Presentation semester project IIG

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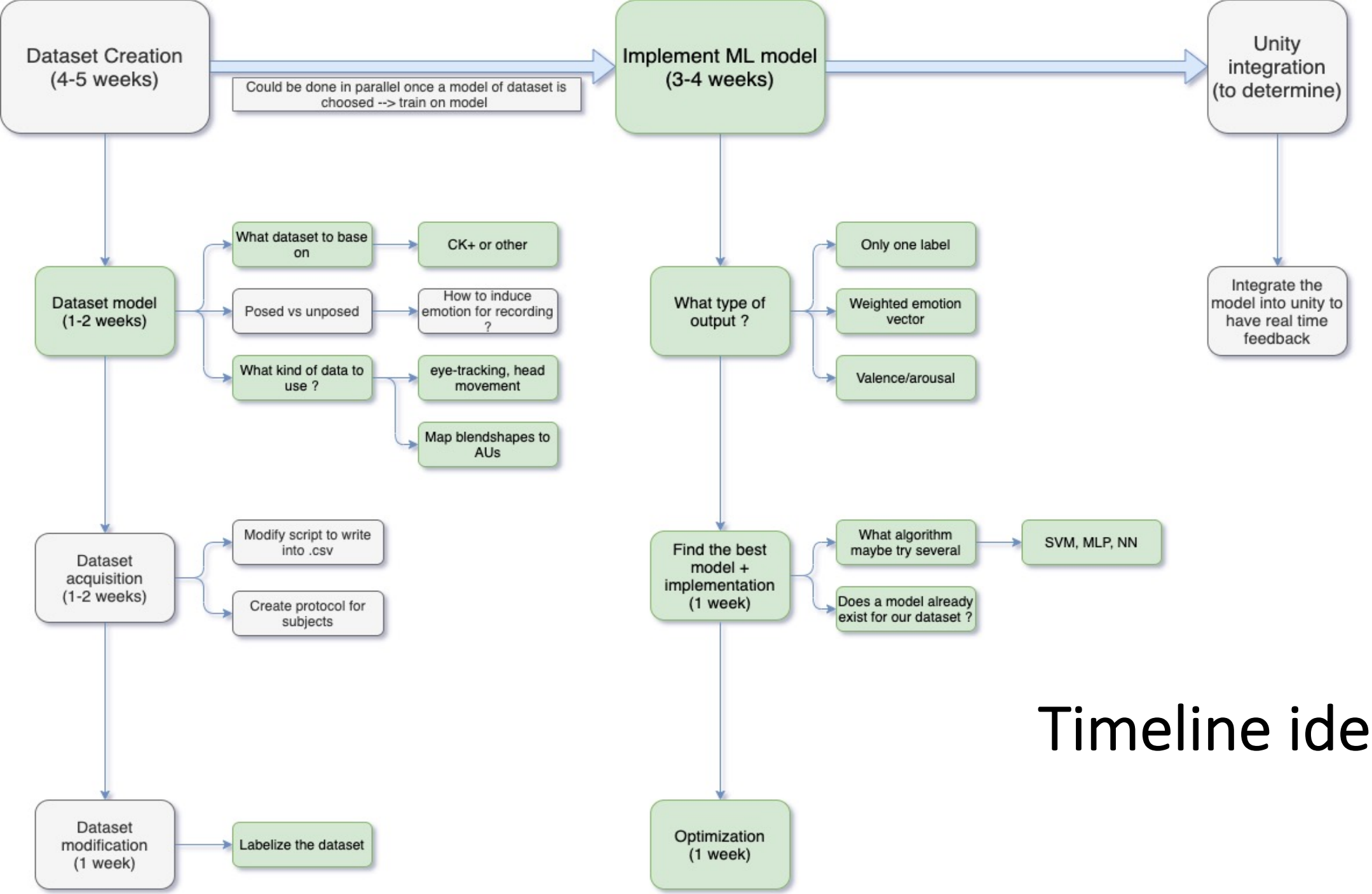
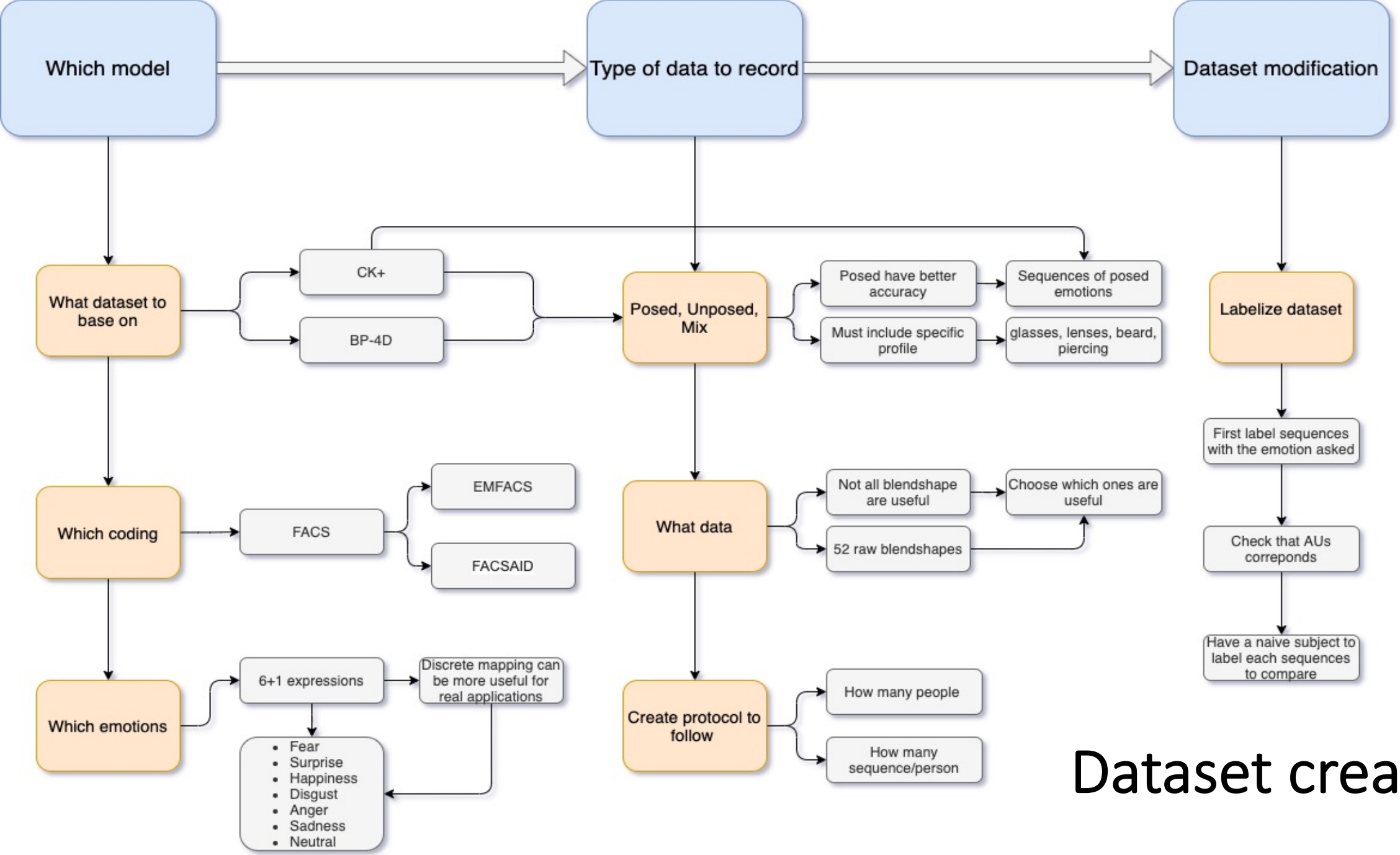


Timeline idea



Dataset creation

Facial Action Coding System (FACS)

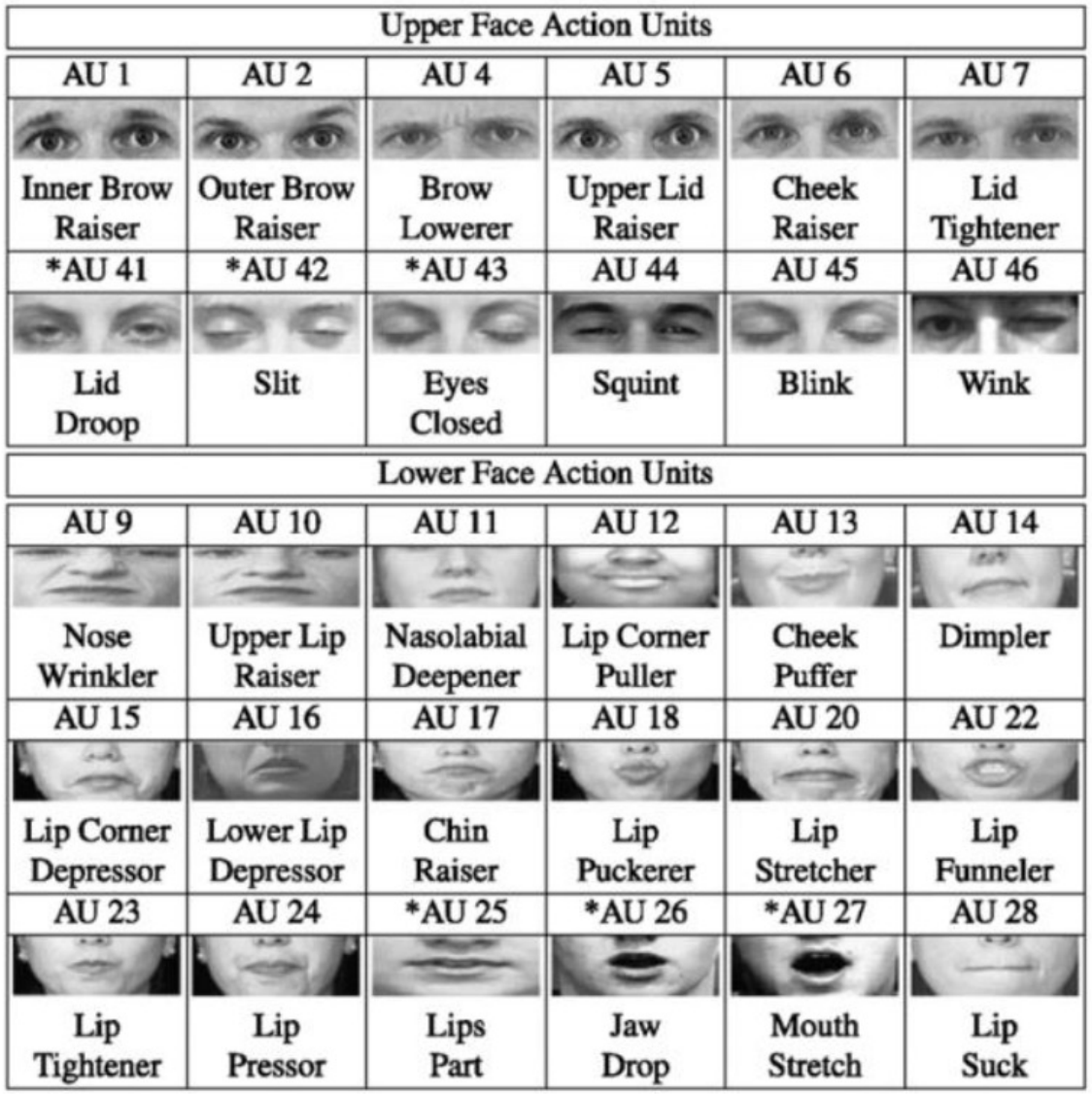


Figure 4: Facial Action Coding System (FACS)

Beh Mei Yin, Delina & Omar, Shariman & A. Talip, Bazilah & Mukhlas, Amalia & Norain, Nur & Othman, Abu Talib. (2017).
Fusion of face recognition and facial expression detection for authentication: a proposed model

Selection of AUs for emotion recognition

Table 2. Set of action units needed for basic emotions

Basic expressions	Involved Action Units
Surprise	AU 1, 2, 5,15,16, 20, 26
Fear	AU 1, 2, 4, 5,15,20, 26
Disgust	AU 2, 4, 9, 15, 17
Anger	AU 2, 4, 7, 9,10, 20, 26
Happiness	AU 1, 6,12,14
Sadness	AU 1, 4,15, 23

Ghayoumi, Mehdi & Bansal, Arvind. (2016).
Unifying Geometric Features and Facial Action Units for Improved Performance of Facial Expression Analysis.

Table 11
Emotion description in terms of facial action units.

Target emotion	Criteria
Happiness or amusement	AU 12 present
Sadness	Either AU 1 + 4 + 15 or 11 or AU 6 + 15
Surprise or startle	Either AU 1 + 2 or 5 must be present for surprise AU 7 for startle
Embarrassment	AU 12 or 24
Fear or nervous	AU 1 + 2 + 4 or AU 1 + 2 + 5
Physical pain	AU 4, 6, 7, 9, 10
Anger or upset	AU 23 and 24 must be present in the AU combination
Disgust	Either AU 9 or 10 must be present

Table 4 Mapping between emotions and AUs

Emotion	Bonus movement	Subtraction action	Action unit
Joy	Smile	Brow Raise Brow Furrow	AU6+AU12
Sadness	Brow Furrow Lip Suck Eye Widen	Brow Raise Smile Lip Press Mouth Open	AU1+AU4+AU15
Surprise	Inner Brow Raise Jaw Drop Eye Widen	Smile Brow Furrow	AU1+AU2+ AU5**D**+AU26
Fear	Inner Brow Raise Brow Raise Eye Widen Lip Stretch	Brow Furrow	AU1+AU2+ AU4+AU5+ AU7+AU20+ AU26
Anger	Brow Furrow Eye Widen Chin Raise	Inner Brow Raise Brow Raise Smile	AU4+AU5+ AU7+AU23
Hate	Inner Brow Raise Brow Furrow Lip Corner Depressor	Brow Raise Eye Widen Mouth Open Lip Suck Smile	AU9+AU15+ AU16
Disdain	Brow Furrow Smirk	Smile	AU12**U**+AU14**U**

Yao, L., Wan, Y., Ni, H. *et al.*
Action unit classification for facial expression recognition using active learning and SVM

Xing Zhang, Lijun Yin, Jeffrey F. Cohn, Shaun Canavan, Michael Reale, Andy Horowitz, Peng Liu, Jeffrey M. Girard,
BP4D-Spontaneous: a high-resolution spontaneous 3D dynamic facial expression database,
Image and Vision Computing

CK+ dataset

Particularities

- 7 emotions
  - Anger
  - Contempt
  - Disgust
  - Fear
  - Happy
  - Sadness
  - Surprise
- Posed expressions (+ unposed smile for CK+)
- Manually FACS coded
- Most used dataset (reliable)

Protocol

People are asked to express and emotion (recorded)

Neutral to apex sequences

Posed expressions

Figure 1. Examples of the CK+ database. The images on the top level are subsumed from the original CK database and those on the bottom are representative of the extended data. All up 8 emotions and 30 AUs are present in the database. Examples of the Emotion and AU labels are: (a) Disgust - AU 1+4+15+17, (b) Happy - AU 6+12+25, (c) Surprise - AU 1+2+5+25+27, (d) Fear - AU 1+4+7+20, (e) Angry - AU 4+5+15+17, (f) Contempt - AU 14, (g) Sadness - AU 1+2+4+15+17, and (h) Neutral - AU0 are included.

P. Lucey, J. F. Cohn, T. Kanade, J. Saragih, Z. Ambadar and I. Matthews,
"The Extended Cohn-Kanade Dataset (CK+): A complete dataset for action unit and emotion-specified expression"

BP-D4 dataset

Particularities

- 8 emotions
  - Anger
  - Disgust
  - Embarrassment
  - Fear
  - Happy
  - Pain
  - Sadness
  - surprise
- Unposed expressions (spontaneous)
- Unposed more representative of reality
- Manually FACS coded
- Less used

How to induce spontaneous emotion

Table 1
Eight tasks for emotional expression elicitation.

Task	Activity	Target emotion
1	*Interview*: talk to the experimenter and listen to a joke (interview).	Happiness or amusement
2	*Video clip*: watch a video clip and discuss it with the experimenter.	Sadness
3	*Startle probe*: sudden, unexpected burst of sound.	Surprise or startle
4	*Improvisation*: play a game in which the subjects improvise a silly song.	Embarrassment
5	*Threat*: anticipate and experience physical threat.	Fear or nervous
6	*Cold pressor*: submerge a hand in ice water for as long as possible.	Physical pain
7	*Insult*: experience harsh insults from the experimenter.	Anger or upset
8	*Smell*: experience an unpleasant smell.	Disgust

Difficult to implement in this project

Xing Zhang, Lijun Yin, Jeffrey F. Cohn, Shaun Canavan, Michael Reale, Andy Horowitz, Peng Liu, Jeffrey M. Girard, BP4D-Spontaneous: a high-resolution spontaneous 3D dynamic facial expression database, Image and Vision Computing,

Blendshapes

Eye_Right_Down
Eye_Left_Wide
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Eye_Left_squeeze
.
.
Jaw_Right
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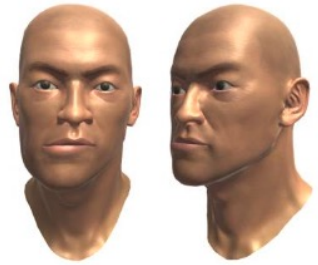
.
.
.
Mouth_Smile_Left
Mouth_Sad_Left

Eye_Left_squeeze	
	**Description** The blendShape close eye tightly when Eye_Left_Blink value is 100.

Jaw_Right	
	**Description** This blendShape moves the jaw further rightward with a higher value.

- 38 lips blend shapes (37+1 no detect)
- 14 eyes blend shape

52 blend shapes in total

Mapping selected AU to Blend shape				
AUs	**AUs Definition**	**corresponding Blend shapes**	**Blendshapes definitions**	**Comments**
AU 1	Inner Brow Raiser	Eye_Left_Up and Eye_Right_Up	Influences the muscles around the eye, moving these muscles further upward with a higher value.	/
AU 2	Outer Brow Raiser	Eye_Right_Left or Eye_Left_Left	influences the muscles around the left eye, moving these muscles further lef/rightward with a higher value.	/
AU 4	Brow Lowerer	Eye_Left_Down and Eye_Right_Down	influences the muscles around the left eye, moving these muscles further downward with a higher value.	/
AU 5	Upper Lid Raiser	Eye_Left_Wide and Eye_Right_Wide	open avatar's right eye wide, it should be done when Eye_Blink_Right = 0.	/
AU 6	Cheek Raiser	/	/	/
AU 7	Lid Tightener	Eye_Left_Blink and Eye_Right_Blink	influences blinking of the left eye, closing it further with a higher value.	determine value (not 100%)

AU 9	Nose Wrinkler	/	/	showed by AU10
AU 10	Upper Lip Raiser	Mouth_UpperRight_Up + Mouth_UpperLeft_Up	Lowers the left/right upper lip further with a higher value.	/
AU 12	Lip Corner Puller	Mouth_Smile_Right and Mouth_Smile_Left	raises the left/right side of the mouth further with a higher value.	/
AU 14	Dimpler	/	/	/
AU 15	Lip Corner Depressor	Mouth_Sad_Right and Mouth_Sad_Left	lowers the left/right side of the mouth further with a higher value.	/
AU 16	Lower Lip Depressor	Mouth_Lower_DownRight and Mouth_Lower_DownLeft	lowers the left/right lower lip further with a higher value.	/
AU 17	Chin Raiser	Mouth_Lower_Overlay	stretches the lower lip further and lays it on the upper lip further with a higher value.	not really accurate
AU 20	Lip stretcher	/	/	/
AU 23	Lip Tightener	Mouth_Pout	allows the lips to pout more with a higher value.	not really accurate
AU 26	Jaw Drop	Jaw_Open	opens the mouth further with the higher value.	determine value (not 100%)

References

- Beh Mei Yin, Delina & Omar, Shariman & A. Talip, Bazilah & Mukhlas, Amalia & Norain, Nur & Othman, Abu Talib. (2017). Fusion of face recognition and facial expression detection for authentication: a proposed model. 1-8. 10.1145/3022227.3022247.
- Ghayoumi, Mehdi & Bansal, Arvind. (2016). Unifying Geometric Features and Facial Action Units for Improved Performance of Facial Expression Analysis.
- Zhang, Xing & Yin, Lijun & Cohn, Jeffrey & Canavan, Shaun & Reale, Michael & Horowitz, Andy & Liu, Peng & Girard, Jeffrey. (2014). BP4D-Spontaneous: A high-resolution spontaneous 3D dynamic facial expression database. Image and Vision Computing. 32. 692-706. 10.1016/j.imavis.2014.06.002.
- Yao, Li & Wan, Yan & Ni, Hongjie & Xu, Bugao. (2021). Action unit classification for facial expression recognition using active learning and SVM. Multimedia Tools and Applications. 80. 10.1007/s11042-021-10836-w.
- Lucey, Patrick & Cohn, Jeffrey & Kanade, Takeo & Saragih, Jason & Ambadar, Zara & Matthews, Iain. (2010). The Extended Cohn-Kanade Dataset (CK+): A complete dataset for action unit and emotion-specified expression. 2010 IEEE Computer Society Conference on Computer Vision and Pattern Recognition - Workshops, CVPRW 2010. 94 - 101. 10.1109/CVPRW.2010.5543262.
- Zhang, Xing & Yin, Lijun & Cohn, Jeffrey & Canavan, Shaun & Reale, Michael & Horowitz, Andy & Liu, Peng & Girard, Jeffrey. (2014). BP4D-Spontaneous: A high-resolution spontaneous 3D dynamic facial expression database. Image and Vision Computing. 32. 692-706. 10.1016/j.imavis.2014.06.002.
- M. Pantic, M. Valstar, R. Rademaker and L. Maat, "Web-based database for facial expression analysis," *2005 IEEE International Conference on Multimedia and Expo*, 2005, pp. 5 pp.-, doi: 10.1109/ICME.2005.1521424.
- Facial Action Coding System (FACS) – A Visual Guidebook, https://imotions.com/blog/facial-action-coding-system