

# Segmentation and Labeling of Mixed-type Noisy Handwritten Document

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## 1 Document Image Enhancement Using Integral images

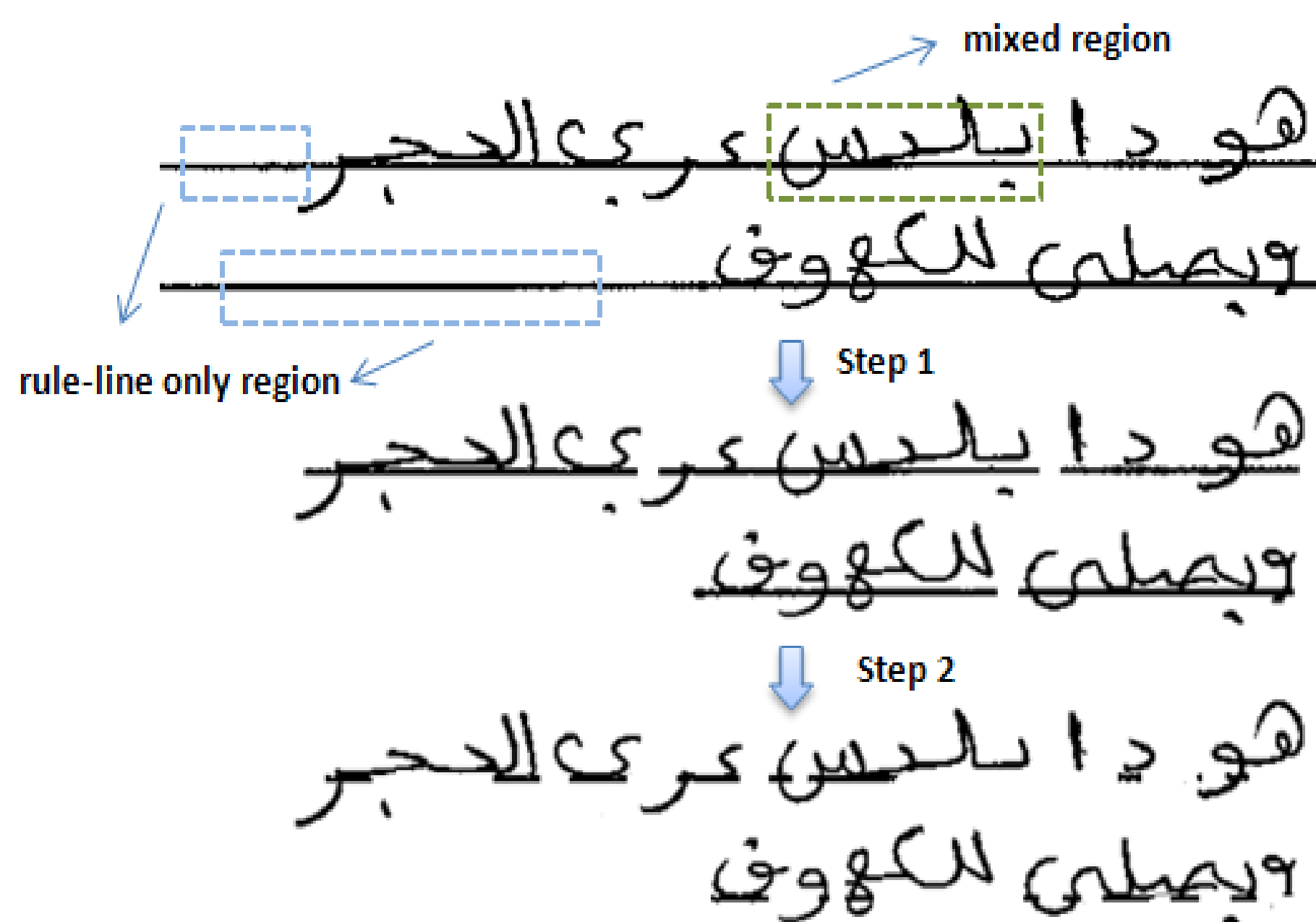


Fig. 1.1 Rule-line removal

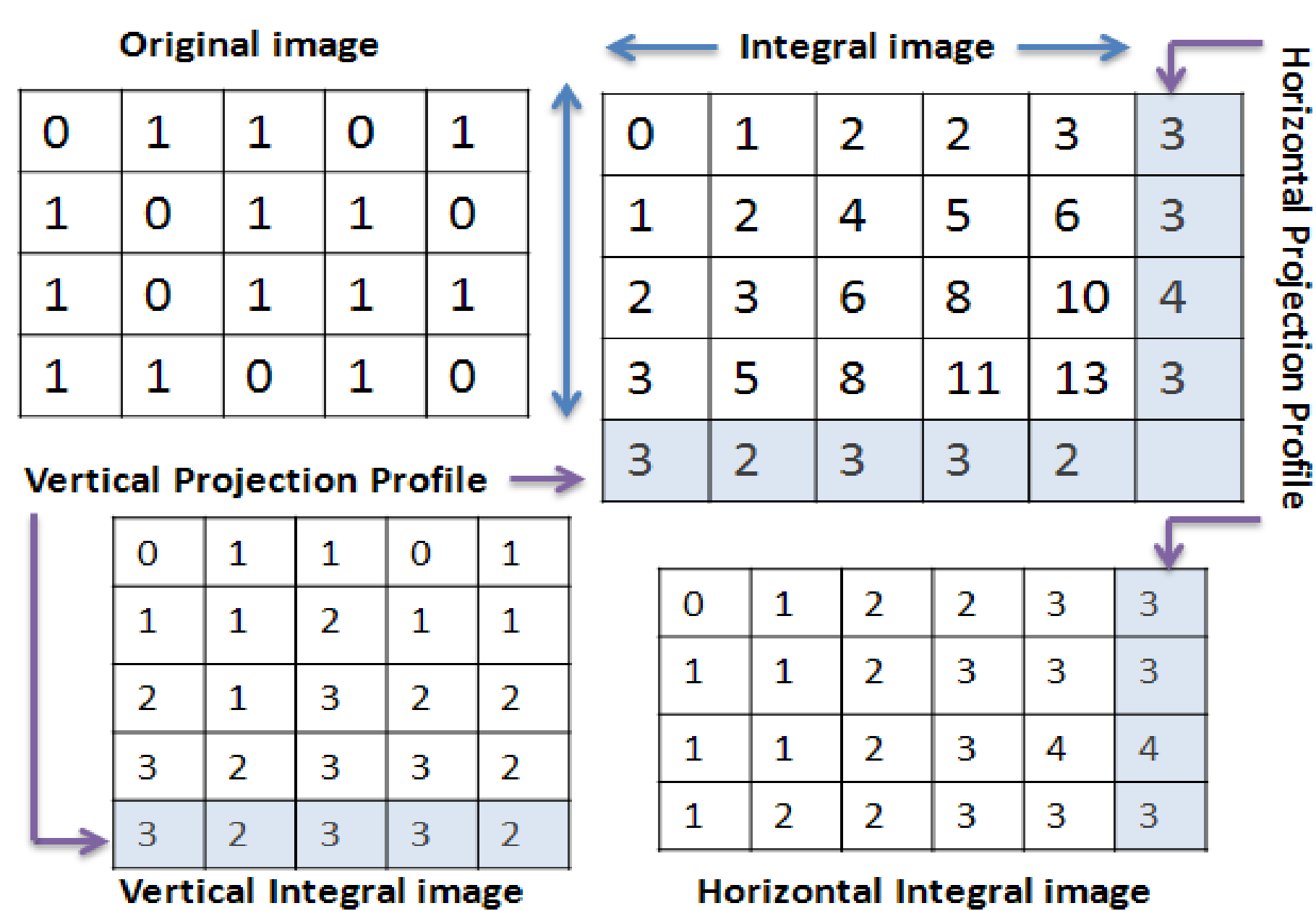


Fig. 1.2 Integral image

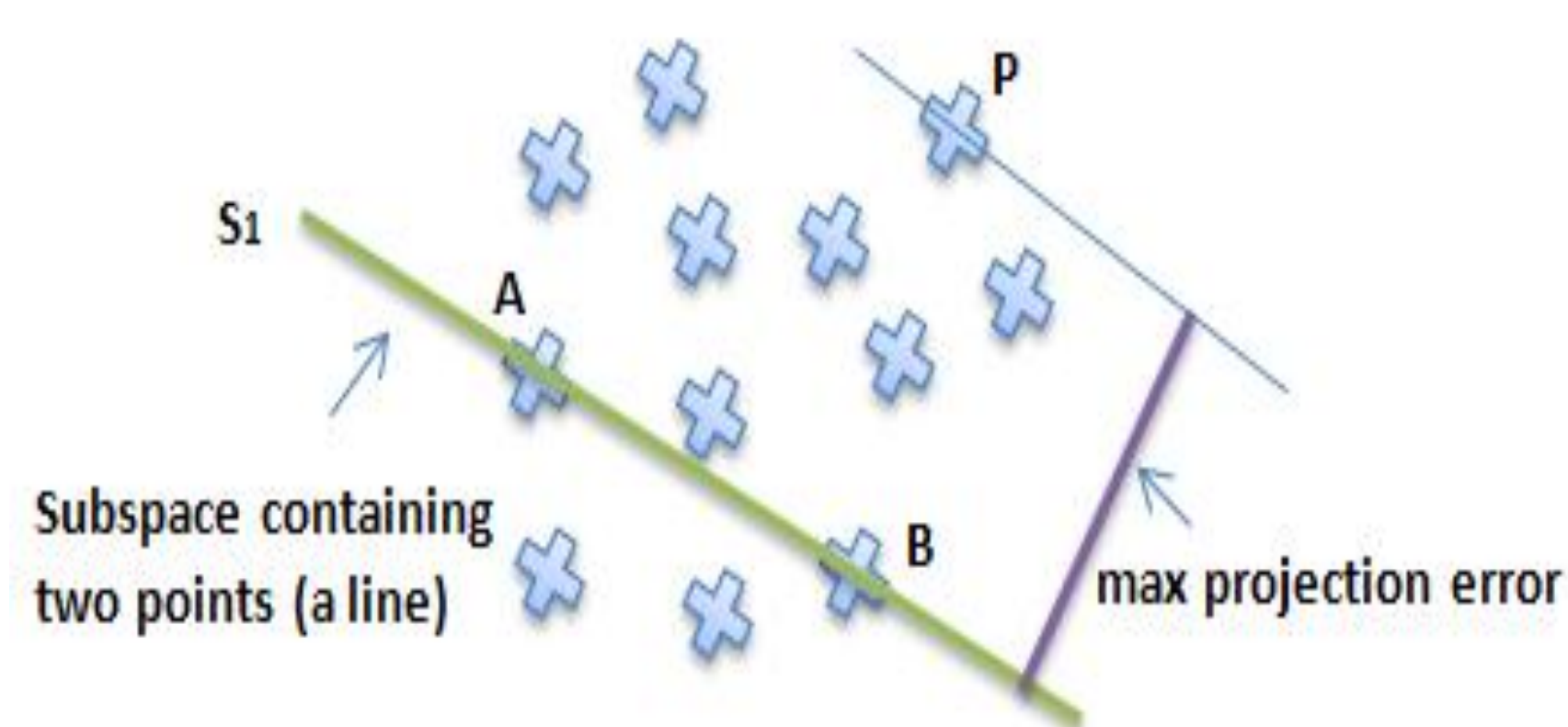


Fig. 1.3 Data Selection

### Experimental Results:

Table 1.1 F1-Scores for rule-line removal

Dataset	Handwritten Arabic	Constructed(Arabic)
SVM + integral image	94	91.4
Subspace + moment features	91.5	88.6

Table 1.2 Time Performance (in minutes)

Dataset	Constructed(Arabic)
SVM + integral image	47
Subspace + moment features	182

## 2 Touching Handwritten Text-Line Segmentation using EM

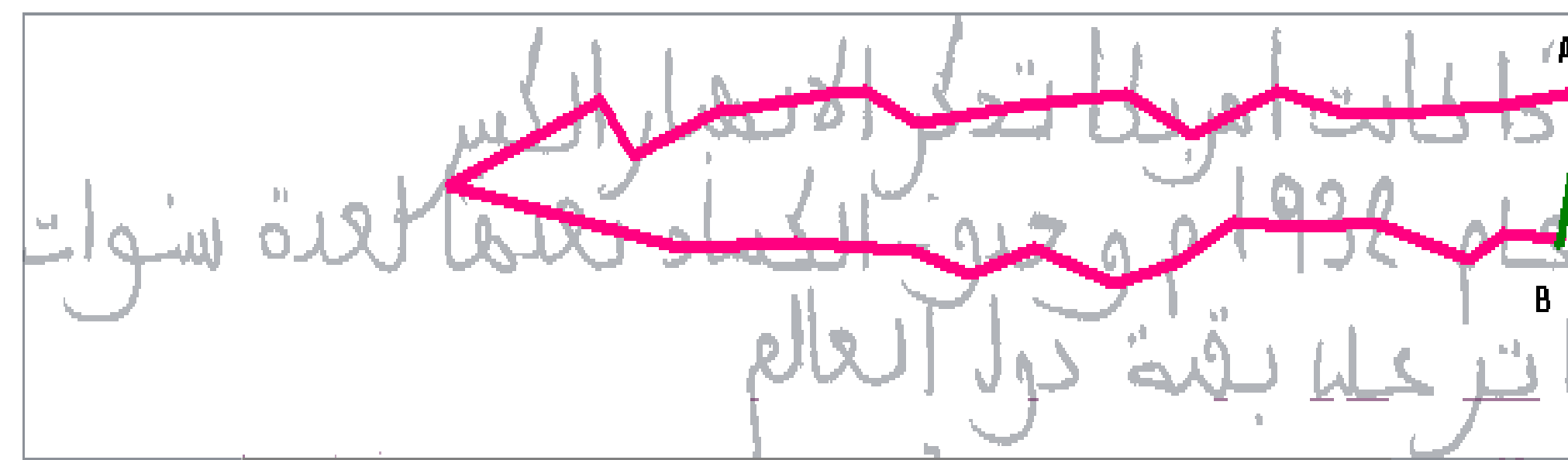


Fig. 2.1 Graph distance Vs. Euclidian distance

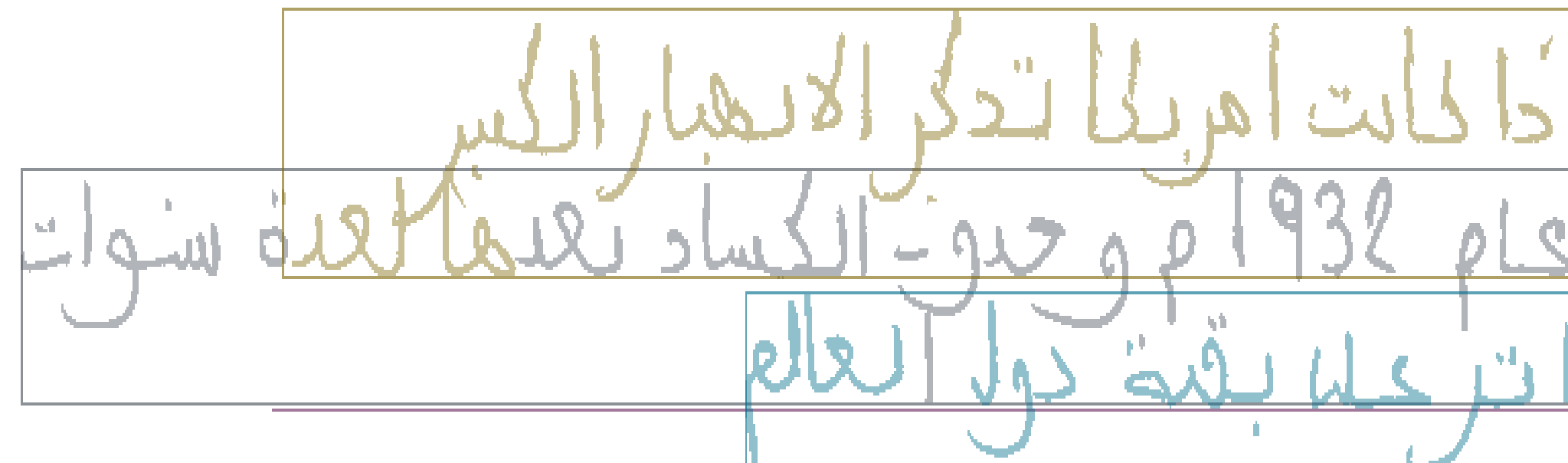


Fig. 2.2 EM based iterative error correction

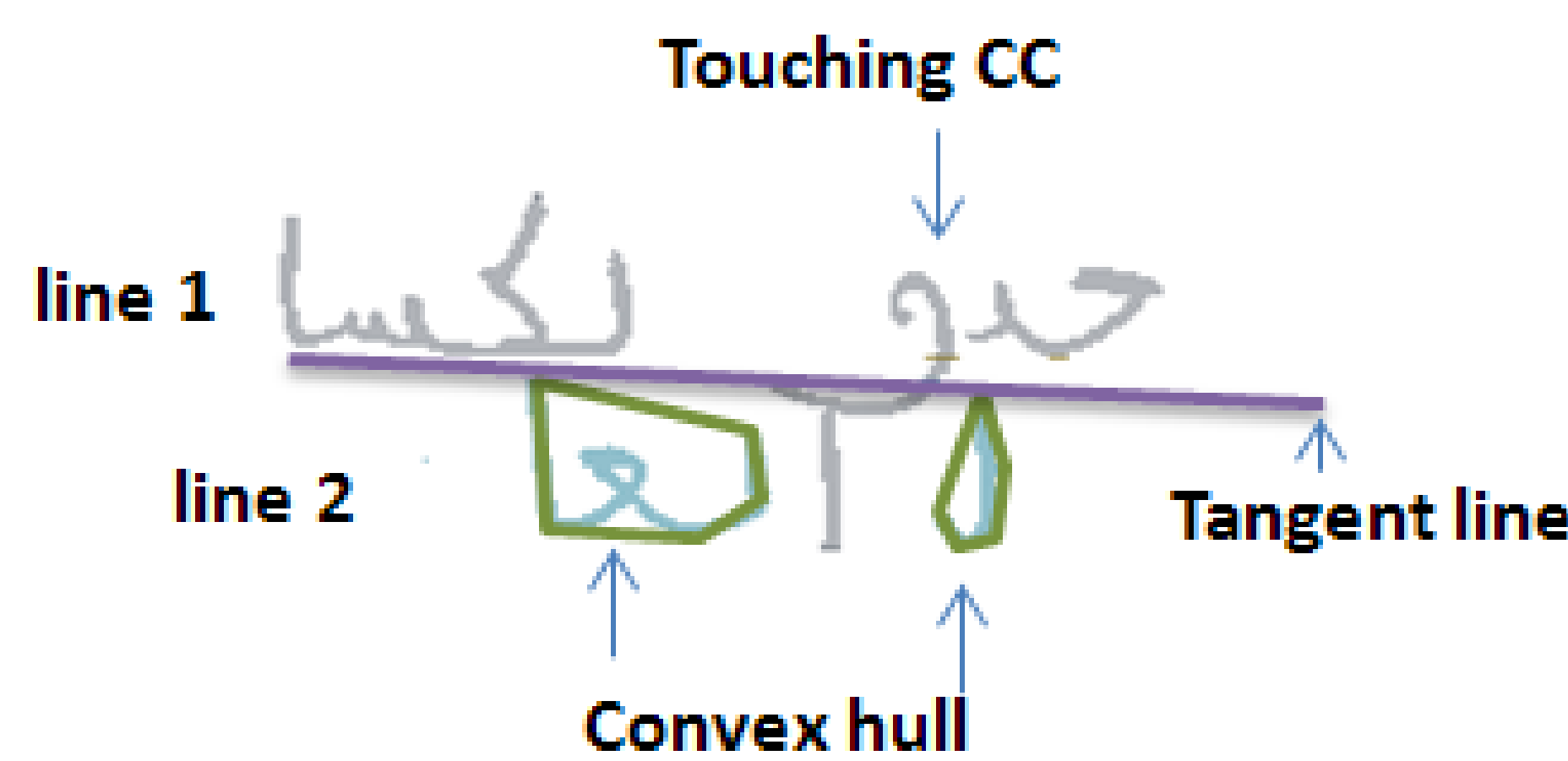


Fig. 2.3 Touching Component correction

### Evaluation:

$$\text{Matching Score} = \frac{T(P(r_i) \cap P(g_j))}{T(P(r_i) \cup P(g_j))}$$

### Experimental Results:

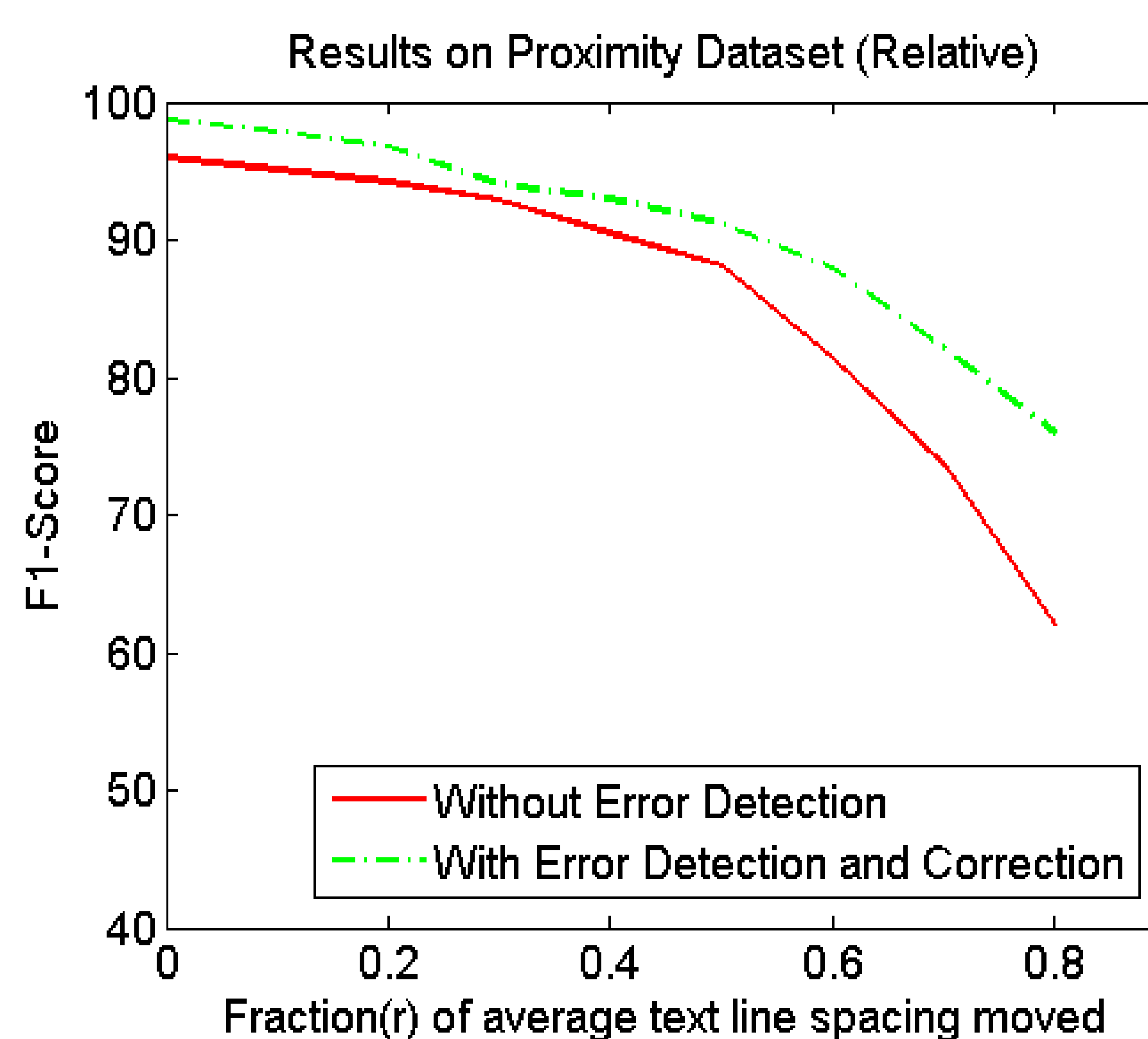


Fig. 2.3 Plot of F1-score on proximity data

Table 2.1 Results on ICDAR 2009 Segmentation competition dataset

Methods	CUBS	PAIS	LRDE	PPSL	Proposed
Accuracy (F-measure)	99.5	98.5	92	93.4	97.8

### Future Work:

- Adapt the proposed method for different scripts like devnagri, japanese

## 3 Document Image Labeling using Multiple Instance Learning

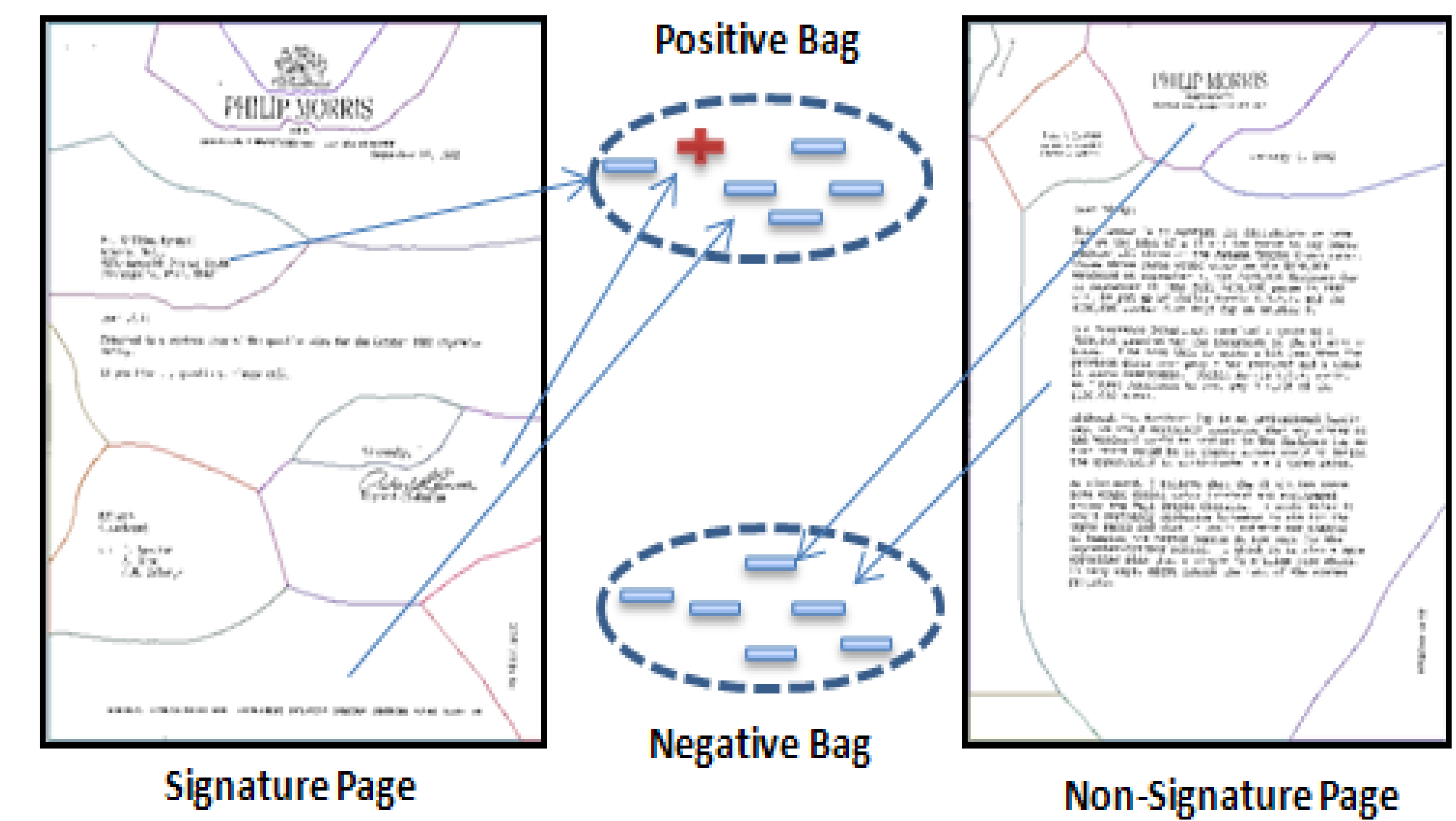


Fig. 3.1 Multiple Instance Learning setting

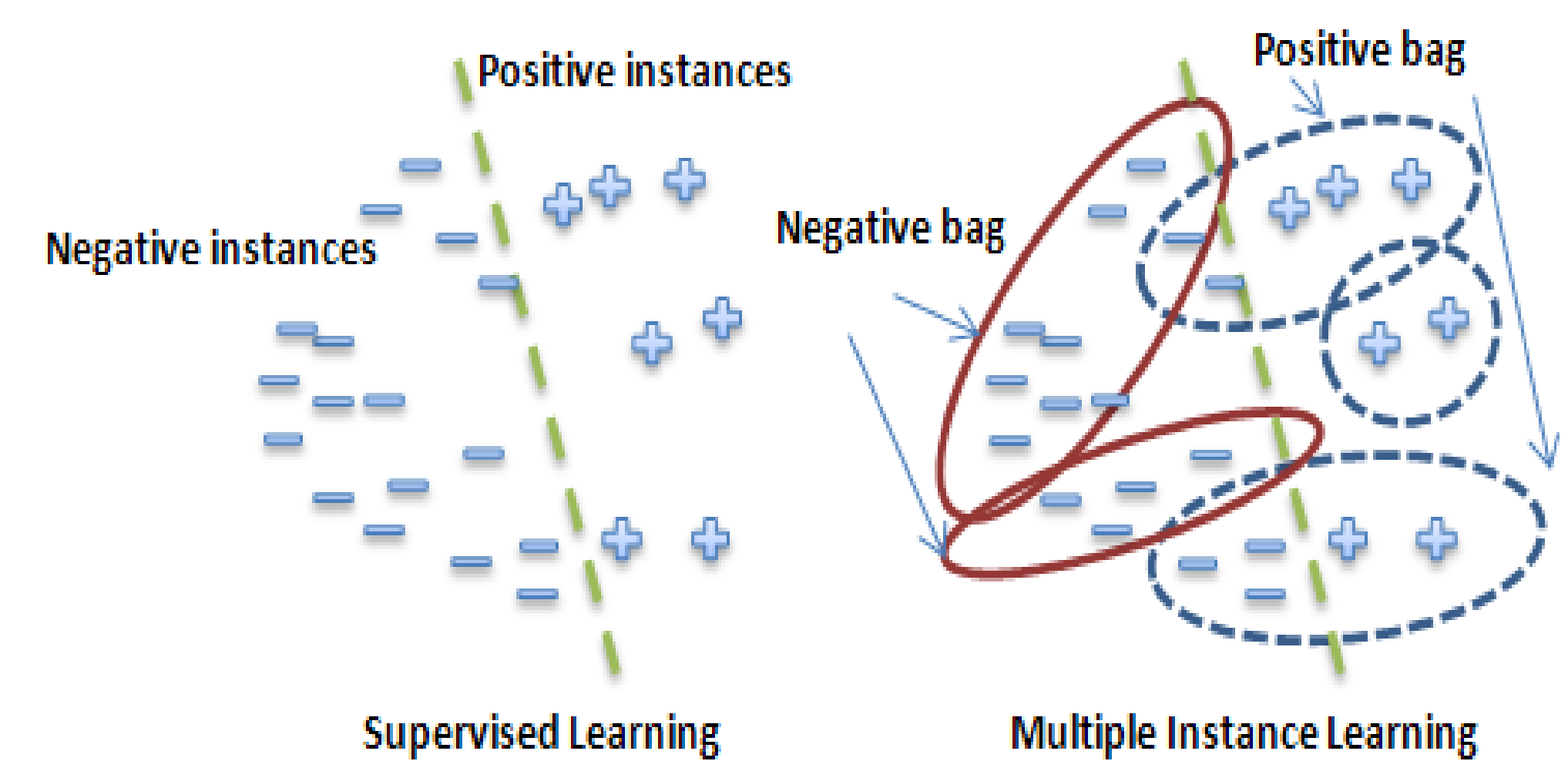
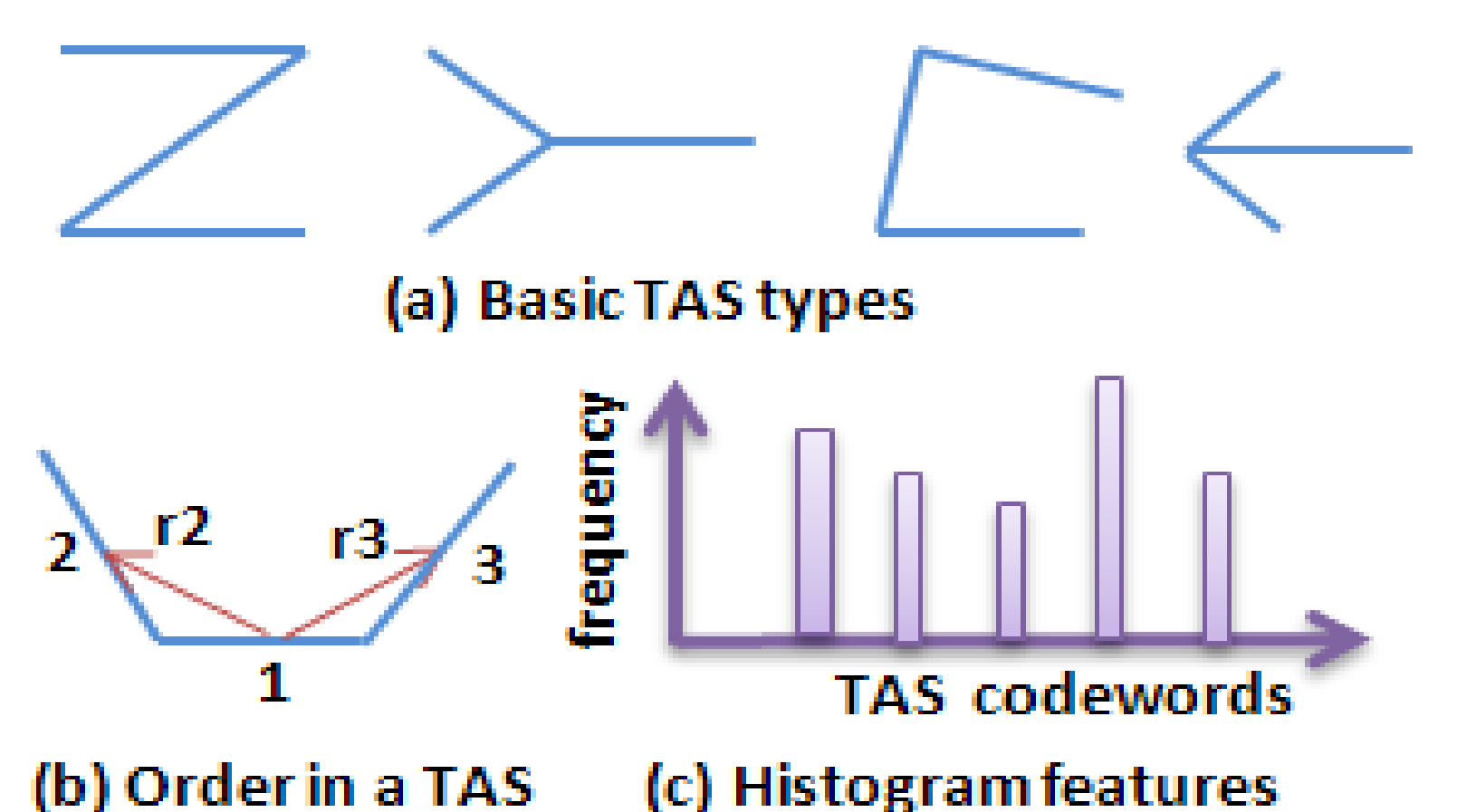


Fig. 3.2 Supervised learning Vs. MIL

### Features:



### Experimental Results:

Table 3.1 Signature Detection

Methods	Supervised SVM	MISMO	MILR	MIDD	SVM (baseline)
Accuracy	95.2	92.2	94.2	94.8	77.2

Table 3.2 Machine-print zone Detection

Methods	Supervised SVM	MISMO	MILR	MIDD	SVM (baseline)
Accuracy	87.0	81.2	82.6	83.2	74.0

Table 3.3 Time Performance (in sec)

Methods	Supervised SVM	MISMO	MILR	MIDD
Training	2.2	31.2	2.77	262.6
Testing	1.4	2.1	1.2	4.6

### Future Work:

- Apply MIL for multi-class zone classification