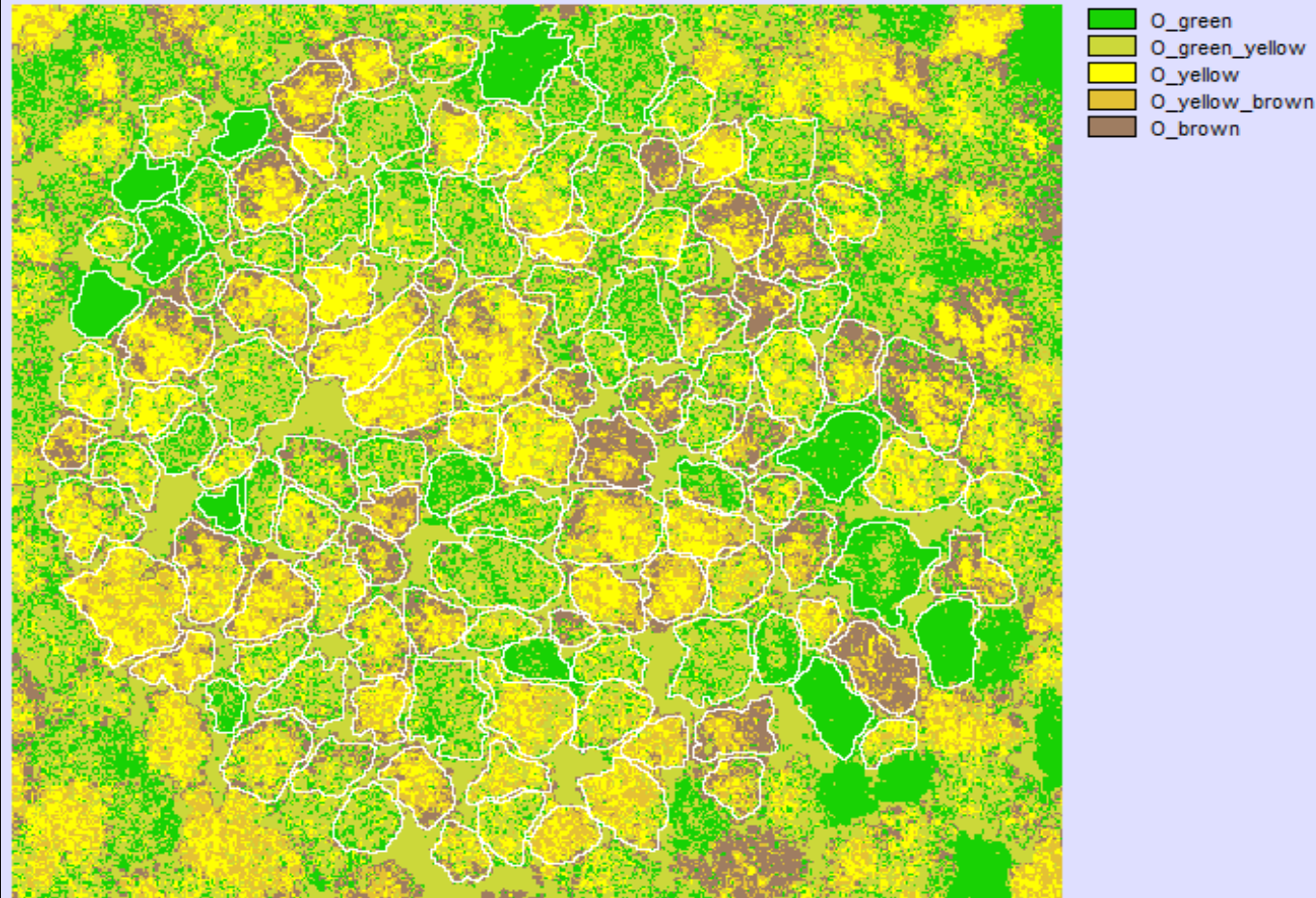
## Fisher Classification



Ambiguous  
results of pixel-  
based  
classification

Within crowns  
are pixels  
classified into  
different  
classes

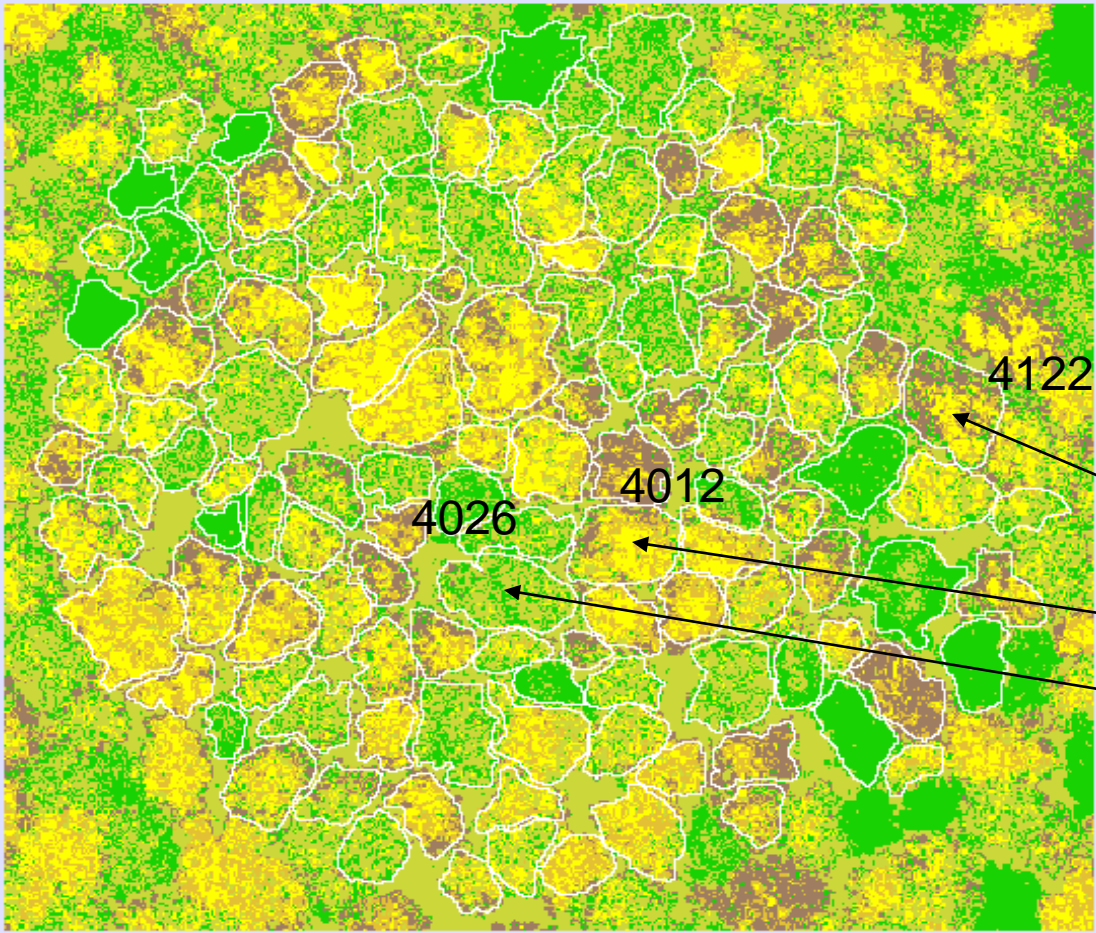
## Classification kNN



Ambiguous  
results of pixel-  
based  
classification

Within crowns  
are pixels  
classified into  
different  
classes

# Classification kNN



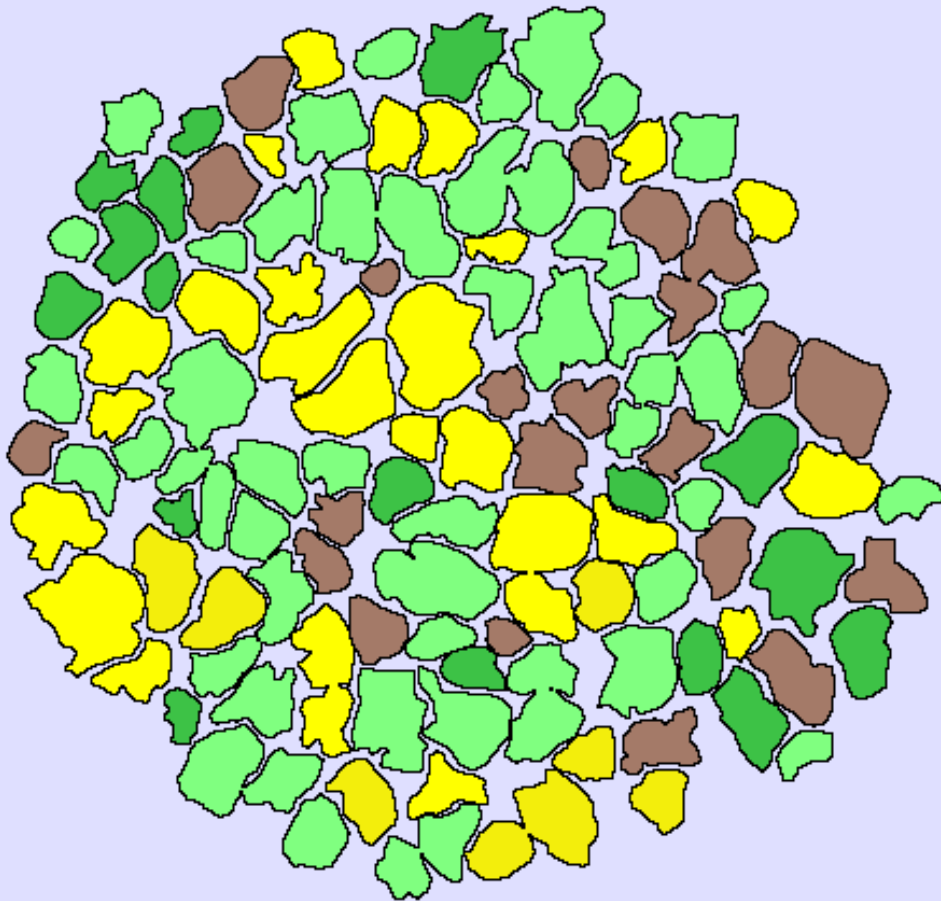
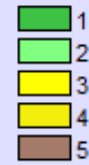
- O\_green
- O\_green\_yellow
- O\_yellow
- O\_yellow\_brown
- O\_brown

## Solution?

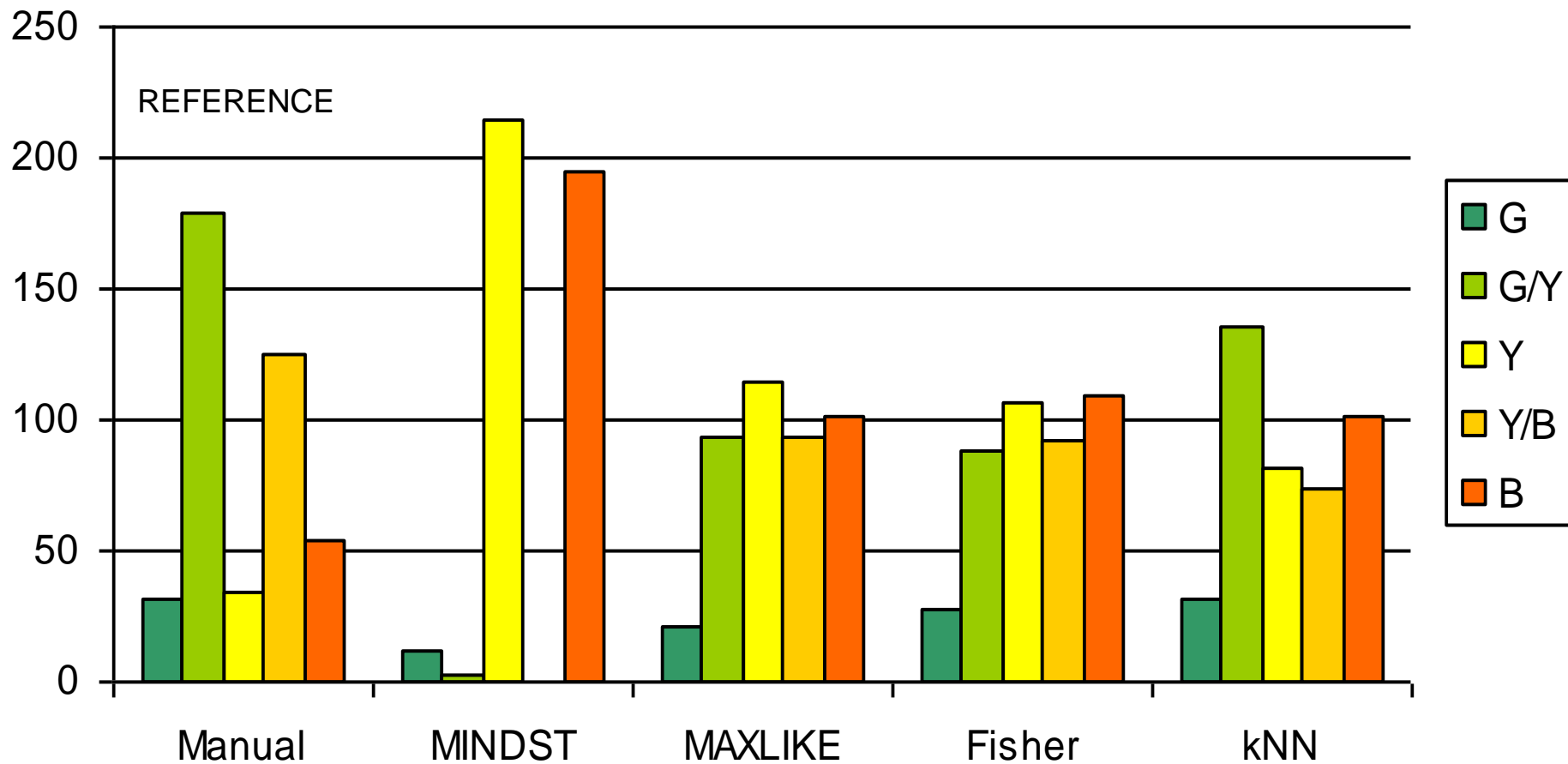
Majority of pixels (mode) may be used to decide about crown's classification

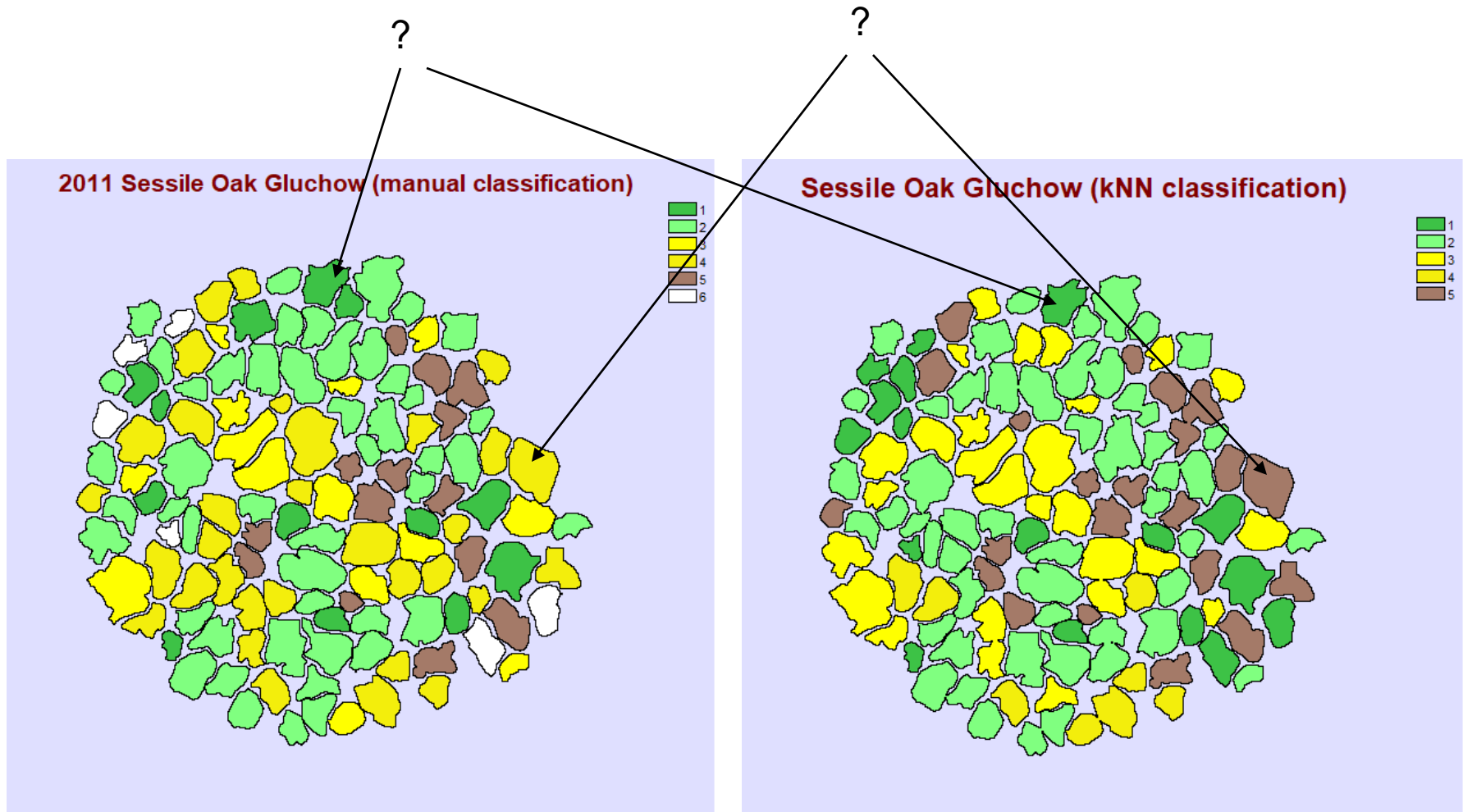
G	G/Y	Y	Y/B	B
13	12	23	16	36
6	16	34	29	15
33	59	5	1	2

# Sessile Oak Gluchow (kNN classification)



# Classification of Crowns with regard to mode value (majority)





Manual classification

kNN classification

## Manual classification

	G	G/Y	Y	Y/B	B	$\Sigma$
G	<b>12</b>					12
G/Y		<b>2</b>				2
Y	6	122	<b>34</b>	52	1	215
Y/B						0
B	14	55		73	<b>53</b>	195
$\Sigma$	32	179	34	125	54	<b>424</b>

**Minimum  
distance  
classification**

Overall accuracy = 23,82%

Kappa = 0,1504



## Manual classification

	G	G/Y	Y	Y/B	B	$\Sigma$
G	<b>12</b>					12
G/Y		<b>2</b>				2
Y	6	122	<b>34</b>	52	1	215
Y/B						0
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**Minimum  
distance  
classification**

Overall accuracy = 23,82%

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**Similarity measures**

LARSS – Low Altitude Remote Sensing Seminar, 10-11 May 2018, UMCS Lublin, Poland

## Manual classification

	G	G/Y	Y	Y/B	B	$\Sigma$
G	<b>18</b>	3				21
G/Y	14	<b>77</b>	1		1	93
Y		80	<b>25</b>	10		115
Y/B		17	8	<b>69</b>		94
B		2		46	<b>53</b>	101
$\Sigma$	32	179	34	125	54	<b>424</b>

**Maximum  
likelihood  
classification**

Overall accuracy = 57,08%

Kappa = 0,4540

## Manual classification

	G	G/Y	Y	Y/B	B	$\Sigma$
G	<b>23</b>	5				28
G/Y	9	<b>78</b>			1	88
Y		70	<b>29</b>	8		107
Y/B		22	5	<b>65</b>		92
B		4		52	<b>53</b>	109
$\Sigma$	32	179	34	125	54	<b>424</b>

**Fisher**  
classification

Overall accuracy = 58,49%

Kappa = 0,4748

## Manual classification

	G	G/Y	Y	Y/B	B	$\Sigma$
G	<b>23</b>	6		1	1	31
G/Y	9	<b>117</b>	1	9		136
Y		37	<b>24</b>	21		82
Y/B		17	9	48		74
B		2		46	<b>53</b>	101
$\Sigma$	32	179	34	125	54	<b>424</b>

**kNN**  
classification

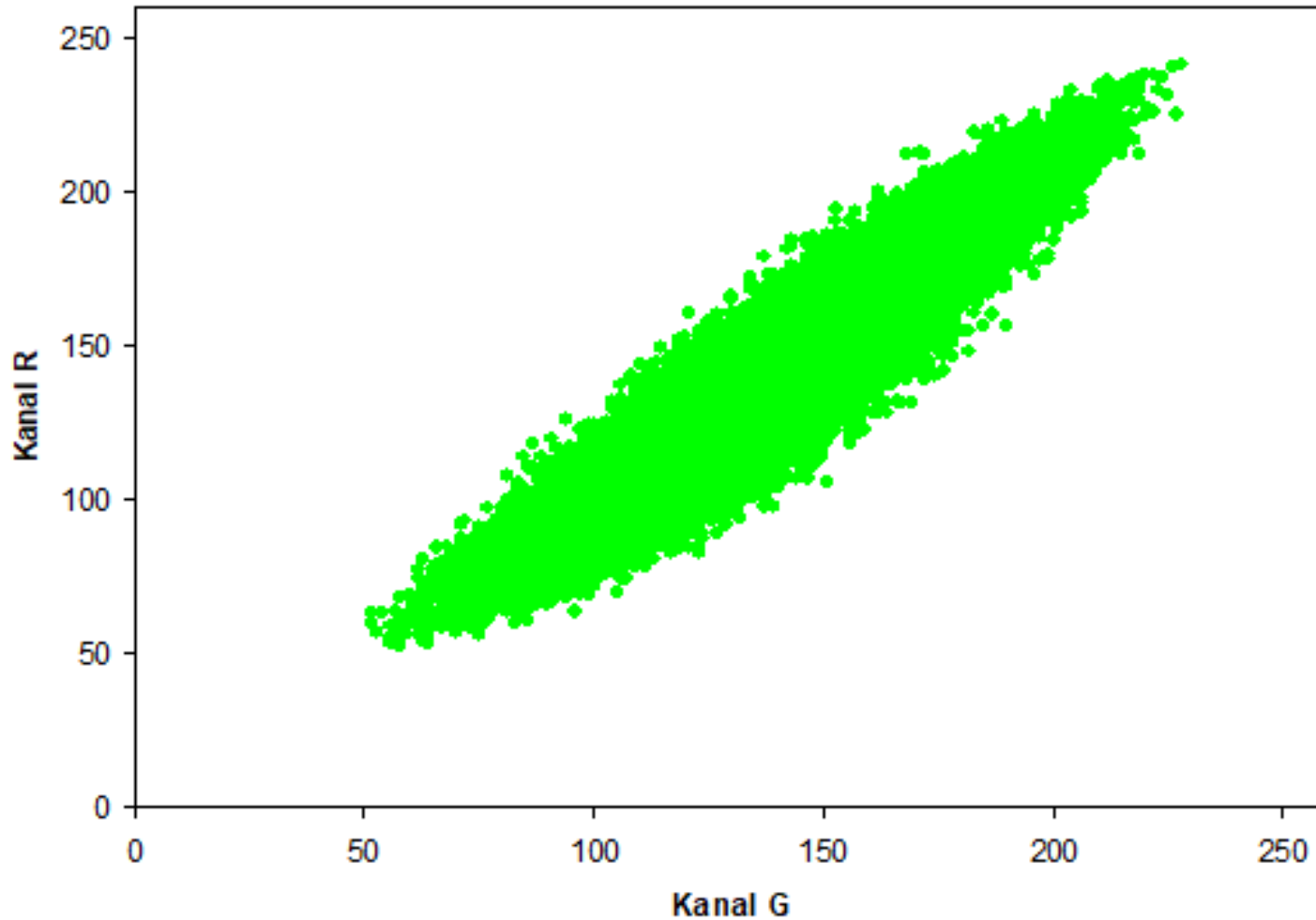
Overall accuracy = 62,50%

Kappa = 0,5077

## Classification Similarity - SUMMARY

Classification procedure	Overall accuracy (similarity)	Kappa Index of Agreement
MINDIST	23.82%	0.1504
MAXLIKE	57.08%	0.4540
Fisher	58.49%	0.4748
kNN	62.50%	0.5077

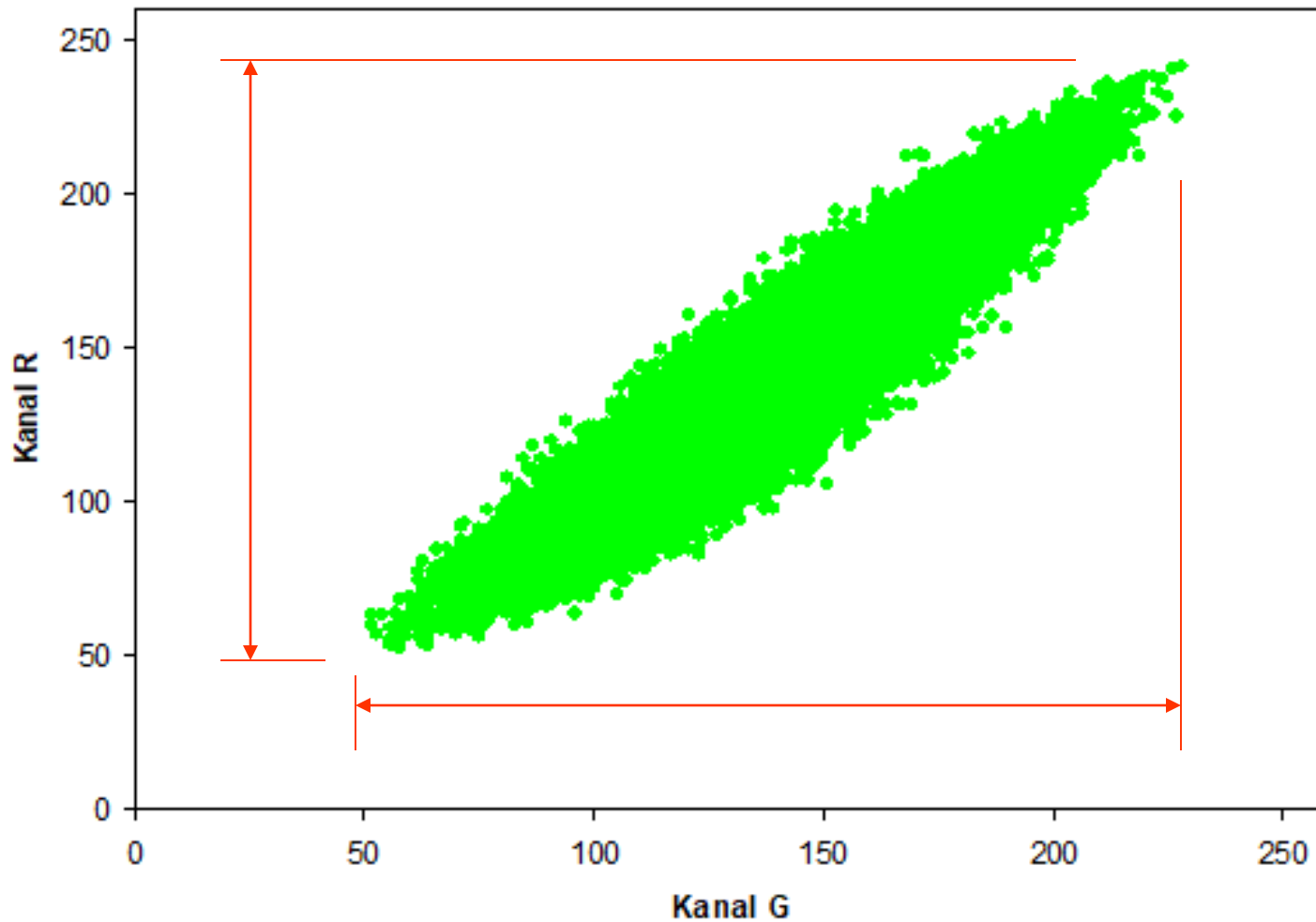
Green



Scattergram of  
all pixels picked  
up from crowns  
classified as

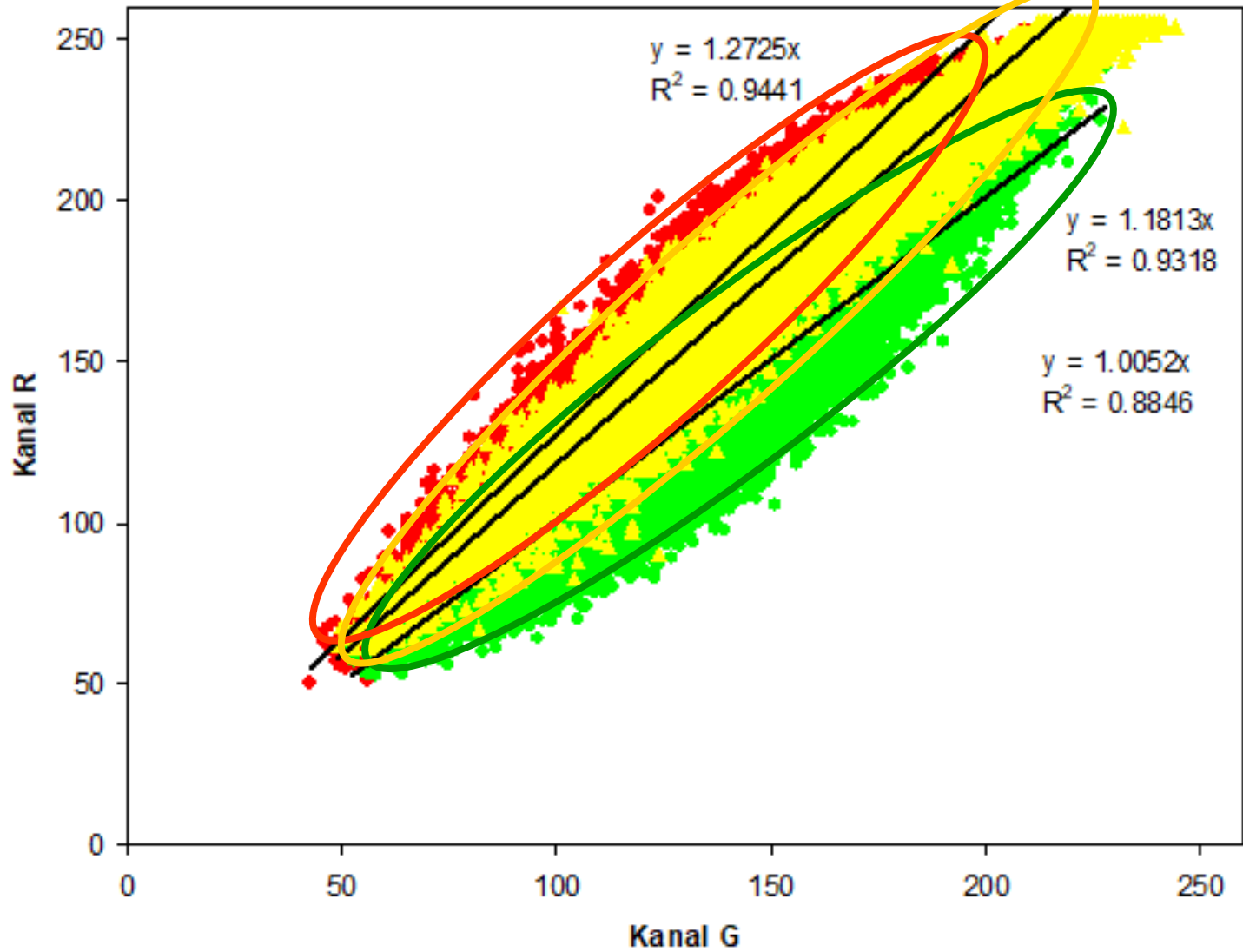
G – green

Green



Scattergram of all pixels picked up from crowns classified as

G – green

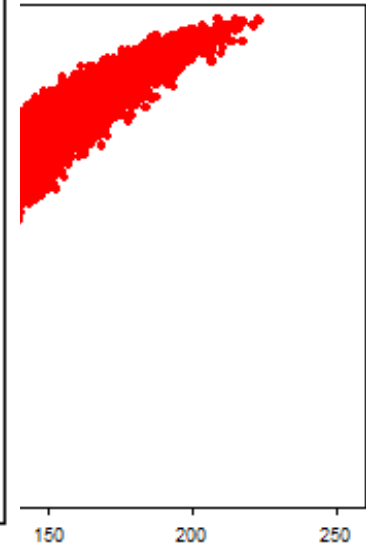


Scattergrams for all pixels picked up from crown's segments:

G – green

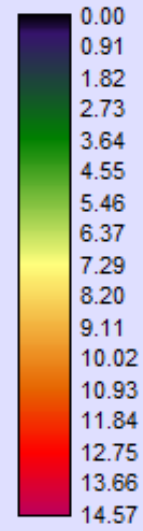
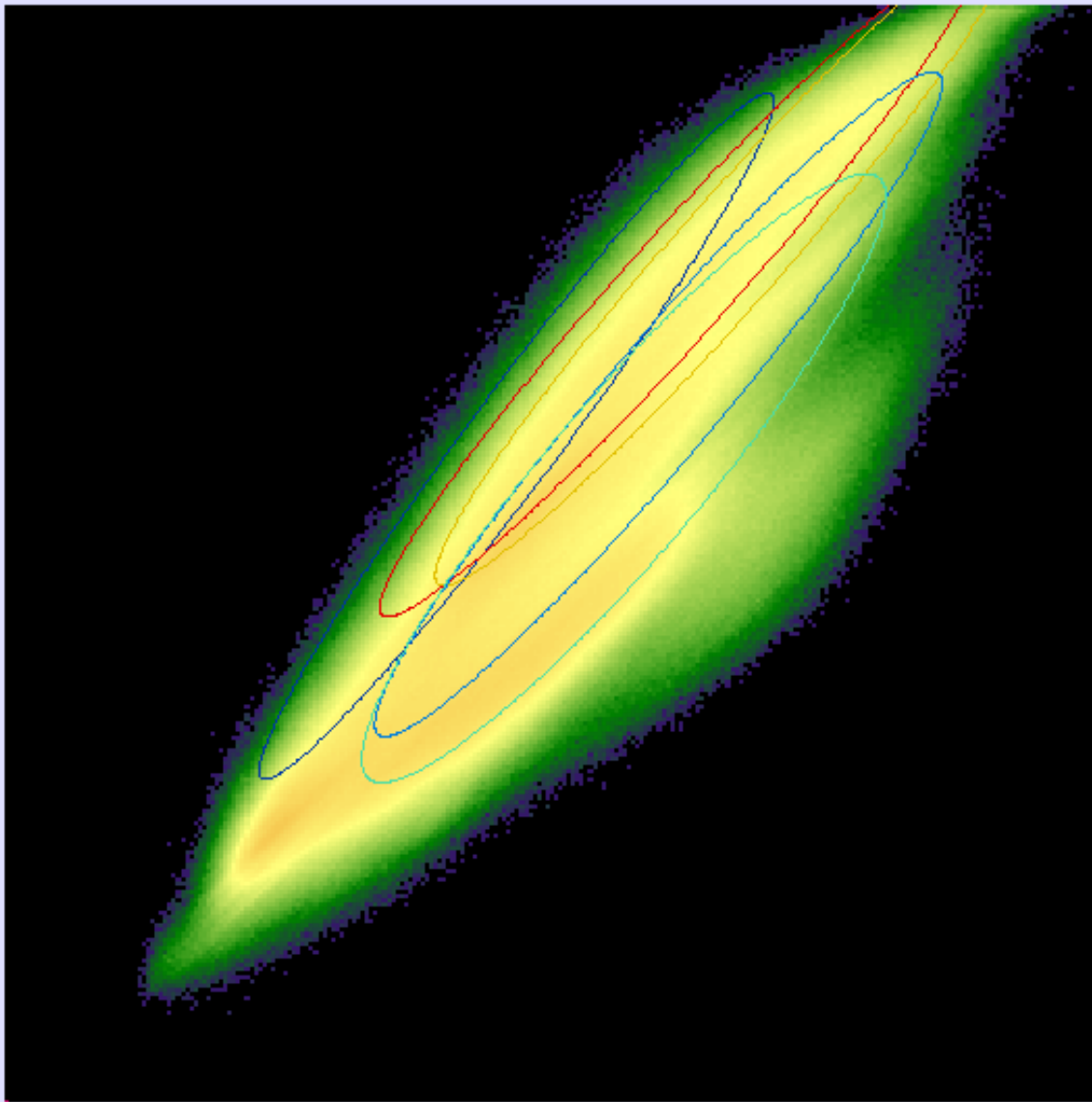
Y – yellow

B – brown





## Scatterplot of C\_XUAV3 (Y axis) and C\_XUAV2 (X axis)



Scatterplot for 5  
Oak classes:

G, G/Y, Y, V/B, B

Bands:

R (Y axis)

G (X axis)

## Conclusion

Results of manual and digital classification are similar but not to the point

The best overall similarity (62.5%) is between manual and kNN classification

The crown's colors are changing gradually: G – G/Y – Y – Y/B – B

Ellipses describing the pixel distribution cover each other and are very long and narrow

Both manual and digital classification is harmed with operator's subjectivity

Another digital procedures should be subject of further investigation (SVM, Random Forest?)

The study showed only similarity between results achieved with different procedures and can't be assumed as a proof of their correctness

Thank you for your attention!

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