



On the Classification of Human Movements

LUDOVIC HOYET

Videos on <https://people.rennes.inria.fr/Ludovic.Hoyet/distinctiveness.shtml>

Context

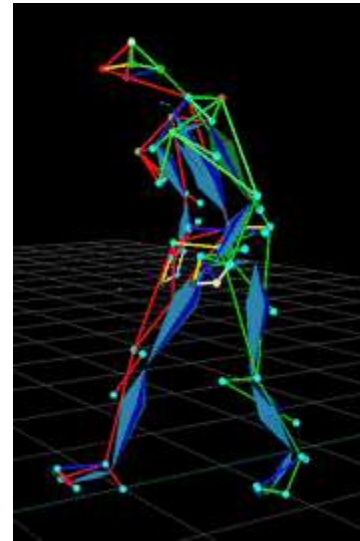
- ▶ Human motion capture data is becoming more accessible



- ▶ Carnegie Mellon University database: 100+ subjects
- ▶ Trinity College Dublin database: 50+ subjects
- ▶ In Rennes: 100+ subjects (in particular tennis serves)

Context

- ▶ There is a need for automatic classification of motions

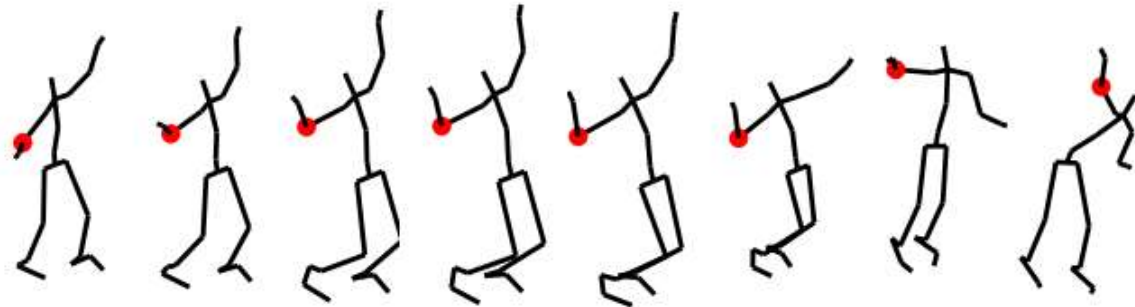


Context

- ▶ There is a need for automatic classification of motions



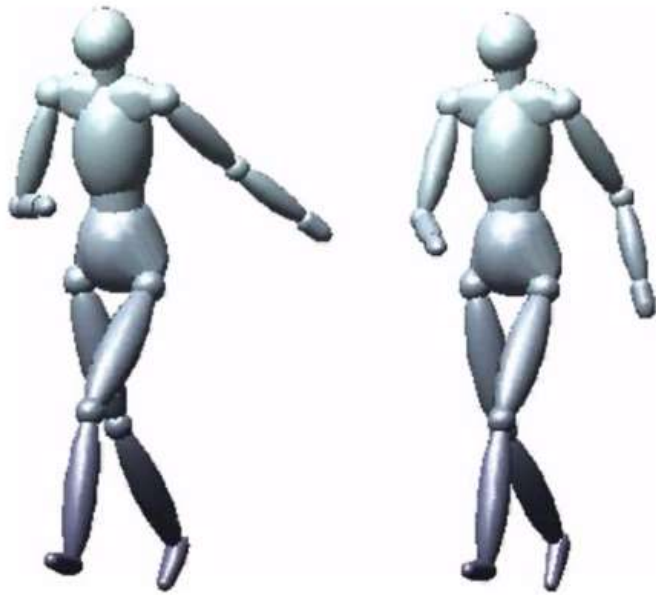
[Ennis et. al 2013]



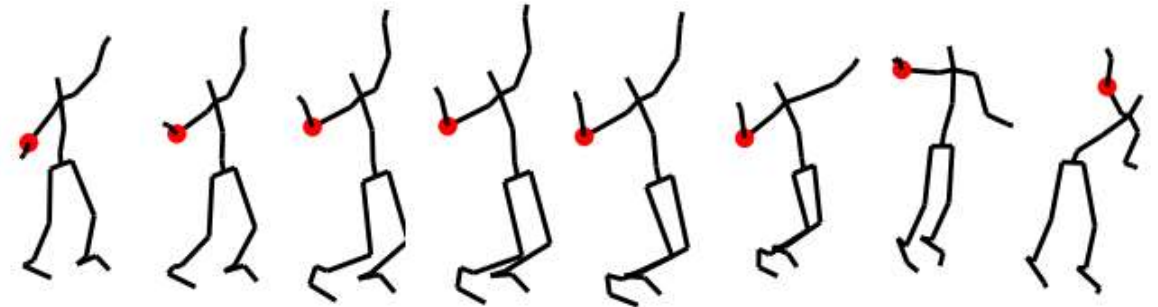
[Morel et. al 2016, 2017]

- ▶ Emotions, style, sports performance, actions, ...
- ▶ It would also be interesting for us to identify which motion features contribute to a given parameter
 - ▶ E.g.: arm movements important for happiness?

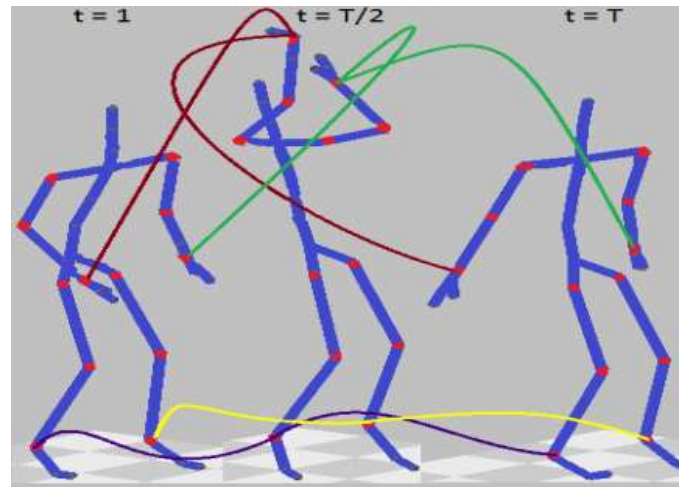
State of the Art



Emotions – Sparse regression
[Roether et. al 2009]



Sports performance – DTW [Morel et. al 2016, 2017]



Action recognition
[Boulahia et al. 2016]

...

Our interest

- ▶ Evaluating the Distinctiveness and Attractiveness of Human Motions on Realistic Virtual Bodies [ACM TOG 2013]
 - ▶ Captured 15 male and 15 female actors: walking, jogging, dancing
 - ▶ Added average male and female motions
 - ▶ Evaluated how attractive and distinctive these motions were perceived to be

Our interest

- ▶ Evaluating the Distinctiveness and Attractiveness of Human Motions on Realistic Virtual Bodies [ACM TOG 2013]



Distinctiveness

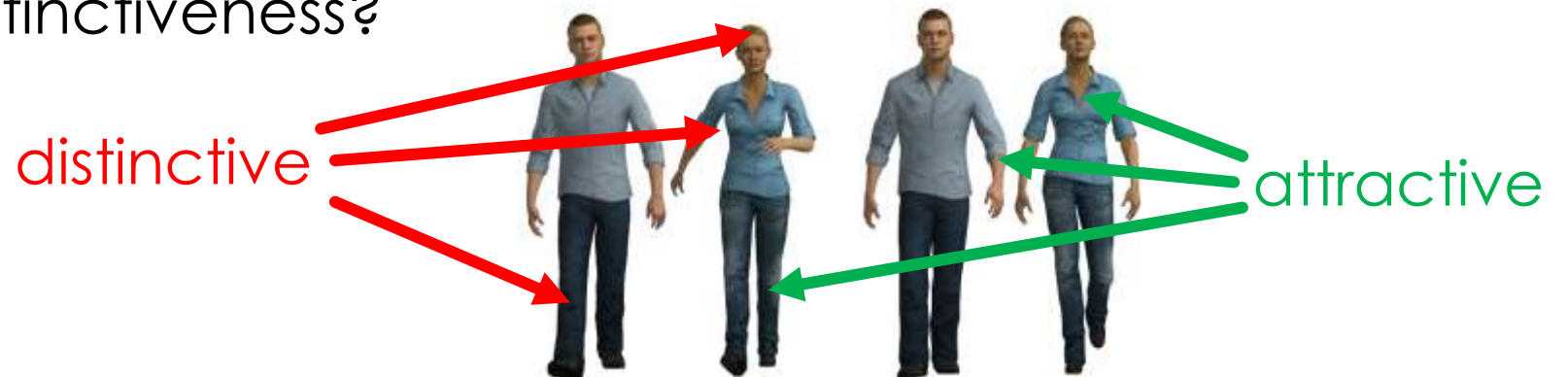
Our questions then

- ▶ Could we automatically detect how attractive/distinctive motions are?



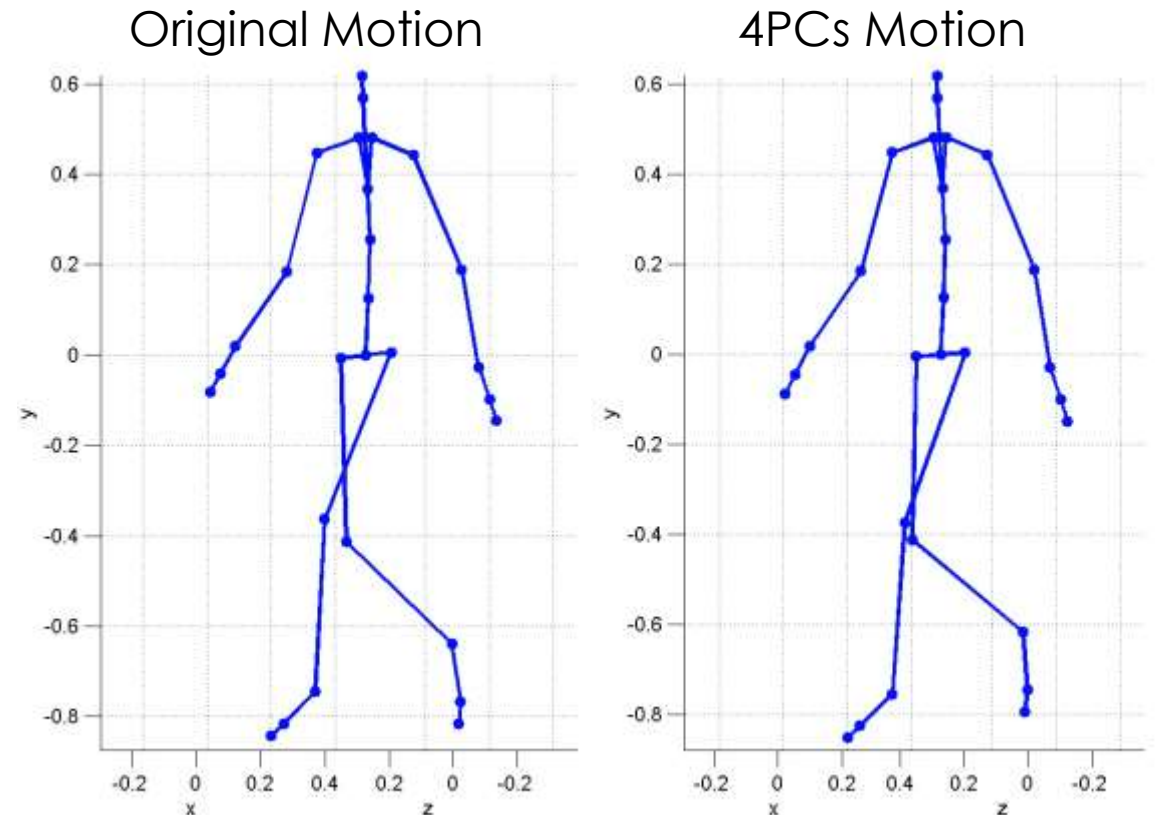
- ▶ Attractive / non distinctive : useful to hide clones in large groups, or for attractive main character
- ▶ Non attractive / Distinctive : might need to recapture, or for specific character

- ▶ Could we identify which features of the motion contribute to attractiveness/distinctiveness?



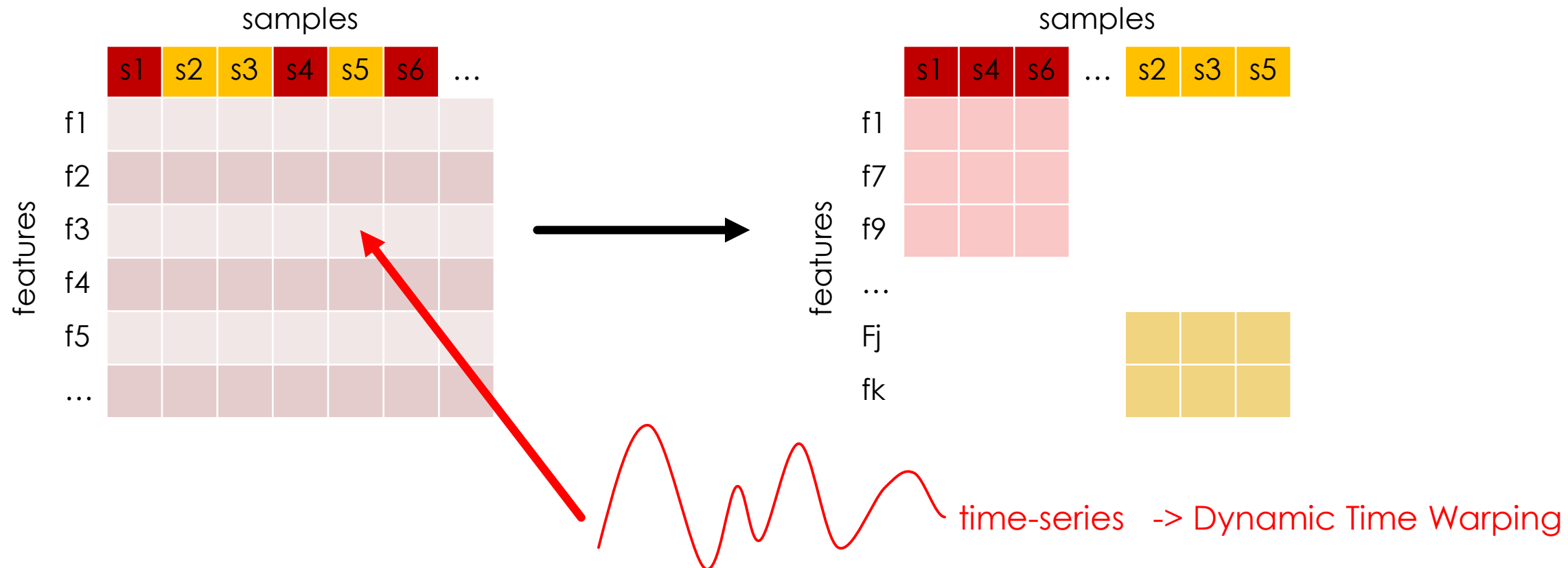
First try: Classification (2013)

- ▶ Master thesis of Kenneth Ryall
 - ▶ Dimensionality Reduction (PCA)
 - ▶ The first 4 PCs cover on average
 - ▶ Walk: $94\% \pm 1.5\%$ of the variance
 - ▶ Jog: $93.7\% \pm 2.1\%$ of the variance
 - ▶ Classification using SVM
 - ▶ No results...



Second try: Feature selection (2017)

- ▶ Florian Elain (4th year INSA), supervised with Antonio Mucherino
 - ▶ Adaptation of bi-clustering approach to human time-series data



Second try: Feature selection (2017)

- ▶ Florian Elain (4th year INSA), supervised with Antonio Mucherino
 - ▶ → A triclustering approach for feature selection
 - ▶ Results are currently being analysed on locomotion + tennis datasets
 - ▶ Selects 100+ features
 - ▶ Need to analyse feature labels (right/left/symmetrical, body part, position/rotation, etc.)
 - ▶ Tried to learn classifiers using selected features
 - ▶ From 20 to 40% error on 2-class classifiers

Our first insights on these problems

- ▶ Amount of "controlled" data is really a problem for us
 - ▶ 15 male / 15 female actors
 - ▶ Sometimes information can be costly to acquire
 - ▶ Attractiveness/distinctiveness \neq male/female or expert/novice
 - ▶ Can also be on a continuous scale: where are the borders?
 - ▶ More than likely gender specific features \rightarrow cannot merge male/female motions

Thank you for your attention

