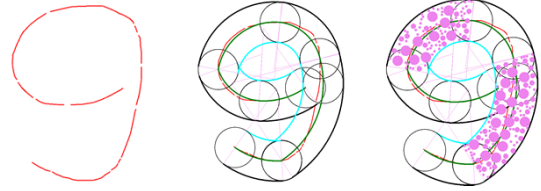


Picture segmentation applications in optometry and vision science

Renārs Trukša, Sergejs Fomins, Gunta Krūmiņa, Jānis Dzenis

Previously

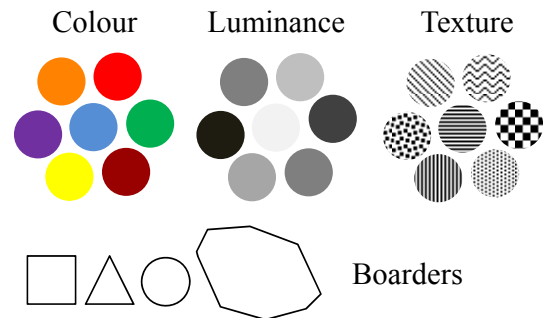


2013 DOC conference

Motivation for developing segmentation algorithm

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

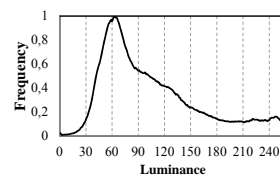
Clues for picture segmentation



Hybird algorithm



Histogram based segmentation



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

$$w \in N$$

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

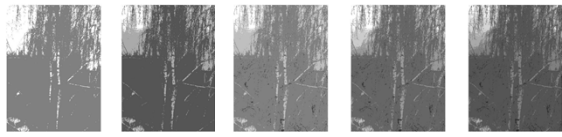
$$v_a \notin b$$

$$v_a > b$$

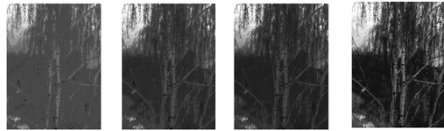
$$\{v_1, \dots, v_i\}$$

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

Examples

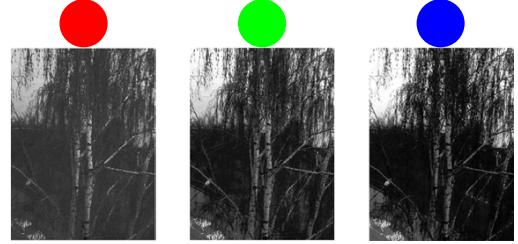


w=40, nr=2 w=17, nr=3 w=15, nr=4 w=8, nr=5 w=7, nr=6



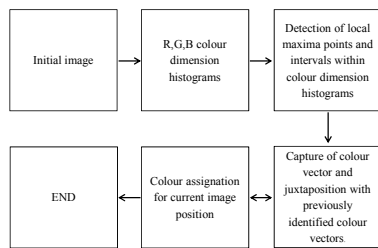
w=5, nr=7 w=3, nr=12 w=2, nr=15 w=1, nr=38

Examples

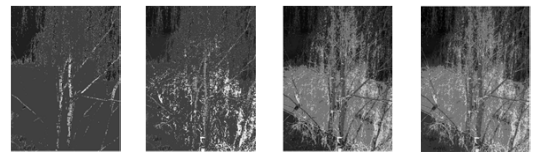


w=1, nr=31 w=1, nr=38 w=1, nr=47

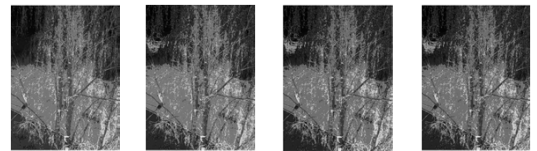
Segmentation by colour



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

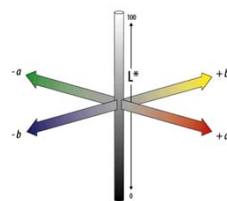
Cross reference



w=7, nr=62 original



Colour space based colour recognition



- Problems to solve:
- RGB⇒XYZ
 - Colour searching algorithm

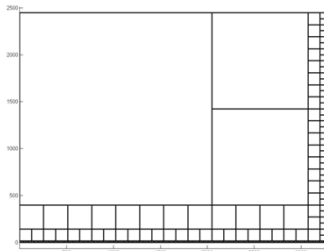
$$L^* = 116 \left(\sqrt[3]{\frac{X}{X_n}} \right) - 16$$

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

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

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

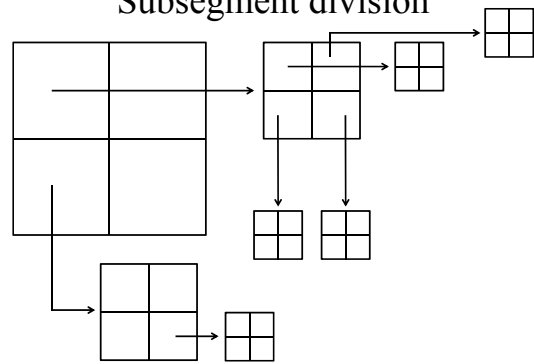
Splitting algorithm



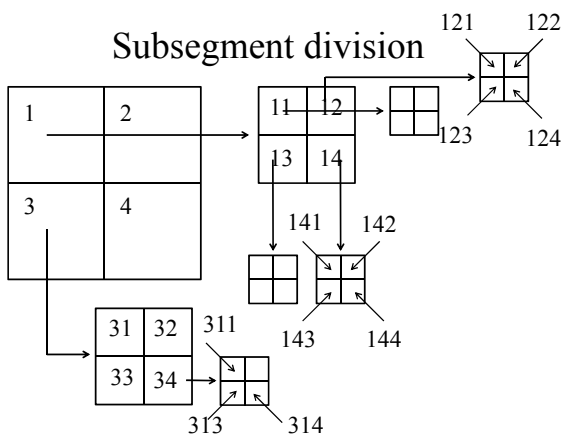
- Image size 3264x2448 px
 Subsegments :
- 2048x2048 px one
 - 1024x1024 px two
 - 256x256 px twelve
 - 128x128 px forty three
 - 64x64 px thirty four
 - 16x16 px two hundred four

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

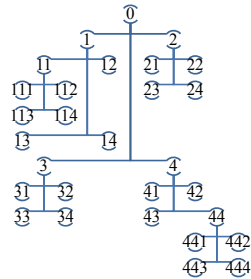
Subsegment division



Subsegment division

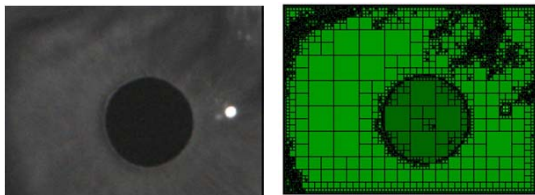


Subsegment division



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

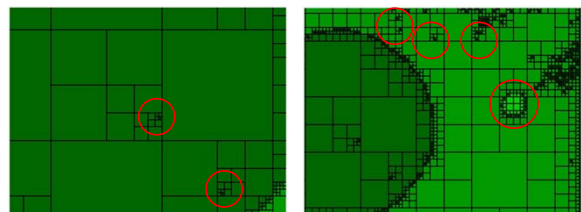
Example



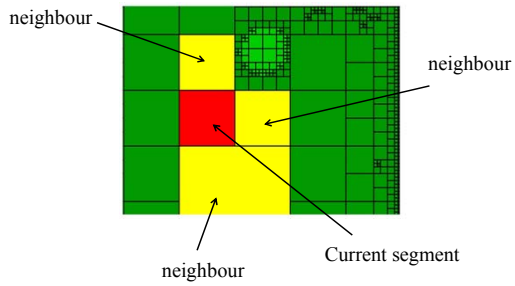
Original

Segmented

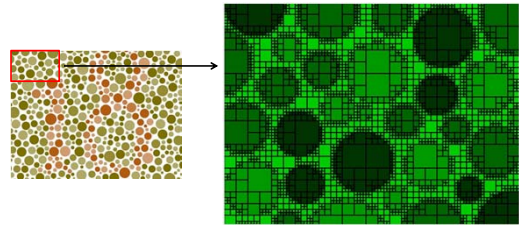
Example



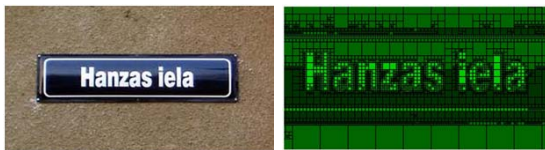
How to find neighbours?



Other useful applications



Other useful applications



Original

Segmented

Thank you for attention!
Questions?

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