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Higher order symmetry for non-linear classification of human walk detection

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The paper focuses on motion-based information extraction from cluttered video image-sequences. A novel method is introduced which can reliably detect walking human figures contained in such images. The method works with spatio-temporal input information to detect and classify patterns typical of human movement. Our algorithm consists of real-time operations, which is an important factor in practical applications. The paper presents a new information-extraction and temporal-tracking method based on a simplified version of the symmetry pattern extraction, which pattern is characteristic for the moving legs of a walking person. These spatio-temporal traces are labelled by kernel Fisher discriminant analysis. With the use of temporal tracking and non-linear classification we have achieved pedestrian detection from cluttered image scenes with a correct classification rate of 97.6% from 1-2 step periods. The detection rates of linear classifier and SVM are also presented in the results hereby the necessity of a nonlinear method and the power of KFDA for this detection task is also demonstrated.

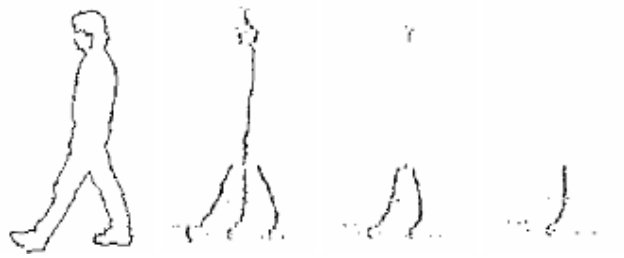

Figure 1. An idealised outline of a walking person, together with the derived Level 1, Level 2, and Level 3 symmetry maps.

Figure 2. Sample symmetry-patterns of real-life pedestrian walking-tracks.

a) b) c)

Figure 3. Typical indoor shot: a) L3S, b) output of tracking c) detected walk patterns.

Table 1. Comparison of classification methods

Method	Detection rate	False-positive	False-negative
LDA	89.0%	8.05%	2.95%
KFDA	97.6%	1.25%	1.15%
SVM	96.0%	1.20%	2.80%