COMPARISON OF SENSOR CONFIGURATION IN TELE-HEALTH APPLICATIONS ON
CLASSIFICATION OF BEHAVIOR

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INTRODUCTION
The effectiveness and success of tele-health services crucially depend on the ease with which clients can use and access the
service. In the case of tele-monitoring applications in which clients must wear sensors, ease and comfort of use are compromised if
the sensors must be tightly fixed to the body at precise points. Several studies (e.g. [1]) have shown that it is possible to reliably
monitor physical behaviors of ambulant clients by means of accelerometers that are tightly attached to the lower part of the body. In
this study we investigate to what extent reliable information about the behaviors can be obtained from accelerometers that are
attached to the client's clothes, instead of to the body.

METHODS
We carried out experiments with five healthy subjects. Six Minimod 3-D acceleration sensors (Mcrobberts) were used to capture
information about the behavior of the subjects. These sensors were split up into two sets; one set was tightly fixed to three body
segments (both upper legs and the torso). The other set was attached to the clothing of the subject on corresponding sites (sensors
were put in both pockets of the subjects' trouser and one was attached to the belt). The subjects performed a set of controlled
movements and postures, viz. sitting, laying, standing, walking at four different speeds, walking up and down the stairs, and bicycling
on a home trainer at four different speeds. In addition, a set of semi-natural activities were recorded, viz. sitting at a desk and
working on a computer, reading in a chair without a table, playing a game of pictonary (while standing), bicycling outside, walking up
stairs to fetch some item and a housekeeping task. The signals were exported to Matlab for further processing. We will use a two
stage Hidden Markov Model (HMM) for the classification of posture and movement. In the first stage the posture of the body is
predicted and in the second stage the movement of the body is predicted based on prior knowledge of the prediction in the first
stage. Initial training and validation experiments with the first stage of the model are currently evaluated. The model is trained per
subject. Future steps include training and validation of the whole model on both the body and clothes worn sensor sets.

RESULTS
The Initial training and validation experiments of the first stage of the model showed excellent results for both the body worn sensors
and the sensors attached to the clothes. We observed no significant difference in performance between these sensor sets. In case of
both sensor sets the test set is correctly classified for at least 95%.

DISCUSSION
The first stage of the model can be trained excellent on both sets of accelerometers. Hence, both sensor sets contain the necessary
information for the classification of sitting, lying, and standing. The next step is to train and validate the full classification model on
both sensor sets. We hypothesize that both sets will have comparable good classification results in this second step.

CONCLUSIONS
The acceleration signals from sensors worn in clothing are sufficient reliable for detection of postures in ambulant behavior
monitoring applications.

REFERENCES
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