LATVIJAS UNIVERSITĀTE ANNO 1919

DEVELOPMENTS in Optics and Communications 2014

ESF EIROPAS SOCIĀLAIS FONDS

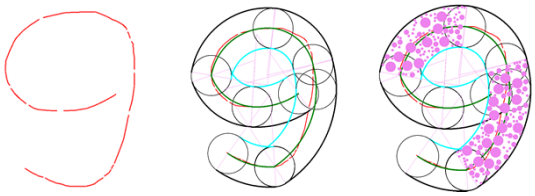
EIROPAS SAVIENĪBA

IEGULDĪJUMS TAVĀ NĀKOTNĒ

Picture segmentation applications in optometry and vision science

Renārs Trukša, Sergejs Fomins, Gunta Krūmiņa, Jānis Dzenis

Previously



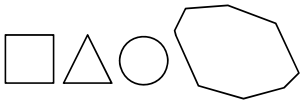
2013 DOC conference

Motivation for developing segmentation algorithm

- Ease data analysing process
- Describe visual stimuli
- Change object properties within picture

Clues for picture segmentation

Colour Luminance Texture

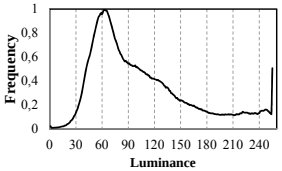


Boarders

Hybird algorithm

Initial segmentation → Image splitting → Segment division → Merging process

Histogram based segmentation



$n = \{v_1, v_2, ..., v_{255}\} \in N$

$w \in N$

$b = \{v_{a-w}, .., v_{a+w}\} \in n$

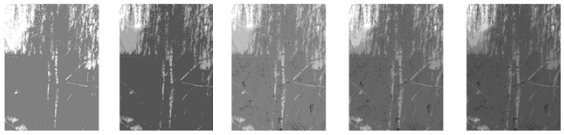
$v_a \notin b$

$v_a > b$

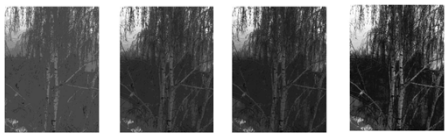
$\{v_1, .., v_i\}$

$\frac{v_i + v_{i+1}}{2}$

Examples

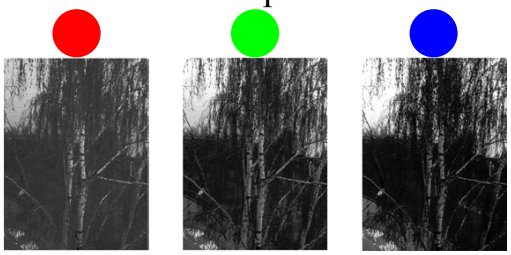


w=40, nr=2 w=17, nr=3 w=15, nr=4 w=8, nr=5 w=7, nr=6



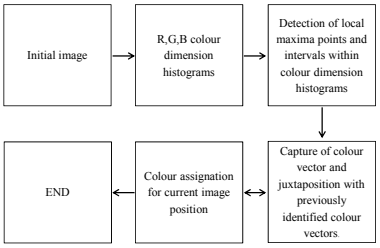
w=5, nr=7 w=3, nr=12 w=2, nr=15 w=1, nr=38

Examples

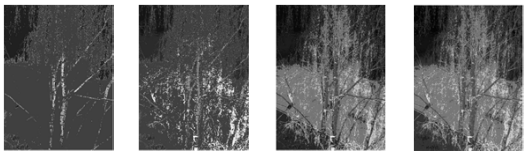


w=1, nr=31 w=1, nr=38 w=1, nr=47

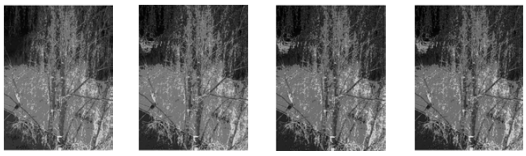
Segmentation by colour



Examples



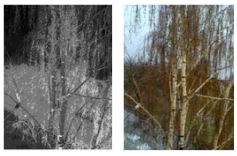
w=20, nr=8 w=15, nr=12 w=10, nr=26 w=8, nr=53



w=7, nr=62 w=6, nr=76 w=5, nr=88 w=4, nr=105

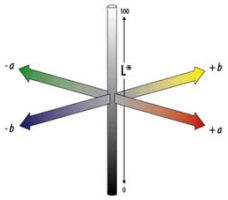
Example

Cross reference



w=7, nr=62 original

Colour space based colour recognition



Problems to solve:

- RGB⟹XYZ
- Colour searching algorithm

$$L^* = 116\left(\sqrt[3]{\frac{X}{X_n}}\right) - 16$$

$$a^* = 500\left(\sqrt[3]{\frac{X}{X_n}} - \sqrt[3]{\frac{Y}{Y_n}}\right)$$

$$b^* = 200\left(\sqrt[3]{\frac{Y}{Y_n}} - \sqrt[3]{\frac{Z}{Z_n}}\right)$$

$$\Delta E = \sqrt{(a_c - a_t)^2 + (b_c - b_t)^2 + (L_c - L_t)^2}$$

Splitting algorithm

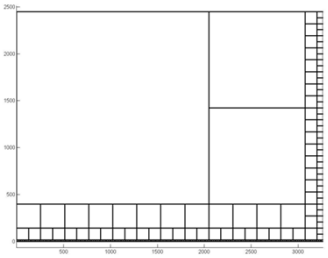
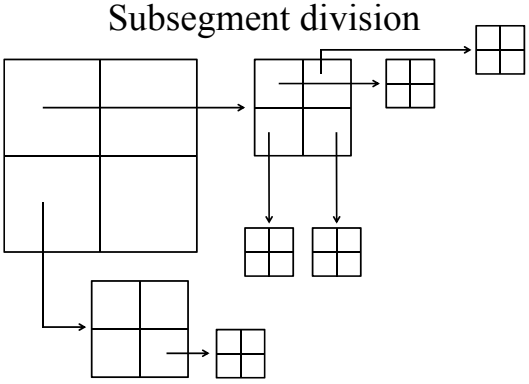


Image size 3264x2448 px
Subsegments :

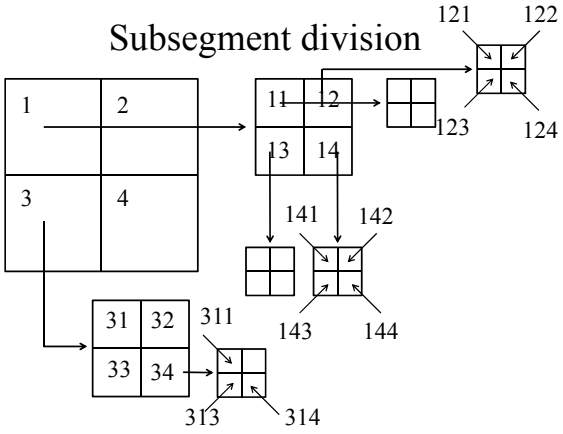
- 2048x2048 px one
- 1024x1024 px two
- 256x256 px twelve
- 128x128 px forty three
- 64x64 px thirty four
- 16x16 px two hundred four

$$2^{\text{int}(\log_2(edge))}$$

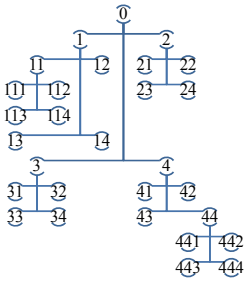
Subsegment division



Subsegment division

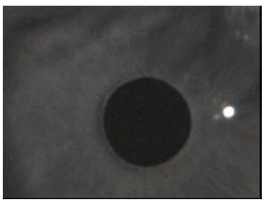


Subsegment division

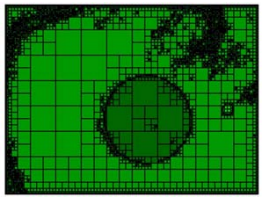


Steps:
1
11
111
112
113
114
12
121
122
123
124
13
…..
31
311
312

Example

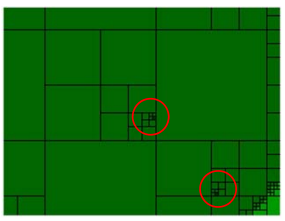


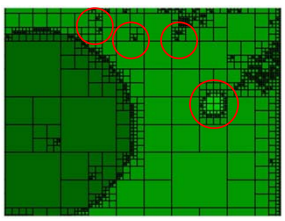
Original



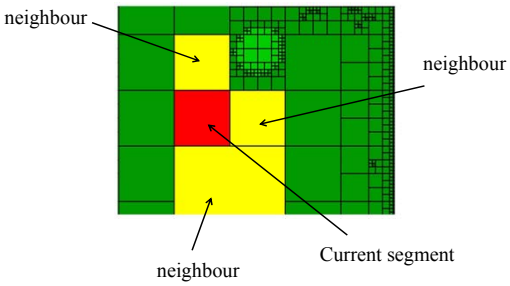
Segmented

Example

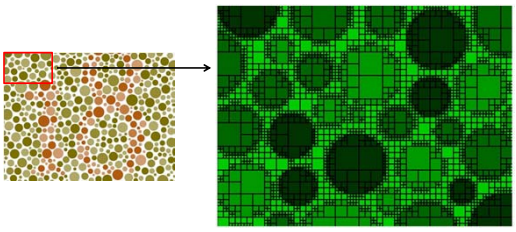




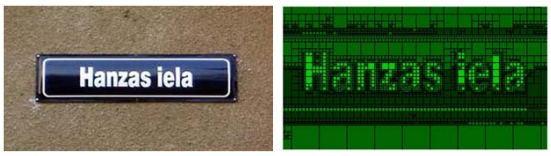
How to find neighbours?



Other useful applications



Other useful applications



Original Segmented

Thank you for attention! Questions?

S.Fomins, G.Krumina supported by ESF
Nr. 2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001

ESF EIROPAS SOCIĀLAIS FONDS
EIROPAS SAVIENĪBA
IEGULDĪJUMS TAVĀ NĀKOTNĒ