Estimation of Human Emotion by Analyzing Facial Expression Transition of Image Sequences

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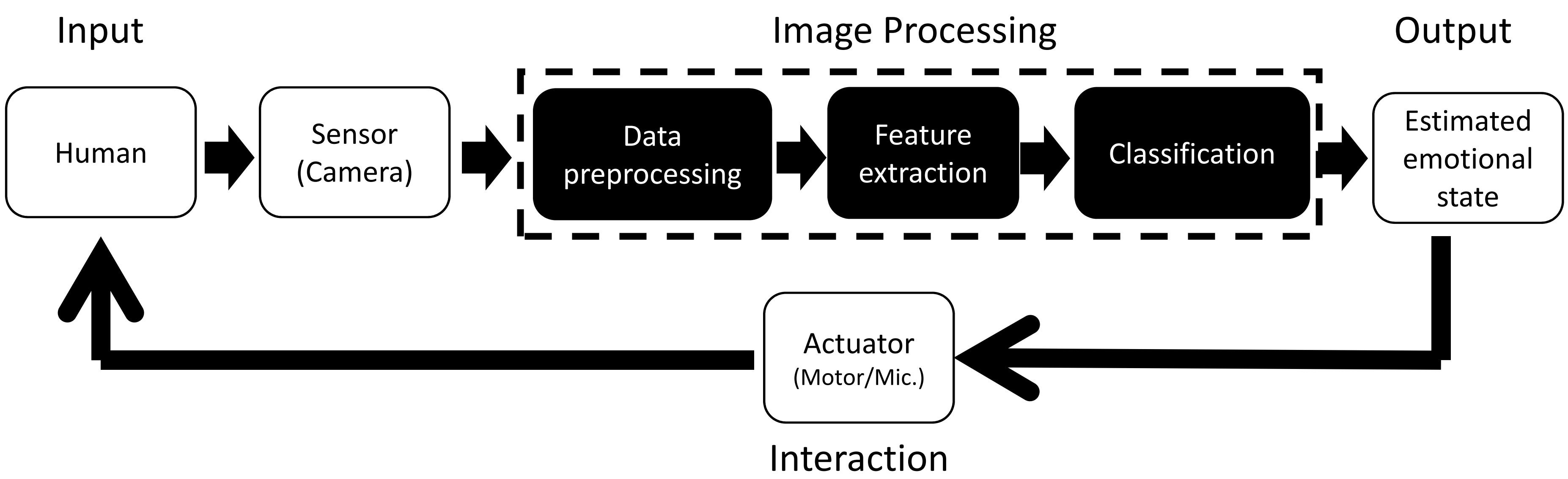
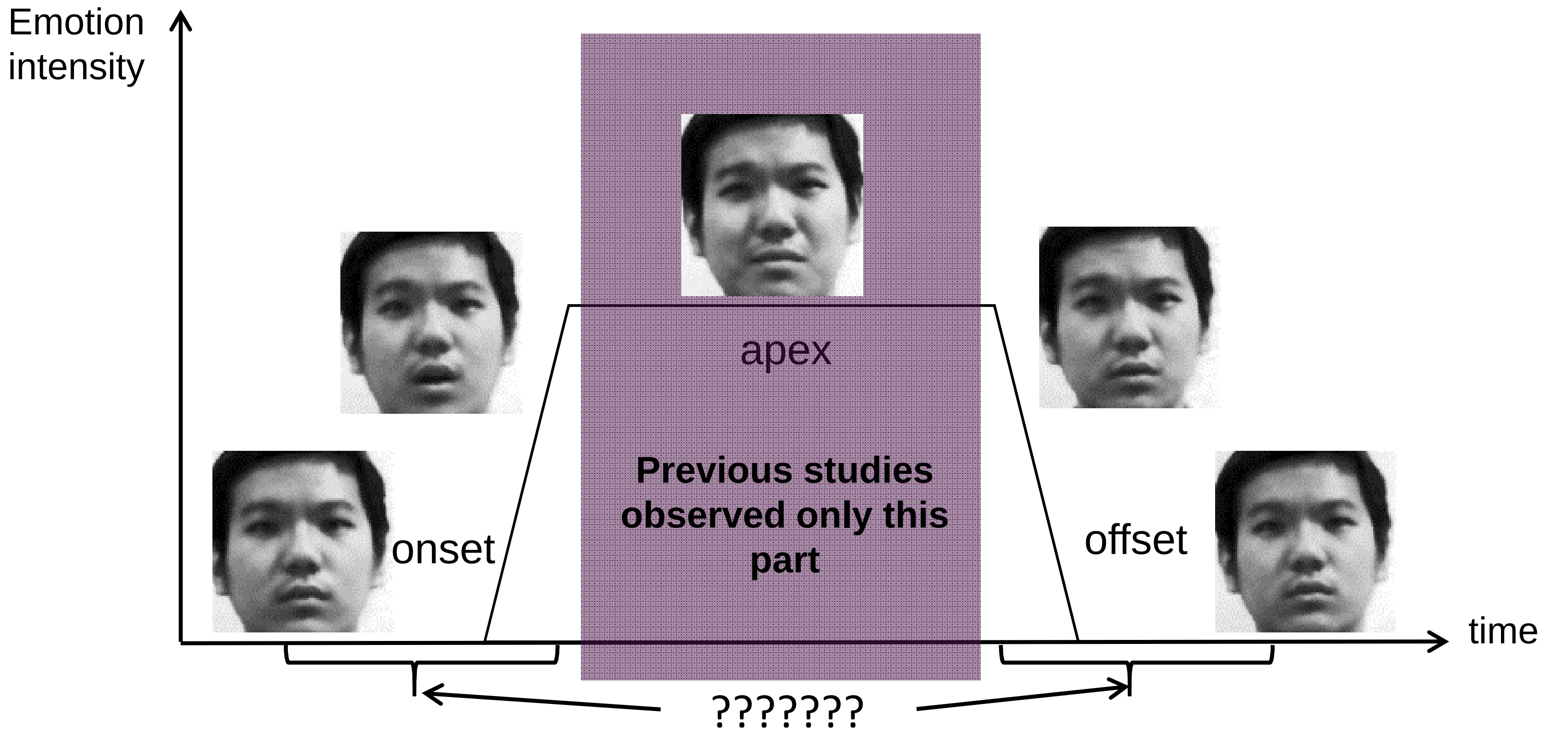
Theoretical Framework



Overview of emotion analysis system in human-machine interaction

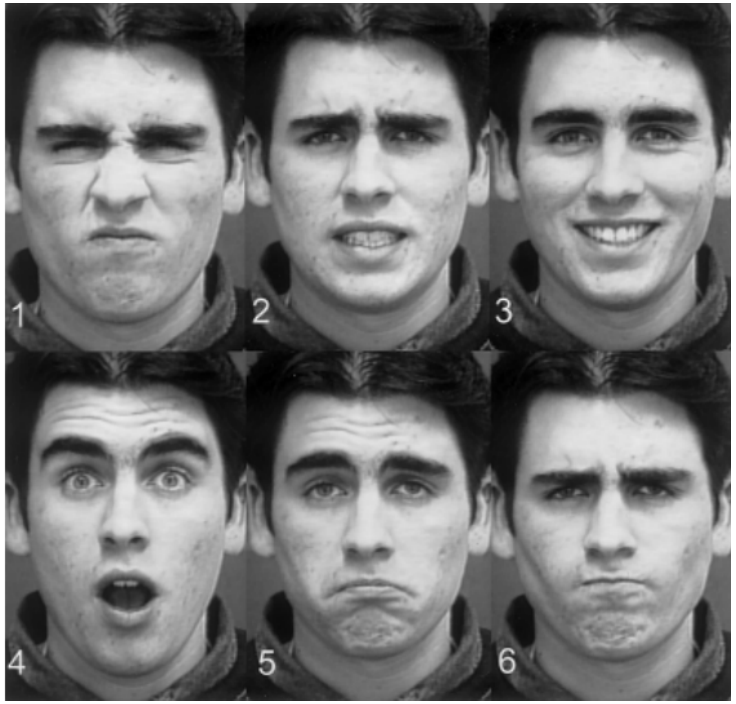
Problem

- Training process used only still peak emotion expressions. The rest were neglected.
- Cannot capture subtle (weak) expression



Problem

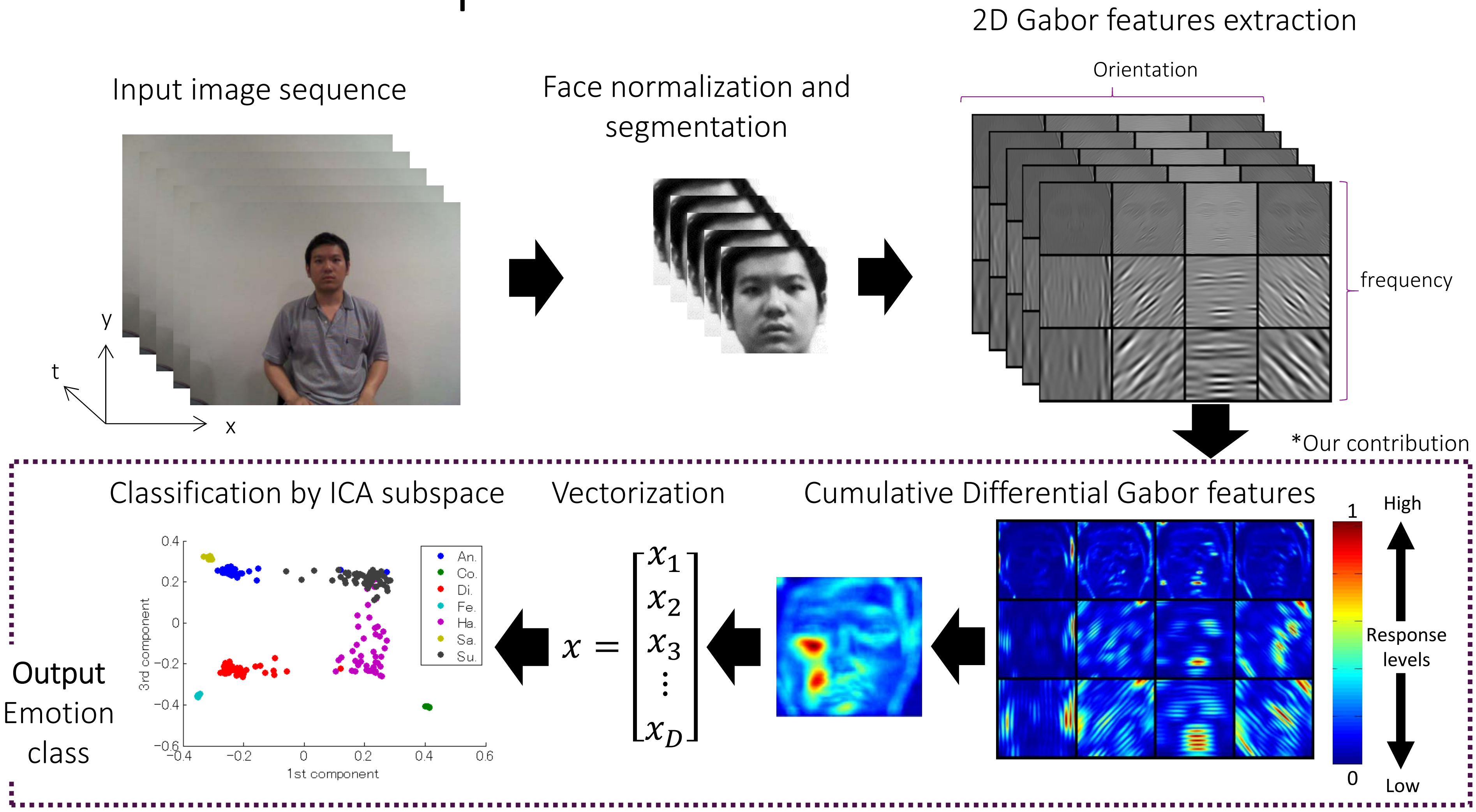
- Limited by Ekman's basic emotion (Ekman, 1972)



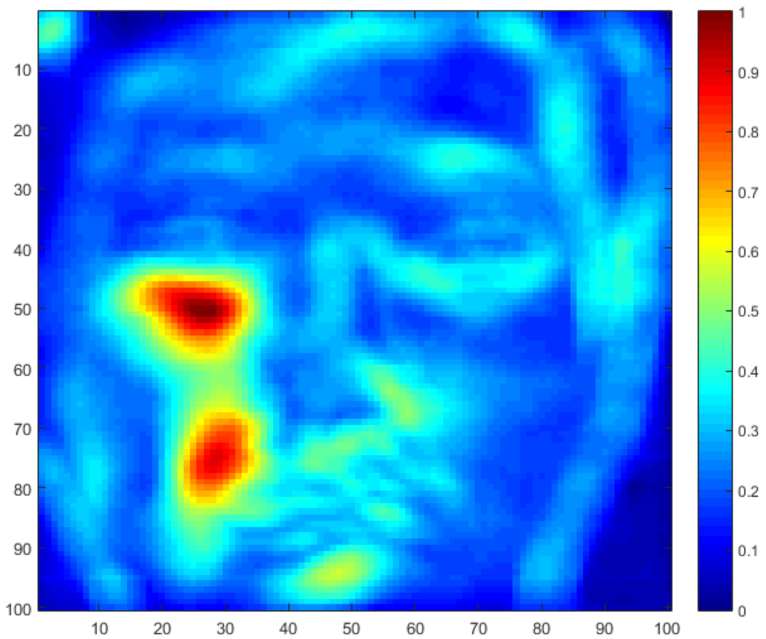
Basic emotion expression
(Ekman, 1972, CK dataset)
(1) disgust, (2) fear, (3) joy,
(4) surprise, (5) sadness, (6) anger

- Almost every facial expression analysis in computer vision field used this category
- Discrete class
- People do not express these expressions all the time

Robust Temporal Feature



We introduces a novel feature modeled from dynamic facial expression by the extension of 2D Gabor features and independent component analysis



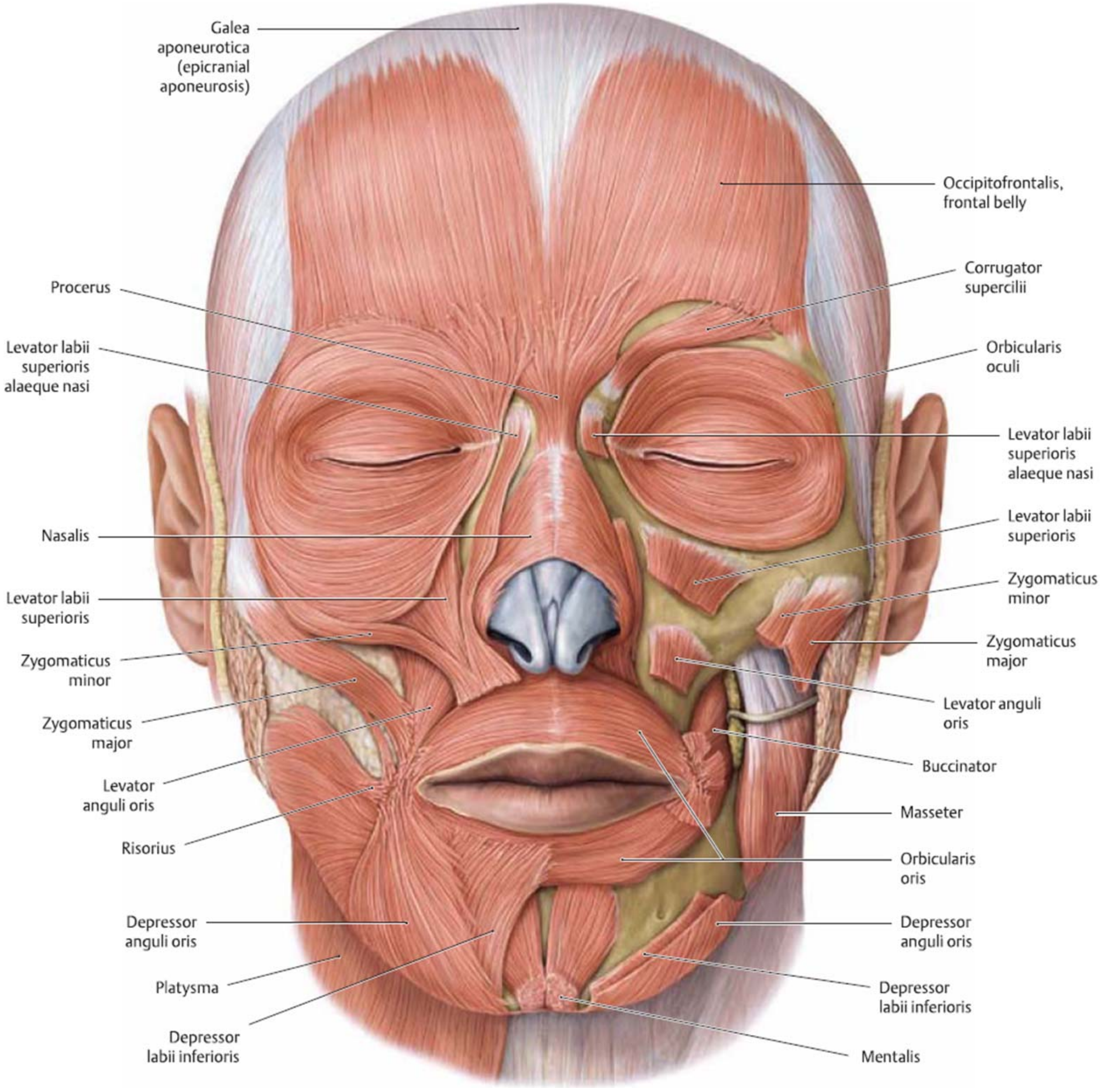
<u>Robust against</u> :

- Face alignment error (translation, scaling)
- Other types of interferences (illumination varying, blur, noise)

Low-frequency components reduce influences from head motions and face detection/tracking errors

High-frequency components compensate the loss information

Facial Action Coding System (FACS)

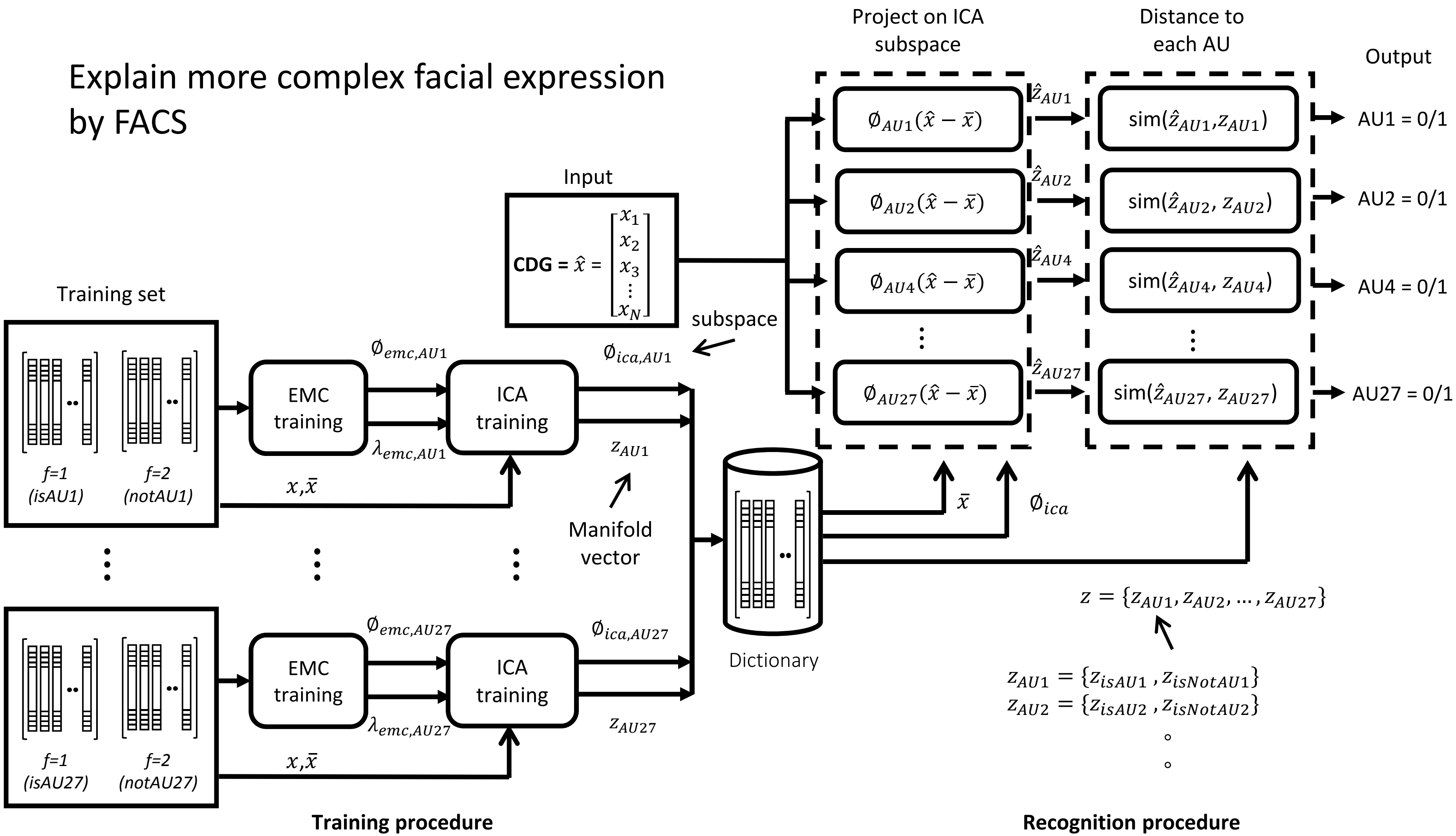


Muscle and Face appearance used in psychology (Ekman et al. 2002)

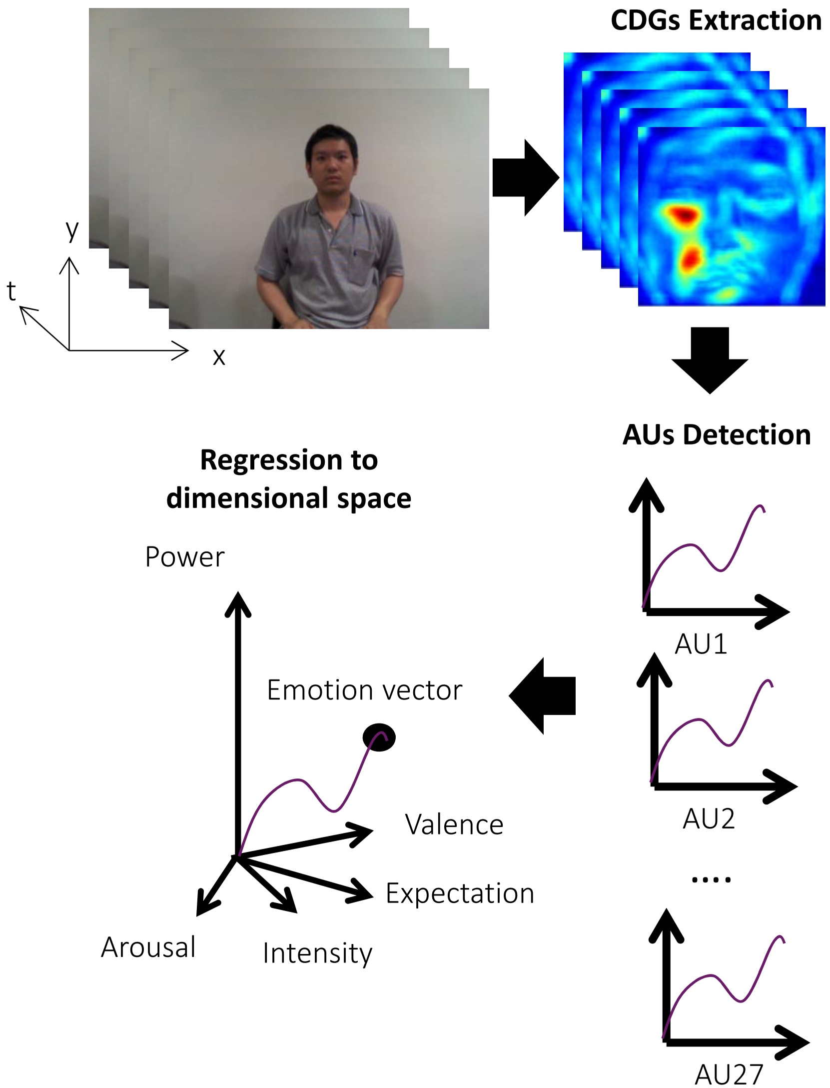
AU Number	FACS Name	Muscular Basis
1	Inner Brow Raiser	frontalis (pars medialis)
2	Outer Brow Raiser	frontalis (pars lateralis)
4	Brow Lowerer	depressor glabellae, depressor supercilii, corrugator supercilii
5	Upper Lid Raiser	levator palpebrae superioris, superior tarsal muscle
6	Cheek Raiser	orbicularis oculi (pars orbitalis)
7	Lid Tightener	orbicularis oculi (pars palpebralis)
9	Nose Wrinkler	levator labii superioris alaeque nasi
10	Upper Lip Raiser	levator labii superioris, caput infraorbitalis
11	Nasolabial Deepener	zygomaticus minor
12	Lip Corner Puller	zygomaticus major
13	Sharp Lip Puller	levator anguli oris (also known as caninus)
14	Dimpler	buccinator
15	Lip Corner Depressor	depressor anguli oris (also known as triangularis)
16	Lower Lip Depressor	depressor labii inferioris
17	Chin Raiser	mentalis
18	Lip Pucker	incisivii labii superioris and incisivii labii inferioris
20	Lip Stretcher	risorius w/ platysma
21	Neck Tightener	platysma
22	Lip Funneler	orbicularis oris
23	Lip Tightener	orbicularis oris
24	Lip Pressor	orbicularis oris
25	Lips Part	depressor labii inferioris, or relaxation of mentalis or orbicularis oris
26	Jaw Drop	masseter; relaxed temporalis and internal pterygoid
27	Mouth Stretch	pterygoids, digastric

Facial Action Coding System (FACS)

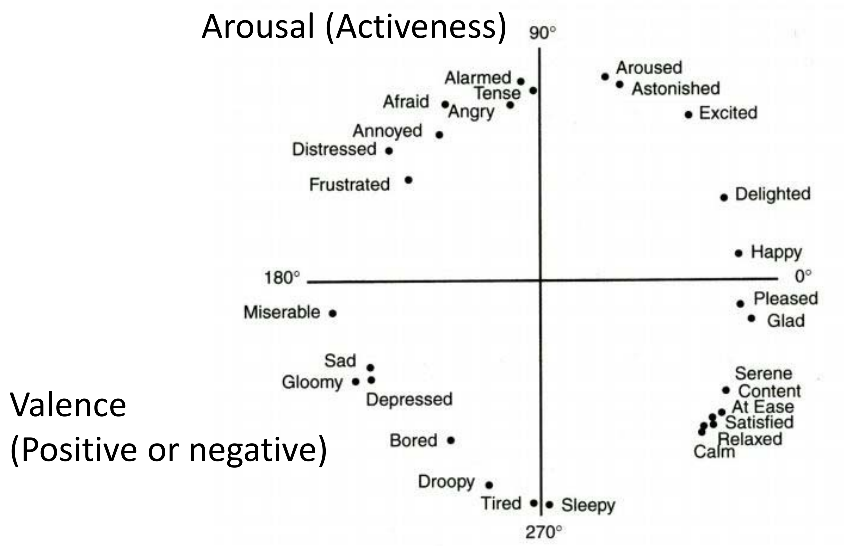
Explain more complex facial expression by FACS



Beyond basic emotion



Dimensional emotion model



Russell's Circumplex model

- Continuous values
- More complex emotion

Conclusion

- Estimating emotion parameters from subtle and complex facial expressions
- A novel robust temporal feature
- A novel Action Units (AUs) detector
- Facial expression beyond Ekman's basic emotions

See more at:

① Prarinya Siritanawan, Kazunori Kotani, Fan Chen: "Cumulative Differential Gabor Features for Facial expression classification", International Journal of Semantic Computing, Vol. 9, No. 2, pp. 193-213 , 2015

② Prarinya Siritanawan, Kazunori Kotani: "Facial action units detection by robust temporal features", in proc. International Conference on Soft Computing and Pattern Recognition (SoCPaR2015), 2015