

DANTE

Dimensional ANnotation Tool for Emotions

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DANTE (Dimensional ANnotation Tool for Emotions) is an emotional annotation tool to annotate any kind of video in terms of valence and arousal continuous dimensions.

DANTE
Dimensional ANnotation
Tool for Emotions



In other terms, it requires: Apache HTTP Server, MySQL and PHP.

To install, configure and test Apache 2.4 and PHP 7 for development on Windows follow the instructions in this link².



1.2 Installation

To install DANTE follow these steps:

- Clone the repository using `git clone https://github.com/PHuSeLab/DANTE.git`.
- Import in a MySQL database the file `annotationdb.sql`, which is responsible of the creation of all the needed tables.
- Edit the file `config.php` according to the environment. (For more details, see section configuration).
- Open the browser to the page `http://localhost/login.php` or wherever you installed DANTE.
- Login with default credentials `admin:admin`.
- Follow the configuration instructions and change the default password!

1.3 Configuration

The configuration file contained in `config.php` is very simple and permits to configure some basics parameters, such as:

- `db_host` correspond to the hostname of the database (default: `localhost`).

²<https://danielarancibia.wordpress.com/2015/09/27/installing-apache-2-4-and-php-7-for-development-on-windows/>

1 DANTE

DANTE is a project developed by the PHuSe Lab¹ from Università degli Studi di Milano, Italy, in collaboration with Département Informatique de Ecole Polytechnique de l'Université François Rabelais de Tours, France. The tool is part of a multimodal dataset acquired with the aim to study emotional response in presence of amusement stimulus.



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1.1 Requirements

The annotation tool is a web-based software, and for this reason it simply requires a LAMP/MAMP/WAMP software bundle, depending on the operating system.

¹<http://phuselab.unimi.it/>

- db_name correspond the database name to use and is the one where was imported the annotationdb.sql file (default: annotationdb).
 - db_user database username.
 - db_pass database password.
 - anno_rate is the recording frequency of the annotation. DANTE will record a value every $1/\text{anno_rate}$ seconds (default: '25').
 - save_mode DANTE is able to save the annotations to the database 'db' or to a text file 'file' (default: 'db').

If you have some problems with *msqli*'s function see section 4.2.

2 The theory behind DANTE

With DANTE project, PHuseLab wants to understand how people feel watching videos with different characters and emotions. The idea is to find a easy and user-friendly tool to annotate precisely the emotions of watchers. First of all, we have to understand what is an emotion and how we can measure it.

3 Define and measure emotions

Our emotions play an important role throughout the span of our lives but define "emotion" is a notorious problem.



Aristotle defined emotions as *things on account of which the ones altered differ with respect to their judgments, and are accompanied by pleasure and pain*: such are anger, pity, fear, and all similar emotions and their contraries (ret. 1378a).

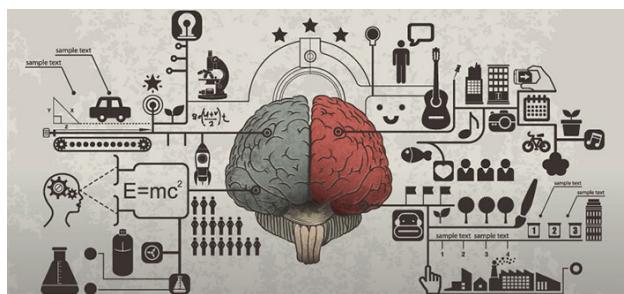
Descartes, in his last published work (1649) defined emotion as "*things which inform us about important changes related to our soul*". Darwin think emotions are a complex expression, that only human being have. So emotions are a result of evolution.

A particularly unfortunate example is William James's asking the question "What is an emotion?" when he really meant "feeling", a misnomer that started a debate which is still ongoing, more than a century later. James think emotion are born in ANS (Automatic Nervous System). James' theory is showed with a

simple example: "you don't run from a bear because you're afraid; you're afraid because you run from a bear".

In recent years, neuroscience has introduced a new way of thinking about our emotions. The scientists behind the latest brain-imaging studies say they can now pinpoint with precision where these feelings are located within our heads. In 2013, for instance, a team of psychologists published a study in which they claimed that they had found neural correlates for nine very distinct human emotions: anger, disgust, envy, fear, happiness, lust, pride, sadness, and shame.

The conclusion is that emotions are difficult to explain but people can try to measure them.



Now let's move on the difference between measuring emotion of ourselves and emotion of somebody else.

To measure emotions of somebody else we can use the Facial Action Coding System (FACS)³ which is a system to taxonomize human facial movements by their appearance on the face. It's a common standard to systematically categorize the physical expression of emotions. The Action Units (AUs) are the fundamental actions of individual muscles or groups of muscles. As AUs are independent of any interpretation, they can be used for any higher order decision making process including recognition of basic emotions, or pre-programmed commands for an ambient intelligent environment. The FACS Manual is over 500 pages in length and provides the AUs interpretation of their meaning.

Let's see which are action units:

AU1 	AU2 	AU4 	AU5 	AU6 
Inner brow raiser	Outer brow raiser	Brow Lowerer	Upper lid raiser	Cheek raiser
AU7 	AU9 	AU12 	AU15 	AU17 
Lid tightener	Nose wrinkle	Lip corner puller	Lip corner depressor	Chin raiser
AU23 	AU24 	AU25 	AU26 	AU27 
Lip tightener	Lip presser	Lips part	Jaw drop	Mouth stretch

³https://en.wikipedia.org/wiki/Facial_Action_Coding_System

and how we can describe the most common emotions using them:

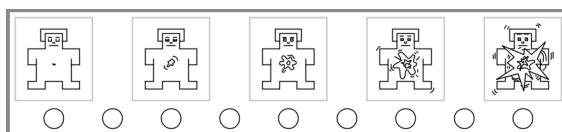
Emotion ↴	Action units ↴
Happiness	6+12
Sadness	1+4+15
Surprise	1+2+5B+26
Fear	1+2+4+5+7+20+26
Anger	4+5+7+23
Disgust	9+15+16

To measure emotions of ourselves we can use different ways. The most common used are:

- Likert scale: it is the scale commonly involved in research that employs questionnaires. It offers a range of answer option from one extreme attitude to another. Typically, it includes a moderate or neutral midpoint. Let's see an example:



- SAM: the main problem of using Likert scale is that "non-English" people don't understand what are values in the scale. So another common scale used is the SAM (the Self-Assessment Makin), in which the values are represented by images. Usually the SAM have 5 values with a neutral midpoint. In DANTE we use the SAM annotation.

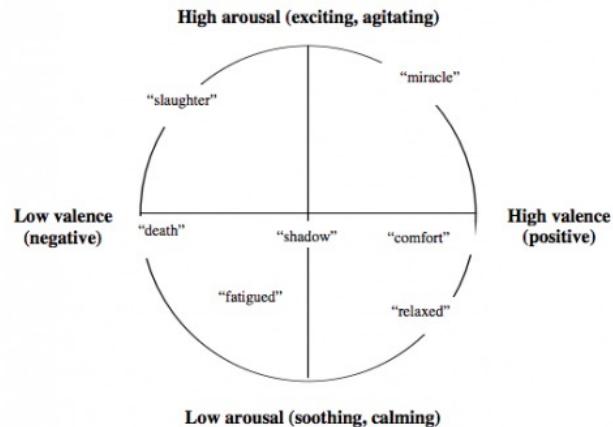


3.1 Valence and Arousal

In general, emotional experiences can be described by 2 terms. Though the two terms are often confused, the difference is pretty simple:

- Valence is positive or negative affectivity. Emotion valence could be described by bipolar scale that, in aggregate, defines a continuum from pleasantness (happy, pleased, hopeful, etc.) to unpleasantness (unhappy, annoyed, despairing, etc.)
- Arousal measures how calming or exciting the information is. Arousal comes from our reptilian brain. It inspires a fight-or-flight response, that, evolutionary, aided our survival

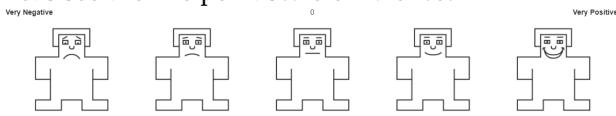
The common framework for dealing with emotional experience is characterized in a two-dimensional space. Valence ranges from highly negative to highly positive, and arousal ranges from calming/soothing to exciting/agitating. Remember this visual:



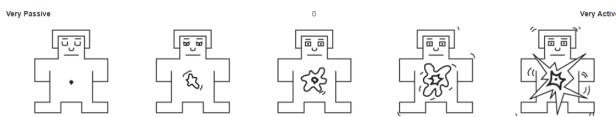
3.2 SAM (the Self-Assessment Makin)

The Self-Assessment Makin is a non-verbal pictorial assessment technique that directly measures the pleasure, arousal and dominance with a person's affective reaction to a wide variety of stimuli. SAM is an emotion assessment tool that uses graphic scales, depicting cartoon characters expressing three emotion elements: pleasure, arousal and dominance. SAM has been used often in evaluations of advertisements, and increasingly also in evaluations of products. SAM is based on the PAD emotion model of Mehrabian⁴ to describe and measure emotional states using numerical dimension (Pleasure, Arousal and Dominance).

Let's see the five point scale of valence:



and of arousal:



4 How DANTE works

DANTE's goal is to annotate how people felt themselves watching other people with different emotions. So it is

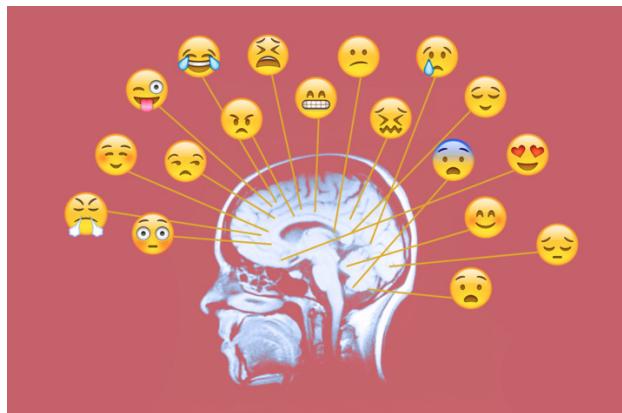
⁴https://en.wikipedia.org/wiki/PAD_emotional_state_model

a way to annotate and save the reactions of different people to study the common behaviours.



DANTE's database contains certain videos representing few people (usually only one) in foreground which talk and move. For each video the watcher can annotate valence and arousal values, one per time. On the left side there is a list of video the watcher can choose. Once selected, the video will open and when the watcher plays the video and starts to annotate (by clicking on the toolbar under the videoplayer), the annotator starts to save values until the video is over. If you are annotating, in the top-right side of the videoplayer there must be the "REC" green light switch on, otherwise, if the REC light is red you are only watching video without annotating. To understand if you are annotating you can also control if there is the emoticon in the screen. To not bore watchers, the video are quite short but once started, you cannot stop it until the end.

When the video ends, annotations saved correctly. You can re-annotate the same video re-play it. The old annotated values are deleted and the new one are saved.



So in the new DANTE model, the watcher can choose between the classic SAM annotator and the new one with emoticons.

Let's see how are valence emoticons:

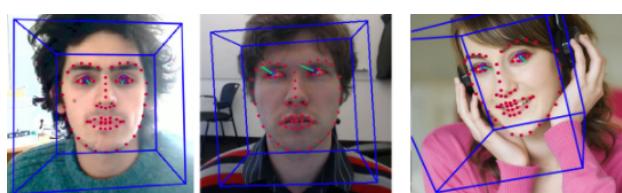


and arousal emoticons:



To create the emoji which follow the head of the video's character, we used the open-source software OpenFace⁵ to create a huge csv file with landmarks and other features of character. To understand this step, let's move on what are landmarks and other features. OpenFace software, create a csv file with:

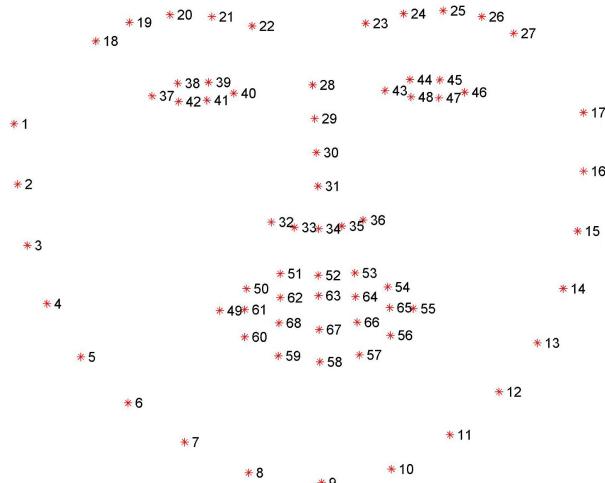
- frames number
- timestamp
- confidence
- gaze direction and angle
- 56 eyes landmarks in 2D (pixels) and 3D (millimeters) coordinates
- 68 face landmarks in 2D and 3D coordinates
- some Action Units



To make the emoji follow the character face we have written a python script which extract from the huge csv file:

- frames number
- timestamp
- x_1, x_17, y_9 and y_22 2D face landmarks

⁵<https://github.com/TadasBaltrusaitis/OpenFace>



The python script control which OpenFace files have not already been reduced and reduce them. We extract only these 4 points because we want to understand where the face is, so we create something like a bounding box where the face is included. We extract the frame and timestamp from the videoplayer using a github repo⁶ and comparing these data with the OpenFace return values, we put the emoji always closed to character face. The emoji is transparent to not disturb the watcher but is useful to give an immediate feedback about what he is annotating.

4.2 Problems occurred

A problem we have occurred is when we decrease the browser window's size. We cannot know the screen resolution or browser's window dimension to resize the emoji.

If you have downloaded the github repo and during the configuration have a fatal error with an undefined mysql's function you have to rename the *php.develop* in *php.ini* and modify it adding the extension *extension=mysqli.dll*.

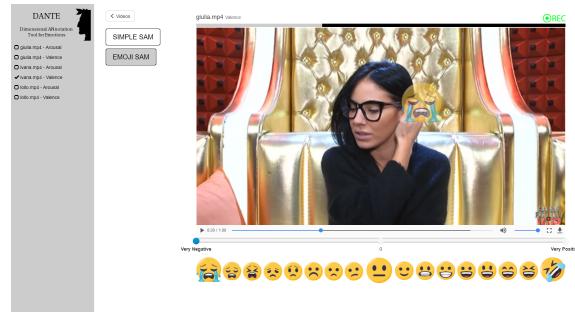
5 Possible future developments

We have used Big Brother's videos because we thought that the big brother's competitors inside the confessional can show a wide variety of behaviours and emotions in front of nonexistent problems. So a future possible development will be extend the variety of database's videos adding some more cultural content like film clips or something like that.

Another future development can be increase the variety of psychometric scale like Likert's to have more people annotating as possible.

6 Conclusion

The repo of DANTE is uploaded on github at link <https://github.com/phuselab/DANTE>. This is the new version of DANTE with the emoticons' new features:



This has been a useful and funny social experiment to understand, with people's help, how they react watching emotions of others to try to define what emotions are and continue the evolution of the definition of emotions starts with Aristotele until the recent psychologists' definition. So we would like to define emotions starts with the common features and Action Units. DANTE is the training set to arrive to the goal.

⁶<https://github.com/allensarkisyan/VideoFrame>