A. Sant'Anna, W. Ourique de Morais, N. Wickström. Gait unsteadiness analysis from motion primitives. Gerontechnology 2008; 7(2):204. The development of intelligent ambulatory monitoring systems and smart living environments is important when considering the aging of society and its implications. This work concerns the use of human motion analysis as a tool for supporting elderly life and suggests a new 'motion language' approach to such tasks. More specifically, the concept of 'motion primitive' has been used to quantitatively analyze gait unsteadiness. The variability of stride time, stance time and swing time was measured, as well as the walk symmetry between the two feet. It has been shown that these measurements are useful in assessing fall risk in the elderly[1]. This assessment provides important information about how much attention and assistance the elderly may need. In addition, periodic analysis may draw attention to changes in one's performance. Accelerometers were chosen as motion sensors for they offer a number of desirable features in monitoring human movements such as response to both movement frequency and intensity, and miniaturization[2]. So far, there have been no other studies on the development of a motion language from accelerometry signals. **Methods** Traditionally, movement detection and classification depends on a large collection of training examples and manual labeling is labor-intensive and error-prone. A more effective technique is to automatically decompose human activity into building blocks which belong to an 'alphabet' of elementary actions (motion primitives). Figure 1 is one example of how actions can be divided into primitives. Here, each primitive is represented by a color. The data analyzed for this work was obtained from two 3-axial accelerometers, placed on each ankle of a person. After piecewise linear segmentation of the data, the recurrent primitives were grouped into symbols based on a bottom-up approach to their appearing frequency. These symbols were, in turn, used to compute the variability of stride time, stance time, swing time and the symmetry between the two feet. **Results and discussion** Results show that motion-primitive segmentation from accelerometry signals can be used to analyze and quantify the unsteadiness of human gait. This is an important assessment of one's risk of falling. Therefore, this methodology supplies powerful tools for monitoring elderly people, not only for safety reasons but also for medical diagnosis. It provides a way of quantifying physical performance and tracking its long-term development, allowing a precise follow-up of the elder's health status. Appropriate segmentation of data into motion primitives opens a way to the creation of a motion language[3]. Such language enables the description of numerous concepts from different combinations of a limited number of primitives. In addition, it enables a higher level analysis when compared to traditional techniques. This representation of human movements largely facilitates the man-machine interface and catapults the development of enabling technologies for the impaired.

References

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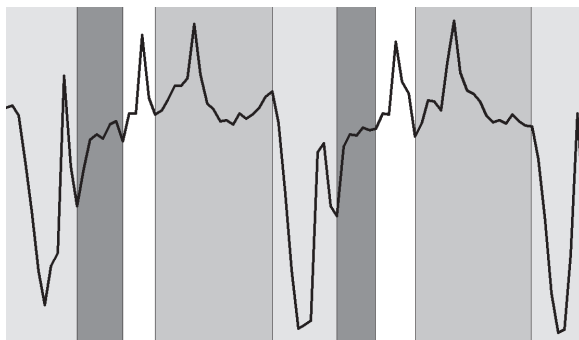3. Guerra-Filho G, Aloimonos Y. Computer 2007;40:42-51

Figure 1 Representation of concept 'running' from motion primitives - accelerometer placed on ankle