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Handwritten Hangul Recognition by Dynamic Lattice Search with Structural Constraints

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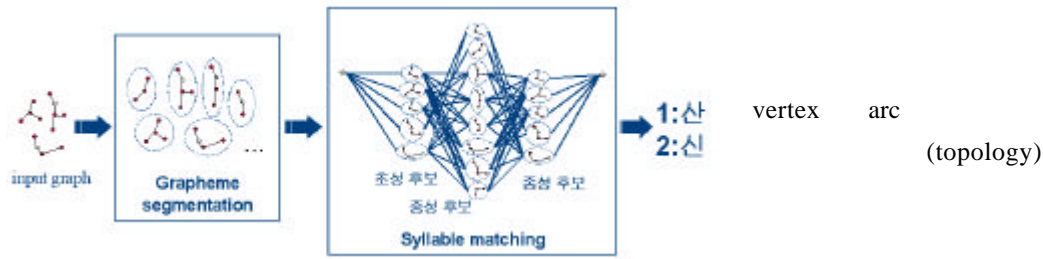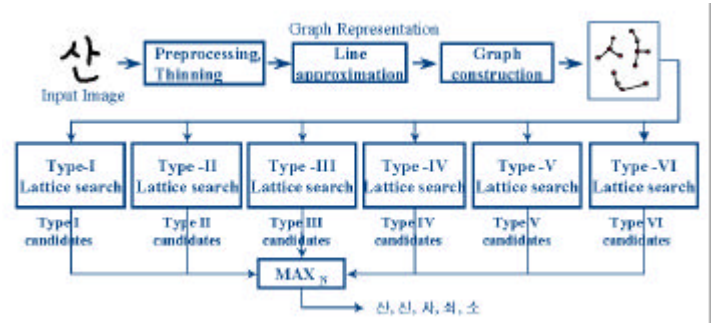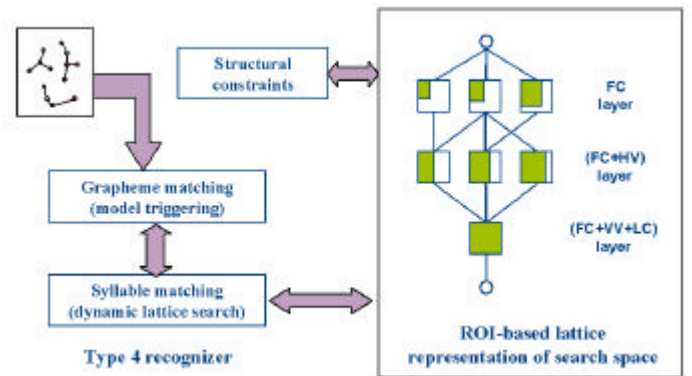,   .
                                                                                                                 ,
                                                 .

                                 .
                                                                 ,
                                                 .

                         , DP   ,
                                                 .   SERI-DB
         ,
                                                 .

1.   (1).
                                                                                                                 .

                                                 .   ,
, Hidden Markov Model   .

                                                 .   ,
                                                 ,   [8].
                                                                                                 (2).
                 .   subgraph isomorphism
                                                                                 ,
                                                                                 .
         .   ,
                 ('   '   '   ),
                                                 .
                 ,   ,   2
                                                                                 ,
                                                                                                                 .

귀 귀 귀 커 귀
귀 궈 커 뤼

[7].

그림 1.

, ,

.

.

.

. 2
(random graph)
, 3

. . 4

, Interactive .
Activation Model (IAM) ,
[5]. , 2. [8]
1
.

.
Wickens ,

[6]. .
(redundancy) . ,
, , ,
.
. ,
.
(word superiority effect) .

.

.

1:산 vertex arc ,
2:신
(topology)

Grapheme segmentation
초성 후보 중성 후보
중성 후보
Syllable matching

.

.

그림 2.

3. Random graph

4.

5.   6

(3).   ,   vertex
                                                                    arc
                                                .

        ,   vertex
arc   .

                        (X:), G:
    , M: X   G   ).

$$\arg\max_{\{M,G\}} P_M(G\,|\,X) \ ? \ \arg\max_{\{M,G\}} P_M(X\,|\,G)P(G)$$

                                                .

                    NP-complete   .

                        ,
                                        .
                                            .

                    (candidate pruning technique)
        .

3.

                                4   .
                        ,   ,
6   6   .

                                .

                                                                                            ,

                                        ,

                                                        (5).

                        ,   ,   , best-first
search   .

                                            .

3.1.

                                                            .
                                                                .
                                                                        ,

                                                        .

                                                        .   2
                                                    ‘   ,   .

Lattice representation (4형식 문자)

FC layer
(FC+VV) layer
: X
(FC+VV+LC) layer
X X

6.

.

,   ,   ,   ,

,   .

1   .

.   .

,

DP   matching
(dynamic   programming   matching)   .
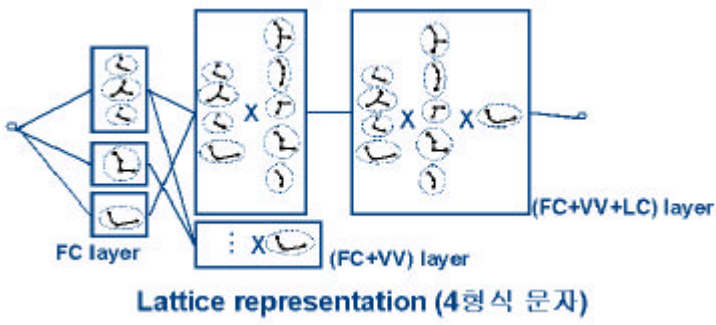ROI(region of interest)   ,   ,

(6),   ,

DP matching   best-first search   (fuzzy)   .

.   (model triggering),

ROI   bounding box   ,   .

ROI   ‘   ’,   ,

,   ‘   ’,   ,

. Best-first search   .   2   1   ‘   ’

2   ‘   ’, ‘   ’,   ,

.

,   .

n   ,

.   .   17

.

,   ,   .   ,

.

3.2.

Subgraph isomorphism

(subgraph)

7.
특징
Level 1
Level 2
Level 3
발화
검증

.   1

2   .

(1) Topological constraint   (2) Positional constraint   (3) Noise constraint
부분 문자후보 '구'   초성 후보 'ㄴ'   중성 후보 'ㅏ'

8.
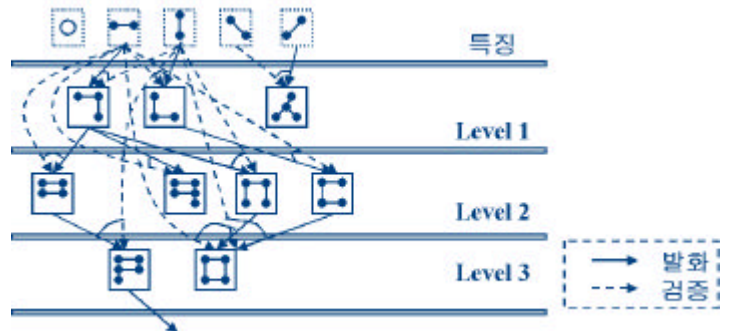
MODEL   ' '
TRIGGERED_BY   ' '
VERIFIED_BY   ' '
RELATION   RIGHT_CLOCKWISE

MODEL   ' '
TRIGGERED_BY model   'G'
VERIFIED_BY   ' '
RELATION   DOWN_CNT_CLOCKWISE WITH 2nd PRIMITIVE
SUP_RELATION   PARALLEL WITH 1st PRIMITIVE
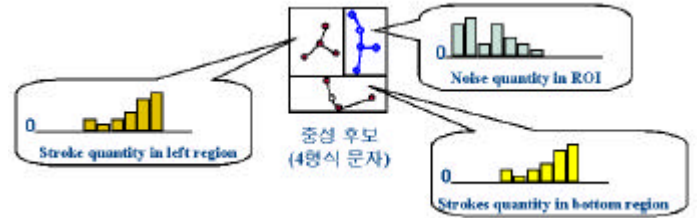
9.

Subgraph isomorphism
O(M ? S ? C)   (M:
     , S: , C:
                          ),
                                     (feature-directed
matching)   M   S
     .

4.

                          520
DB   SERI-DB
                              [8]   .

3.3.
                                                                    200 set, 104,000
                                                   ,   1 set, 520
                                                                    .

                   ,   ,
          .   .

               ,
          .   90%   .

                                                  2   .

          .
          (8).   ,   0.4 %   .

(topological constraint).   ,   10   11
                              (positional   .
constraint).
                                                            .   ,
          (noise   constraint). Topological   ',   '
constraint
          .   subgraph isomorphism
          ROI
ROI   .
          (9).

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,   ,

.

.

	6671.3	747.2
	91.2 %	90.8 %

1.   [8]

5.

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10.

11.