Touching Text Segmentation and Shape Analysis

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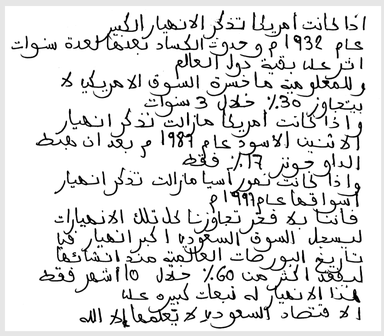
Motivation

Segment touching text between text lines.
Need a general solution for multiple environments.



Challenges

- Numerous stroke shapes
- Numerous touching configuration
- Irregular nature of handwriting

Previous work

- Empirical methods
  - efficient
  - not robust to variations
- Recognition based methods
  - require candidate segmentations
  - have high computational cost.

Problem

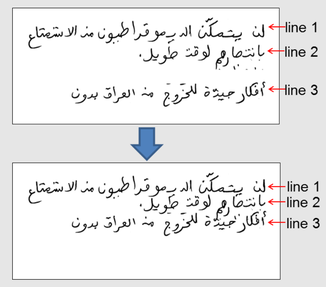
- Assume a text line segmentation algorithm is able to roughly detect the touching location
- Focus on segmenting the Local Touching Patterns (LTPs) that only cover part of the connected components shared by two different characters

Approach

- Construct a dictionary of LTPs
- For an input LTP, find the best match in the dictionary
- Transform the template's known segmentation to obtain the input LTP's segmentation.

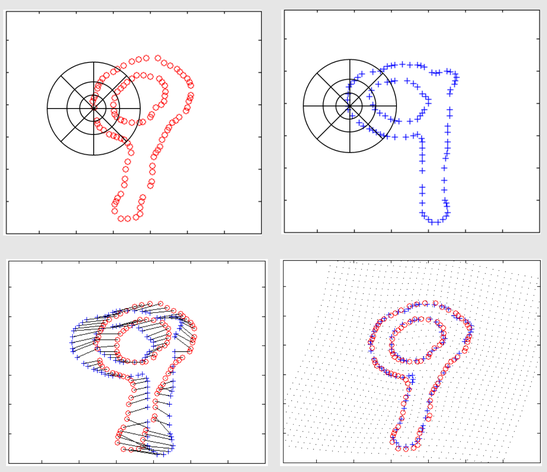
Data collection

- Reduce the spacing between text lines to create touching
- LTP s are obtained with known segmentations (ground truths).



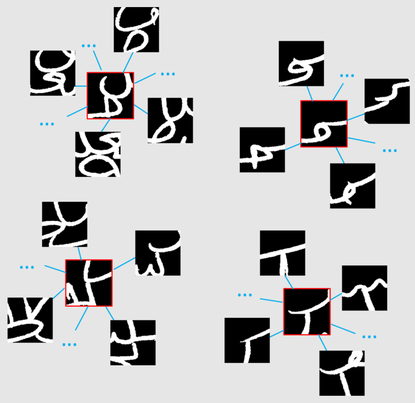
Shape matching and transform

- Shape context characterizes points distribution, invariant to rotation and scale
- Thin Plate Spline (TPS) is a coordinates transform that warps one shape into another

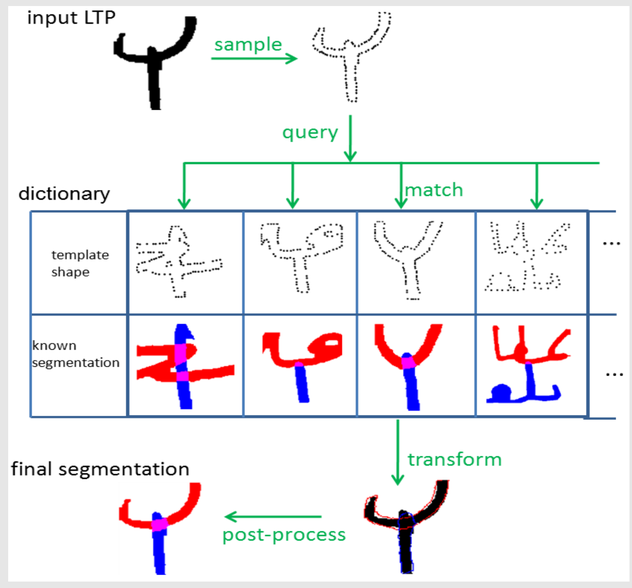


Dictionary and exemplars

- Clustering using Affinity Propagation.
  - deterministic
  - no need to prescribe the number of clusters.
- Exemplars (i.e. centroids) represent different touching configurations



System flow



Evaluation

Similar to ICDAR text segmentation contest criterion

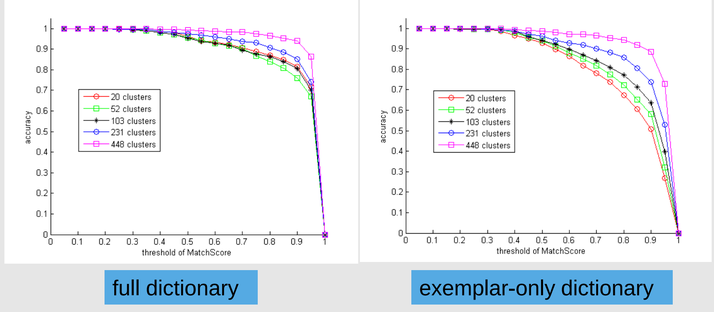
$$MatchScore = \frac{2 \times MS_A \times MS_B}{MS_A + MS_B}$$

$$MS_A = \frac{area(Q_A \bigcap G_A)}{area(Q_A \bigcup G_A)}$$

$$MS_B = \frac{area(Q_B \bigcap G_B)}{area(Q_B \bigcup G_B)}$$

dictionary	accuracy	
	SC+TPS	IDSC+DP
full	0.696	0.563
exemplar-only	0.714	0.555

Evaluation on training data



full dictionary exemplar-only dictionary

Examples

Summary

The proposed approach provides a extensible framework for segmenting touching components.

Various touching patches are reasonably segmented without ad-hoc heuristics.

For future work, we will incorporate prior knowledge of shapes for efficient segmentation of simple touching patterns.

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