# Learning from actors: application of laban movement analysis to affective body movement using HMMs

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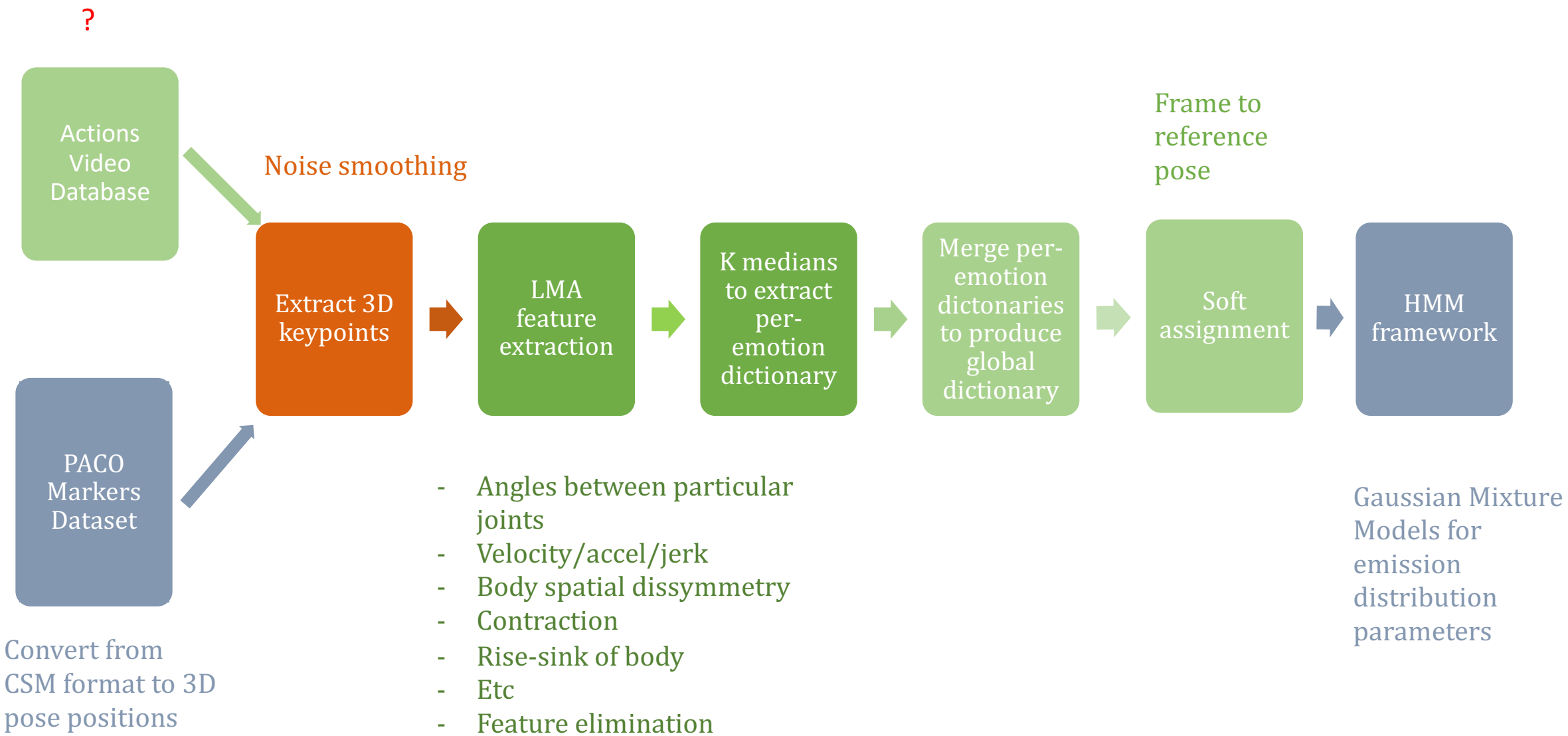
Work mainly based on:

Truong, Arthur and  Zaharia, Titus (2017). Laban movement analysis and hidden Markov models for dynamic 3D gesture recognition. *EURASIP Journal on Image and Video Processing* 2017.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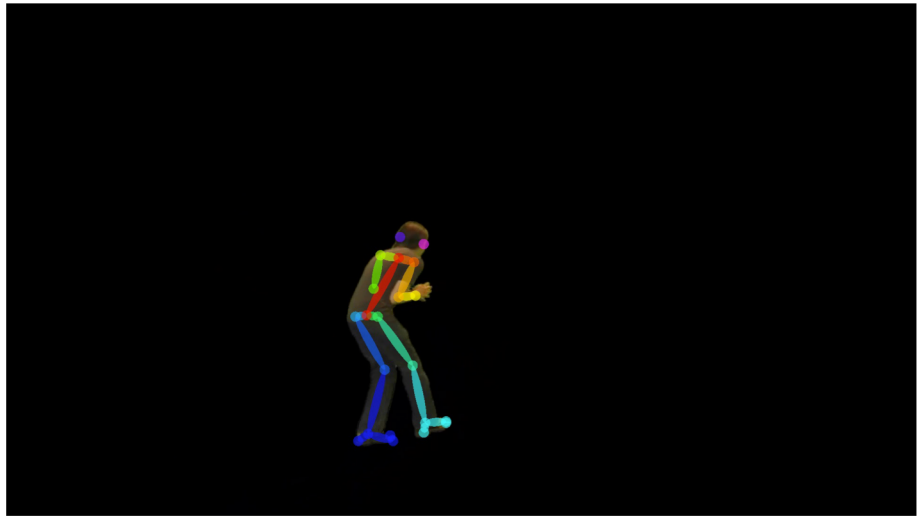
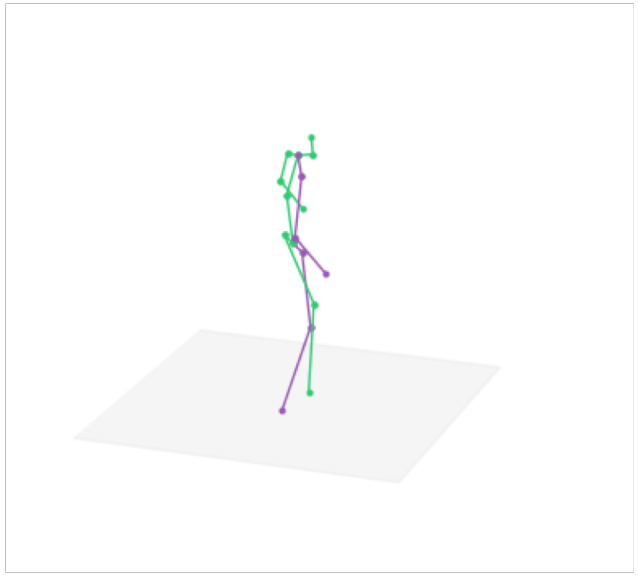
Actions Video Database
PACO Markers Dataset
Convert from CSM format to 3D pose positions
Noise smoothing
Extract 3D keypoints
LMA feature extraction
- Angles between particular joints
- Velocity/accel/jerk
- Body spatial dissymmetry
- Contraction
- Rise-sink of body
- Etc
- Feature elimination
K medians to extract per-emotion dictionary
Merge per-emotion dictonaries to produce global dictionary
Frame to reference pose
Soft assignment
HMM framework
Gaussian Mixture Models for emission distribution parameters

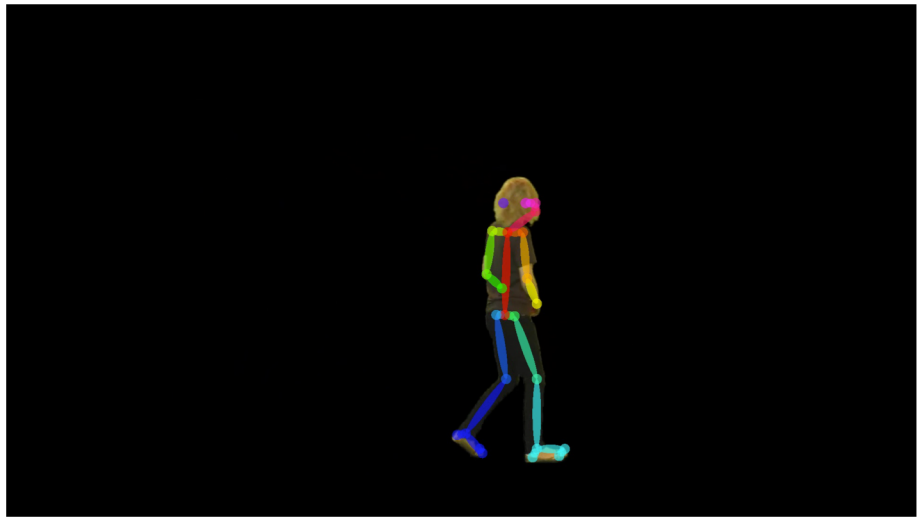
2D

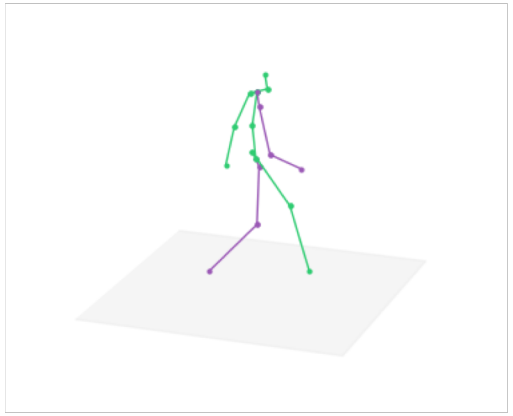
3D



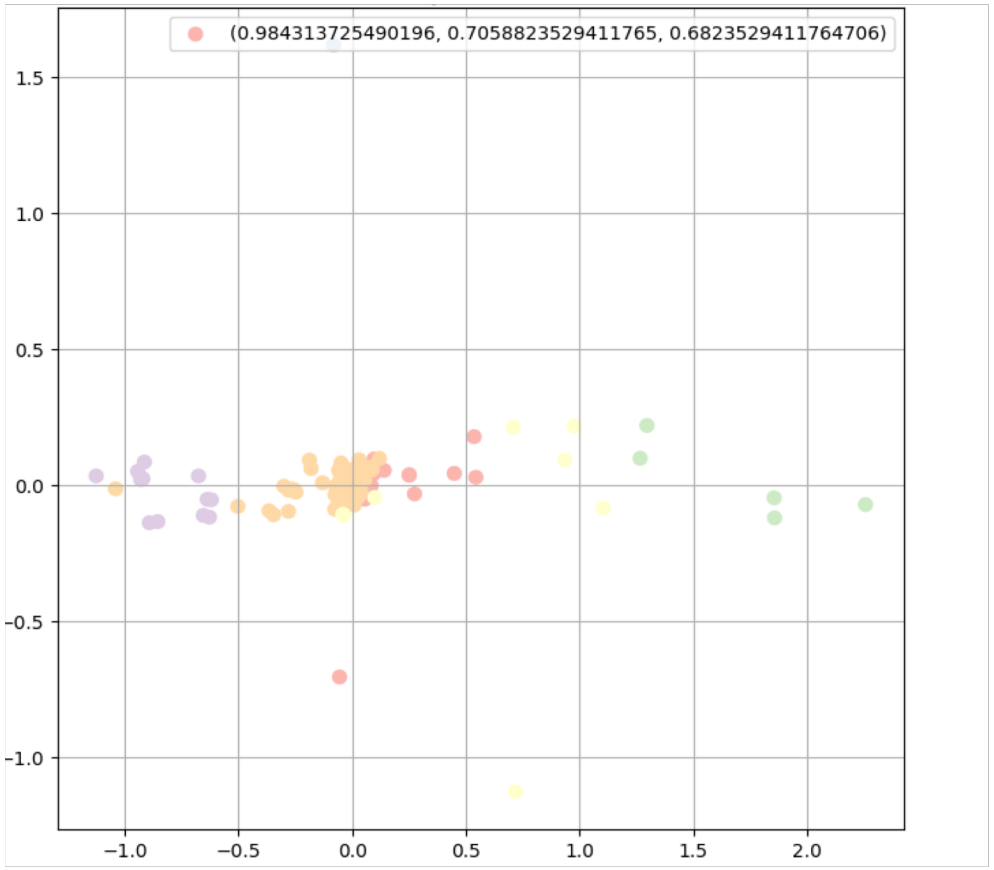


VS





Clusters for angry LMA dictionary projected into 2 dimensions using PCA




| Thresh | Global Dictionary Size |
|---|---|
| 3.5 | 30 |
| 4.0 | 28 |
| 4.5 | 22 |
| 5.0 | 17 |
| 5.5 | 16 |

Results from Merging Process. Thresh=5.0 gives 3.4 poses to each emotion category on average.

## Soft assignment probability

$$\mathrm{o(t)} = (\mathrm{d'}_1(t), d'_2(t), \ldots, d'_{17}(t))$$

where d is the relative position of the frame vector at time t to the space drawn by the dictionary poses at time t.

**Next steps:** HMM training and testing. Smoothing for better results. Apply to PACO markers dataset.