Generic to Specific Recognition Models for Membership Analysis in Group Videos

Wenxuan Mou, Christos Tzelepis , Vasileios Mezaris , Hatice Gunes, Ioannis Patras

Published in:
Conference on Automatic Face and Gesture Recognition (FG) 2017

Centre for Intelligent Sensing
Queen Mary University of London

CIS centre for intelligent sensing

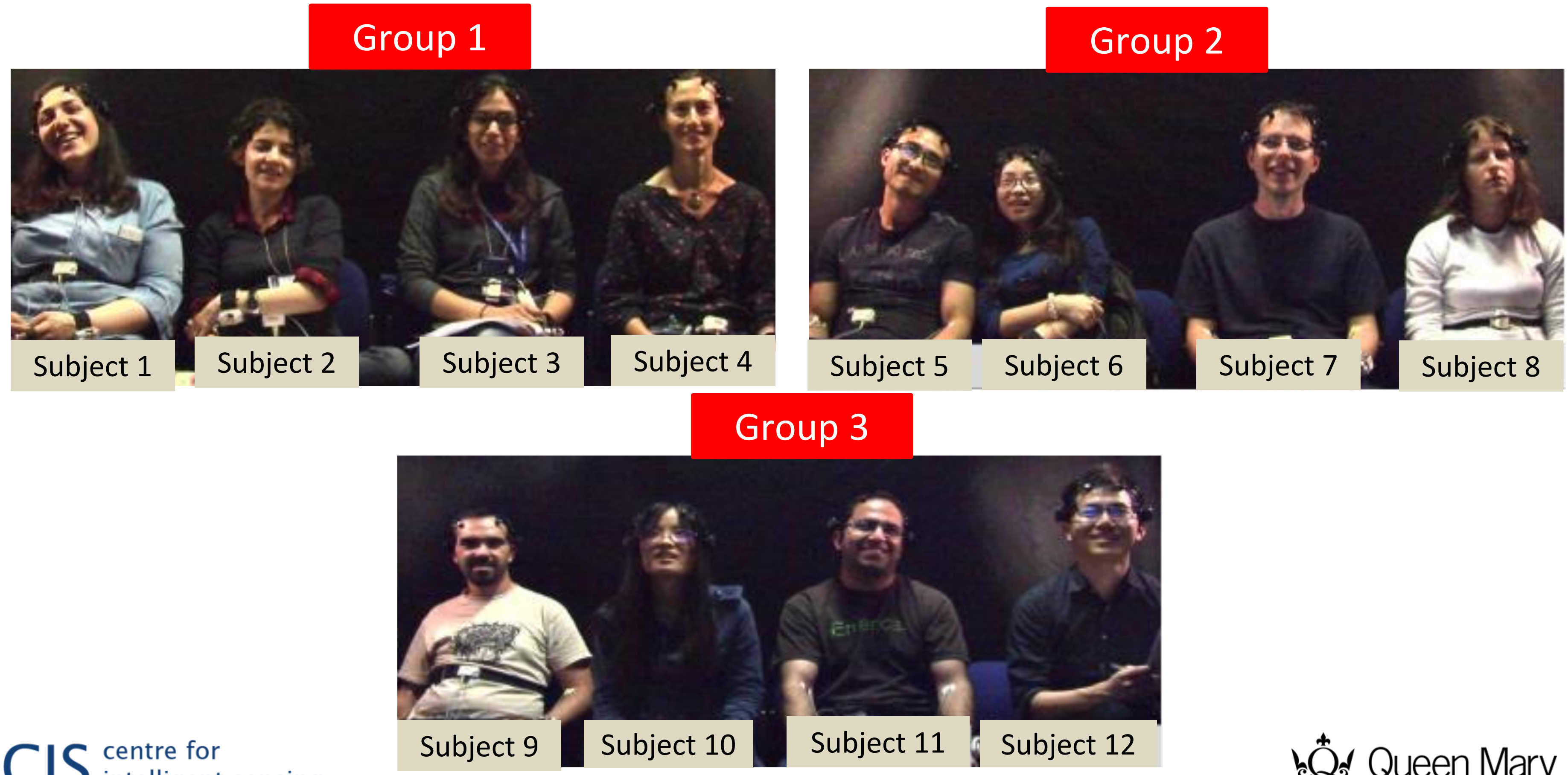
Queen Mary University of London

Outline

- Introduction
- The proposed framework
- Experiments and results
- Analysis and discussions
- Conclusions and future work

Introduction

- Definitions of group membership recognition
  - Recognize which group each individual is part of



Introduction

- Motivation

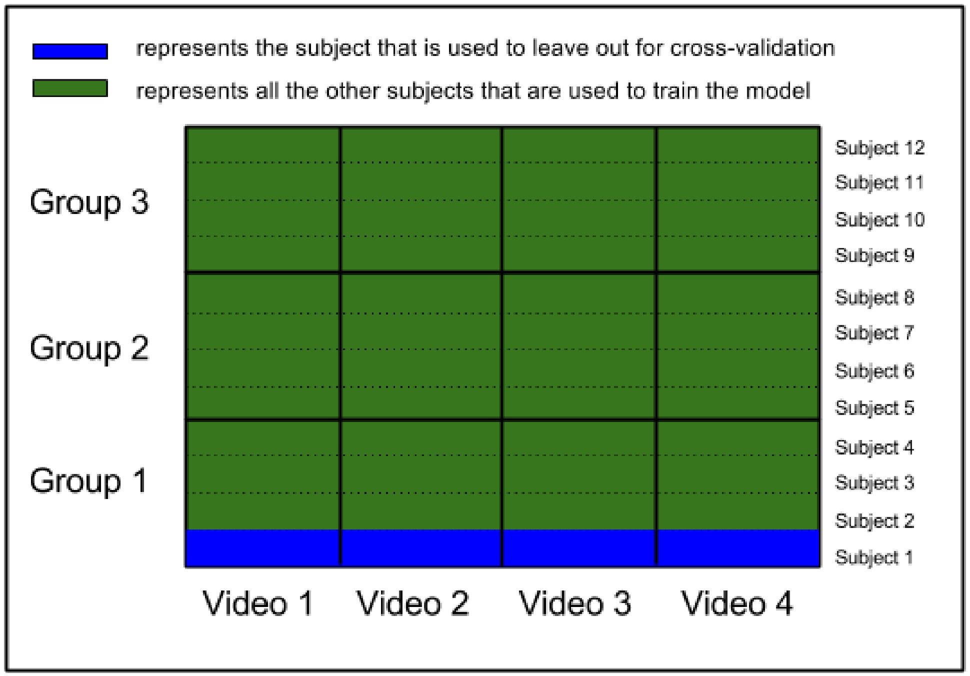
  - People in a group share similar behaviors and emotions [1]

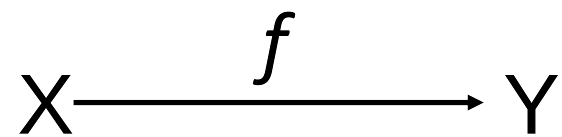
  - Body fea1qtures work better than the face features in predicting group membership [2]

[1] S. G. Barsade, "The ripple effect: Emotional contagion and its influence on group behavior," Administrative Science Quarterly, 2002.
[2] W. Mou, H. Gunes, and I. Patras, "Automatic recognition of emotions and membership in group videos," in CVPRW, 2016.

The Proposed Framework

- Group membership recognition is modelled as a classification problem





X: Body behaviors

Y: Group membership (Group 1 ? 2 ? 3 ?)

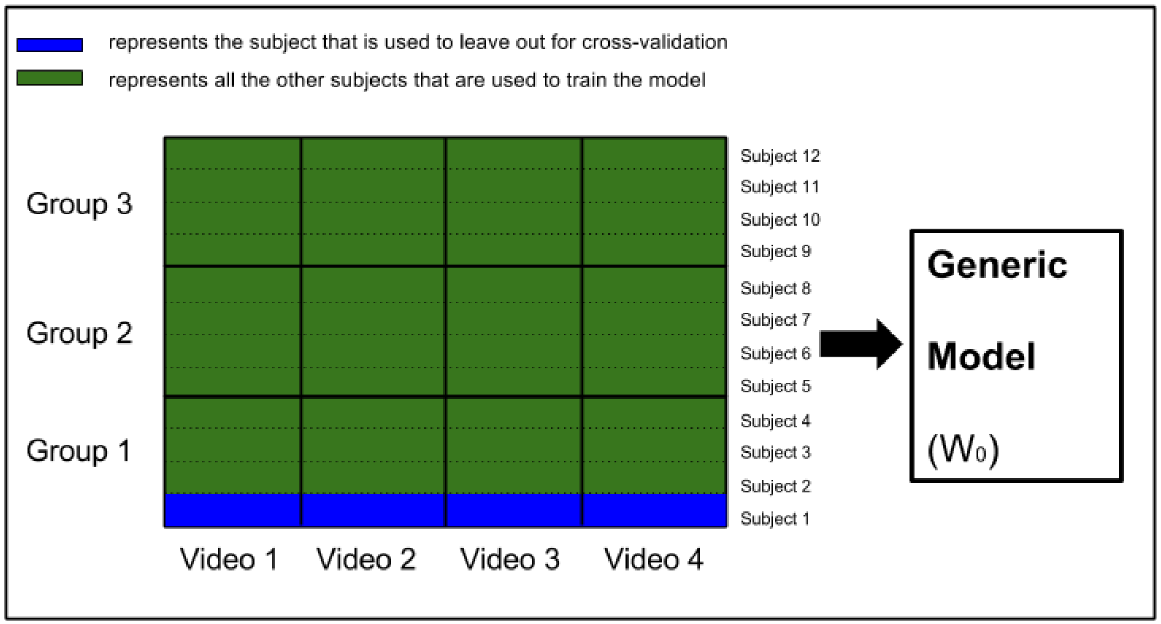
f : Linear-SVM

12 subjects from 3 groups watching 4 videos

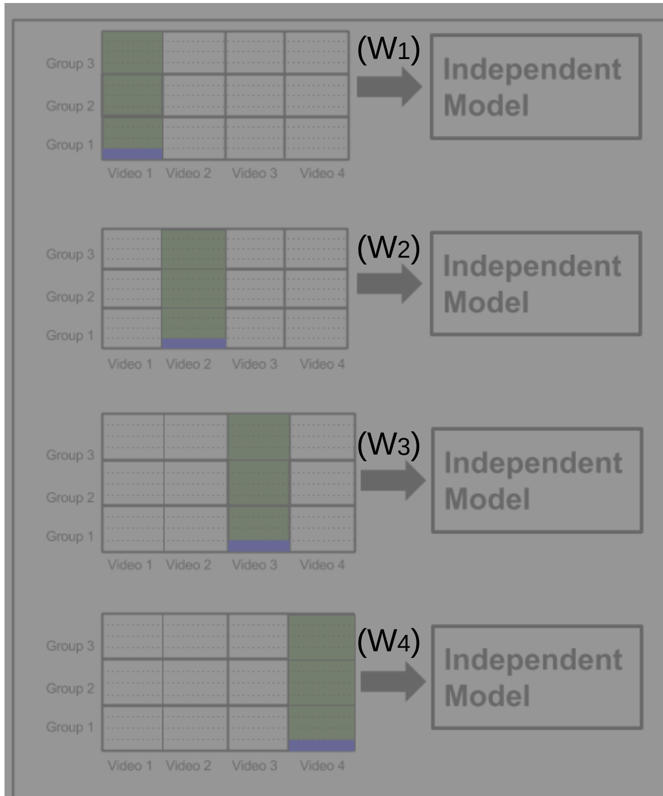
Leave one subject out (blue) cross-validation

The Proposed Framework

- Generic model and independent model



Generic recognition model



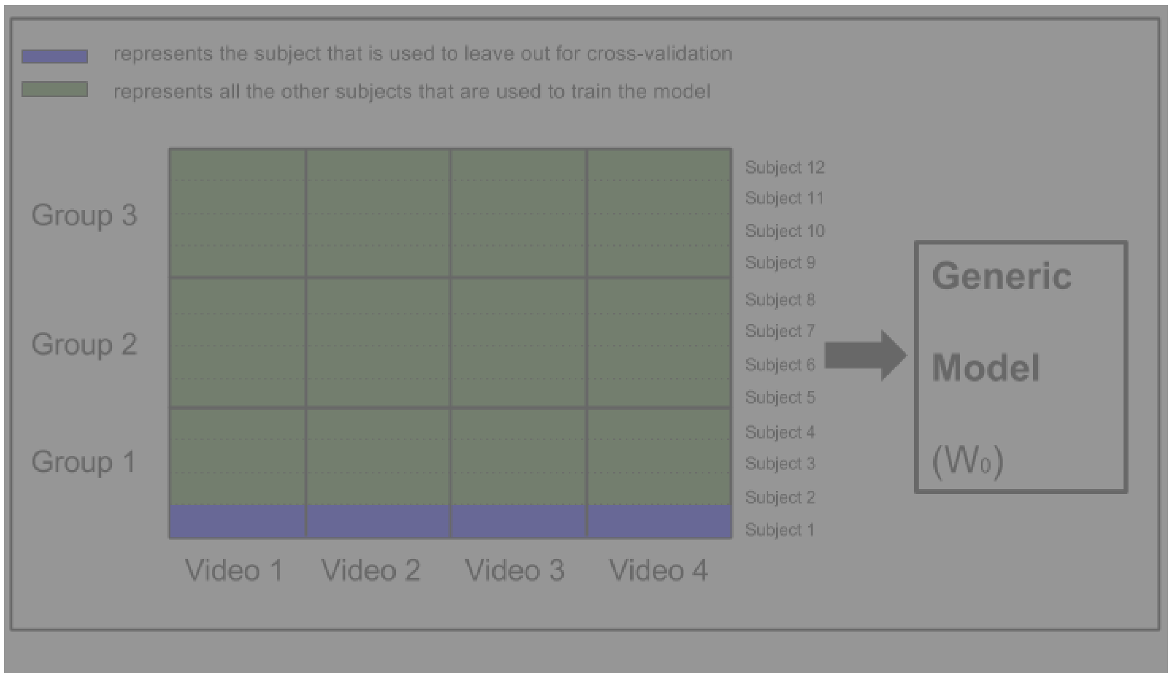
Independent recognition model

CIS centre for intelligent sensing

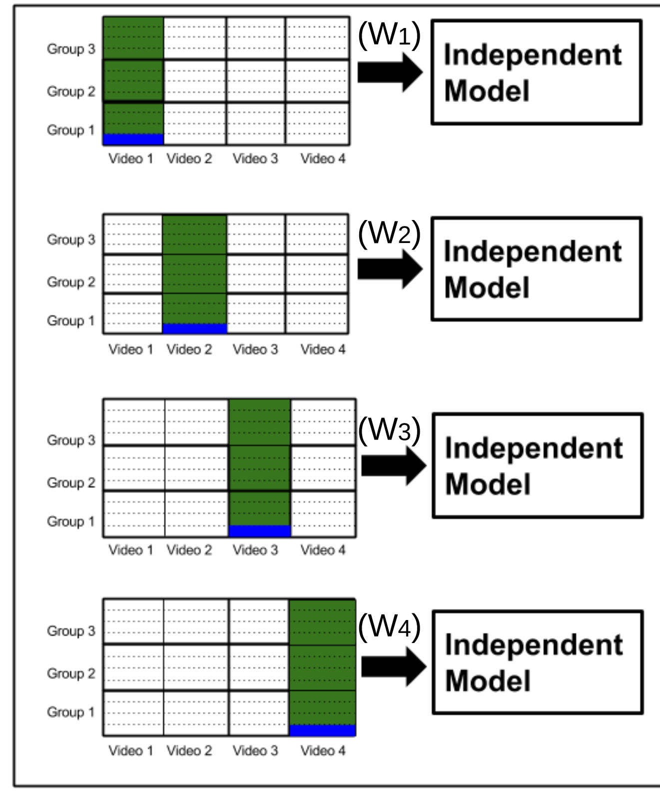
Queen Mary University of London

The Proposed Framework

- Generic model and independent model



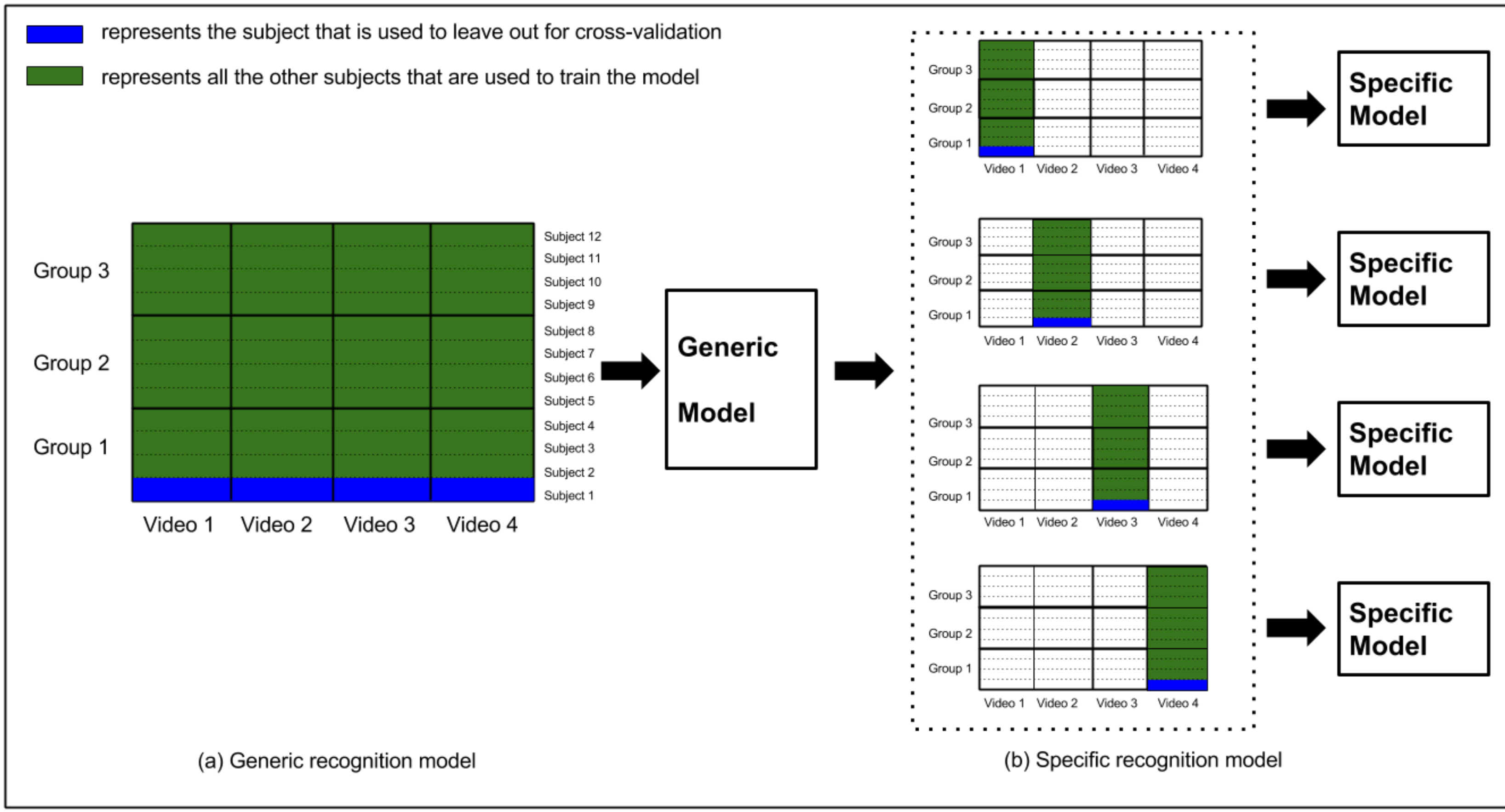
Generic recognition model



Independent recognition model

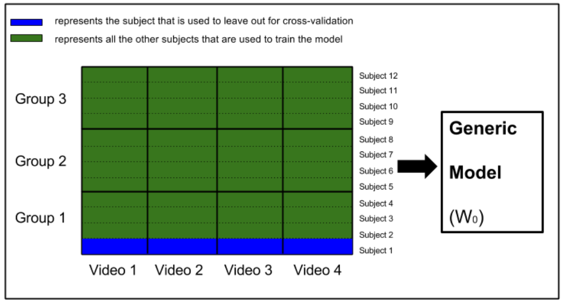
The Proposed Framework

- The proposed two-phase learning model



The Proposed Framework

- Generic model



$$P_{generic}: \min_{w_0, b_0} \frac{\lambda}{2} ||w_0||^2 + \frac{1}{l} \sum_{i=1}^{l} L\big(w_0\,, b_0; (x_i, z_i)\big)$$

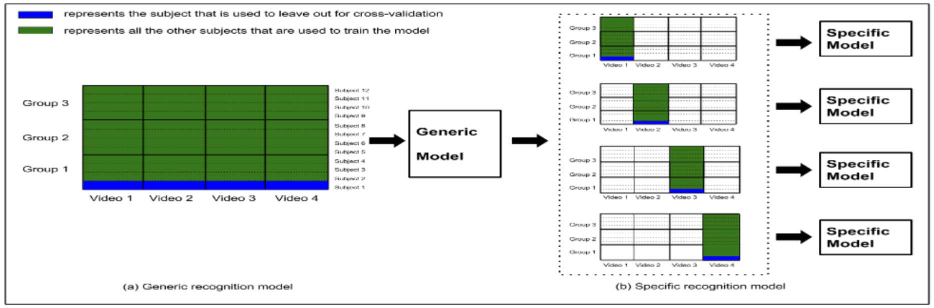
λ : the regularization parameter

w_0, b_0 : the optimization parameters

L : the loss function and is given by the hinge-loss

The Proposed Framework

- Specific model



(a) Generic recognition model

(b) Specific recognition model

$$P_{specific}: \min_{w,b} \frac{\mu}{2}||w||^2 + \frac{\nu}{2}||w - w_0||^2 + \frac{1}{|X_t|}\sum L(w, b; (x_i, z_i))$$

X_t : a subset of the original training set

μ and ν : regularization parameters

$\frac{\nu}{2}||w - w_0||^2$: is used to bias w to be close to w_0

The Proposed Framework

- Optimization: stochastic gradient descent (SGD)

Objective function of $P_{specific}$:

$$J(w, b) = \frac{\mu}{2}||\mathrm{w}||^2 + \frac{\nu}{2}||w - w_0||^2 + \frac{1}{k}\sum_{(x_i, z_i)\in X_t} L(w, b; (x_i, z_i))$$

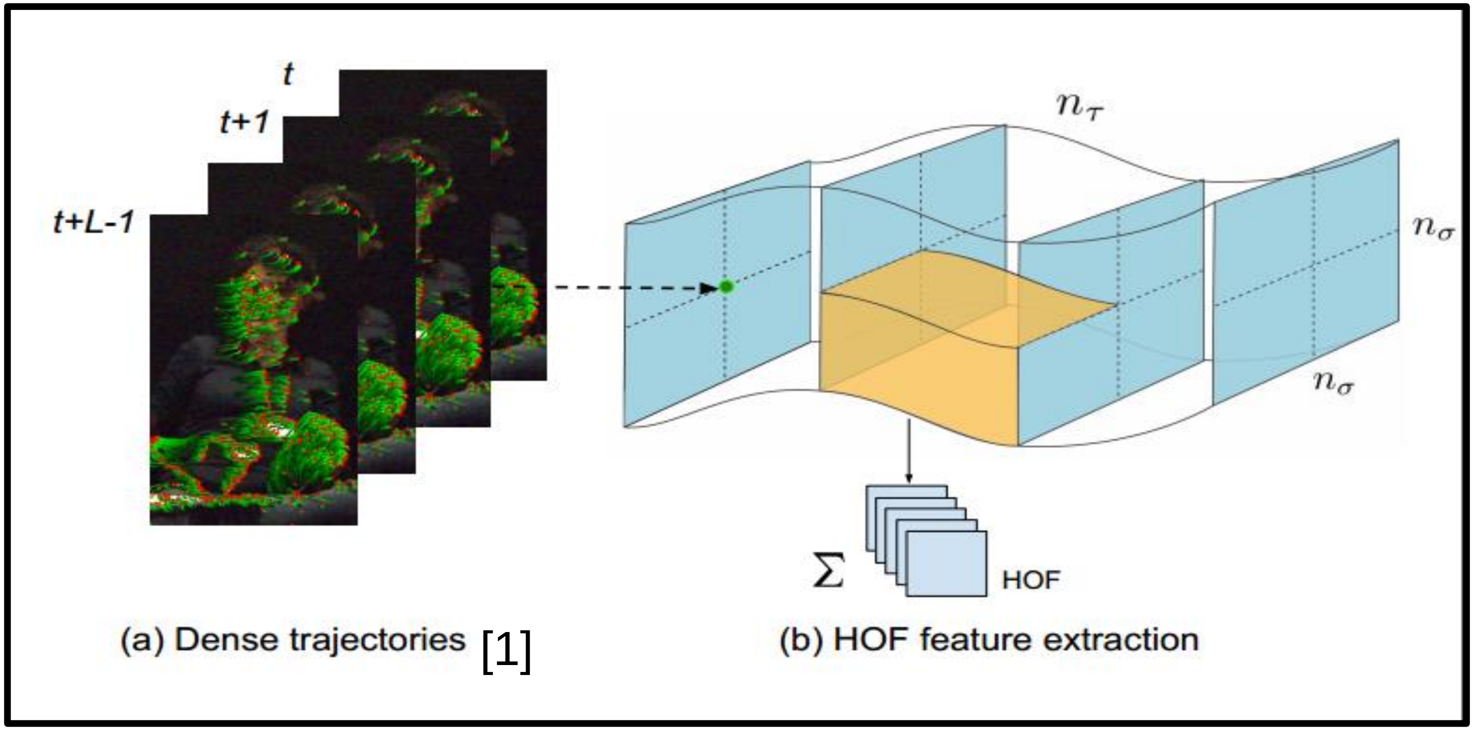
Update w and b : $w^{(t+1)} = w^t - \frac{\delta_t}{k}\frac{\partial J}{\partial w}$ $\quad b^{(t+1)} = b^t - \frac{\delta_t}{k}\frac{\partial J}{\partial b}$

The first derivatives of J with respect to w and b:

$$\frac{\partial J}{\partial w} = \mu w - \nu(w - w_0) + \sum_{(x_i, z_i)\in X_t} \frac{\partial J}{\partial w} \qquad \frac{\partial J}{\partial b} = \frac{1}{k}\sum_{(x_i, z_i)\in X_t} \frac{\partial J}{\partial b}$$

The Proposed Framework

- Feature extraction



[1] H. Wang et al, "Dense trajectories and motion boundary descriptors for action recognition," IJCV, 2013.

Experiments and Results

- Experiment setup
  - Data: 3 groups of data, 12 participants
  - Feature: Body HOF feature
  - Classifier: linear-SVM
- Experimental results

Different Models	Average Accuracy (p-value)
Specific recognition model	52% ($p<0.01$)
Generic recognition model	35% ($p=0.41$)
Independent recognition model	33% ($p=0.42$)
Chance level	33%

Conclusions and Future Work

- Conclusions

  - The proposed two-phase learning model outperforms the other models

  - Group membership recognition results also indicates that individuals influence each others behaviours within a group and their nonverbal behaviours share commonalities

Conclusions and Future Work

- Future work
  - Testing with a larger database
  - Applying the two-phase learning model to other applications, such as affect recognition

Thank you!