

CROSSING NUMBER FEATURES: FROM BIOMETRICS TO PRINTED CHARACTER MATCHING

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CHALLENGES OF DOCUMENT INTEGRITY CHECK



P&S process impact

- Ink dispersion in the paper.
- Inhomogeneous lighting conditions during the acquisition.
- Re-sampling inherent to the P&S process.



(a)



(b)

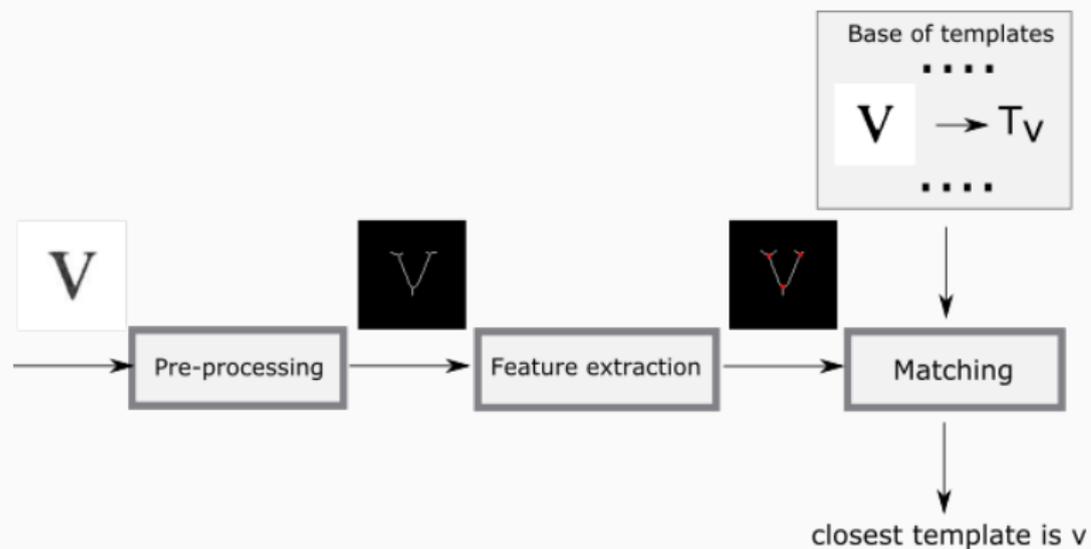


(c)



(d)

PROPOSED PIPELINE



PRE-PROCESSING STEP

1. Morphological operations

- Pre-processing 1: opening with square structural element of size 3×3 .
- Pre-processing 2: 2×2 open-close operation.

2. Binarization process

- using classical Otsu thresholding method

3. Thinning (skeletonization) process

- using classical thinning method based on medial axis transform



(a)



(b)



(c)

SINGLE VS DOUBLE P&S PROCESS

	M_1	M_2	M_3	SM_1	SM_2	SM_3
Pre-processing 1						
P&S 300 dpi	91.92%	86.54%	84.62%	94.23%	82.69%	95.00%
P&S 600 dpi	95.77%	90.77%	73.46%	97.31%	86.15%	97.31%
double P&S 600 dpi	66.92%	65.77%	54.23%	73.08%	66.54%	74.23%
Pre-processing 2						
P&S 300 dpi	85.38%	86.15%	83.46%	84.62%	78.08%	88.08%
P&S 600 dpi	89.62%	88.85%	90.00%	90.00%	85.38%	91.15%
double P&S 600 dpi	78.08%	75.38%	76.54%	80.00%	70.77%	83.46%

Table: Percentage of correctly recognized characters using suggested crossing number comparison techniques.

CONCLUSIONS

- Contributions
 - Crossing numbers based features for printed character matching
 - Feature extraction from character skeleton
 - Smoothed features: more than 95% of accuracy (300/600 dpi)
 - Interesting results for double P&S
 - Generalization for different fonts
- On-going and future work
 - Modification of the pre-processing operations
 - Compact text hashing for integrity check

QUESTIONS ?

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