



TOWARDS INTELLIGENT HOME CAREGIVER

VIOLETA MIRČEVSKA and BOŠTJAN KALUŽA



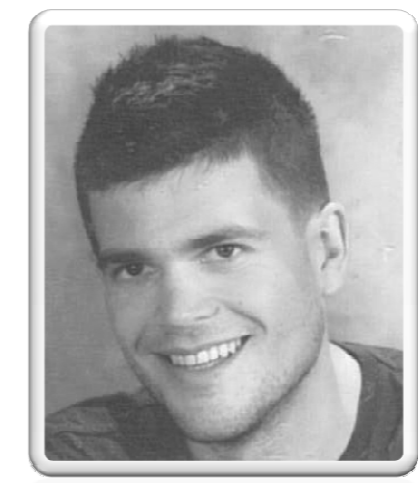
Study program: New Media and E-Science,
Jožef Stefan International Postgraduate School

Mentor: prof. dr. Matjaž Gams

Department of Intelligent Systems,

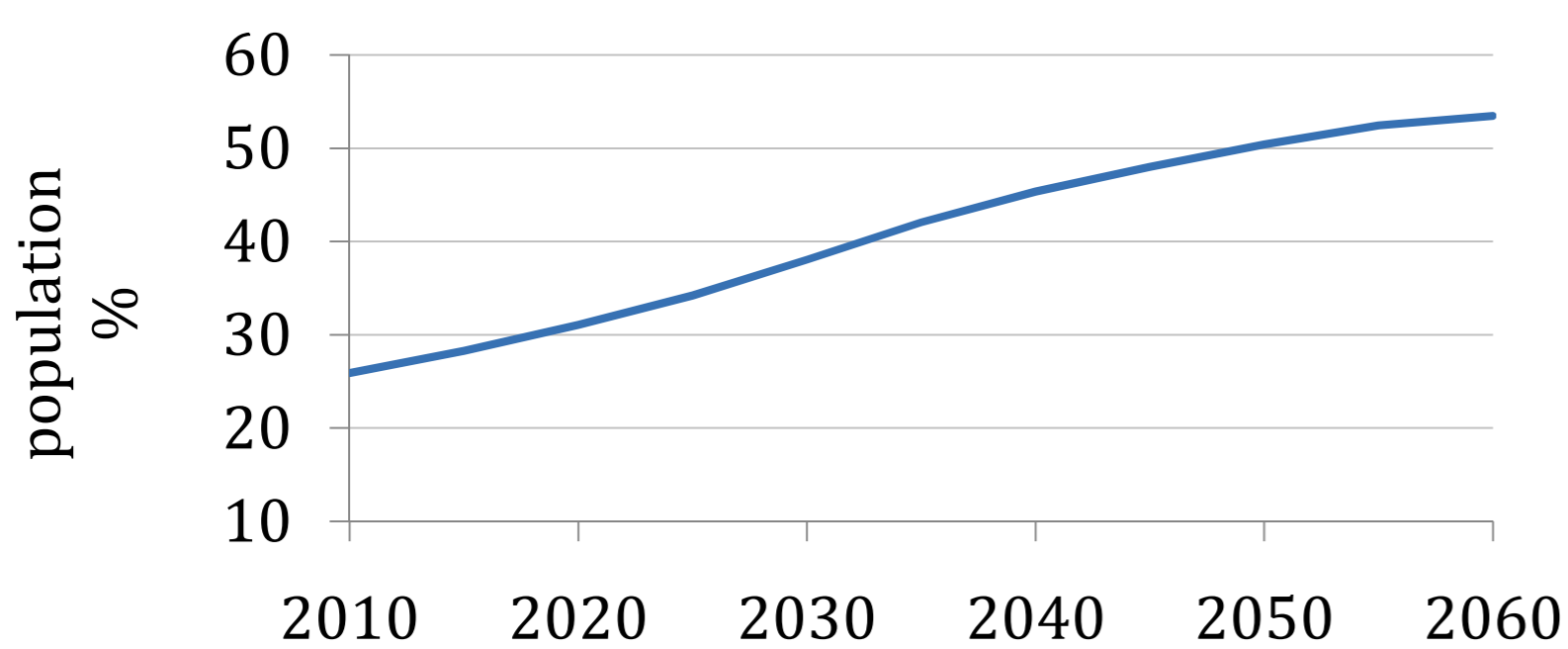
Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana

{violeta.mircevska, bostjan.kaluza}@ijs.si



Problem: Aging population

- The population of the developed countries is aging at an alarming rate
- The population over 65 is anticipated to rise from 17.9 % in 2007 to 53.5 % in 2060



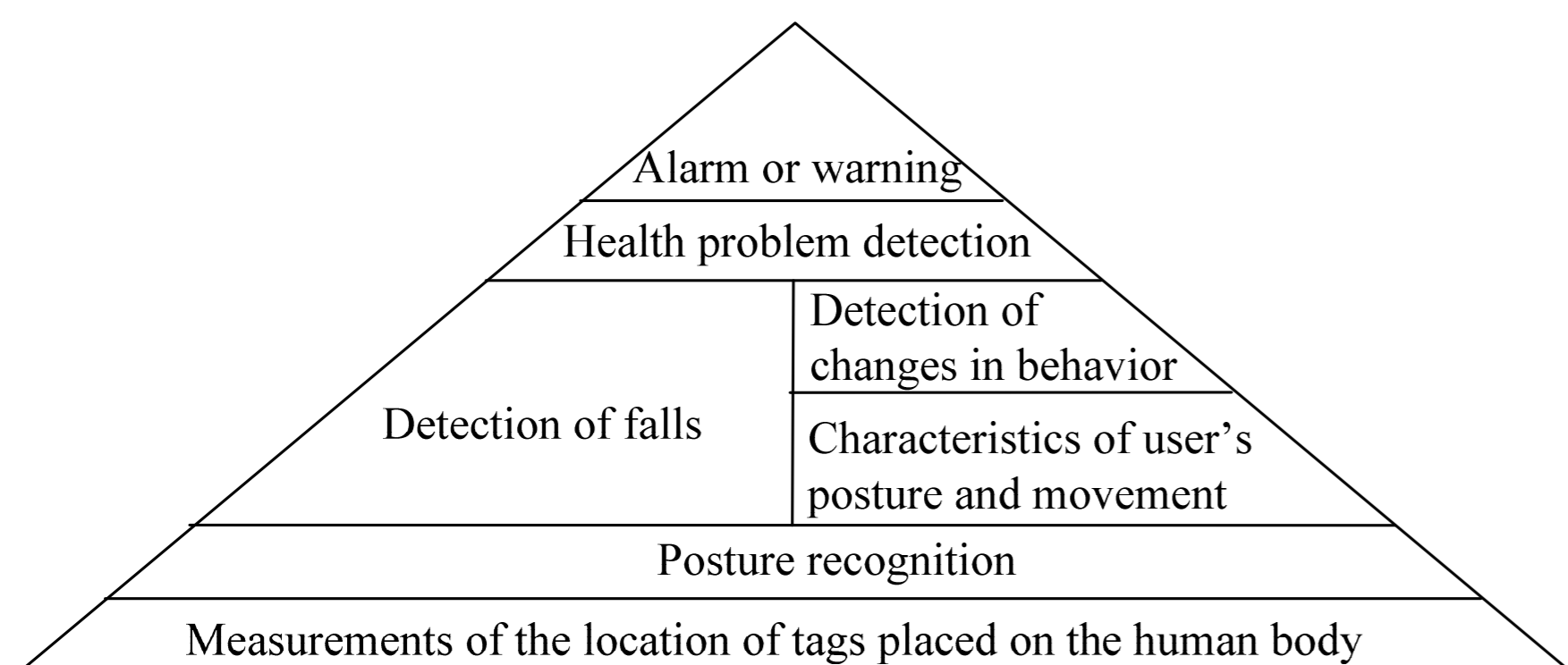
Solution: Ambient intelligence (AmI)

- AmI refers to electronic systems that are sensitive and responsive to presence of people
- AmI is a vision of intelligent systems that are:
 - context aware
 - personalized
 - adaptive
 - anticipatory
 - socialized
 - emphatic
 - conscious

system intelligence

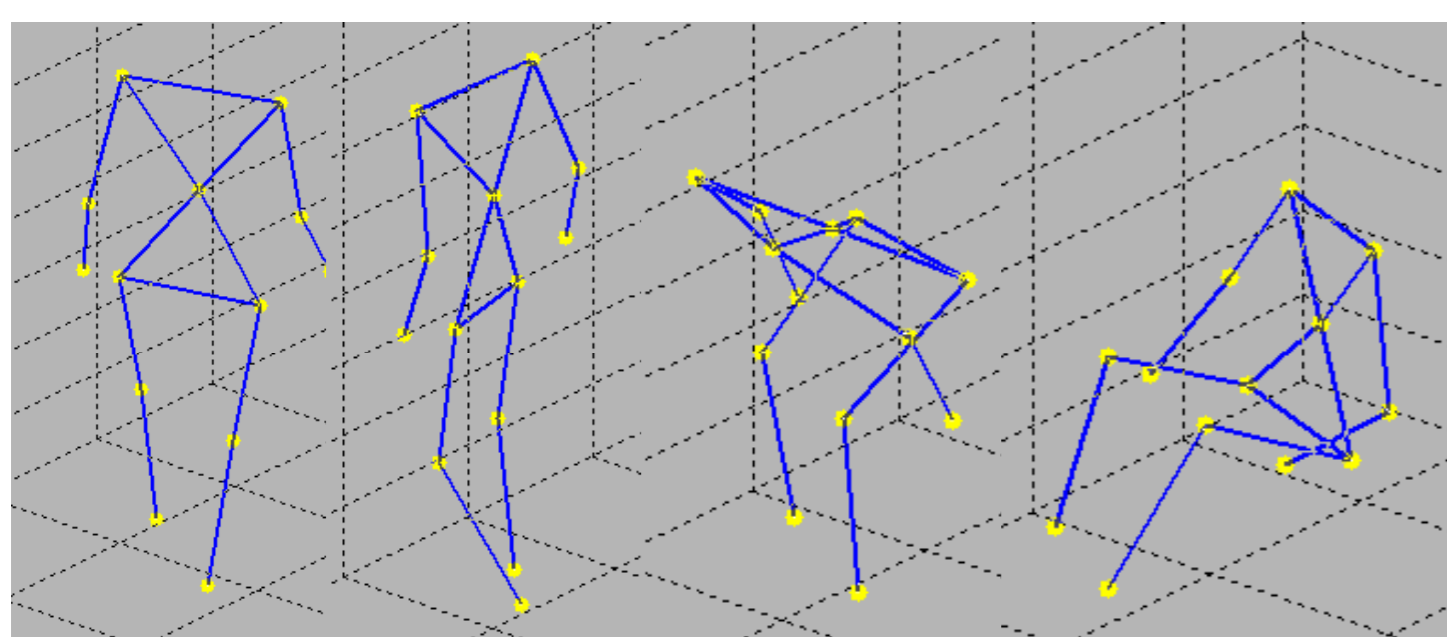
social intelligence

CONFIDENCE: Ubiquitous Care System to Support Independent Living



- Aims at prolonging the period of independent living of elderly people, thus reducing costs and burden on the working age population
- Detects health problems:
 - immediate, e.g. falls, dizziness
 - short-term, e.g. limping due to injury
 - long-term, e.g. Parkinson's disease
- Warns a user and alarms caregiver (medical service) if needed

Posture reconstruction



Human posture is reconstructed from 3D positions of tags attached to human body.

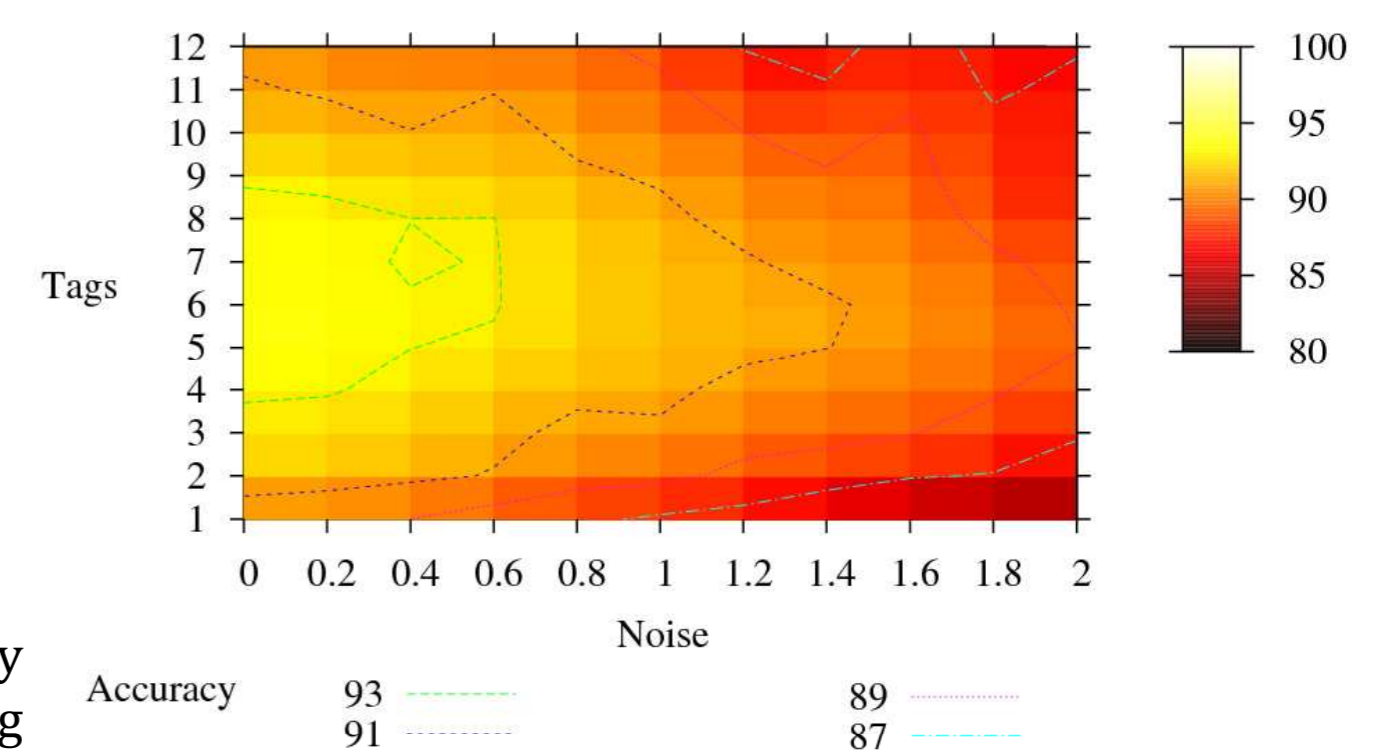
Rules for posture recognition

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IF DistZ(ankle, chest) < 0.3 AND DistXY(ankle, chest) > 1.2
  AND ABS(Vz(chest)) < 0.02
THEN LYING
IF DistZ(ankle, chest) < 0.2 AND ABS(Vz(chest)) < 0.02
THEN LYING
IF DistZ(ankle, chest) > 1.2 AND DistXY(ankle, chest) < 0.35
  AND Vz(chest) > -0.07
THEN STANDING
IF Vz(chest) < -0.15
THEN FALLING
...
    
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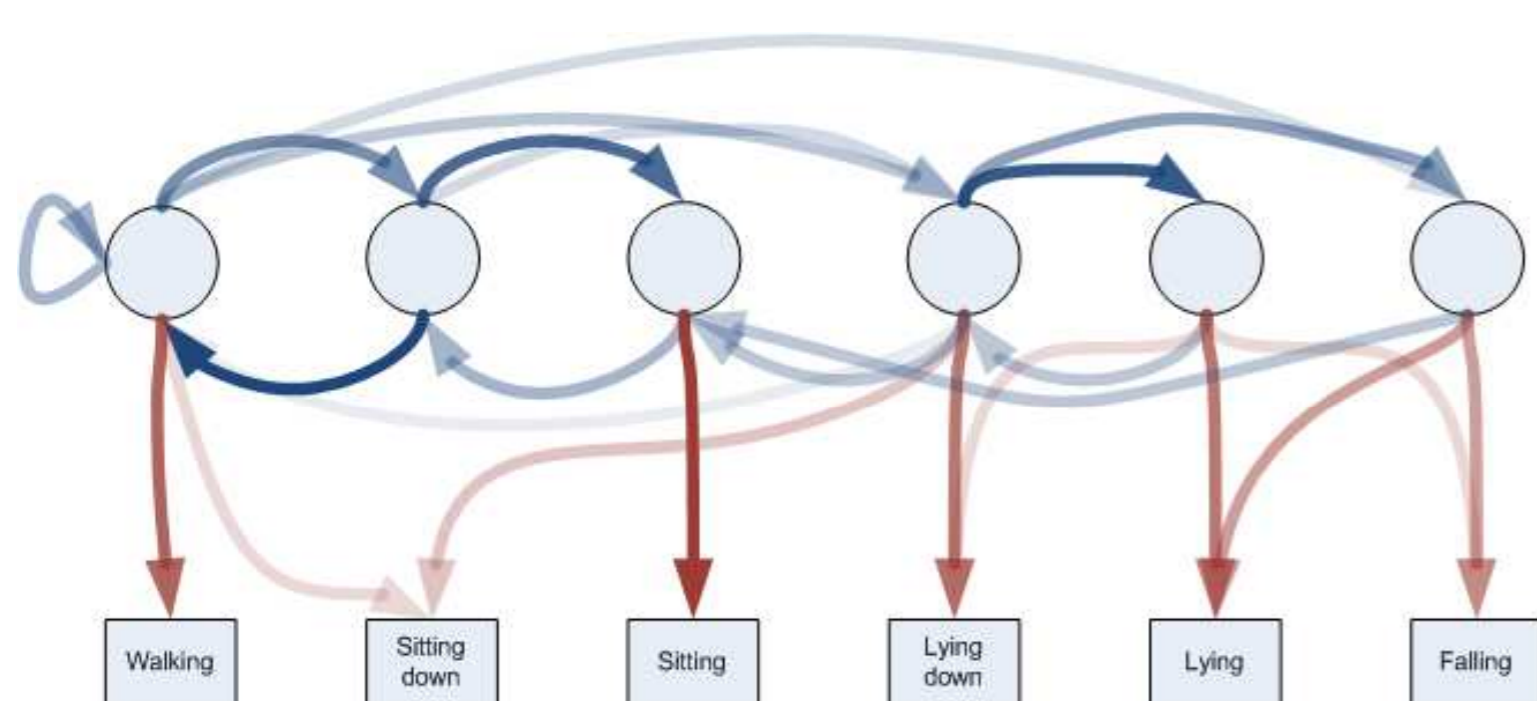
Rules are extracted from decision trees and modified by common-sense. This overcomes the problem of over-fitting which arises from the difficulty of obtaining a training set that represents all variations of the postures and movements.

Activity recognition



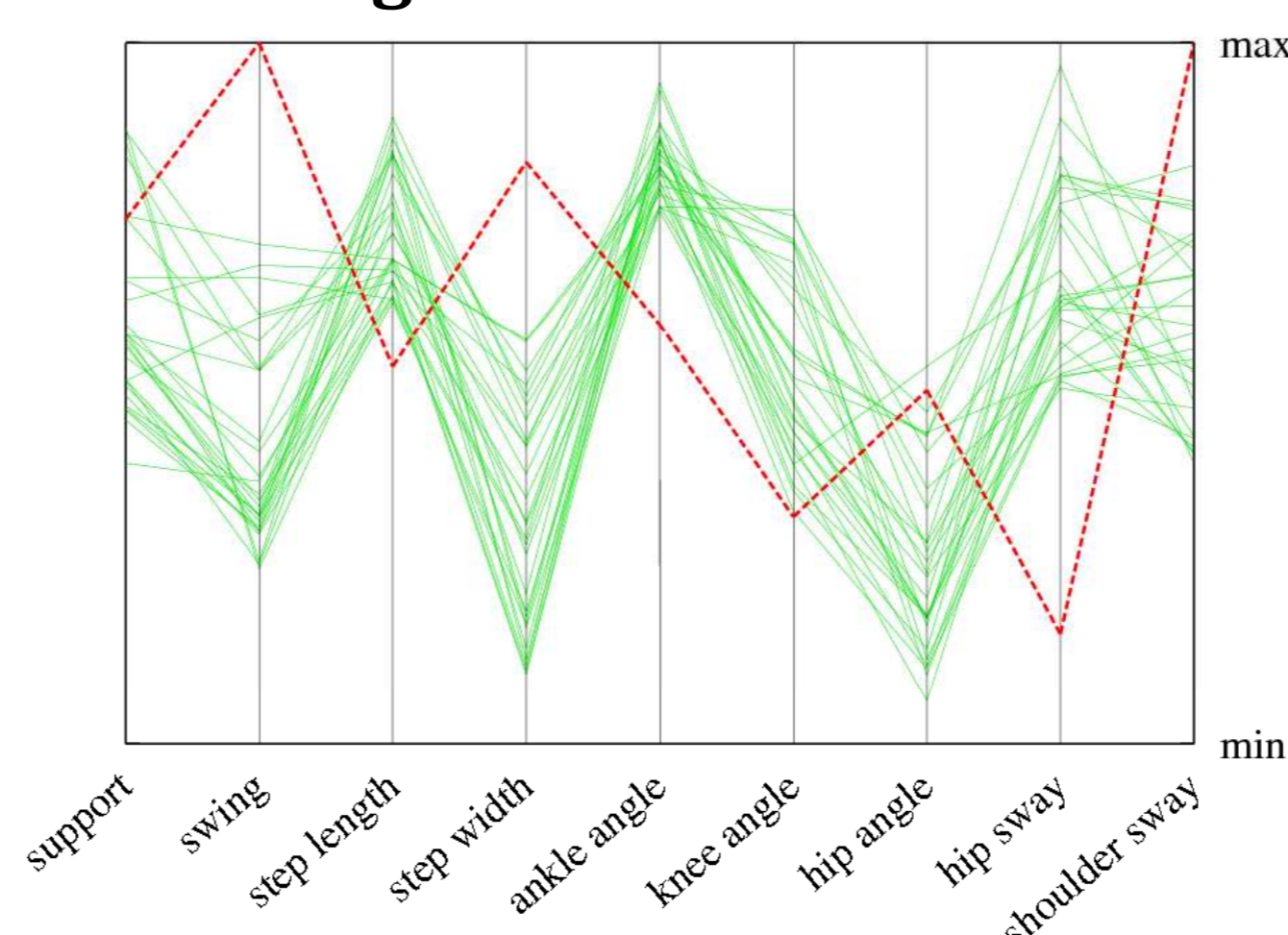
Activity recognition with over 90 % accuracy is achieved with machine learning algorithm SVM.

Smoothing spurious behavior

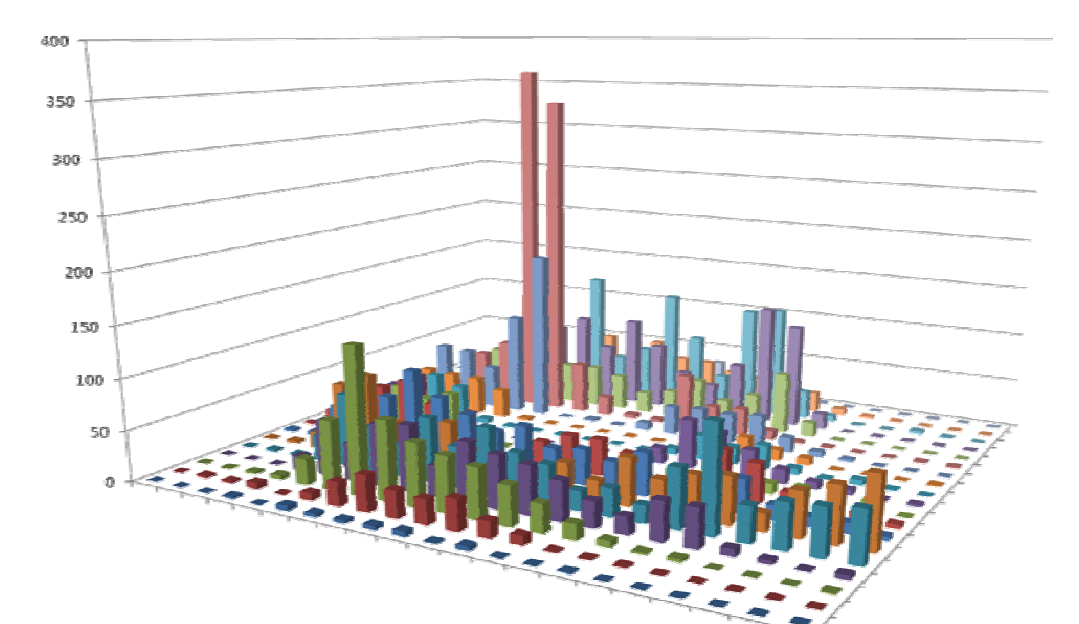


Activity recognition produces some wrong classifications which cause spurious state transitions. HMM classifier eliminates spurious behavior and increases accuracy.

Measuring deviation of the walking characteristics



Behavioral changes



How often does a person do activities on a particular macro timing? E.g., each Monday a person wakes up between 7 and 8 a.m. and goes to the toilet within 10 minutes.