

# **Towards sociable robots**

## **Implementation and Application of a system for fast, accurate and robust automatic face detection and expression recognition**

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Computer animated agents and robots bring a social dimension to human computer interaction. Face to face communication is a real-time process that contains a rapid exchange of nonverbal signals. We present progress on an automatic expression coding system that works in real-time, and is designed to support social interaction between computers and humans. The system detects frontal faces in the video stream and codes them with respect to 7 dimensions: neutral, anger, disgust, fear, joy, sadness, surprise. The face finder employs a cascade of feature detectors trained with boosting techniques (Viola, Jones 2001;Fasel et al 2002). The expression recognizer is based on a Gabor representation of the image patch, followed by a bank of classifiers. We compared SVMs, Adaboost, or a combination of the two employing feature selection by Adaboost, followed by feature integration using SVM's. Both accuracy and considerations for real-time processing are presented.

The system was tested on the Cohn-Kanade dataset of posed facial expressions (Kanade et al 2000). Generalization to new subjects for a 7-way forced choice based on 626 examples, was 93.3% correct. Training on a second dataset, Pictures Of Facial Affect data (Ekman, Friesen 1976), improved robustness to lighting conditions. Most interestingly, the outputs of the classifier change smoothly as a function of time, providing a potentially valuable representation to code facial expression dynamics in a fully automatic and unobtrusive manner. The system has been deployed on a wide variety of platforms including Sony's Aibo pet robot, ATR's RoboVie, and Colorado University's CU Animator, and is currently being evaluated for applications including automatic reading tutors, clinical diagnosis, and assessment of human-robot interaction.