Real-time Automatic Emotion Recognition from Body Gestures

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Main goals

- ASC affected children have difficulties both in recognizing and expressing emotions
- ASC Inclusion Project goals: development of a platform to support children to enhance their ability in such tasks
- Body Gesture module goal: development of a system monitoring and analyzing children body movements
- Focus on the upper part of the body

Why Body Movement?

- The research in emotion recognition has mainly focused on face and voice analysis
- Body movement brings a huge amount of information about people behavior
- Psychological studies detected a set of dimensions that can be found in each emotion with different characteristics

Expressive Gesture Analysis from Body Movement

Four dimensions have been individuated, as being most communicative to the children:

- **Intensity**: strong Vs. weak movement.
- **Speed:** fast Vs. slow movement.
- **Occupation:** space occupation by the body.
- **Interaction:** turning towards or away from another (person/object).

Expressive Gesture Analysis from Body Movement: Features

The features we individuated for automated real-time analysis of upper body movements include the following:

Measured Analysis Features	*Related Dimension(s)*
Contraction/Expansion	Direction
Kinetic Energy	Intensity, Speed
Impulsiveness	Speed
Periodicity	Interaction, Speed
Fluidity	Intensity
Symmetry	Occupation
Rigidity	Intensity
Acceleration of forearms	Speed
Trunk leaning	Interaction, Occupation

Dataset and Recordings

emotions expression recordings

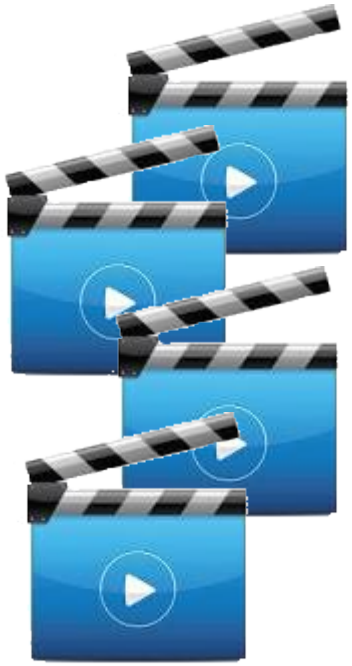
- recordings of upper body movements with video cameras, Optical Motion Capture System and RGB-D sensor
- dataset based on adults: 15 people expressing the 6 basic emotions with their body repeated at least 5 times

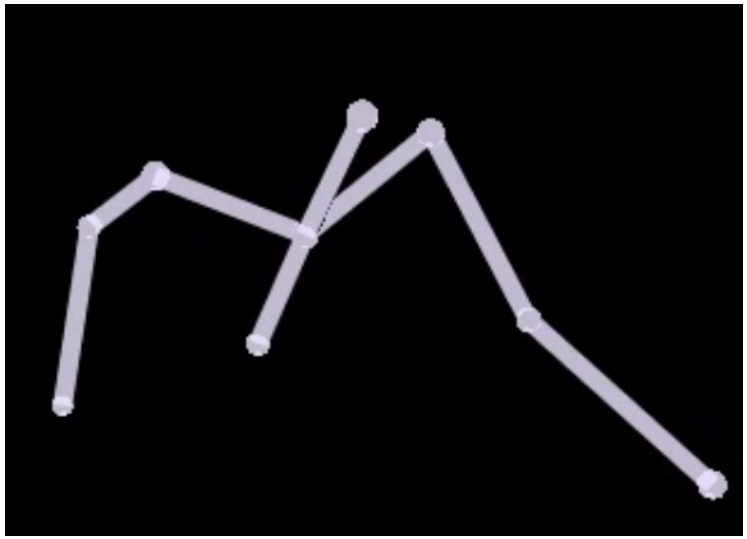
dataset was used to

- develop algorithms for the analysis of expressive features and emotions
- MoCap recordings: select the most important variables and test ML techniques
- RGB-D sensor: in the resulting serious games

Dataset and Recordings (II)

- human evaluation using on-line platform
- Participants were asked to recognize the expressed emotion in short videos
- 3D coordinates point-light display as stimuli





The Gesture Analysis Module

- only the upper part of the body considered
- studies on the most suitable feature vector were performed
- data representation: histograms of each extracted feature
- final feature vector composed by the concatenation of these histograms
- feature vectors used to train a SVM classifier with ECOC refinement of the results

The Gesture Analysis Module (II)

- testing: leave-one-subject-out cross validation
- six classes problem considered

	Human Eval.	System
Happiness	81.2%	47.6%
Sadness	86.3%	80.2%
Anger	73.8%	70.2%
Fear	48.5%	60.7%
Surprise	35.2%	52.2%
Disgust	37.1%	57.1%
Overall	61.9%	61.3%

Game Demonstration: a single player game

1. The computer shows a point-light video to the player

2. The player selects the emotion recognized in the video

3. The player tries to express the same emotion with the body

3. The computer gives a feedback on the performance of the player

Emotional Charades: a two players game

1. Player1 chooses an emotion to express

2. Player2 and the computer observe the silhouette of Player1 expressing the emotion

3. Player2 and the computer guess the emotion

4. Player1 says whether Player2 or the computer gave the correct answer

Future Work

- Creation of a new dataset including recordings of Typically Developing children
- fine-tuning of both feature analysis and ML techniques based on the TD children dataset
- testing of algorithms with recordings of ASC children (during exercises with therapists)
- integration of our algorithms in the final multimodal setting: multimodal fusion of face, voice, upper body
- integration in the final serious game platform
- formative assessment: give feedback on movement qualities (energy, speed, fluidity etc.)
- update module to include carers and parents (social interaction)

Acknowledgements

The research leading to this software product has received funding from the European Community's Seventh Framework Programme (FP7, 2007-2013), under grant agreement n° 289021.