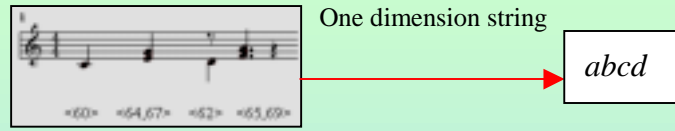# Efficient K-NN Search in Polyphonic Music Databases Using a Lower Bounding Mechanism

Ning-Han Liu, Yi-Hung Wu, Arbee L.P. Chen

Department of Computer Science, National Tsing Hua University

Hsinchu, Taiwan 300, R.O.C

One dimension string

abcd

$S_q = a_{q1} a_{q2} x a_{q3} x a_{q4} x x a_{q5} x x a_{q6} x a_{q7} x a_{q8} x a_{q9}$ (query)

$S_1 = a_{11} a_{12} a_{13} a_{14} a_{15} a_{16} a_{17} a_{18} a_{19}$ (candidate)

0	1	1	2	2	1	1	1

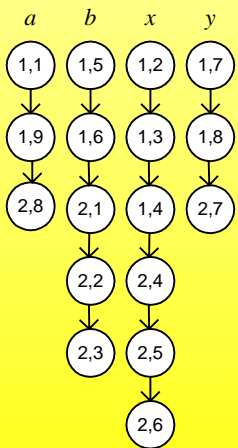$a_{11}\ a_{12}\ a_{13}\ a_{14}\ a_{15}\ a_{16}\ a_{17}\ a_{18}\ a_{19}$

$$LB(S_1, S_q) = 9 + \sum_{i=1}^{9} cost(a_{qi}, a_{1i})$$

$$LB(S_1, S_q) = \sum_{i=0}^{n} L(C_i) + \sum_{i=1}^{n} cost(a_{qi}, a_{1i})$$
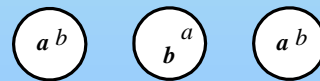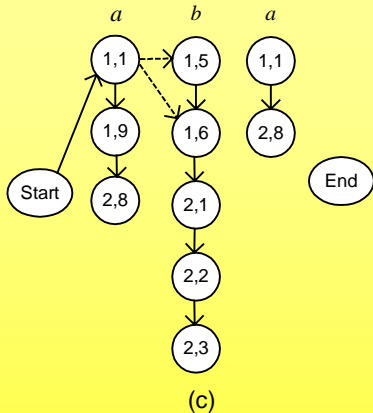
Query: *aba*

Data 1: *a x x x b b y y a*
Data 2: *b b b x x x y a*
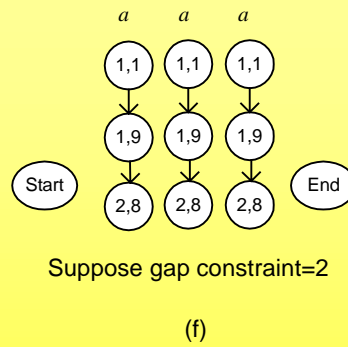Query: *a b a*

(a)

Candidates
aba(0)
aaa(0.4)
abb(0.4)
bba(0.4)
aab(0.8)
baa(0.8)
bbb(0.8)
_ba(1)
a_a(1)
ab_(1)
bab(1.2)
_aa(1.4)
bb_(1.4)
aa_(1.4)
_bb(1.4)
a_b(1.4)
b_a(1.4)
b_b(1.8)
ba_(1.8)
_ab(1.8)
_b_(2)
a__(2)
__a(2)
__b(2.4)
b__(2.4)
_a_(2.4)

(b)

(c)

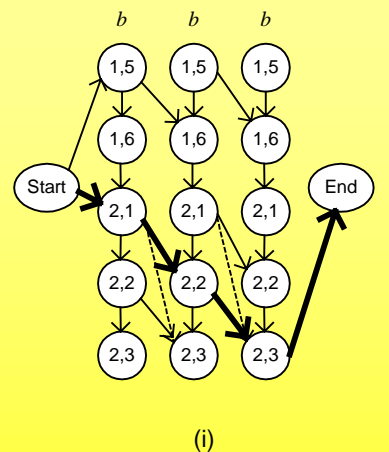| Event-pattern	Interval
ab	3
ba	infinite

(d)

Candidates
aaa(0.4)
bbb(0.8)
a_a(1)
_aa(1.4)
bb_(1.4)
aa_(1.4)
_bb(1.4)
b_b(1.8)
_b_(2)
a__(2)
__a(2)
__b(2.4)
b__(2.4)
_a_(2.4)
a_b(3.4)
abb(3.4)
aab(3.8)
ab_(4)
_ab(4.8)

(e)

Suppose gap constraint=2

(f)

Event-pattern	Interval
ab	3
ba	infinite
aa	infinite

(g)

Candidates
bbb(0.8)
bb_(1.4)
_bb(1.4)
b_b(1.8)
_b_(2)
a__(2)
__a(2)
__b(2.4)
b__(2.4)
_a_(2.4)
a_b(3.4)
abb(3.4)
ab_(4)
_ab(4.8)

(h)

(i)

Data1: *acb* Data2: *addbec*

Event-Pattern	Interval
ab	1
bc	1
cd	infinite
abc	3
abcd	infinite

Candidate: *abcd*