CLASSIFICATION OF ELECTRICAL APPLIANCES AS TOOL FOR MONITORING ACTIVITIES OF DAILY LIVING

M. Mertens[1], T. Croonenborghs [1,4], K. Milisen [2], E. Devriendt[2], J. Tournoy [3], J. Davis [4], B. Vanrumste [1]

[1] K.H. Kempen University College, MOBILAB, Belgium

[2] K.U.Leuven, Division of Geriatric Medicine, Belgium

[3] K.U.Leuven, Gerontology and Geriatrics section, Country

[4] K.U.Leuven, Department of Computer Science, Belgium

1 Introduction

The aim of the AMACS project is to develop and evaluate a system that can automatically detect the activities of daily living (ADL) of older persons living alone at home. This automatic detection is based on measurements of contactless sensors that are installed in the home environment of the older person. In this project we use sensors that can measure the consumption of public utilities (electricity, water and gas), movement sensors and video cameras as shown in Fig.1. This abstract describes the results of the first step towards recognition of ADL: the automatic recognition of electrical appliances used by the elderly.

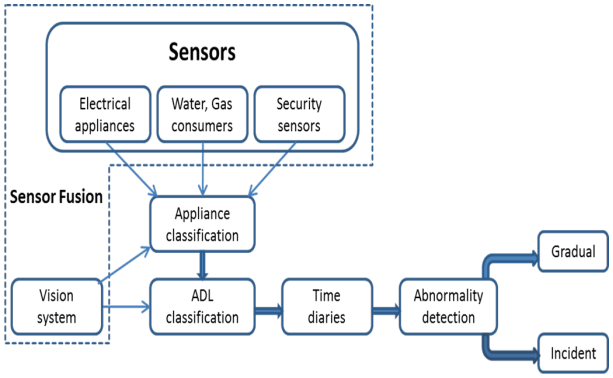

Figure 1: Overview of the AMACS project

2 Methods

Recently there has been some interest in the automatic classification of electrical appliances[1], mainly in the field of energy management. We try to improve results by using extended features describing the electrical current signal and by applying machine learning techniques.

We divide the appliances in four categories, based on their electrical architecture: lighting, motored appliances (hairdryers, mixers, etc.) heating and electronics appliances (TV sets, radios, computers, etc.)

The features we use to discriminate between appliance classes include power, phase shift with respect to mains voltage, harmonics, correlation with a pure sine wave, etc.

We measured the current profile of 30 commonly used appliances which can be linked to an ADL (microwaves, hairdryers, lighting, etc.) during 2 seconds with 5kS/s sampling speed with 12 bit resolution.

Our training set consisted of 106 measurements of 16 appliances. Using a simple J48 tree classifier in Weka, we correctly classified 95 out of 106 instances. The confusion matrix obtained with this classifier using 10-fold cross-validation is shown in Table 1.

Predicted					
a	b	c	d		
12	0	0	2	a=light	Actual
0	**16**	2	4	b=motor	
0	2	**40**	0	c=heat	
0	0	1	**27**	d=electronics	

Table 1: Confusion matrix of J48 tree classifier

3 Conclusions and Future Work

This test is a good first step in appliance discrimination towards detecting performed ADL, especially when it will be combined later on with information such as e.g. position information. The next step in our research is working with combined signals. When several appliances are switched on together, we need to first decompose the electrical current signal into the discrete current profiles before classification.

References

[1] M. Berges, E. Goldman, H. S. Matthews, L.Soibelman, Learning Systems for Electric Consumption of Buildings, 2009, Austin, Texas