# MORE

#### EXPLORATORY STUDY ON CLASSIFICATION OF ELECTRICAL APPLIANCES ON RASPBERRY PI WITH MATHEMATICA

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K.H.Kempen and Lessius are joining up to become more.



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#### **MOBILAB**

- Multidisciplinary expertise-centre
- Bridging Technology and Care
- Demand driven: close cooperation with the field
  - SME's, rehab/care centers, hospitals ...
- 4 research lines
  - Active & Healthy ageing
  - Biomedical technology
  - Orthopaedic technology
  - Sports- and rehabilitation technology





THOMAS

#### **AGEING OF POPULATION**





#### **Side effects**

Ratio elderly / caretakers Higher risk on age related syndroms

=> Quality of care under presure

"In Europa, every 24 seconds a person is diagnosed with Alzheimer disease or another variant of dementia."

(Expertisecentrum Dementie Vlaanderen)





#### **AMACS PROJECT - MOBILAB**

#### Monitoring the activities of daily living (ADL) of older people living at home

- automatically
- ✓ non-intrusively
- using contactless sensors
- Iimited number of sensors



- Learn regular living patterns (ADL)
- Detect abnormalities
- Report events







#### **AMACS - METHOD**



## **ELECTRICAL APPLIANCES**



## **ELECTRICAL APPLIANCES**



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#### **ELECTRICAL APPLIANCES**





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#### **EXPERIMENT OBJECTIVE**

#### "Is it possible to do automatic recognition of usage of electrical appliances on a low cost platform?"

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### **RASPBERRY PI 2**



- The Raspberry Pi 2 Model B
- Compared to the Raspberry Pi 1 (A, B, +) it has:
  - A 900MHz quad-core ARM Cortex-A7 CPU (BCM2836 SoC)
  - 1GB RAM
  - Like the (Pi 1) Model B+, it also has:
    - 4 USB ports
    - 40 GPIO pins

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#### MATHEMATICA







#### MATHEMATICA



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#### MATHEMATICA



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#### Logistic Regression

Naive Bayes

#### Nearest Neighbors (k:=1..3)

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- 11 electrical appliance types (TV sets, coffee machine, vacuum cleaner, etc.)
- sample frequency of 5kHz
- Period of 2 seconds



- I<sub>max</sub>, I<sub>rms</sub>
- CF

- n3, n5
- Power
- I<sub>tt</sub> stdev
- Correlation with perfect sine



- training set = 85
- test set = 24





#### **CLASSIFIER RESULTS**

Algorithm	Accuracy
Logistic Regression	75%
Naïve Bayes	79%
kNN, k = 1	<mark>95.8%</mark>
kNN, k=2	<mark>87.5%</mark>
kNN, k=3	87.5%

Table 1: Accuracy measure



#### CONFUSION MATRIX NEAREST NEIGHBOR, K=1



predicted class

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## CONCLUSION

- Possible to use Raspberry PI to automatically indicate which appliance is being used
- Future work
  - Generalize recognition
  - Data acquisition on Raspberry



## **QUESTIONS?**



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