

GAIT RECOGNITION USING JOINT MOMENTS, JOINT ANGLES AND SEGMENT ANGLES

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INTRODUCTION

Recognition of gait patterns has been studied intensively during the last decades. Different gait strategies have been elucidated by applying different waveform analysis techniques to biomechanical gait data [1,2] and it has been shown that individuals can be identified using joint angles in the sagittal plane [3]. However, little is known about additional biomechanical variables for gait recognition.

METHODS

We examined which biomechanical variables (joint moments, joint angles and segment angles from the lower extremities) obtained in 3D in a clinical gait lab that could be used to distinguish between 21 people on two different days.

The time course pattern of each variable for each of the 21 subjects from the first day was used as reference. The matching variables from the second day for each subject were tested against the 21 references in order to identify the same subject on the second day.

RESULTS AND DISCUSSION

In several cases we found a systematic “DC-offset” between days (Figure 1A) presumably due to variation of marker placement which could be removed by taking the 1st derivative to the displacement data (Figure 1B).

We found that especially joint angular velocities and segment angular velocities provided high recognition rates (Table 1). Pearson’s correlation analysis could be used to recognize all 21 subjects by combining the velocity profile of three of the angles.

CONCLUSIONS

Our findings indicate a number of variables, which seem preferable for waveform analysis such as Fourier transformation or principal component analysis. These variables comprise primarily the frontal plane joint angles.

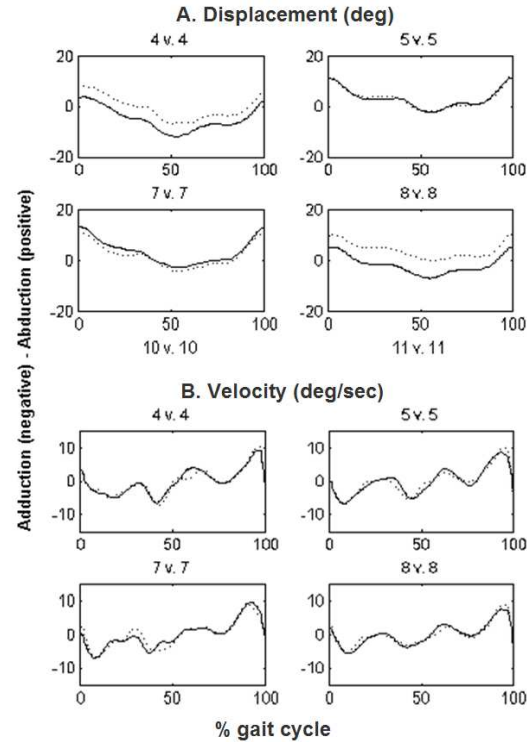


Figure 1: Abduction/adduction hip joint displacement and velocity from four subjects from two different days.

REFERENCES

1. Chau T. *Gait Posture* **13**:49-66,2001.
2. Chau T. *Gait Posture* **13**:102-120,2001.
3. Baofeng G and Nixon M. First IEEE International Conference on. Biometrics: Theory, Applications, and Systems, Washington D.C, USA, Gait Feature Subset Selection by Mutual Information, 2007.

Table 1: Recognition rates obtained using Pearson correlation for joint- and segment angles in the frontal and sagittal plane.

	Joint angle			Segment angle		
	Hip	Knee	Ankle	Thigh	Shank	Foot
Flexion/Extension (deg)	71%	57%	48%	52%	48%	38%
Flexion/extension velocity (deg/sec)	76%	67%	76%	67%	71%	57%
Abduction/Adduction (deg)	62%	38%	57%	48%	67%	57%
Abduction/adduction velocity (deg/sec)	90%	43%	76%	81%	81%	81%