

Probabilistic LMA-based Human Behavior Understanding by Conjugation of Frequency and Spatial Domains

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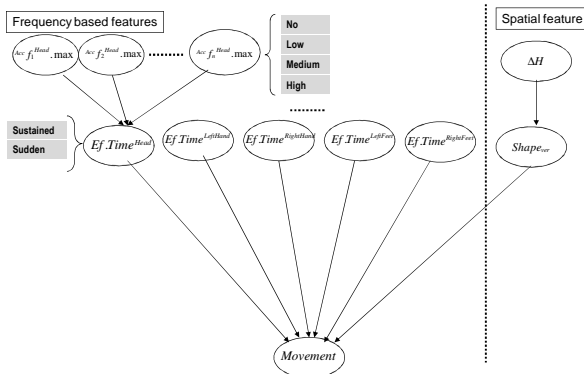
Introduction

- Analysing human motion is a prerequisite for understanding any human activities, such as human behaviour, human-robot and human-human interaction, etc.
- The idea comes from a known human motion analysis system, Laban Movement Analysis (LMA), which was created for choreography and dance notation purpose.
- For implementing the idea, Bayesian Networks (BN) has been used. BN presents many advantages on using prior knowledge and modeling the dynamic dependencies between parameters of object states.

Objectives

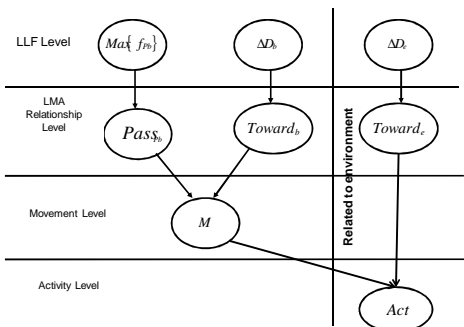
- Modeling LMA Effort component using frequency based features.
- Analysing human motions using frequency and spatial based features in Bayesian approach.
- Body motion and context based Human behaviour understanding using HMM.
- Exploring in LMA Relationship component to find a connection between human motions and human behaviour (human-environment and human human).
- Probabilistic social-based interpersonal behaviour analysis using body motion informations.

Individual body-centered human motion analysis



	Walk	Run	Sit & Bend	Rise	Fall	Stand	%
Walk	56						100
Run		60			2		96.77
Sit & Bend			41			1	97.6
Rise				24			100
Fall				1	22		95.7
Stand						109	100

Context-based Human Behaviour Analysis (HBA)



This BN presents the dependencies of those all different variables (LLFs, Relationship component, movement, activity) in two different space (related or not related to the environmental parameters) in one model.

	Walking	Running	Sitting	Rising	Falling	Standing
Walking	63					2
Running	1	72			2	
Sitting			46			
Rising				34		1
Falling		1		1	26	
Standing						155

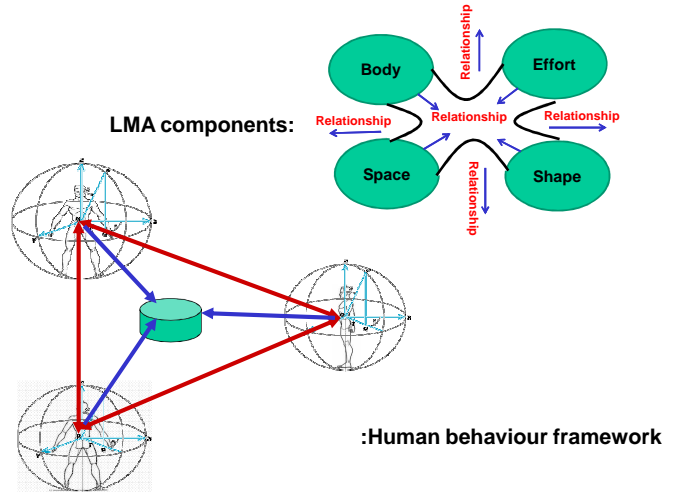
Table 1. Human movement classification result

	Reaching	Spreading	Passing	Other	%
Reaching	138		1	7	94.52
Spreading		149	1	5	96.13
Passing	9	2	45	3	76.17
Other	1	1	4	144	96.00

Table 2. Human activity classification result

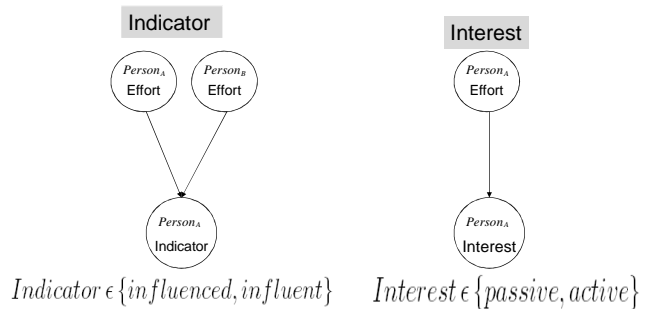
Laban Movement Analysis

- Laban Movement Analysis (LMA) is a well-known method for observing, describing, notating, and interpreting human movement. The theory of LMA consists of several major components, though the available literature is not in unison about their total number.

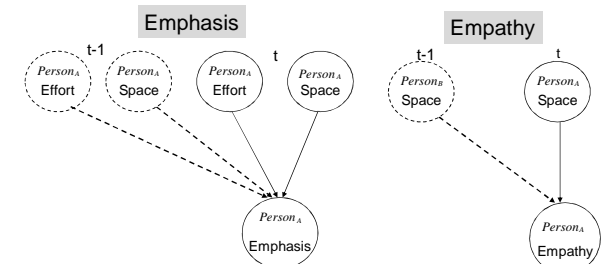


Social based Interpersonal Behaviour

Exploring the existent dependencies between LMA parameters and social interpersonal behaviour. (connection between LMA descriptor and Pentland definitions for social signals).



Indicator $\in \{influenced, influent\}$ Interest $\in \{passive, active\}$



Emphasis $\in \{consistent, inconsistent\}$ Empathy $\in \{uncoordinated, mimicry\}$

Conclusion

- Using frequency-based features to reach the LMA parameters
- Using a Bayesian network to obtain LMA parameters
- Using a Bayesian network to behavior understanding
- Definition of bottom-up strategy for HBA
- Exploring in the Relationship component

Future works

- Modeling Relationship component of LMA for human-environment and human-human interaction.
- Defining LMA-based interpersonal behaviour understanding in Social aspect.

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