

# Sensor data recording and evaluation



## Recognizing Situations

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# Examples & Motivation



Two Situations which are  
worth to recognize

# Situation 1 - *Elderly care*



- Aging society
  - Monitoring activities like:
    - Falling
    - Suddenly ramming
  - Sending notifications to family or medical staff
- Recognizing accidents of elderly

# Situation 2 - Context-aware-reminders



- Setting up a reminder like:  
*"When I meet Alice next time, remind me to do ..."*
- Smartphone senses sounds in the background
- Recognizes phrases like:  
*"Hi Alice"*
- Tags incoming sound data with  
*"Alice"*
- Phone knows Alice's voice



→ Recognizing a meeting without knowing the exact time

# Outline



- **Challenges**  
How to log & evaluate data?
- **Solutions**  
Obtaining useful results
- **Related Work**  
Which research projects already exists?
- **Workplan**  
Which tasks will come up to me?

# Outline



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# Challenges - *Obtaining sensor data*



Sensors in a smartphone:

- accelerometer
- proximity sensor
- light sensor
- magnetic compass
- microphone
- camera
- GPS
- gyroscope
- NFC sensor

• How to obtain this data?

• How to interpret the data?

→ How to recognize a Situation?

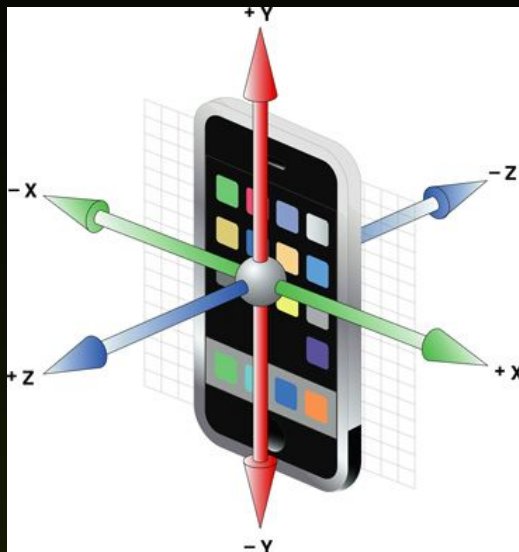


# Challenges - *Raw data nearly useless*



Sensors are giving us raw data like:

$x = 15,52432570654000$   
 $y = -2,220117$   
 $z = 9,81486752$



Many data sets result in a graph:

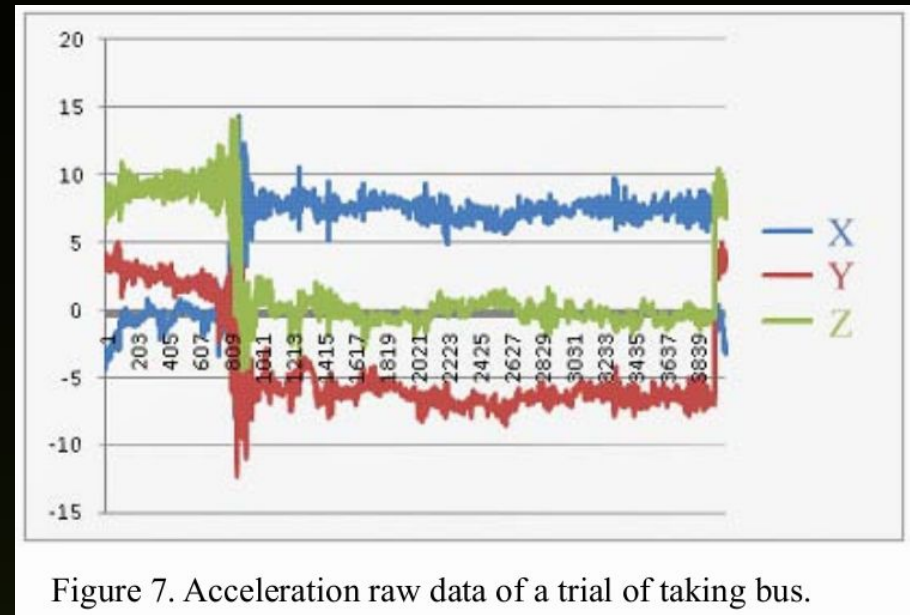


Figure 7. Acceleration raw data of a trial of taking bus.

→ Many data sets still not usefull



# Outline



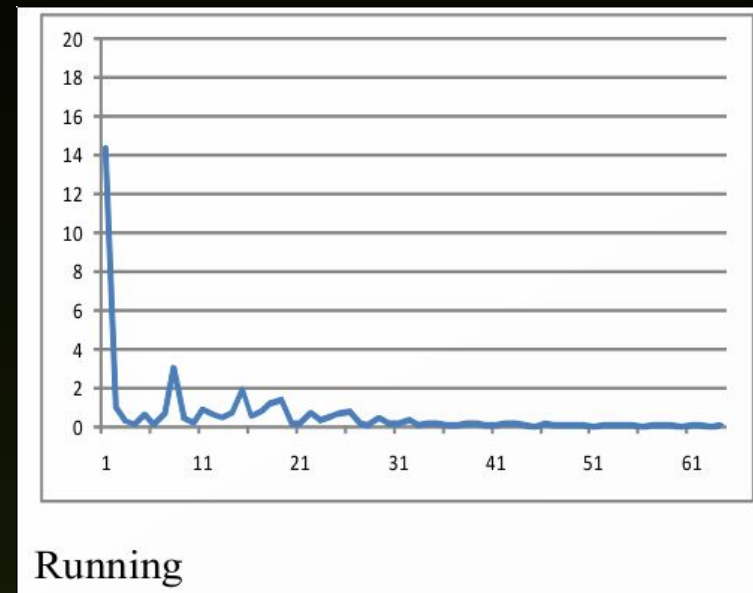
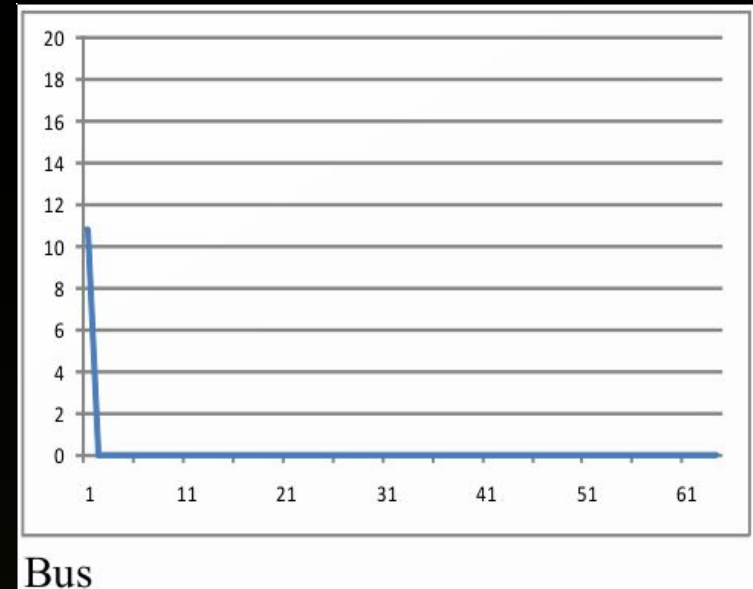
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# Solutions - *Fast Fourier Transformation*



## Fast Fourier Transformation

- Basic idea:  
Each periodic function can be decomposed into a sum of sine and cosine functions.
- Converting raw data to frequency domain.
- practical examples:
  - picture/sound compression
  - spectral analysis
  - solve partial differential equations

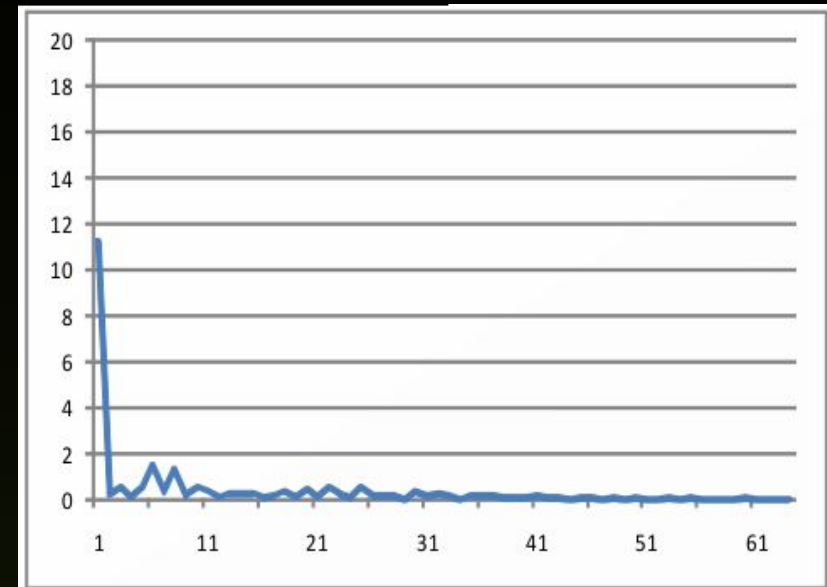


# Solutions - *Statistical Model*



## Deriving a statistical model from the FFT data

- Each kind of activity has a certain pattern  
(e.g.: all running situations have certain things in common)
- Extract common features out of the FFT data
- Derive a model and train it with collected data
- Use this model to recognize situations



# Outline



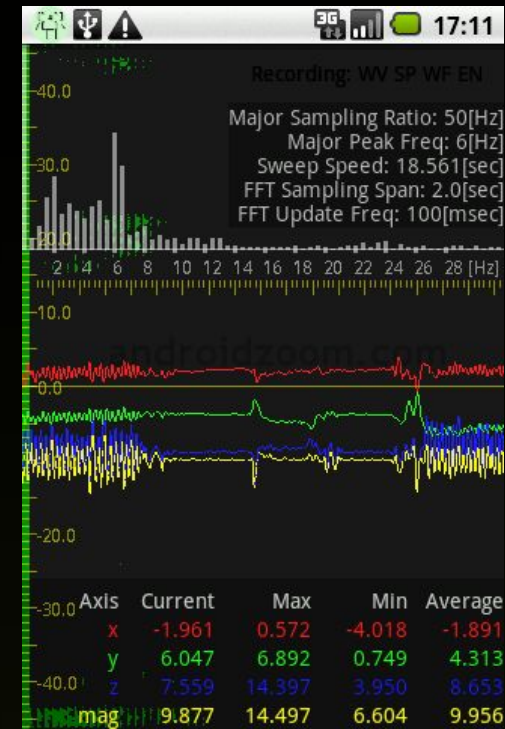
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# Related Work - *What* is available



## Accellogger:

- accelerometer Data logger for Android
- real time FFT
- saving raw data to SD



## Weka:

- machine learning & data mining toolkit
- derive a model from FFT data
- contains classifying & clustering algorithms.



# Related Work - *Open research issues*



## Project MUNICH (Mobile User in an Non-Intrusive Computing Hierachy)

- Project at Microsoft Research
- Sensing user data in the background
- Derive personal Information
- Cloud service to provide users with personalized information
- Deliver better services to the user
- User-defined privacy settings

# Related Work - *Open research issues*



## Transportation Mode prediction

(Ben Nham, Kanya Siangliulue, and Serena Yeung - Stanford University)

- Recognizing different Situations with an iPhone accelerometer
- Recording raw data with iPhone
- Offline analysis & classification of transportation modes

Walking	Running	Biking	Driving	Total
94.68%	98.08%	45.04%	58.40%	74.62%

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# Workplan - *Upcoming tasks*



## My implementation tasks :

- get access to device's sensors
- buffer sensor data for FFT
- saving FFT data

## Relationship to related Work:

- FFT & recording sensor data

## Relationship to teammate's task:

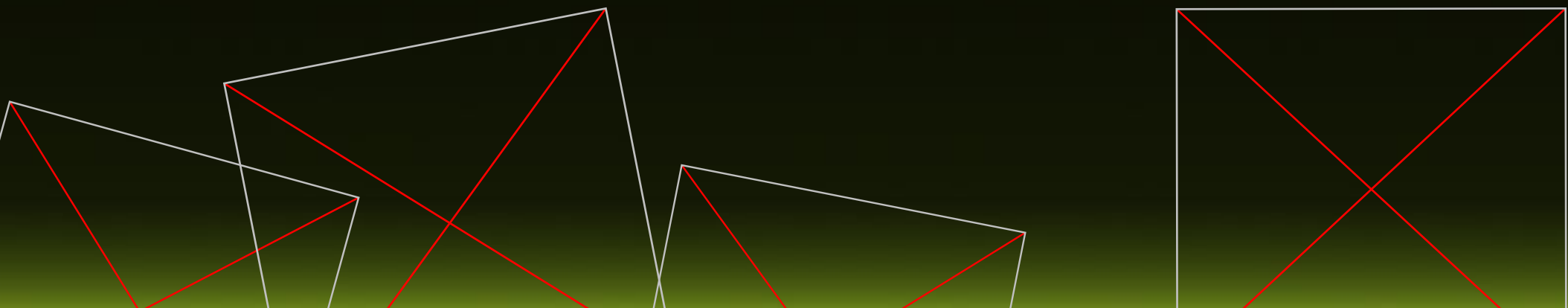
- provide an interface for:
  - switching on/off single sensors
  - obtaining selected data to display them



Thank you for your attention!



Questions ?



# References



Information & related Work

pictures:

[http://www.sciencephoto.com/image/266378/530wm/M3400601-Elderly\\_woman\\_lying\\_on\\_the\\_floor-SPL.jpg](http://www.sciencephoto.com/image/266378/530wm/M3400601-Elderly_woman_lying_on_the_floor-SPL.jpg)

<http://www.citaexam.com/images/clip%20art/calendar.jpg>

TODO =)

TODO