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# Towards the Analysis of Human Movement with Humanoid Robots

## The XV Symposium of Mexican Students

Durham University – 13 July 2017

Miguel P. Xochicale

Department of Electronic Engineering  
University of Birmingham

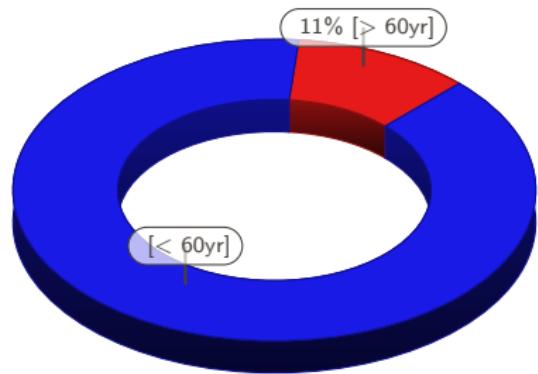


# INTRODUCTION

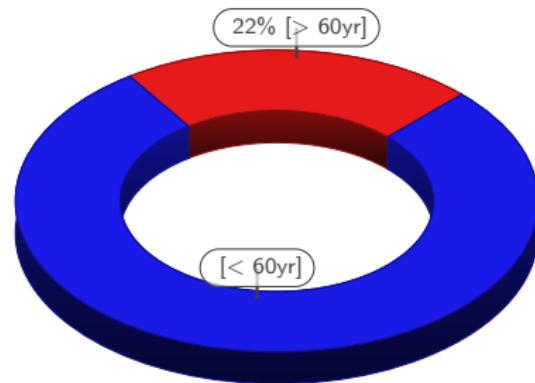
# THE WORLD'S POPULATION IS RAPIDLY AGEING



The proportion of the world's population aged 60 years or over will double from



2000



2050

By 2050 there will be almost 434 million people of 80 years or older worldwide, **of which 80 % will live in low- and middle-income countries.**

## ► WHAT IS NEEDED FOR HEALTHY AGEING

A change in the way we think about ageing and older people



Creation of age-friendly environments



Alignment of health systems to the needs of older people



Development of systems for long-term care



# ► WHAT IS NEEDED FOR HEALTHY AGEING **with ROBOTS**

A change in the way we think about ageing and older people



Creation of age-friendly environments



Alignment of health systems to the needs of older people



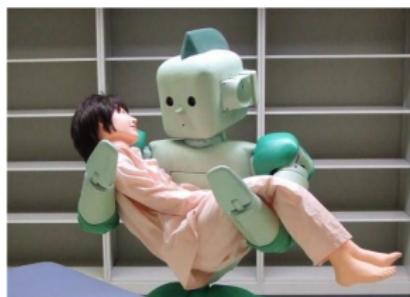
Development of systems for long-term care



# CARING THE ELDERLY WITH HUMANOID ROBOTS

# RI-MAN AND RIBA-II ROBOTS

- RI-MAN can track human face by integrating auditory and visual information.
- RI-MAN can do smell discernment by using semiconductor gas sensors.
- RIBA-II can detect a person's weight from touch alone using capacitive tactile sensors made entirely of rubber.
- RIBA-II can crouch down and lift a patient off a futon at floor level.



# PALRO IS A ROBOT WHO CARES



- PALRO can analysis of sound types, recognise faces, detect moving bodies, identify individual from voice prints, and recognition of sound source direction.
- PALRO is used for recreational activities for elderly people that such as games, exercises, quiz and music.



# NAO (A HUMANOID ROBOT)

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NAO has 25 degrees of freedom, capacitive sensors, sonars, 4 mics, speakers, 2 cameras, internet access.

# NAO AS A PHYSIOTHERAPIST



# ROBOCOACH

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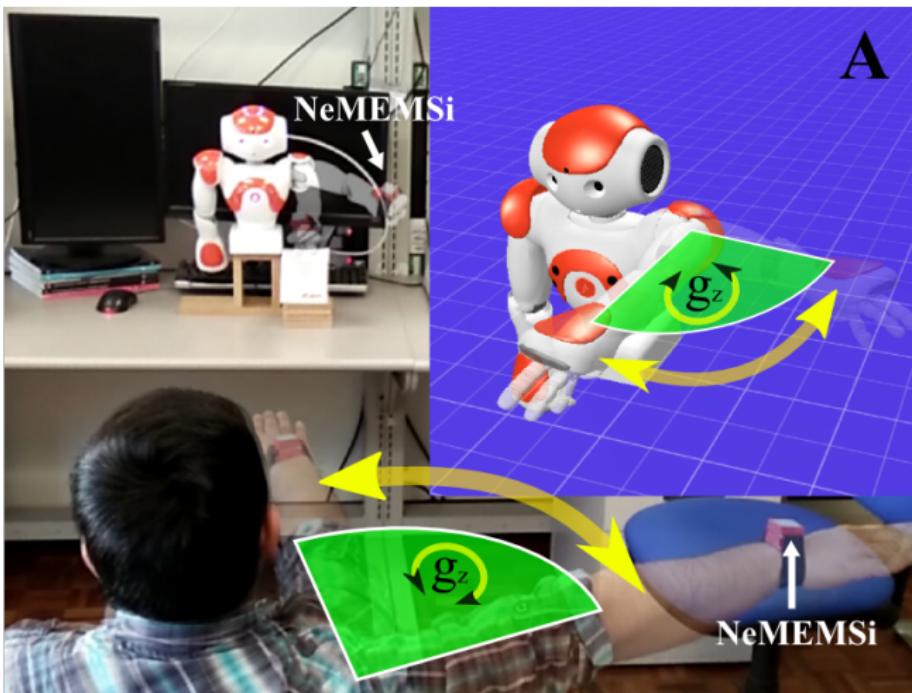


Robocoach coaches the elderly to perform 15 types of arm exercise.

## METHODS AND RESULTS

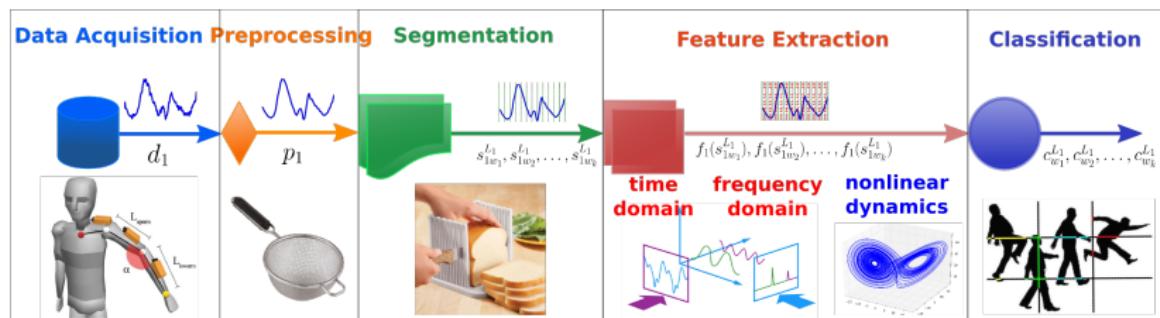
# HUMAN-ROBOT IMITATION

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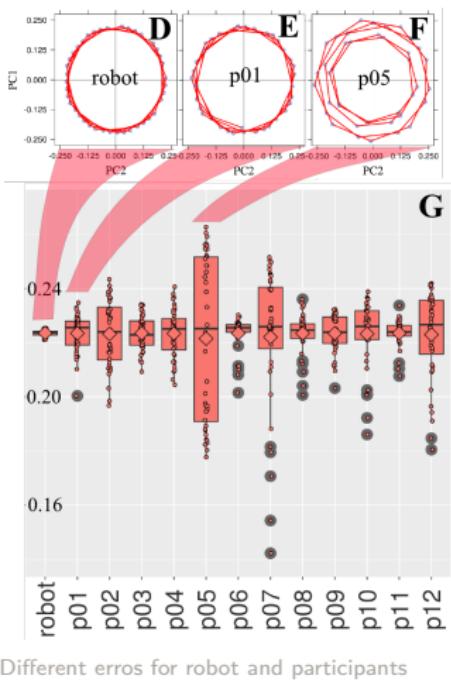


Horizontal Arm Movement of a Front to Front Human-Robot Imitation.

# HUMAN ACTIVITY RECOGNITION CHAIN



# HUMAN-ROBOT IMITATION



## CONCLUSIONS AND FUTURE WORK

# CONCLUSIONS

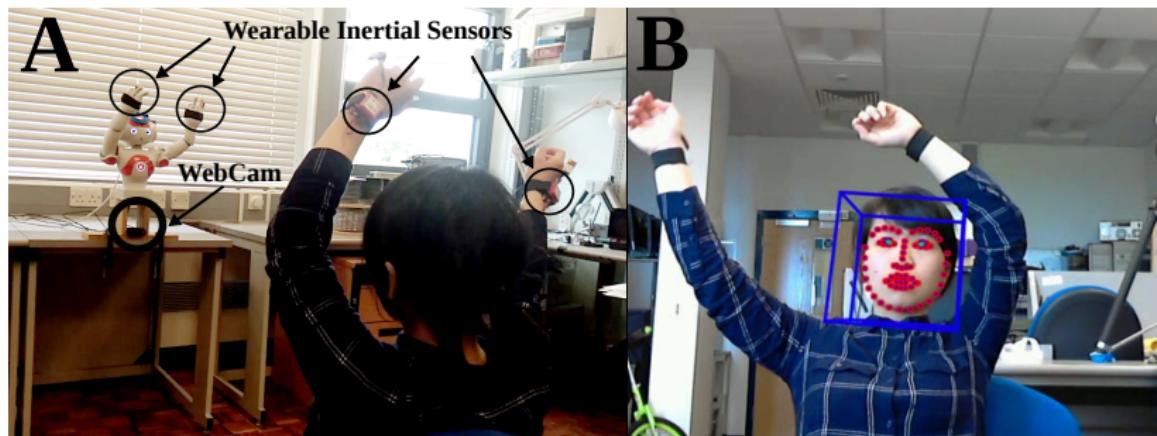


- It has been proposed a metric based on the Euclidean distances in the state space to quantify how close a participant imitate NAO's movement.
- (+) The state space provide a good representation of the variability of the activities.
- (-) The quality of the metric is debatable and needs further investigation.

# FUTURE RESEARCH GOALS



Exploration of complex movements which can be performed by both persons and NAO.

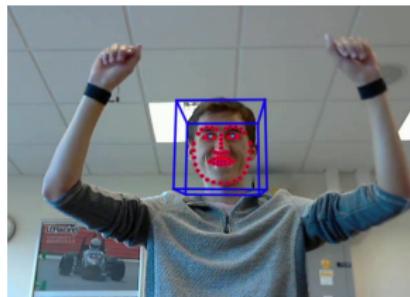
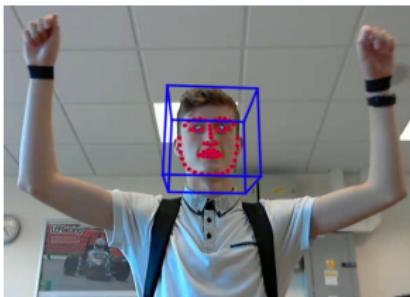
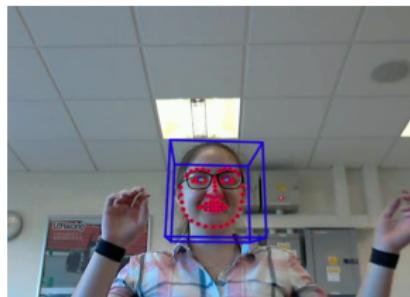
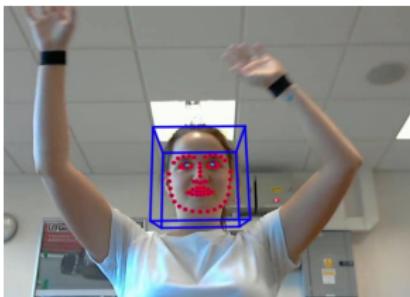


From Motion to Motion and Emotion

# FUTURE RESEARCH GOALS



Exploration of Deep Neural Networks for automatic classification of people's motions and facial expressions.





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# Towards the Analysis of Human Movement with Humanoid Robots

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Miguel P. Xochicale

<http://mxochicale.github.io/>

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