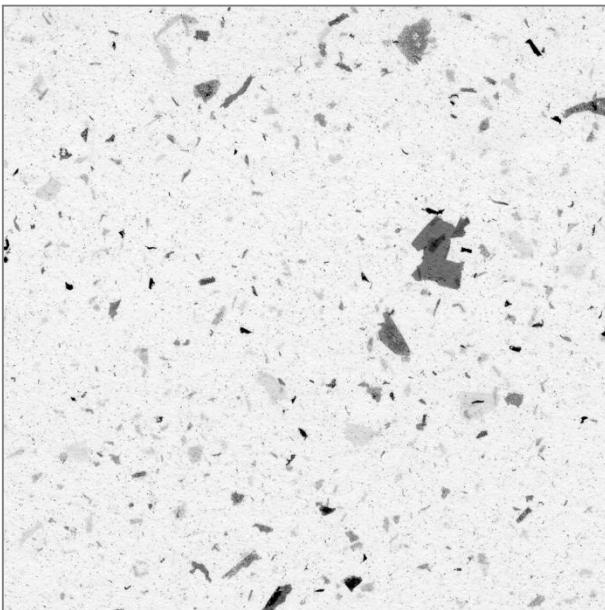


OBDELAVA IN ANALIZA DIGITALNIH SLIK – PRIMERI KARAKTERIZACIJE POVRŠIN

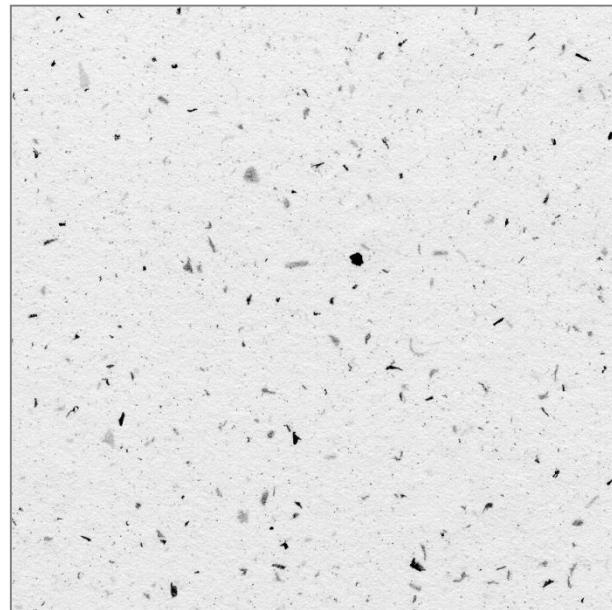
Izr. prof. dr. Aleš Hladnik

1. DEINKING – ANALIZA DELCEV (BLOB ANALYSIS)

- <https://sites.google.com/site/obdelavadigitalnihslik/primeri-uporabe/analiza-delcev>



Pred deinkingom

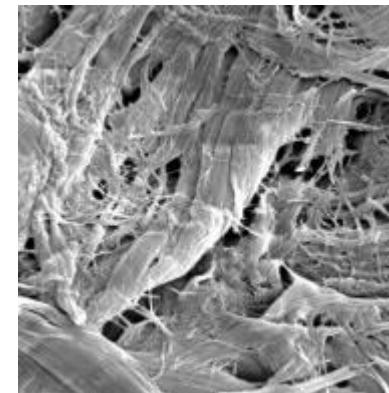


Po deinkingu



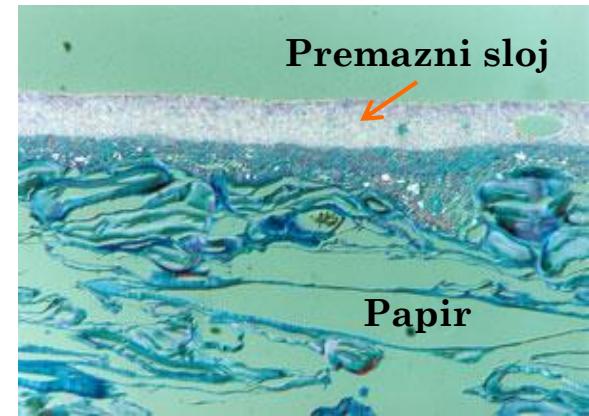
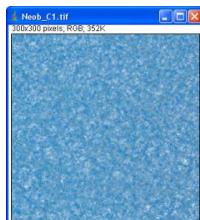
2. VREDNOTENJE HRAPAVOSTI IN MOTTLINGA

- Gladkost/hrapavost papirja
 - Rezultat vpliva procesnih spremenljivk pri industrijski izdelavi papirja
 - Vpliva na optične, mehanske, sorpcijske lastnosti končnega izdelka iz papirja
 - Gladkost lahko povečamo s premazovanjem papirja



Prepletenost papirnih vlaken
(www.organoclick.com)

- Tisk
 - Kakovost odtisa
 - Ostrina natisnjениh točk
 - Barvno ujemanje reprodukcije z originalom
 - Neenakomernost odtisa – mottling

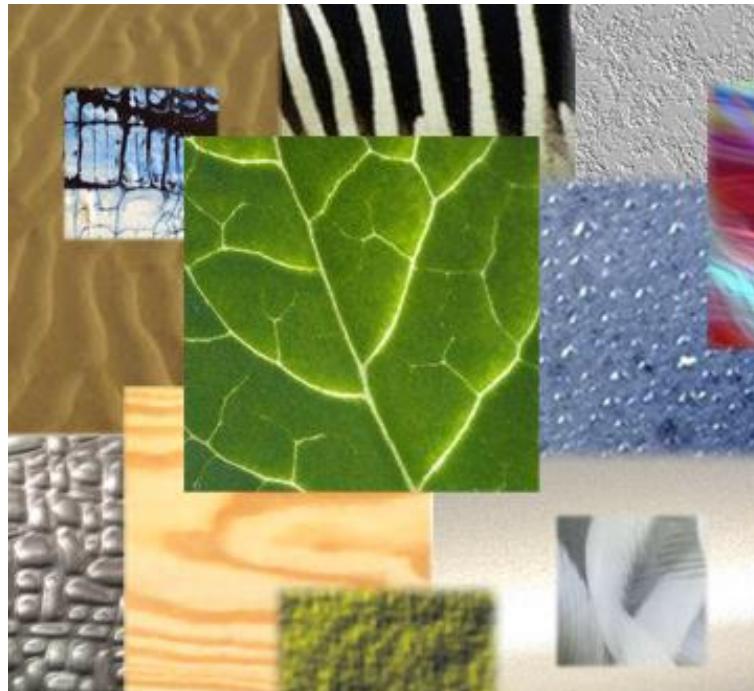


Prerez premazanega papirja
(www.innventia.com)

KAJ JE TEKSTURA?

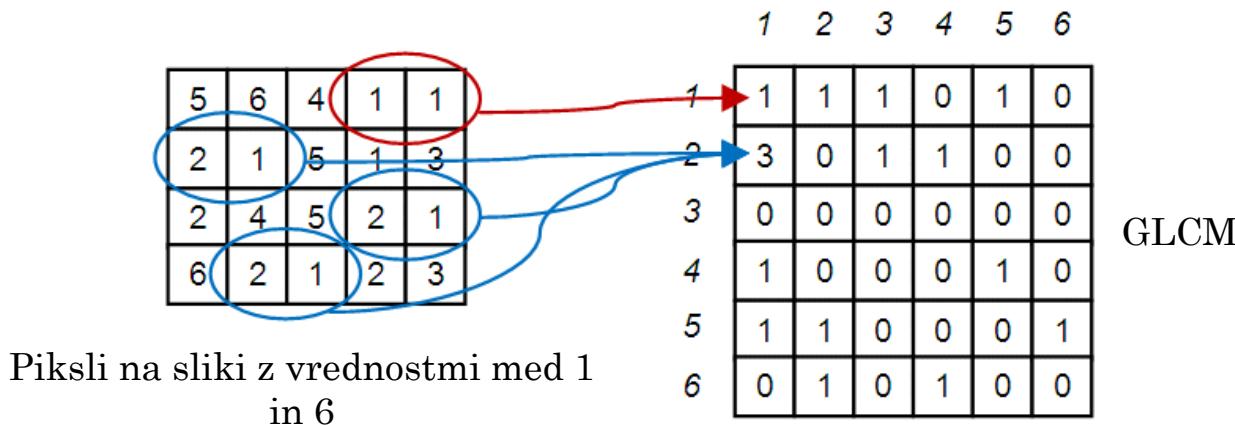
- Pokazatelj lokalnega spreminjanja svetlosti (intenzitete) bližnjih – sosednjih – pikslov na sliki

*Russ, J.C. 1999. The Image Processing Handbook, 3rd edition.
CRC Press, Florida*



GLCM (GREY LEVEL COOCURRENCE MATRIX)

- Matrika, ki beleži pogostost pojavljanja para pikslov z vrednostima i in j , ki se nahajata na specifični razdalji in smeri
 - Privzeto se predpostavlja, da sta piksla horizontalno-sosednja, lahko pa določimo kak drugačen prostorski odnos med njima



- Iz matrike GLCM je možno izračunati različne statistične parametre – teksturne značilke

TEKSTURNE ZNAČILKE

○ Kontrast

- Meri intenzitetni kontrast med pikslom in njegovim sosedom po celotni sliki

$$\sum_{i,j} |i - j|^2 p(i, j)$$

○ Korelacija

- Meri, kako močna je korelacija med pikslom in njegovim sosedom po celotni sliki

$$\sum_{i,j} \frac{(i - \mu_i)(j - \mu_j)}{\sigma_i \sigma_j} p(i, j)$$

○ Energija (Uniformnost)

- Podaja vsoto kvadriranih elementov v matriki GLCM

$$\sum_{i,j} p(i, j)^2$$

○ Homogenost

- Meri podobnost porazdelitve vrednosti elementov v matriki GLCM in na njeni diagonali

$$\sum_{i,j} \frac{p(i,j)}{1 + |i - j|}$$

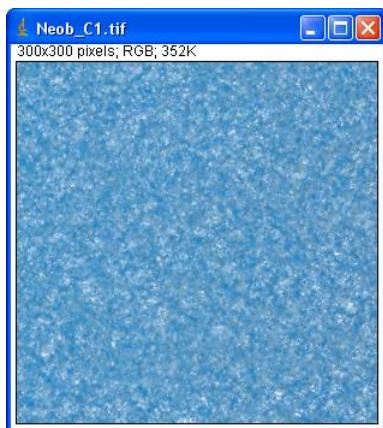


EXPERIMENTALNI DEL – VREDNOTENJE MOTTLINGA

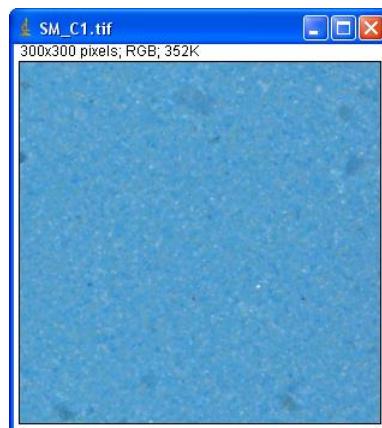
- Sintetični in celulozni papirji

Description	Code
Synthetic paper consisting of three PP layers	Yupo
Double-coated synthetic (PA, PES, viscose) paper	Neob
Uncoated paper made entirely from the chemical bleached wood pulp	Cata
Wood-free, coated paper, 100% virgin fibres	Gpri
100% natural paper, lignin-free fibres	SM

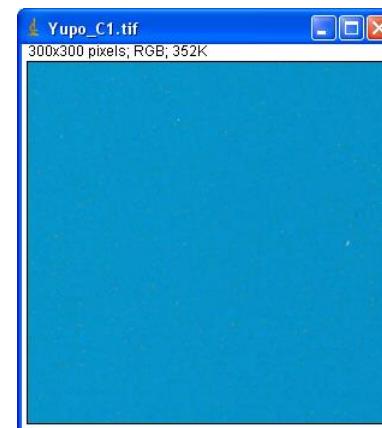
- Ofsetni tisk, nato skeniranje z opt. bralnikom HP Scanjet 4850 (300 dpi)



Neob_C



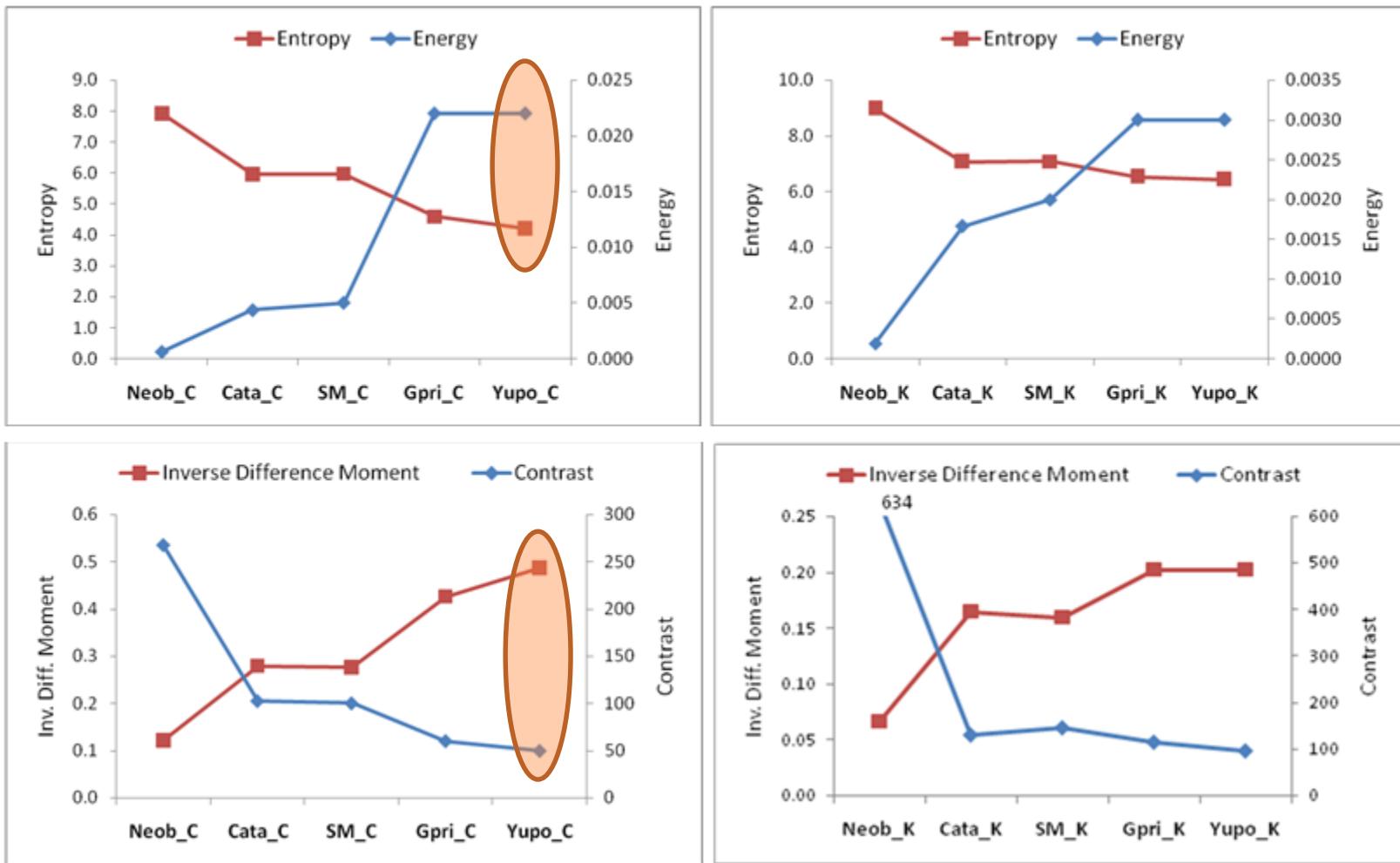
SM_C



Yupo_C



REZULTATI – VREDNOTENJE MOTTLINGA

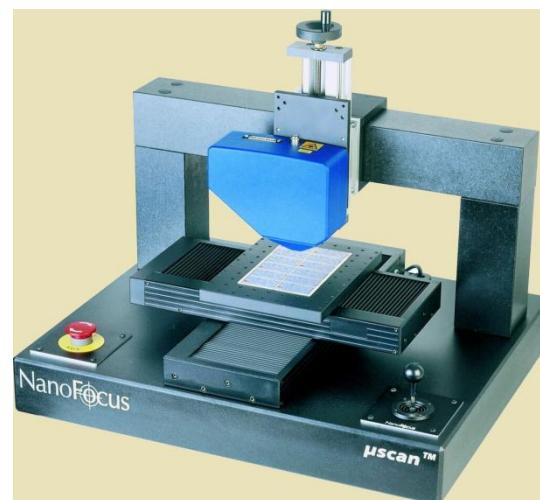


EXPERIMENTALNI DEL – VREDNOTENJE TOPOGRAFIJE

- Vzorci papirja in kartona

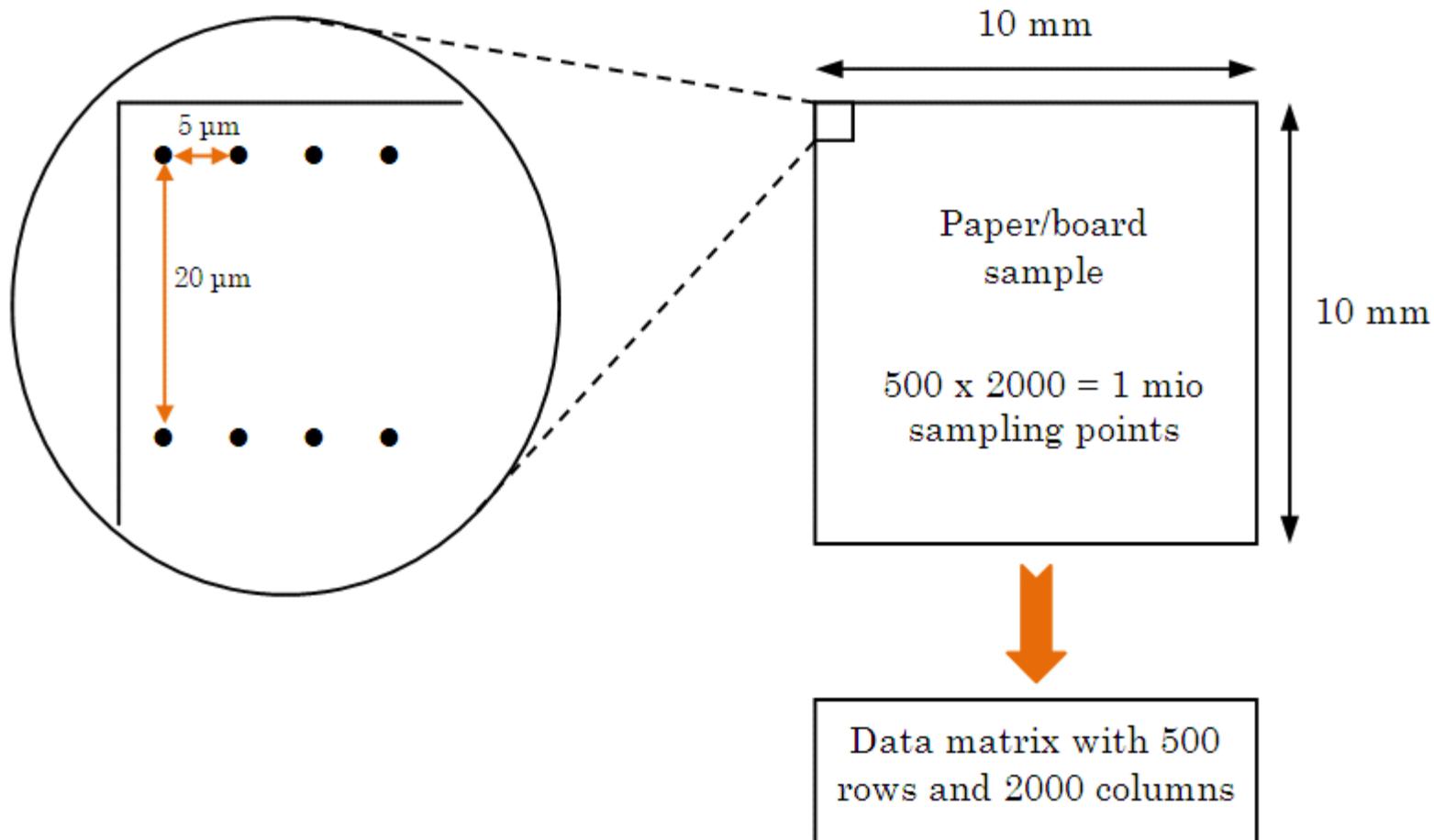
Sample code	Description	Smoothness (Bekk), s	Roughness (PPS), μm
P_IJ	Inkjet paper	24.5	5.7
P_NP	Newsprint paper	8.9	7.5
B_CT	Coated board	3.9	8.4
B_MK	Board with periodic markings	2.4	10.0

- Konfokalni laserski profilometer
 - NanoFocus μ Scan (KCL Espoo, Finska)



EXPERIMENTALNI DEL – VREDNOTENJE TOPOGRAFIJE

- Zajem podatkov – vzorčenje



REZULTATI – VREDNOTENJE TOPOGRAFIJE

- Teksturne značilke izračunane na podlagi matrike GLCM

Sample codes	GLCM based texture measures			ISO topography descript.		Bendtsen roughness	
	Contrast	Correlation	Energy	Homogeneity	Rq	Ra	
Pap1	0.119	0.882	0.321	0.941	3.72	2.95	79
Pap2	0.161	0.900	0.231	0.919	4.87	3.88	314
P_IJ	0.121	0.928	0.246	0.939	4.98	3.96	205
Pap4	0.148	0.939	0.194	0.926	6.11	4.85	262
Pap5	0.179	0.930	0.180	0.911	6.30	4.96	272
B_CT	0.185	0.954	0.137	0.908	8.03	6.36	1100
P_NP	0.166	0.966	0.125	0.917	8.89	7.15	810
B_MK	0.252	0.977	0.086	0.879	17.17	13.49	1980



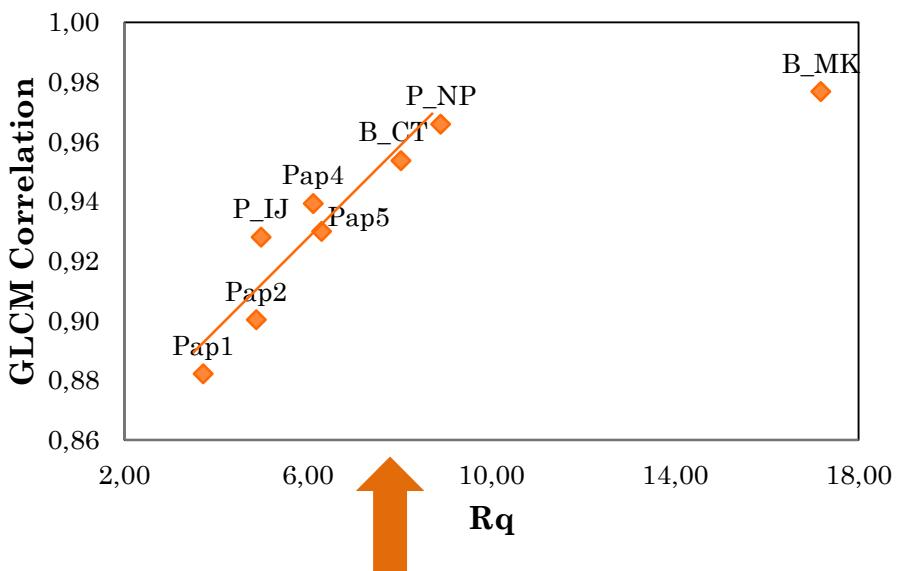
Površina premazanega kartona (B_CT) je bolj gladka kot površina časopisnega papirja (P_NP)

Korelacija in Energija sta dobra pokazatelja gladkosti / hrapavosti substrata

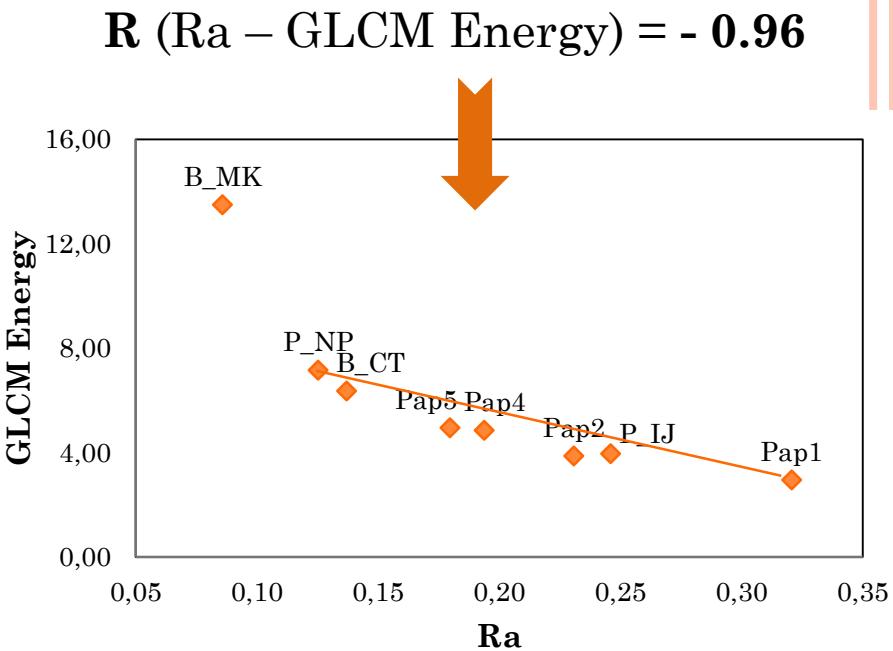


PRIMERJAVA – REZULTATI VREDNOTENJA ISO IN GLCM

- Korelacija med ISO topografskimi deskriptorji in GLCM teksturnimi značilkami



$R (Rq - \text{GLCM Correlation}) = 0.94$



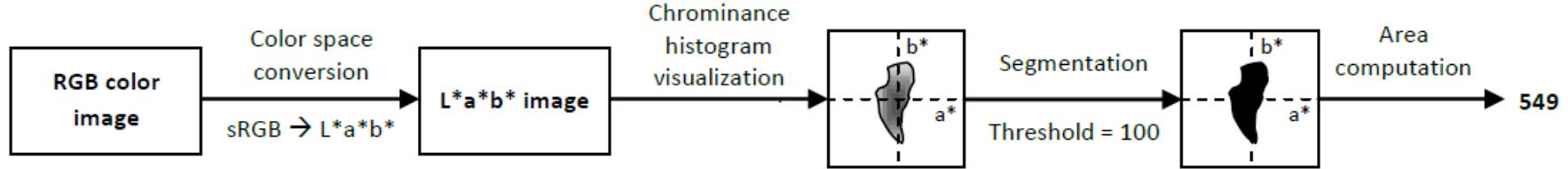
$R (Ra - \text{GLCM Energy}) = -0.96$

3. VREDNOTENJE OBSTOJNOSTI BARVNIH ODTISOV

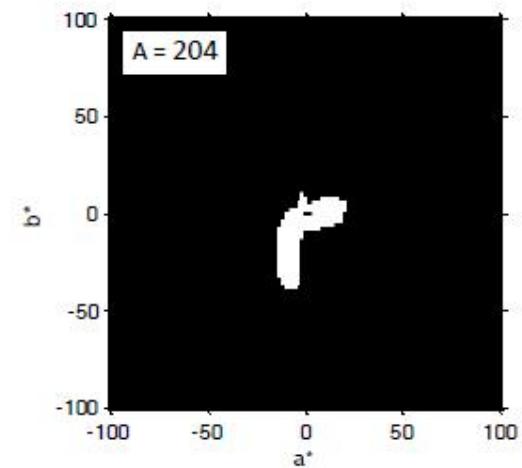
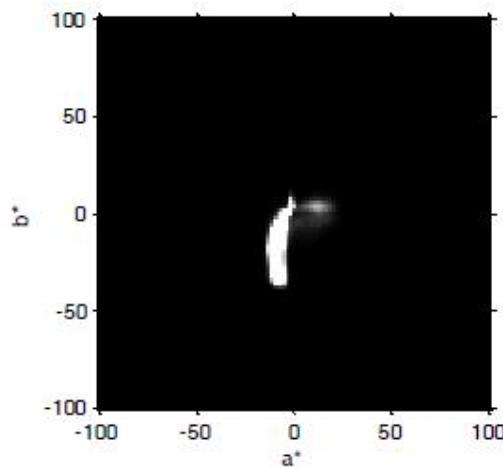
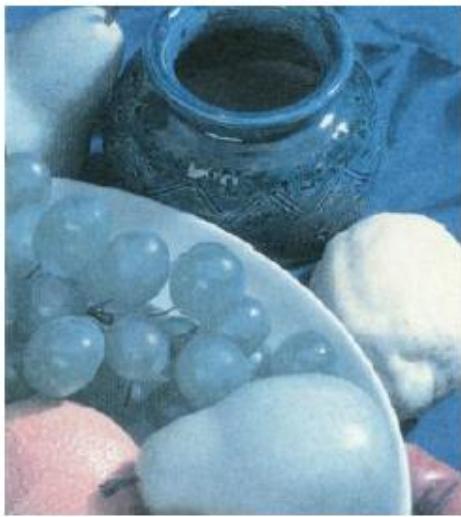
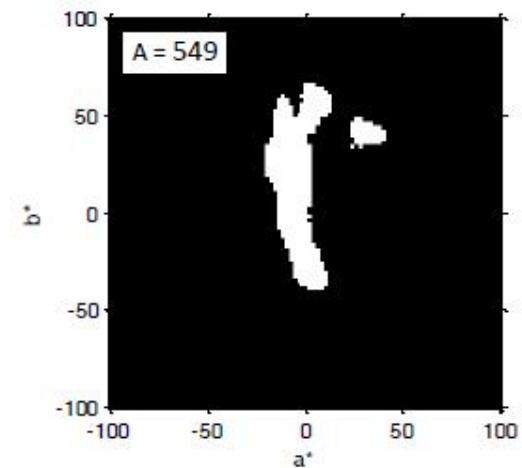
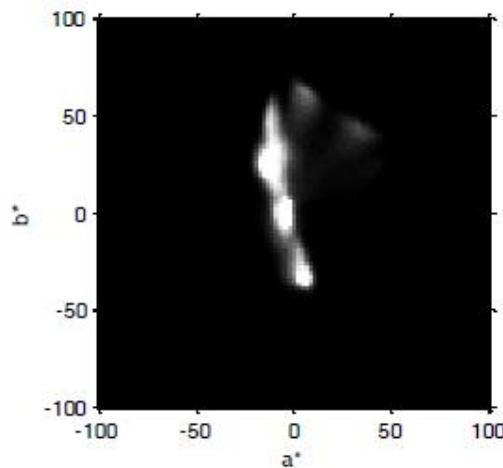
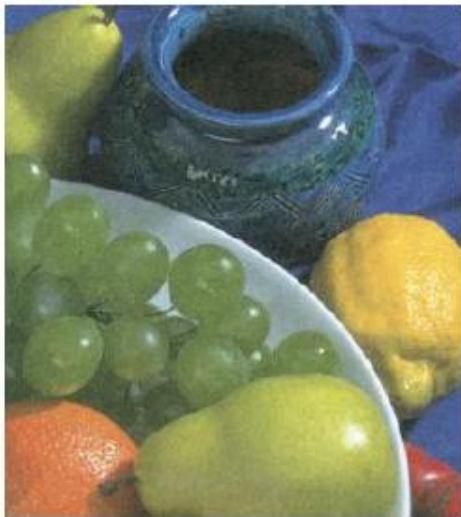
Assessing the lightfastness of prints by image chrominance histogram quantification
Silva Grilj, Diana Gregor-Svetec, Aleš Hladnik, Tadeja Muck



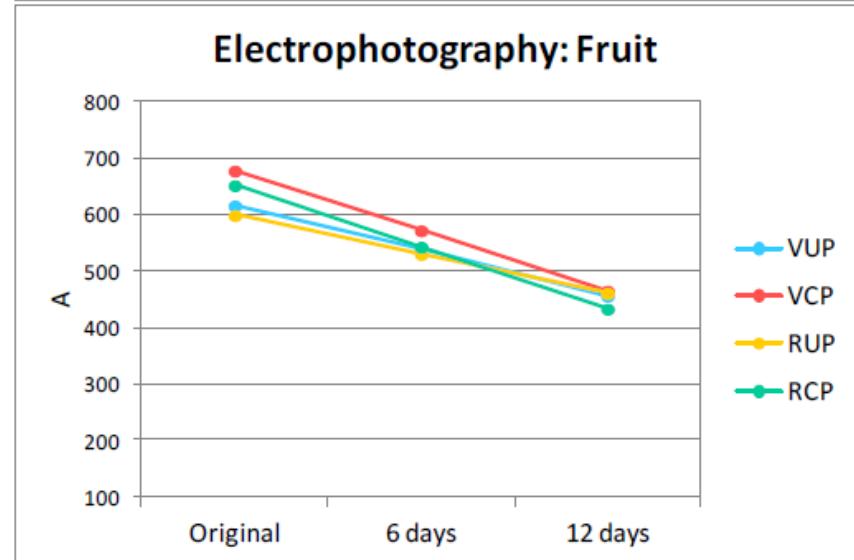
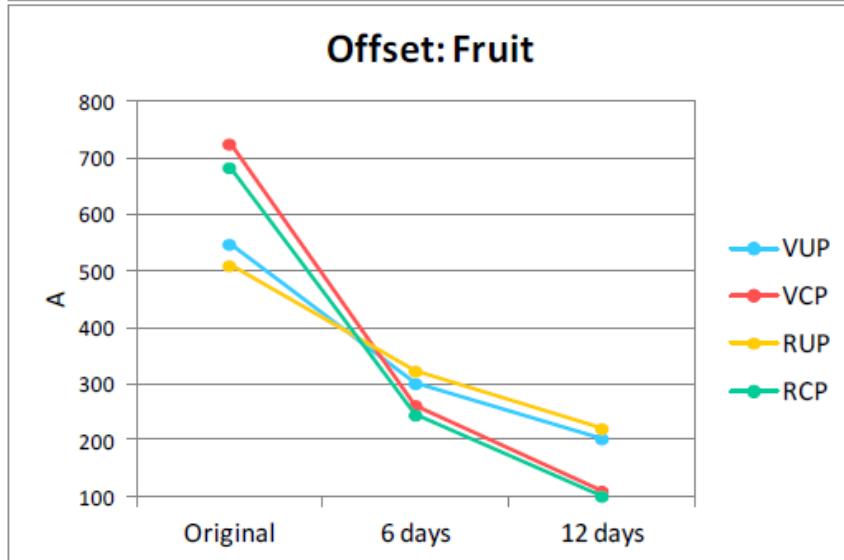
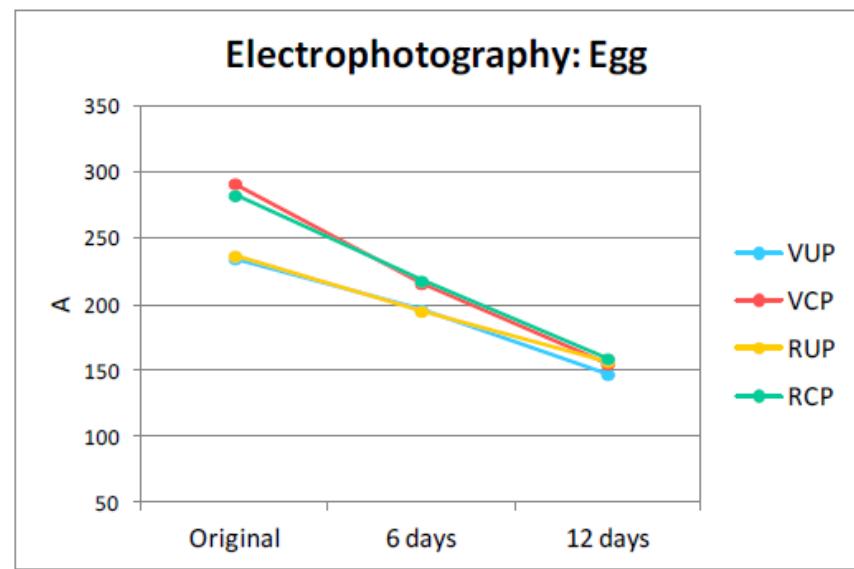
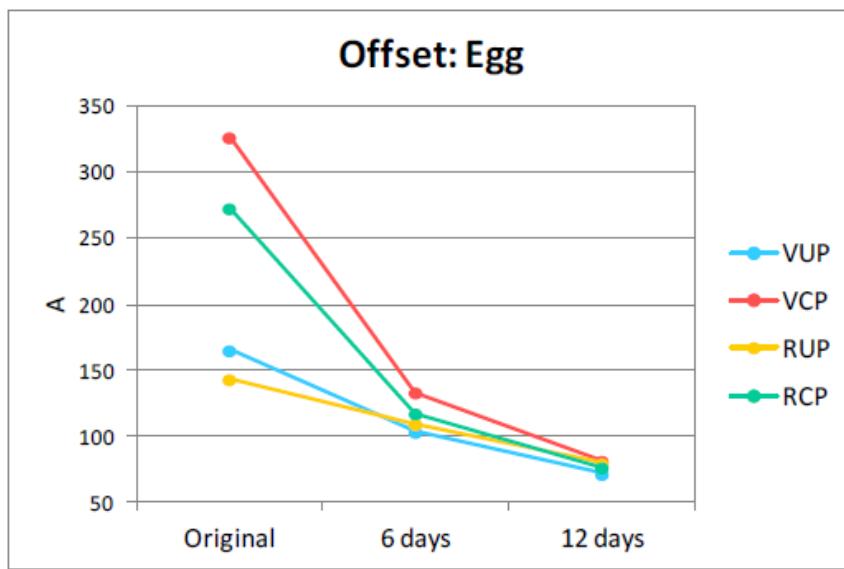
Fig 1. Altona test form images "Fruit" (left) and "Egg" (right).



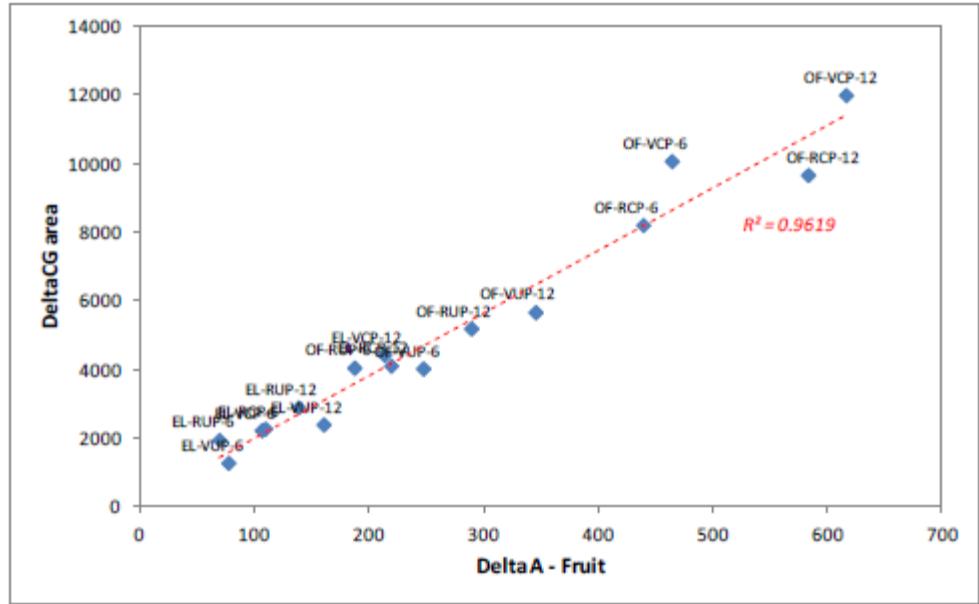
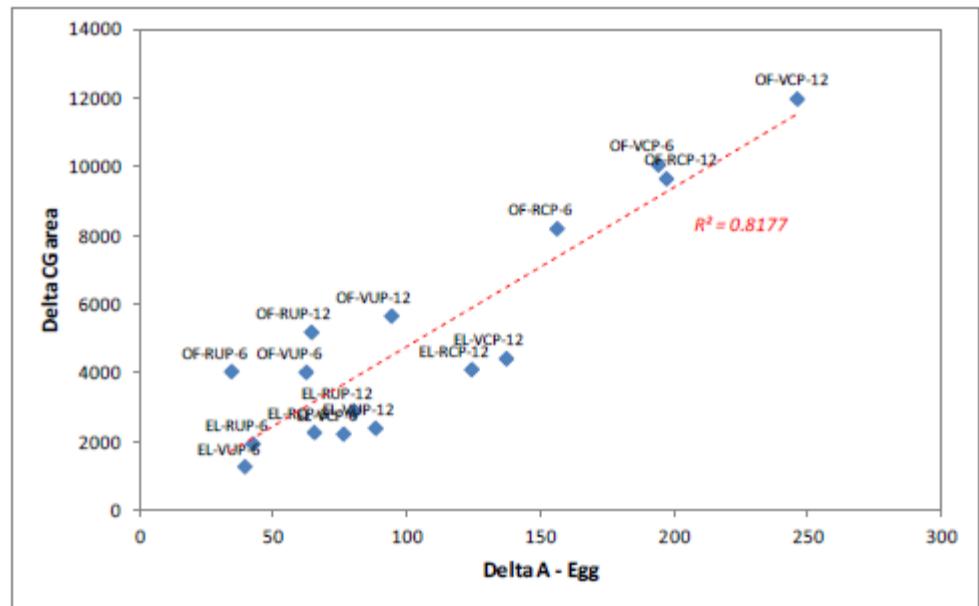
VIZUALIZACIJA IN KVANTIFIKACIJA HISTOGRAMA KROMINANCE



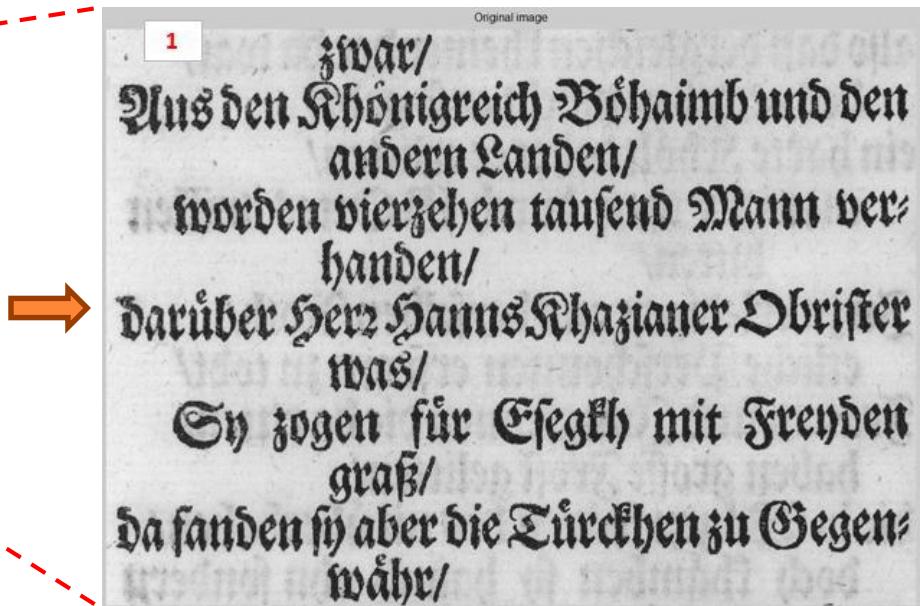
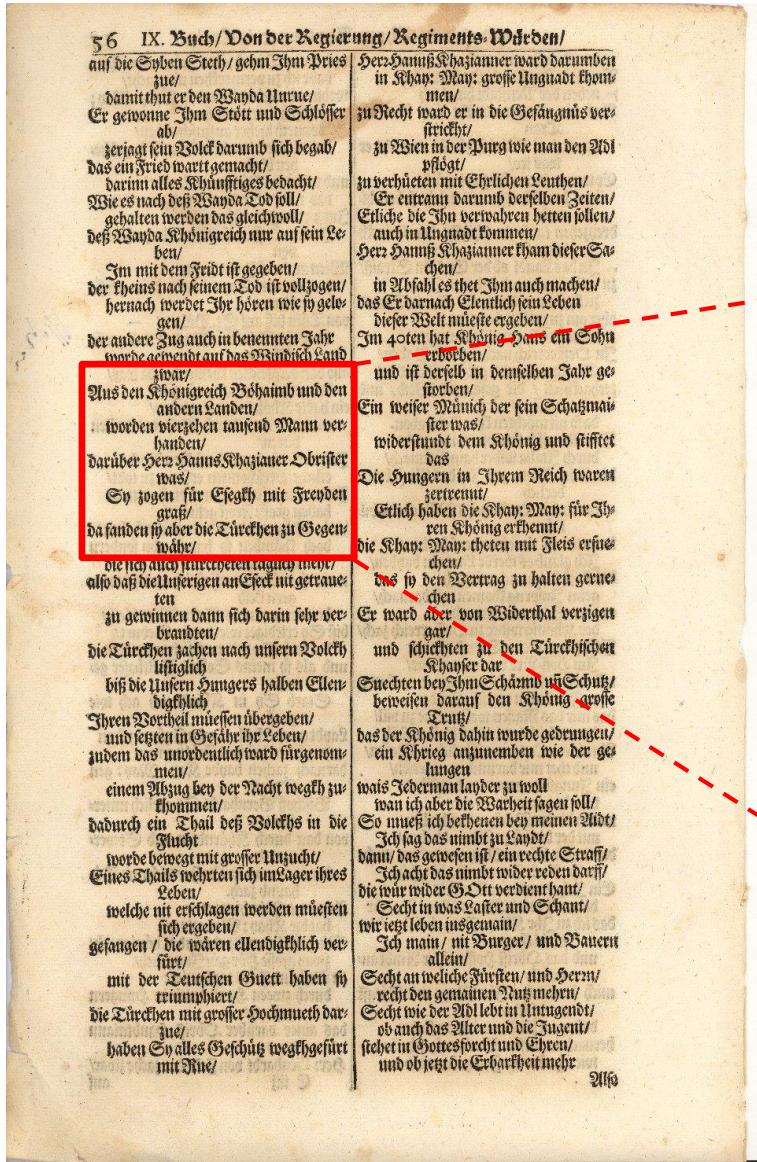
REZULTATI – DVE TEHNIKI TISKA, DVA MOTIVA, ŠTIRI VRSTE PAPIRJA



KORELACIJA MED BARVNIM OBSEGOM (GAMUTOM) IN PARAMETROM A

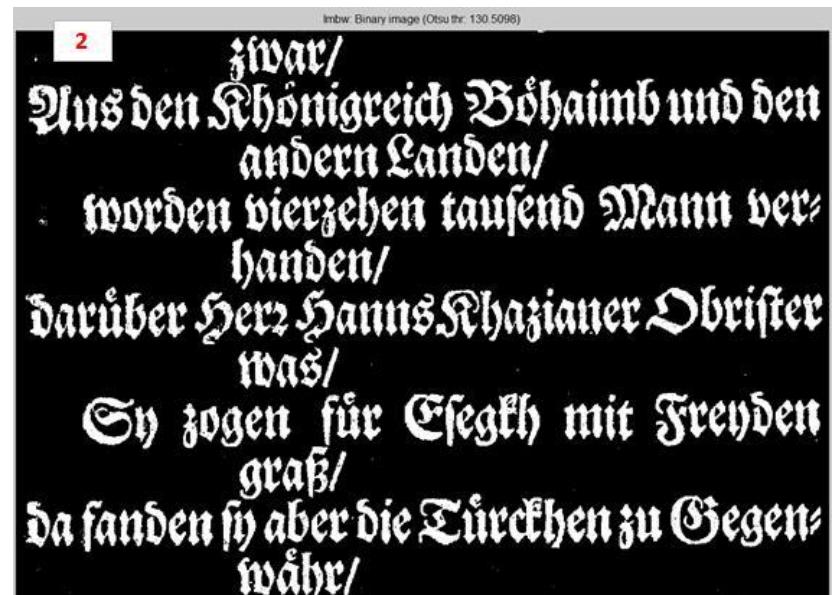
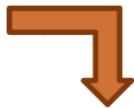
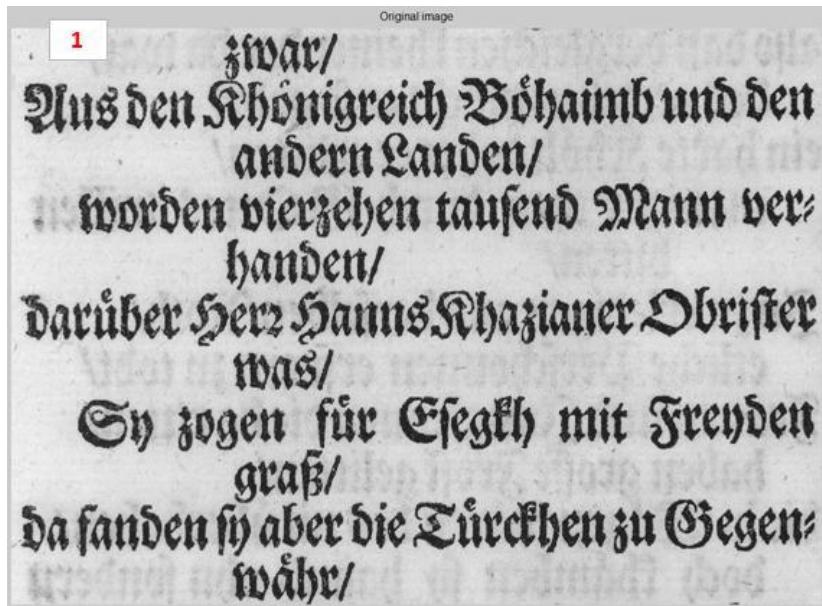


4. OCR – VALVASOR



w · h: 1690 x 1198 ppx

OCR - VALVASOR



OCR - VALVASOR

Imbw: Binary image (Otsu thr: 130.5098)

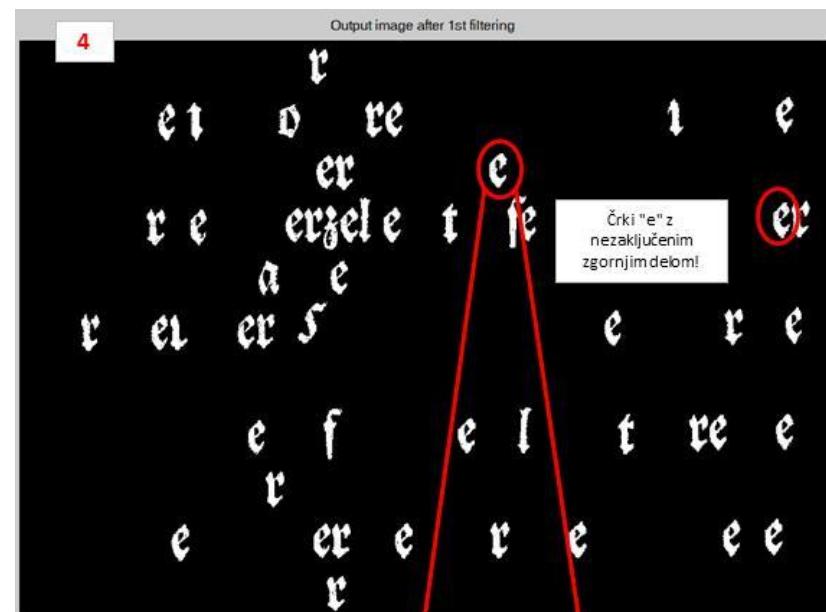
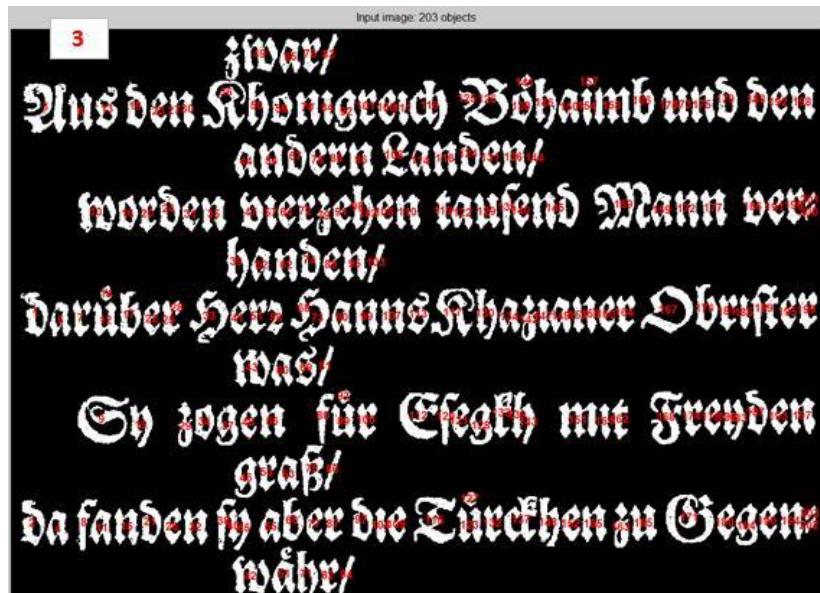
2 zwar/
Aus den Schonigreich Bohaimb und den
andern Landen/
worden vierzehn tausend Mann ver-
handen/
darüber Herz Hanns Khazianer Obrister
was/
Sy zogen für Esegkh mit Freyden
graß/
Da fanden sy aber die Türckhen zu Gegen-
währ/



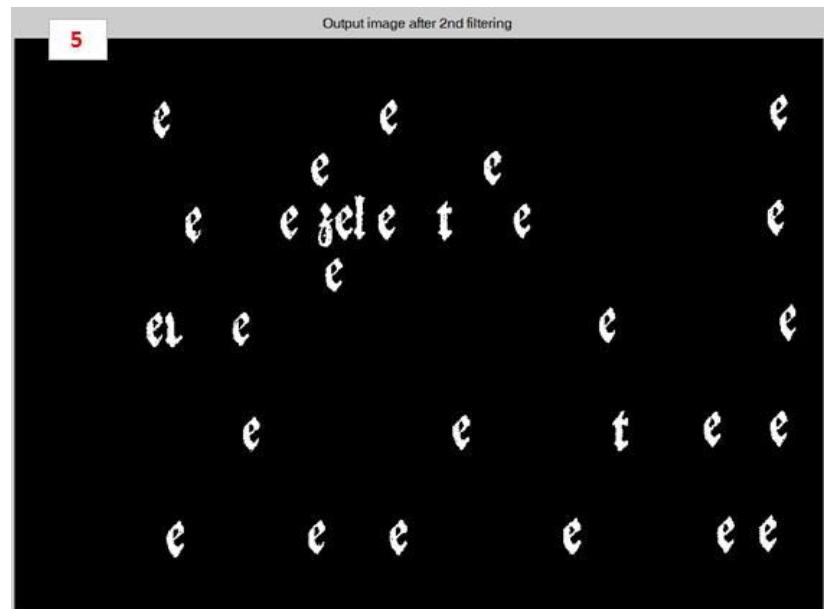
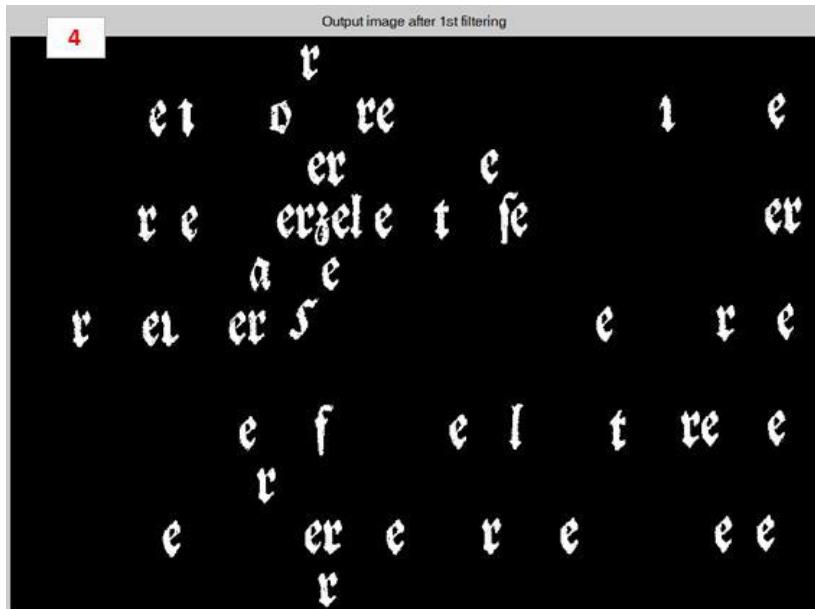
Imbw2: Objects with Area > 200

3 zwar/
Aus den Schonigreich Bohaimb und den
andern Landen/
worden vierzehn tausend Mann ver-
handen/
darüber Herz Hanns Khazianer Obrister
was/
Sy zogen für Esegkh mit Freyden
graß/
Da fanden sy aber die Türckhen zu Gegen-
währ/

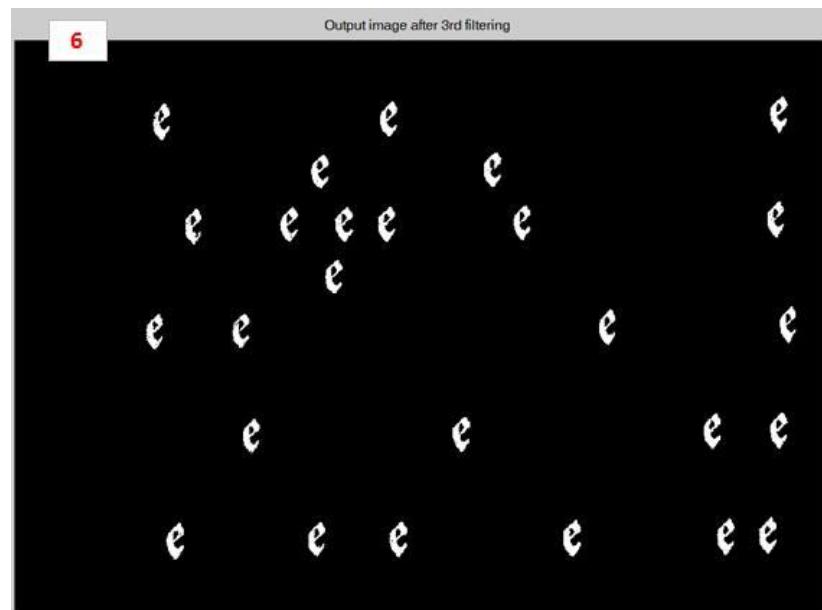
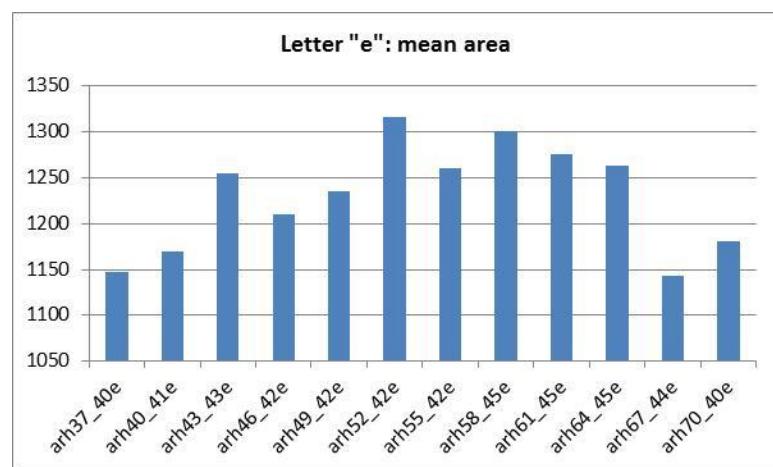
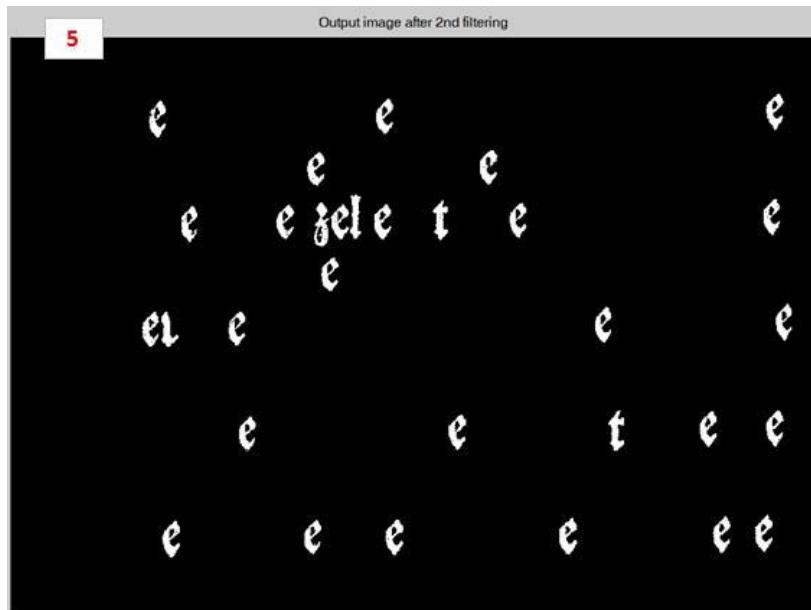
OCR - VALVASOR



OCR - VALVASOR



OCR - VALVASOR



Hvala za pozornost!

Več o postopkih slikovnega procesiranja najdete na:

<http://www.ntf.uni-lj.si/igt/employee/ales-hladnik/vsebine/interaktivni-mediji-2/>

