Recognizing and Expressing Affect

Presentation Summary

Part 1 **Research status of emotion expression recognition**

1.1 Facial expression recognition.

1.2 feature extraction

Part 2 **Models（markov, D-S theory）**

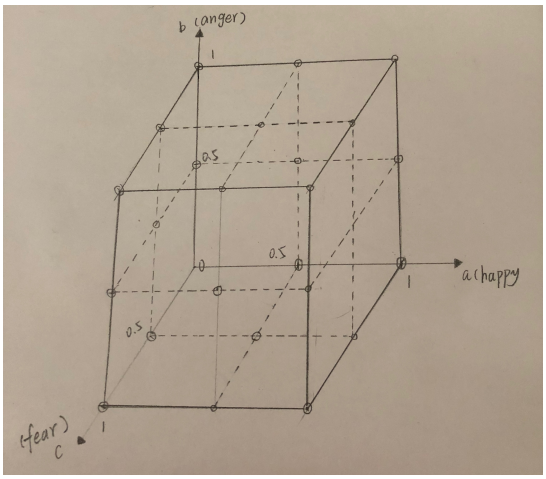
Discrete Affective Space Model

2.1 Markov model

1. Construct a three-dimensional model based on fear, anger and happy, and any emotional status will match a certain point on the 3-dimensional space.

2. Define happy as a, anger as b, fear as c, so, there are a$\epsilon(0, 0.5, 1)$, b $\epsilon(0, 0.5, 1)$, c $\epsilon(0, 0.5, 1)$.

3. Set that every basic emotion only have three intensity.



When someone's emotion go through this space, it is easy for us to find its statistical natures. This process we also call it **Markov**. Therefore, we can **use Markov model to describe how emotions change.**

There is probability of changing emotion status in Markov model, so in this emotion model, there are 27 $P_{i,j}$(i,j ∈ [1,2,3 … … ,27]) and they construct 27 dimensional Probability matrix A_p.

$$A_p=\begin{bmatrix} P_{1,1} & \cdots & P_{1,27} \\ \vdots & \ddots & \vdots \\ P_{27,1} & \cdots & P_{27,27} \end{bmatrix}$$

$P_{i,j}$(i,j ∈ [1,2,3 … … ,27]) is the probability of i_{th} status to j_{th} status. Additionally, there is a relationship among them:

$$\sum_{i=1}^{27} p_{i,j} = 1, i \in [1, 2, 3 \dots \dots, 27]$$

We can conclude that if there are m emotions and there will be m dimensional emotional space, and for every emotion there are n levels, which means that there will be n^m emotion status. Regard l=n^m, we can find that:

$$A_p=\begin{bmatrix} P_{1,1} & \cdots & P_{1,l} \\ \vdots & \ddots & \vdots \\ P_{l,1} & \cdots & P_{l,l} \end{bmatrix} \text{ and}$$

$$\sum_{i=1}^{l} p_{i,j} = 1, i \in [1, 2, 3 \dots \dots, l]$$

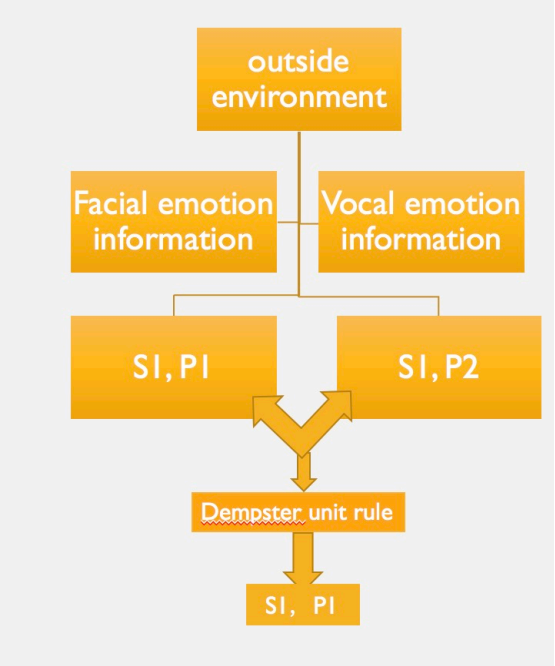
2.2 d-s theory

Combine emotional space model with d-s evidence theory.

This model will capture outer simulation by sensor, and then D-S theory will be applied into it for combining outside emotion information, which finally will promote the transfer of emotion status and reach a new state of emotion.

S = the strength of simulation from outside environment

P = basic credibility



Part 3 **using CNN convolutional neural network to recognize facial expression**

How to recognize facial expression:

1. we can read the data downloaded from website.
2. We will get and save the labels and pictures, setting up the batch for providing data when training network.
3. Construct CNN convolutional neural network.
4. Train it.
5. Check it and calculate the accuracy rates.