

Spontaneous Facial Actions in Video - Systems for Automatic Coding

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Abstract

We present a systematic comparison of machine learning methods, including AdaBoost, Support Vector Machines, and Linear Discriminant Analysis, applied to the problem of fully automatic recognition of facial expressions and individual facial actions. Each video-frame is first scanned in real-time to detect approximately upright-frontal faces. The faces found are scaled into image patches of equal size, convolved with a bank of 72 Gabor intensity filters, and then passed to a recognition engine that codes facial expressions either into 7 emotive dimensions (neutral, anger, disgust, fear, joy, sadness, surprise) or into combinations of the 20 most common facial action units. We report results on a series of experiments comparing spatial frequency ranges, feature selection techniques, and recognition engines. For the problem of recognising emotive expressions, one of the better approaches uses adaboost for feature selection and SVMs for training classifier weights. The generalization performance for a 7-way forced choice was 93% to new subjects with posed expressions. The outputs of the classifier change smoothly as a function of time and thus can be used for unobtrusive motion capture. We also applied the system to fully automated facial action coding. The system was trained to classify 20 action units, whether they occur singly or in combination with other actions. We present preliminary results for applying this system to a dataset of spontaneous facial expressions from 20 subjects. This dataset is particularly challenging both because of speech-related mouth movements, and also because of out-of-plane head rotations which tend to be present during discourse. These factors influence both the accuracy of automated alignment, as well as the image projection of the facial actions. The basic frontal-view system was able to reliably detect facial actions in this database despite these sources of noise. We will discuss various measures of performance and show examples of the dynamics of facial actions and expressions, included combinations of actions and mixtures of expression.