

HMM

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e-mail : lnr32@naver.com, gksrlghd1@gmail.com, nygirl@konkuk.ac.kr, clcccclcc@shoseo.ac.kr

Recognize the Emotional state of the Speaker by using HMM

Na-Ra, Lee*, Ki-Hong, Han*, Hyun-jung, Kim**, Il-Young, Won*

*Cyber Hacking Security Seoul Hoseo Technical College

**Dept, of Computer Science and Engineering Konkuk University

HMM(Hidden Markov Model)

1. support vector machine(SVM)

IT 가 [1]. 가 HMM [4].

[10].

2.

3.

4.

5.

가 .

2.1 Mel-Frequency Cepstral Coefficient (MFCC)

(Envelope [8,9].

Detection)

MFCC(Mel-Frequency Cepstral Coefficient) [3] MFCC(Mel-Frequency Cepstral Coefficient)

MFCC 가 Mel-frequency cepstrum (MFC)

가 MFC

[3]. Mel-scale

(cosine transform)

MFC Mel-

Frequency Cepstral Coefficients(MFCCs)

MFCC

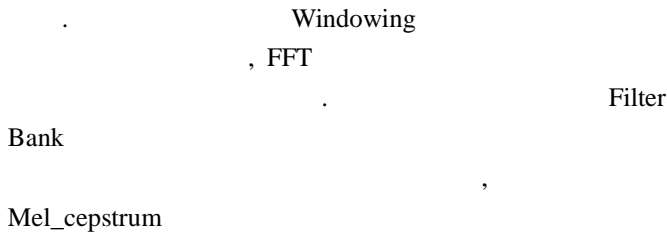


Fig 1

Fig 1. MFCC Feature Extraction

2.2 Hidden Markov Model (HMM)

LPC(Linear Predict Cording)
 MFCC(Mel-Frequency Cepstral Coefficient)
 HMM (hidden) (modeling)
 HMM (hidden) 가 [5].
 HMM 2 3 5 (hidden state set), (observable state set), distribution),

(observation symbol sequence) [6]
 $O = \{o_1, o_2, o_3, \dots, o_T\}$ (1)

(2) $Q = \{q_1, q_2, q_3, \dots, q_n\}$ (2)

(3) 가 $V = \{v_1, v_2, v_3, \dots, v_m\}$ (3)

(4) $\pi = \{\pi_i\}$ (4)
 $\pi = \pi_i, \pi_i = P(q_1 = i), 1 \leq i \leq N$ (4)

(5) i j (state transition probability) (5)
 $A = a_{ij}, a_{ij} = P(q_t = j | q_{t-1} = i), 1 \leq i, j \leq N$ (5)

(6) j k $B = b_j(k), b_j(k) = P(o_t = v_k | q_t = j), 1 \leq k \leq M, 1 \leq j \leq N$ (6)

HMM $\lambda = (\pi, A, B)$
 N, M, T
 A, B, π 가 T
 HMM 가
 [6]. The Evaluation Problem, The Decoding Problem, The Learning Problem
 The Evaluation Problem $O = \{o_1, o_2, o_3, \dots, o_T\}$
 HMM $\lambda = (\pi, A, B)$ $P(O|\lambda)$
 The Decoding Problem $O = \{o_1, o_2, o_3, \dots, o_T\}$ $\lambda = (\pi, A, B)$
 $Q = \{q_1, q_2, q_3, \dots, q_t\}$ 가
 The Learning Problem $O = \{o_1, o_2, o_3, \dots, o_T\}$ $P(O|\lambda)$ (parameter)
 $\lambda = (\pi, A, B)$ (7)

(7) $max_{\lambda} \{P(O|\lambda)\}$ (7)
 가 forward, Viterbi, Baum-Welch 가

[7].

3.

HMM

(A/D)

가

MFCC

Fig 2

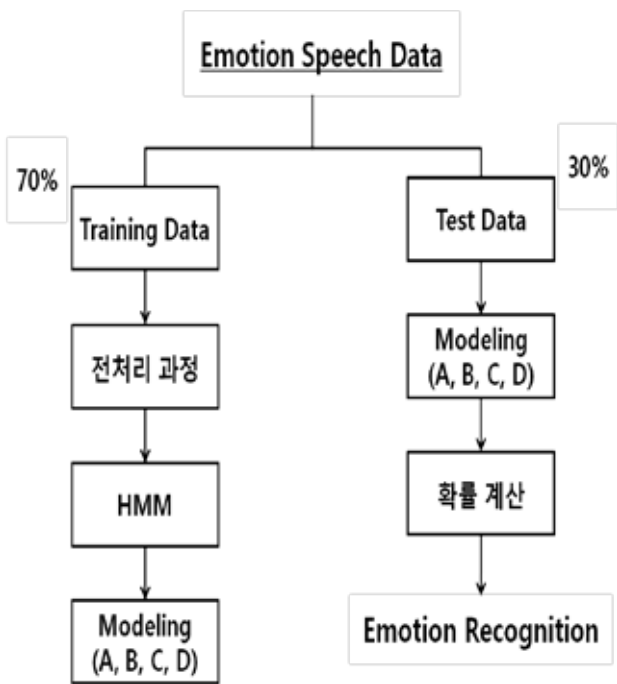


Fig 2. Emotional Recognition System

Table 1. Experimental Result

: %

	70	20	20	30
()	10	70	20	20
	10	20	60	30
	10	30	40	60

4.

4.1

4 가

10
44.1kHz, 16 bit
가

visual studio 2010

windows 7 32bit

4.2

10
30%

70%

MFCC

HMM

5.

HMM

MFCC

10

4 가

가

MFCC

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