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Abdominal Morphometric Data Acquisition Using Depth Sensors

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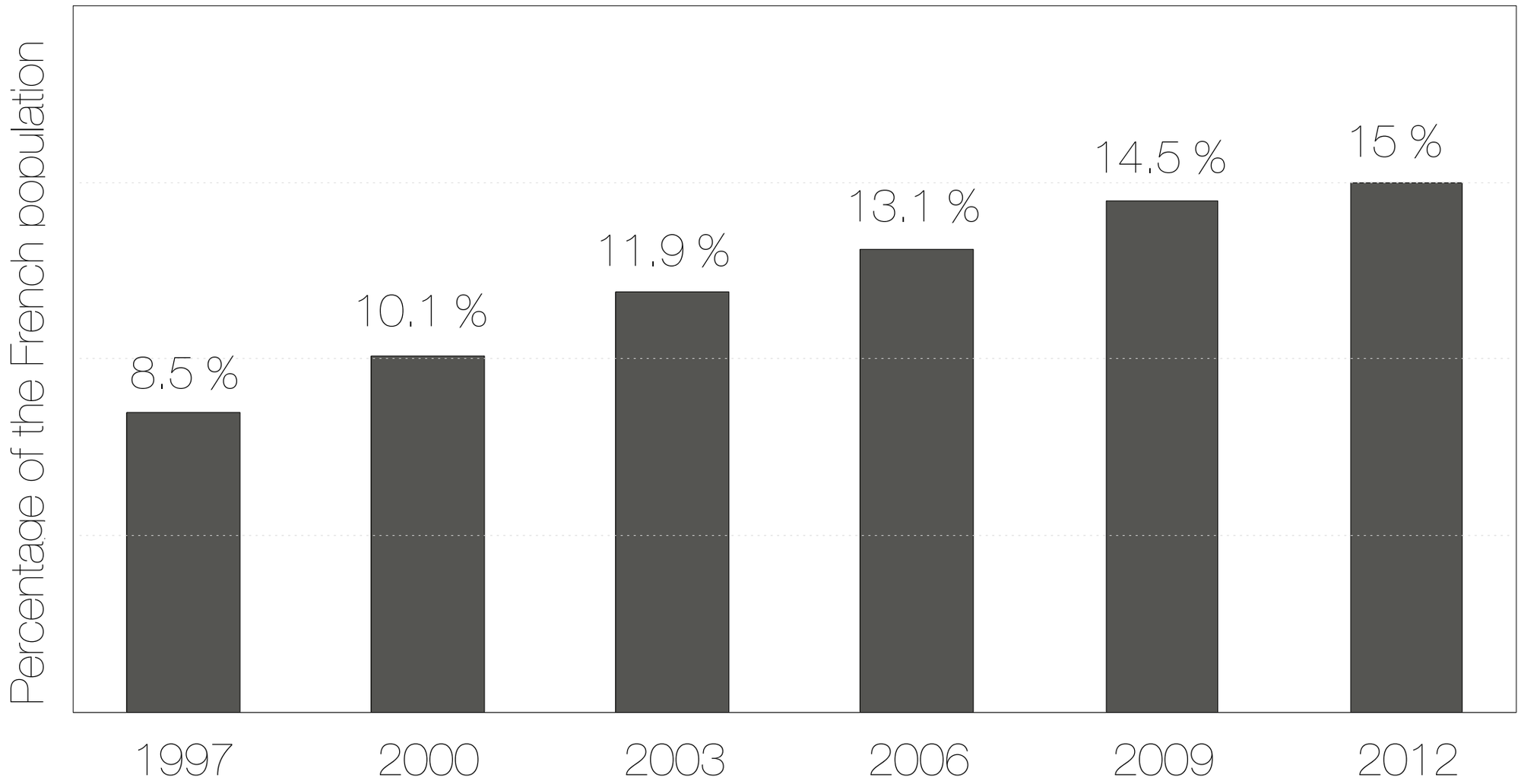
Outline

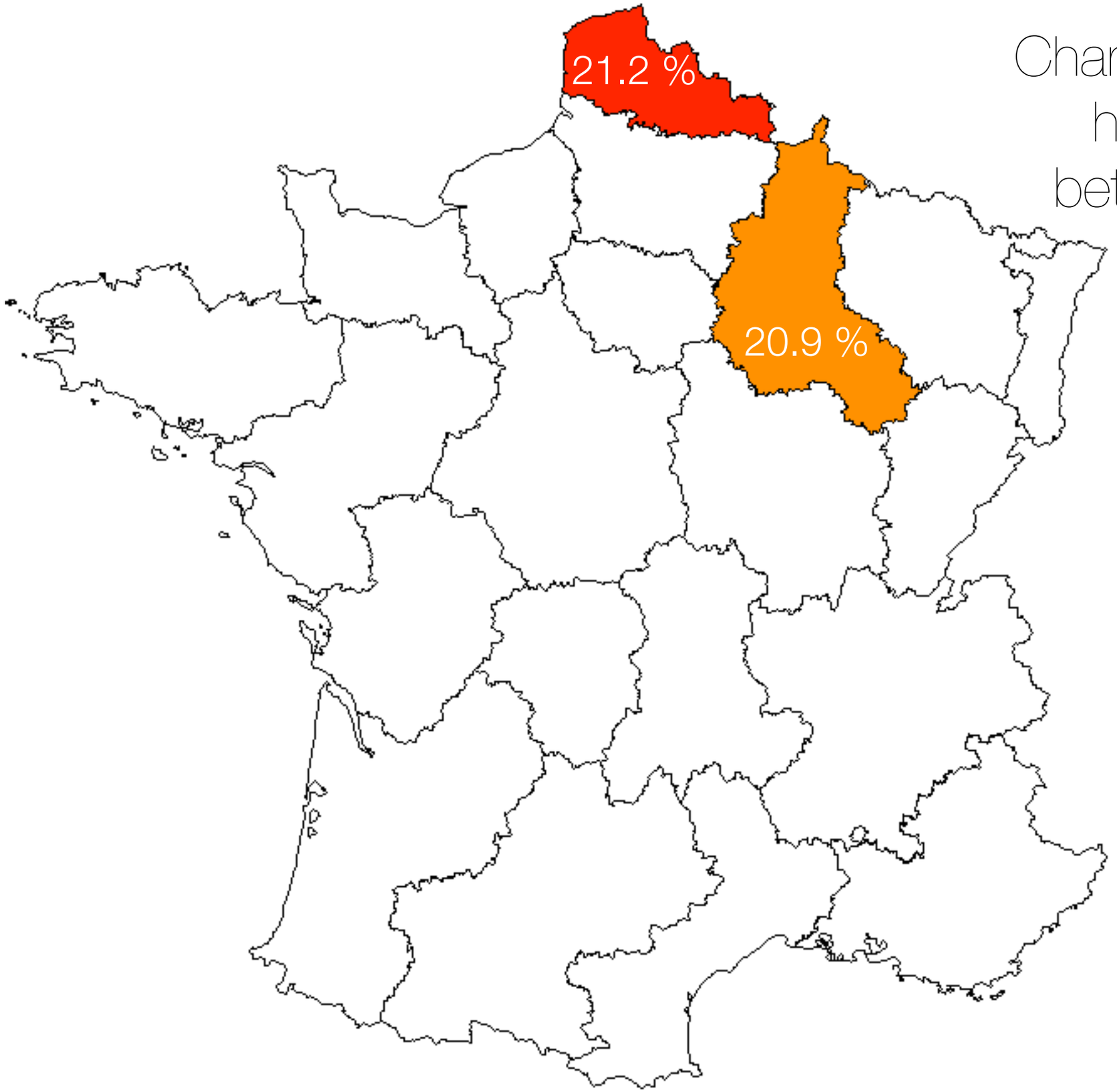
- Medical context: prevalence of obesity
- Project overview
  - Software architecture
  - First results
- Further works

Context: prevalence of obesity



ObEpi study conducted in 2012

Context: prevalence of obesity



Champagne-Ardenne region:
highest increasing rate
between 1997 and 2012
(+145.9 %)

Context: prevalence of obesity

- Priority of the Public Health policy, especially in the Champagne-Ardenne region.
- Large scale study of eating disorders (300 patients per year) based on surveys (eating behaviour, social and psychological environment) and morphometric measurements.

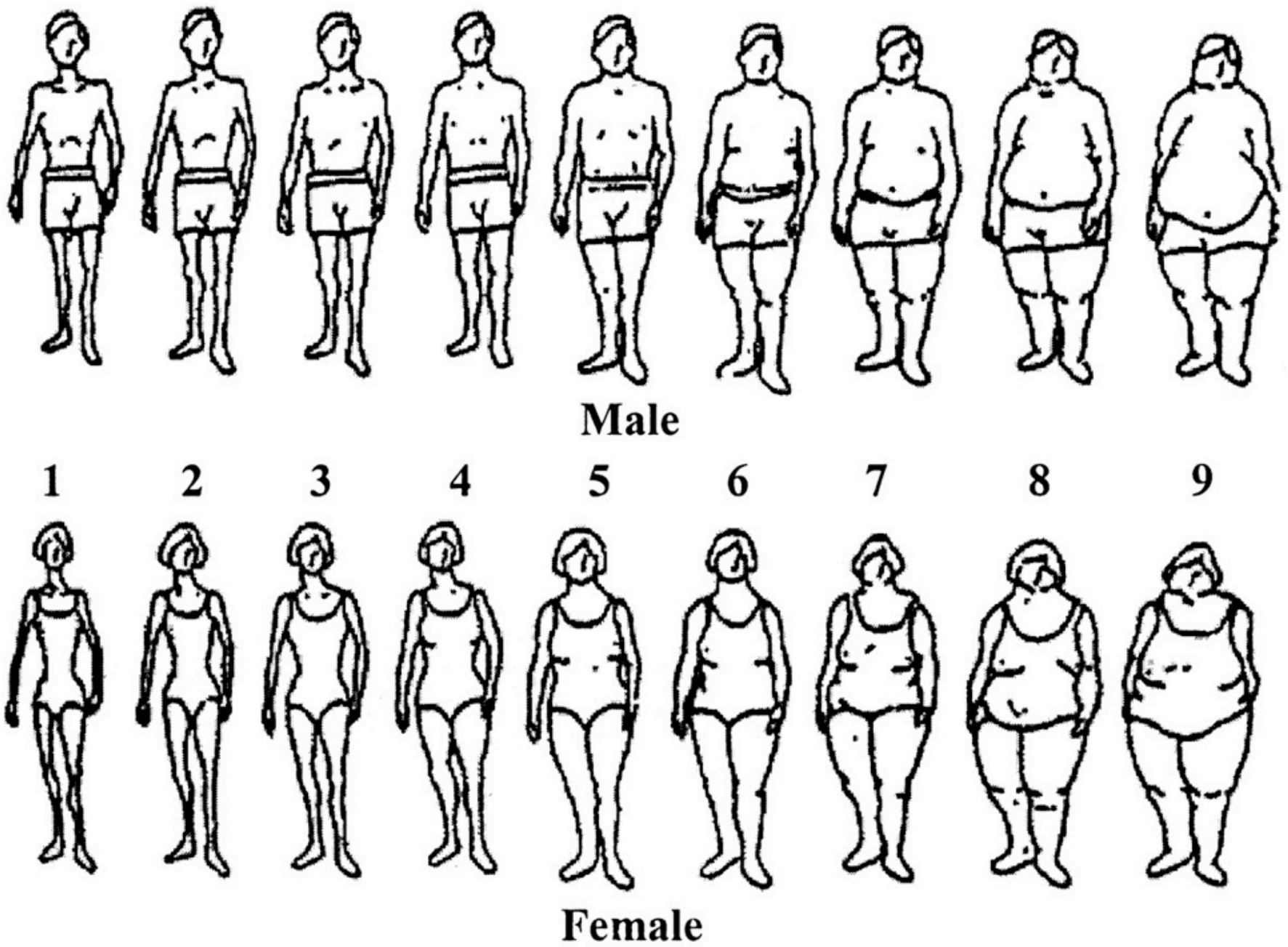
Pr. Bertin, Dpt of Endocrinology, University Hospital, Reims

Project overview

Our contribution (as computer scientists) consists in improving the data acquisition process:

- Answers provided by patients are subject to bias
  self perception, food quantity, eating frequency, ...
- Morphometric data acquisition relies on heavy medical equipment

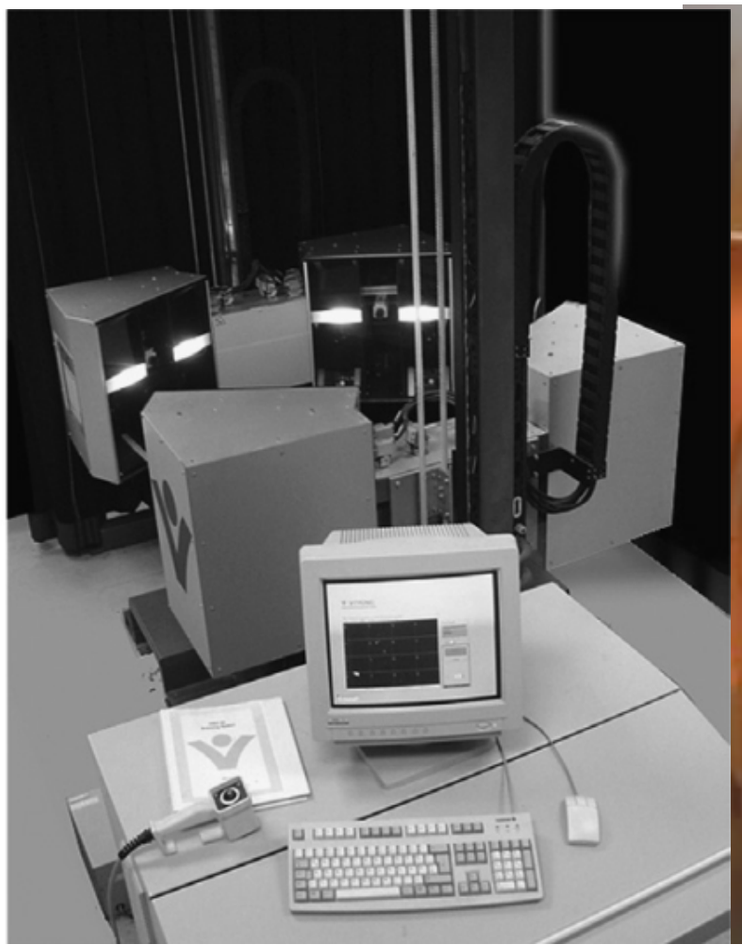
Self perception of overweighted people



Stunkard figure rating scale

Morphometric data acquisition

Vitus 3D 1600



PETSCAN

Project overview

Aim: use the KINECT gaming peripheral as a **measurement device** in order to :

- acquire objective data which will be confronted to the patient answers
- provide realtime feedback during lunchtime to change the eating behaviour of overweighted patients

KINECT™
for XBOX 360

YOU ARE THE CONTROLLER

Microsoft KINECT peripheral

Operating principle

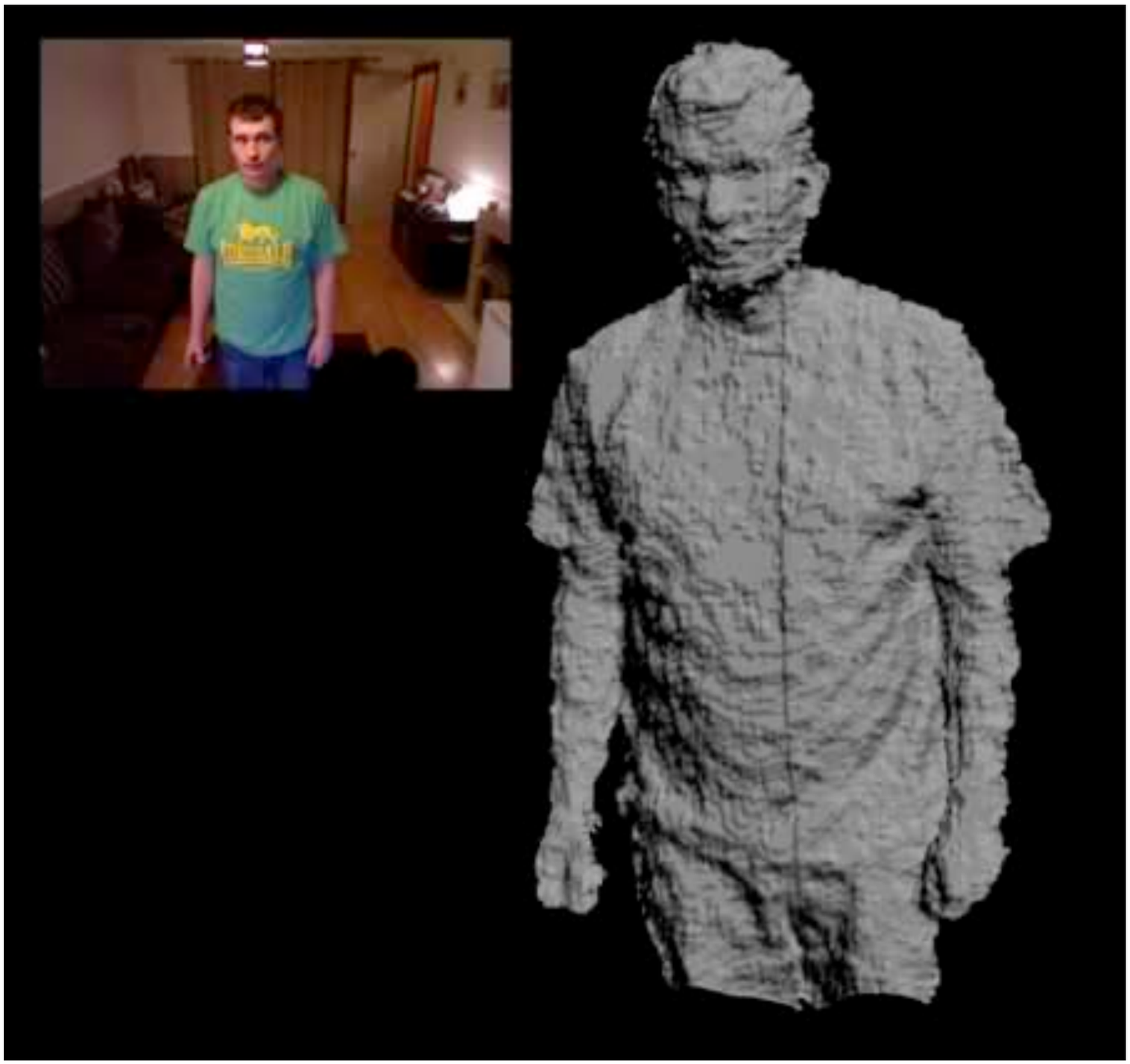
Depth map (Z coordinate)

Color map (X Y coordinates)

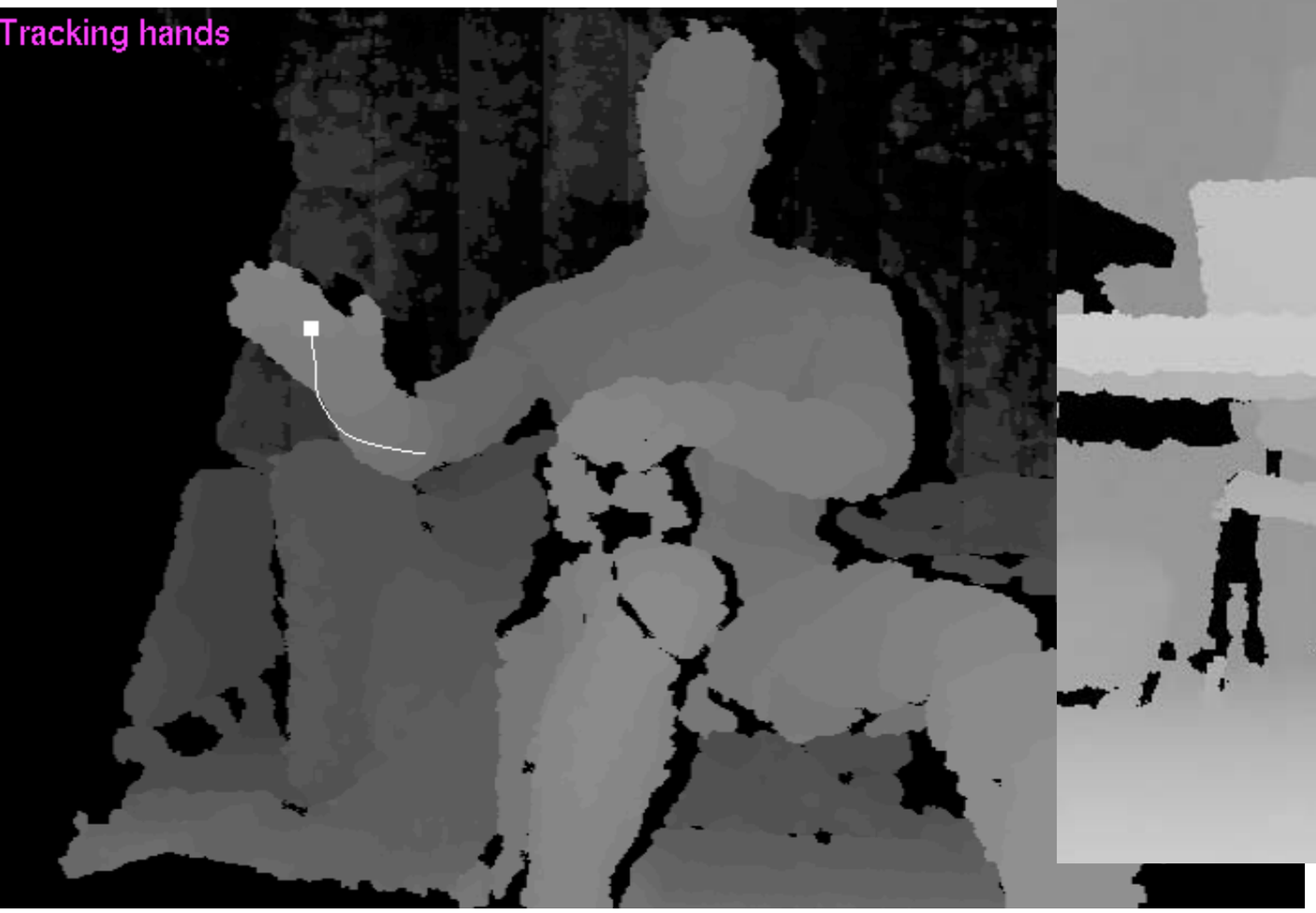
Alignment & merging

3D RGB point cloud

3D reconstruction



Body part tracking



New kids on the block

KINECT for XBOX (November 2010) 99 €

ASUS Xtion Pro Live (Spring 2011) 200 €

KINECT for Windows (February 2012) 249 €

PrimeSense Carmine (January 2013) 200 $

A word about accuracy/precision

- Accuracy (difference between the measured value and the real value) ranges from **5mm** to **25mm** (2m range)
- Precision (difference between two consecutive measured values) ranges from **4mm** to **14mm**

Improved accuracy achieved by meaning the 10 measured values: **7mm**

Software architecture

NutriSTIC: our C++ software

+ Hardware independence
+ Cross platform

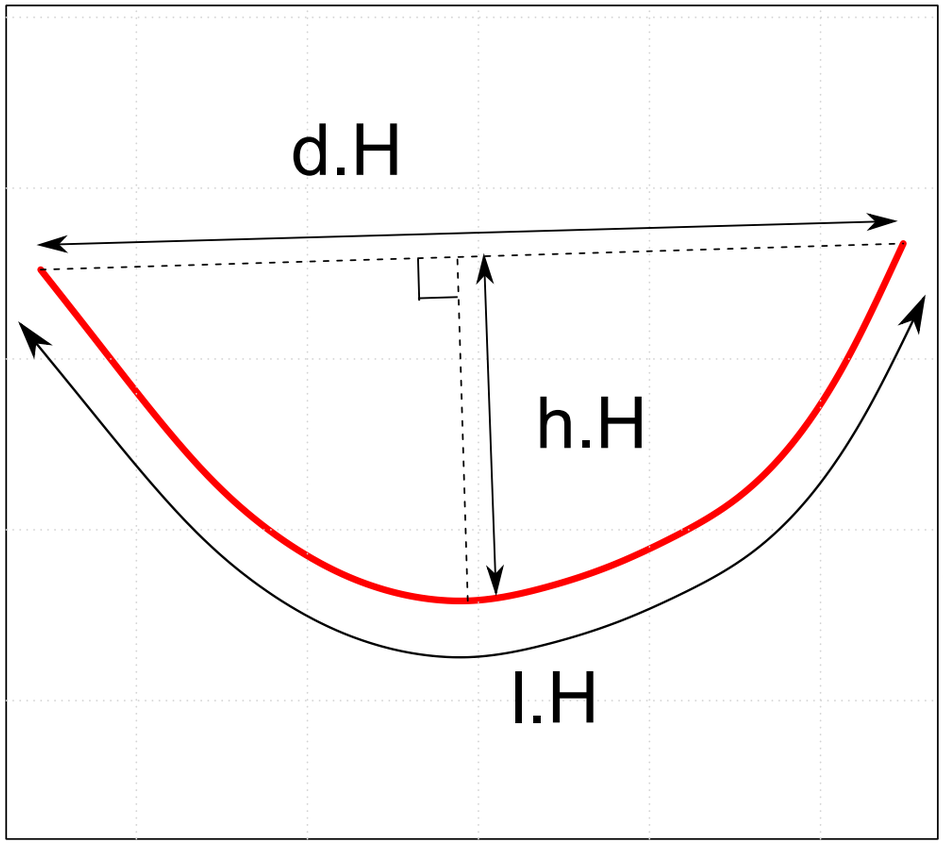
OpenNI®
The standard framework for 3D sensing

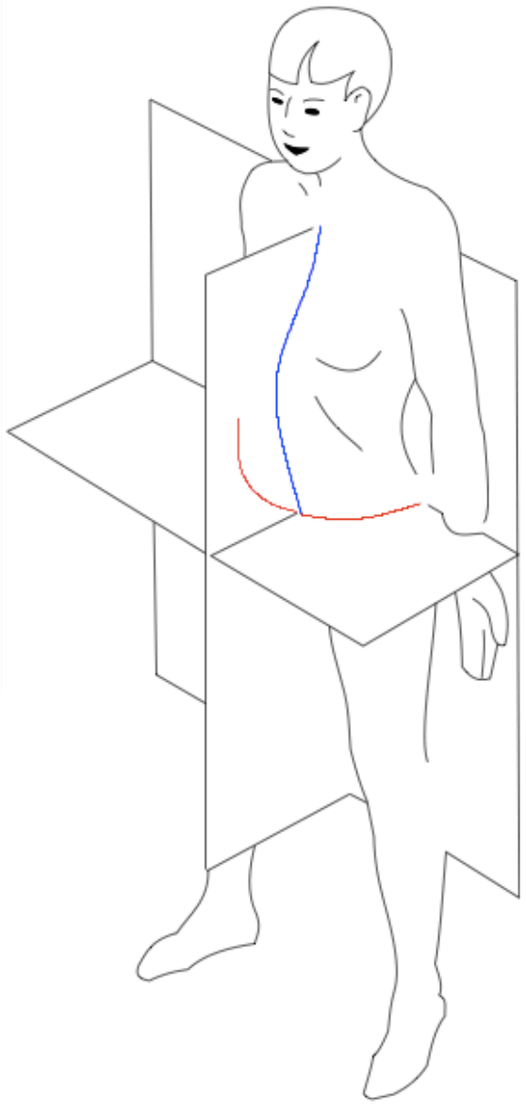
NiTE™
Natural Interaction Middleware

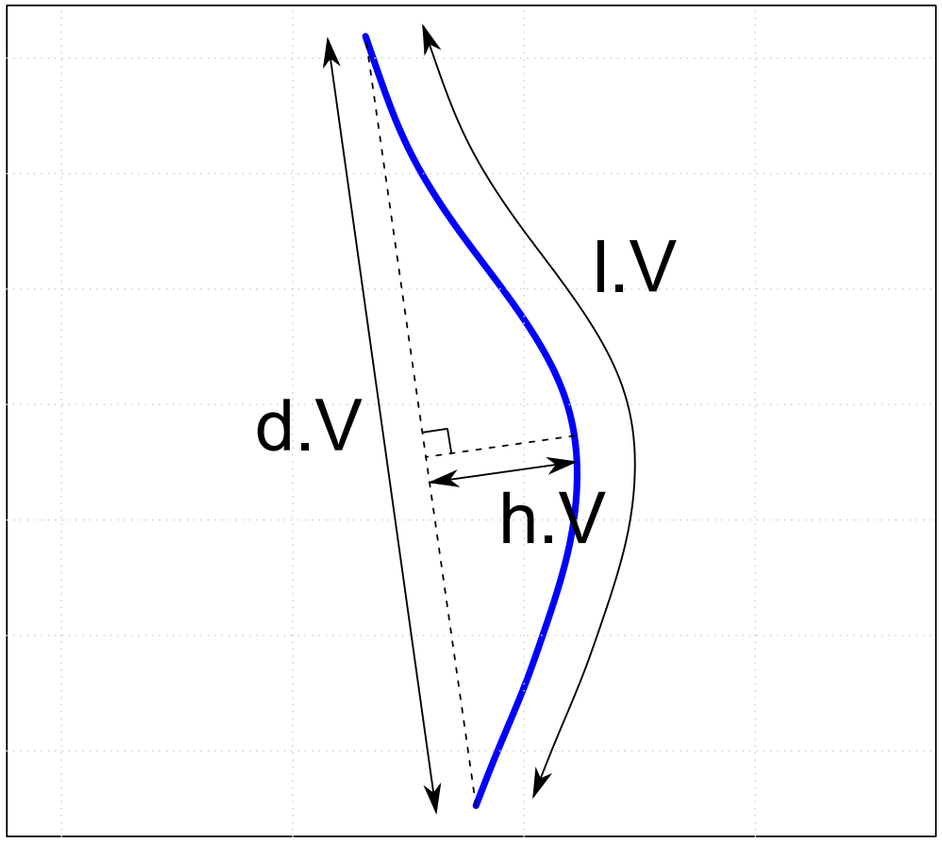
PrimeSense

KINECT for Windows

Horizontal & vertical profiles







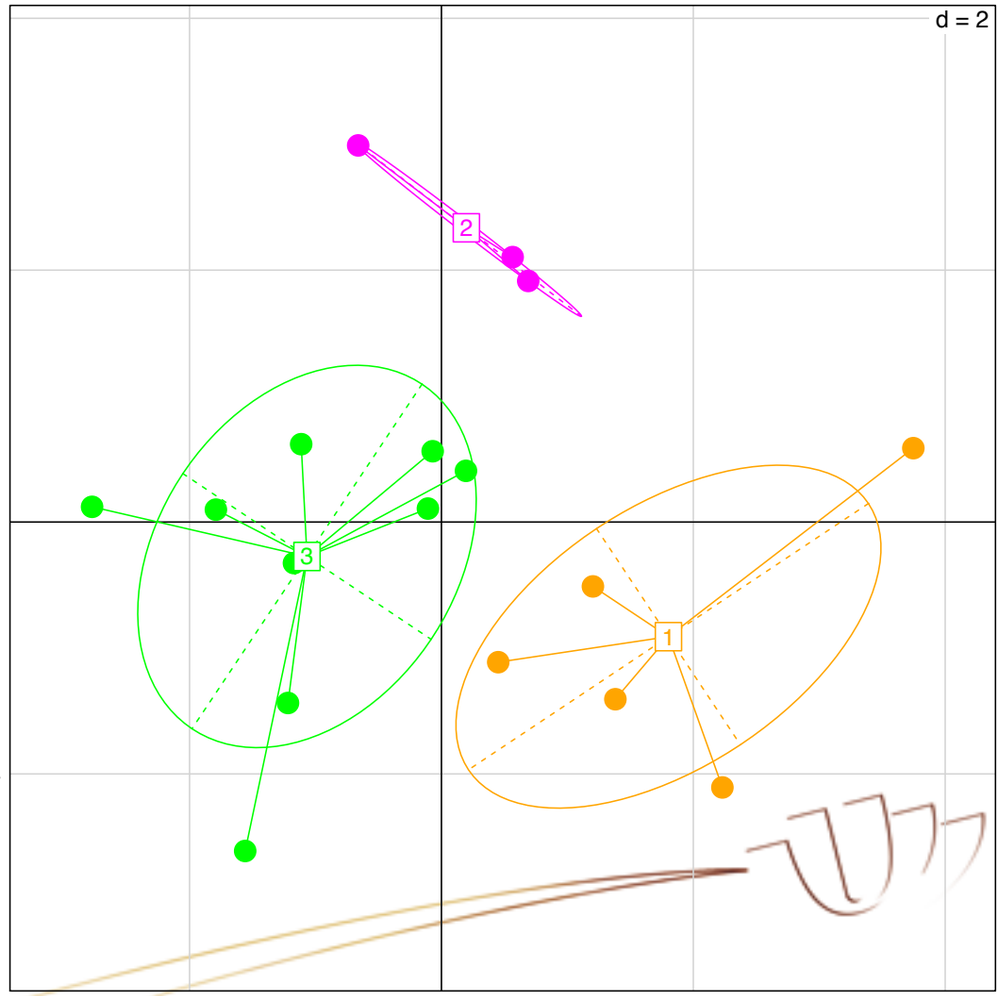
Typologies of overweighted people

Patient	d_H	h_H	l_H	d_V	h_V	L_V
#1	304.3	86.6	362.5	195.1	15.1	198.4
#2	253.2	50.2	276.0	172.5	8.8	174.8
...	...	...	...	...	...	...
#n	308.3	53.2	333.1	198.8	15.0	208.2

Principal Component Analysis

Patient	Comp. 1	Comp. 2
#1	304.3	86.6
#2	253.2	50.2
...	...	...
#n	308.3	53.2

Clustering

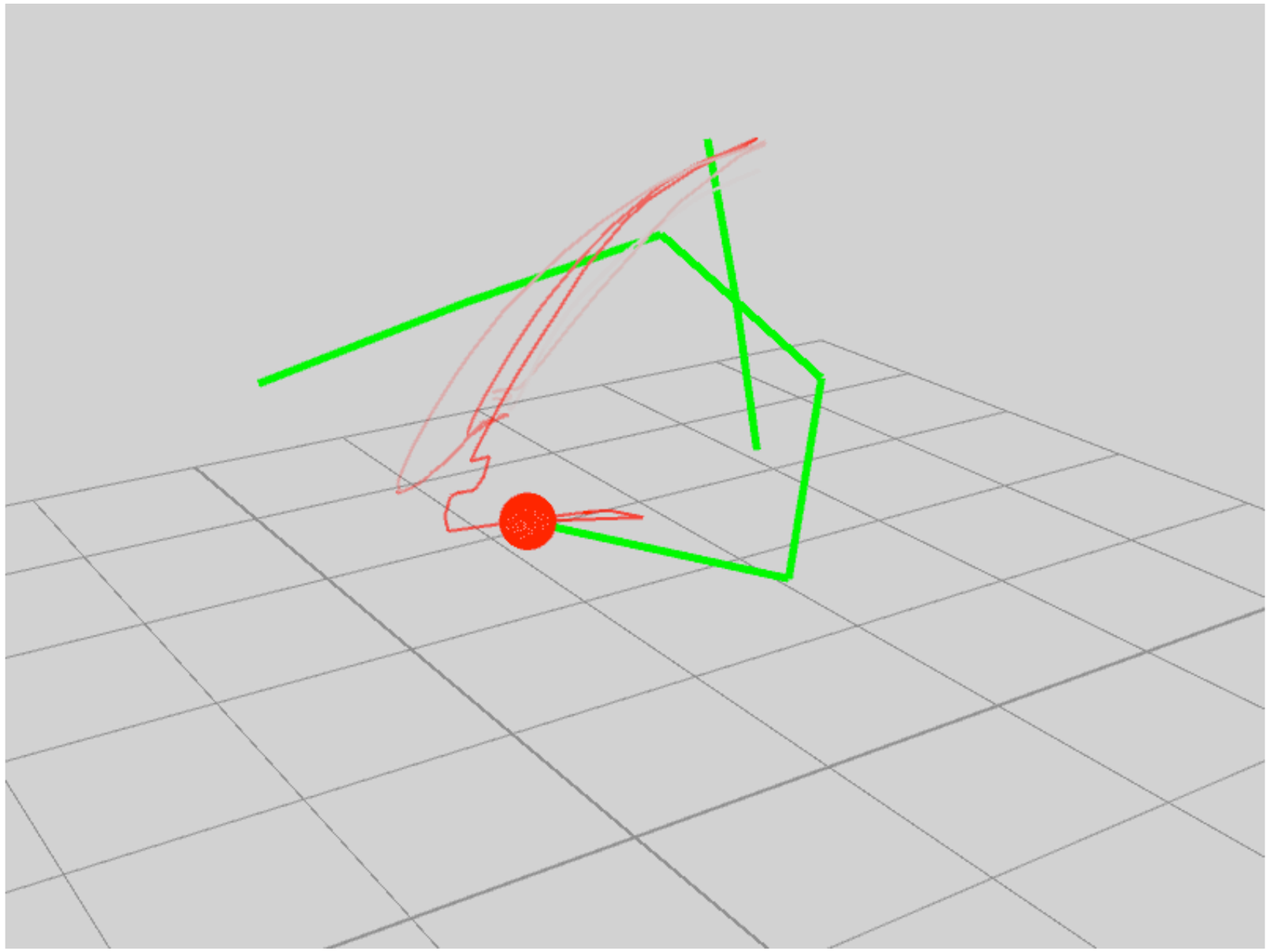


Further works

- Our software was tested with 17 healthy individuals and only 3 patients
  Graphical User Interface improvements, software robustness

- Study of eating behaviour kinetics
  Frequency of swallowing, duration of chewing, …

Further works



First attempt at recording hand kinetics

Thank you for your attention

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