

# **General Approach towards Sensor-based Human Monitoring**

(Scenario: Activity Monitoring)

**Dr. Muhammad Adeel Nisar**

(Courtesy: Prof. Dr. Marcin Grzegorzek)

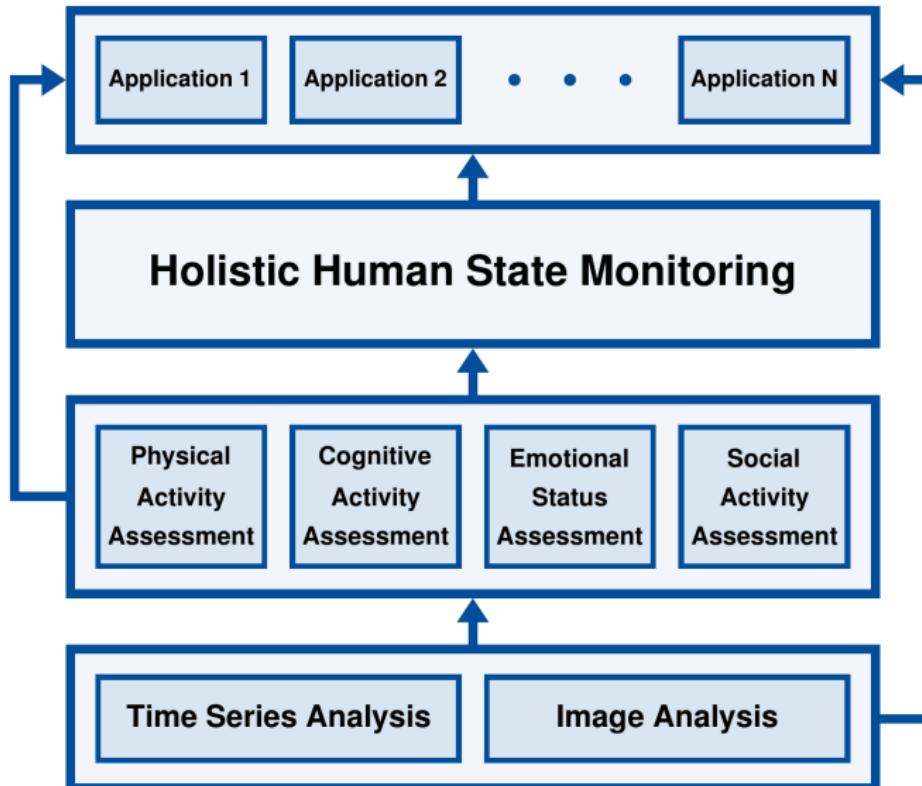
**Department of Information Technology**

University of the Punjab, Lahore

- ① Introduction
- ② General Approach to Supervised Pattern Recognition
- ③ Approaches Based on Visual Sensor Data
- ④ Approaches Based on Sensor Data from Wearables
- ⑤ Combining Video and Sensor Data from Wearables
- ⑥ Conclusion

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# Holistic Human Monitoring



① Introduction

② General Approach to Supervised Pattern Recognition

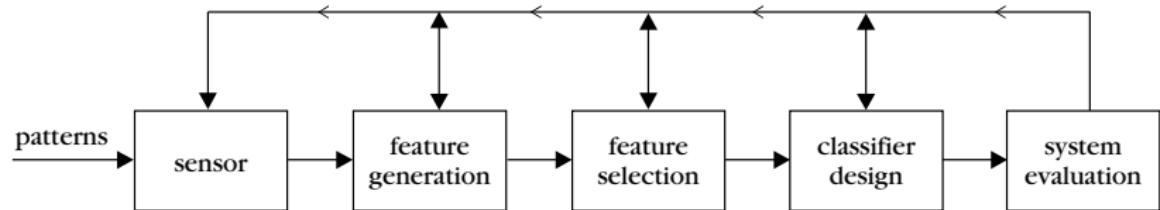
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# Basic Stages of Pattern Analysis



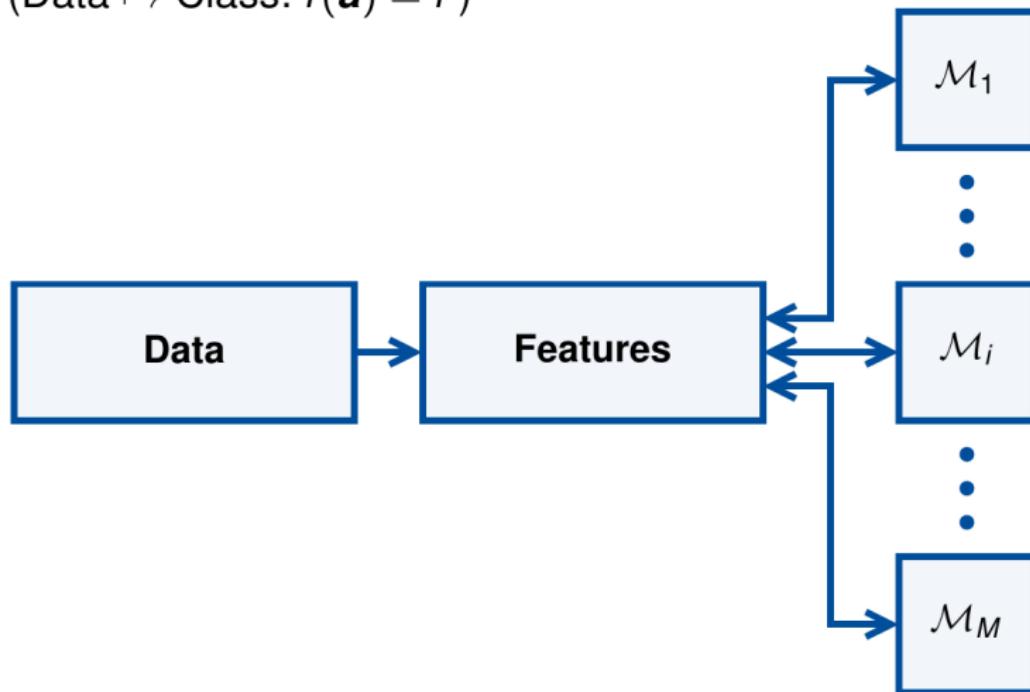
## Pattern Recognition – Supervised Learning

(Classes:  $\{\omega_1, \omega_2, \dots, \omega_i, \dots, \omega_M\}$ )



## Pattern Recognition - Automated Classification

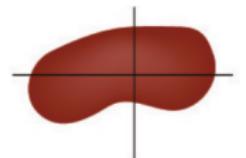
(Data  $\mapsto$  Class:  $f(\mathbf{a}) = \hat{i}$ )



# Automated Skin Cancer Detection



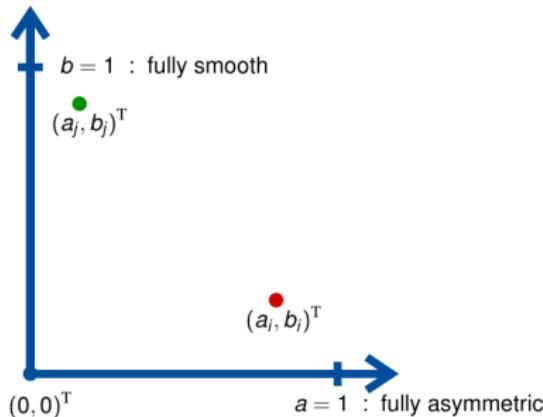
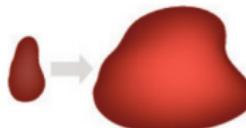
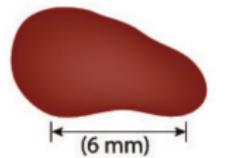
# Automated Skin Cancer Detection

**A****Asymmetry**

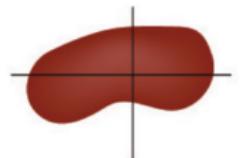
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**B****Border**

$$b \in [0, 1]$$



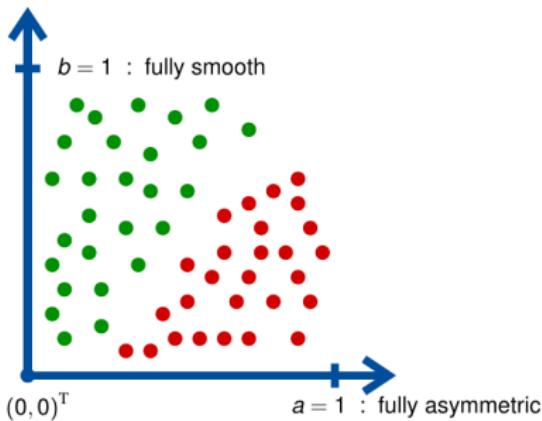
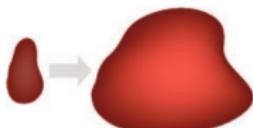
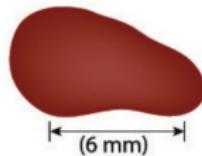
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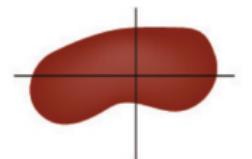
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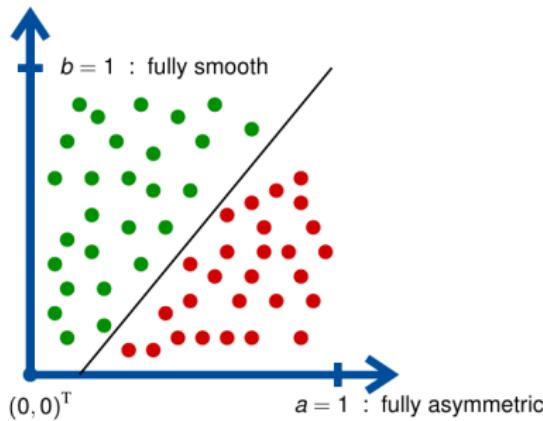
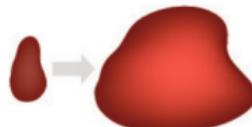
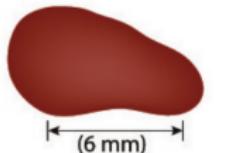
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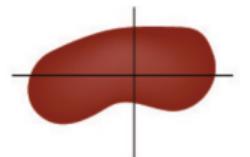
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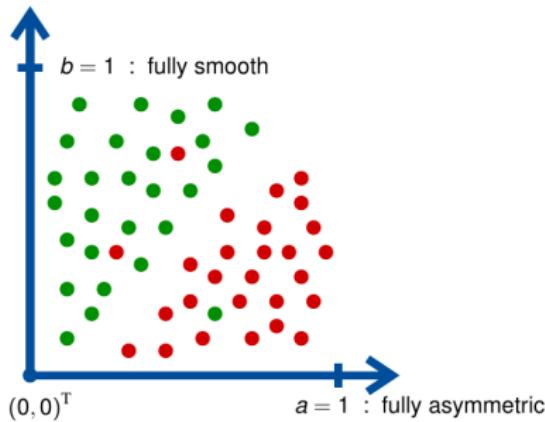
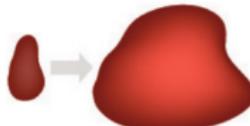
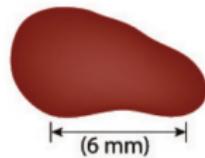
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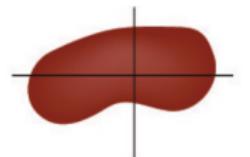
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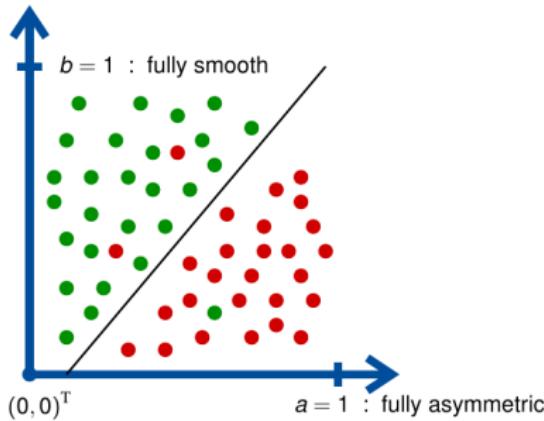
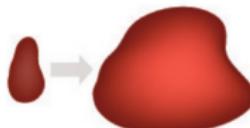
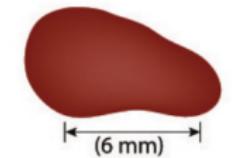
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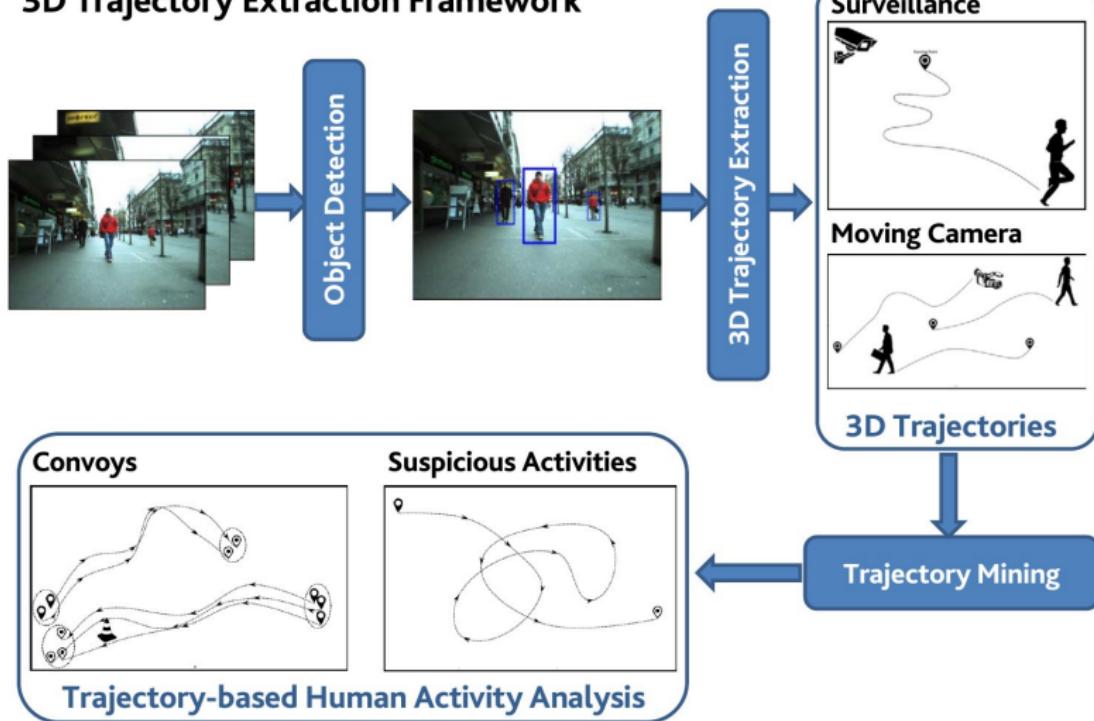
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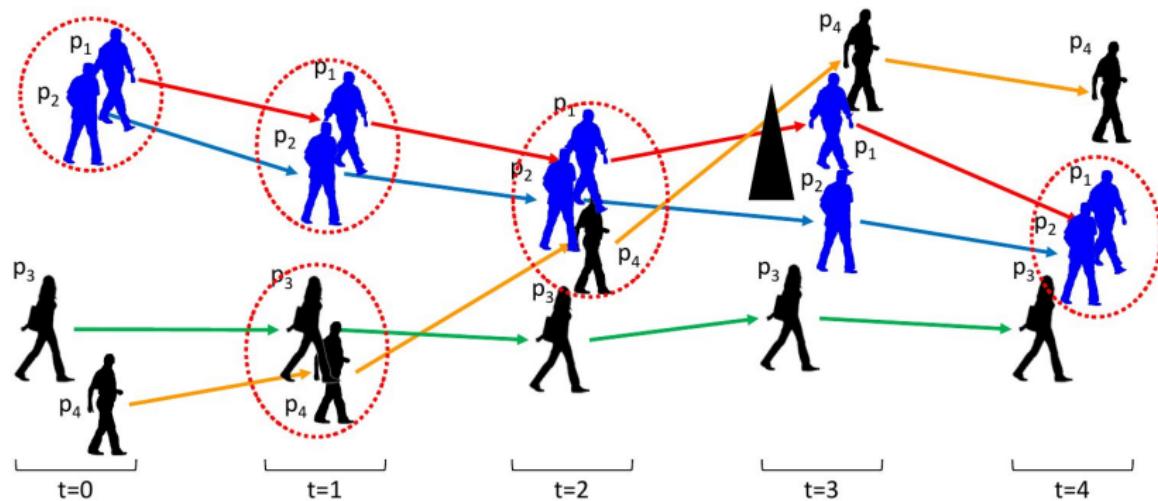
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# 3D Trajectory Estimation from a Single Camera

## 3D Trajectory Extraction Framework

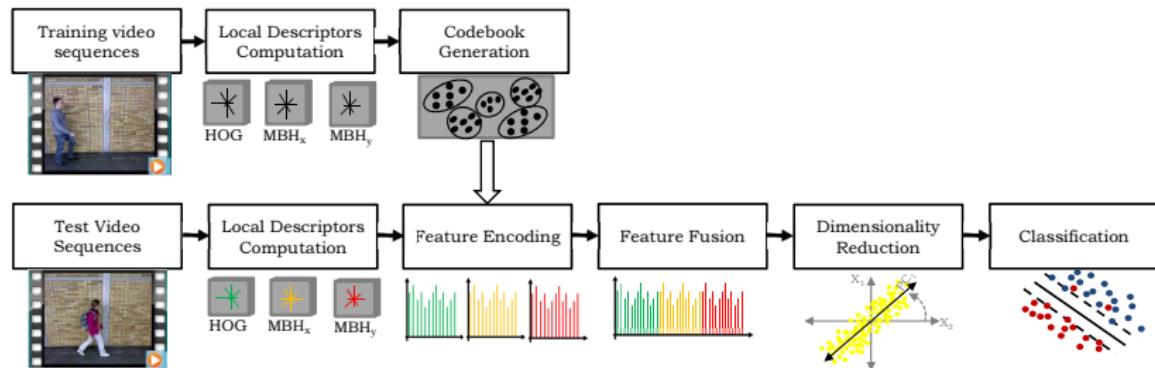


# Convoy Detection in Crowded Surveillance Video



[https://www.youtube.com/watch?v=p4zN39u\\_Waw](https://www.youtube.com/watch?v=p4zN39u_Waw)

# Video-based Gait Recognition

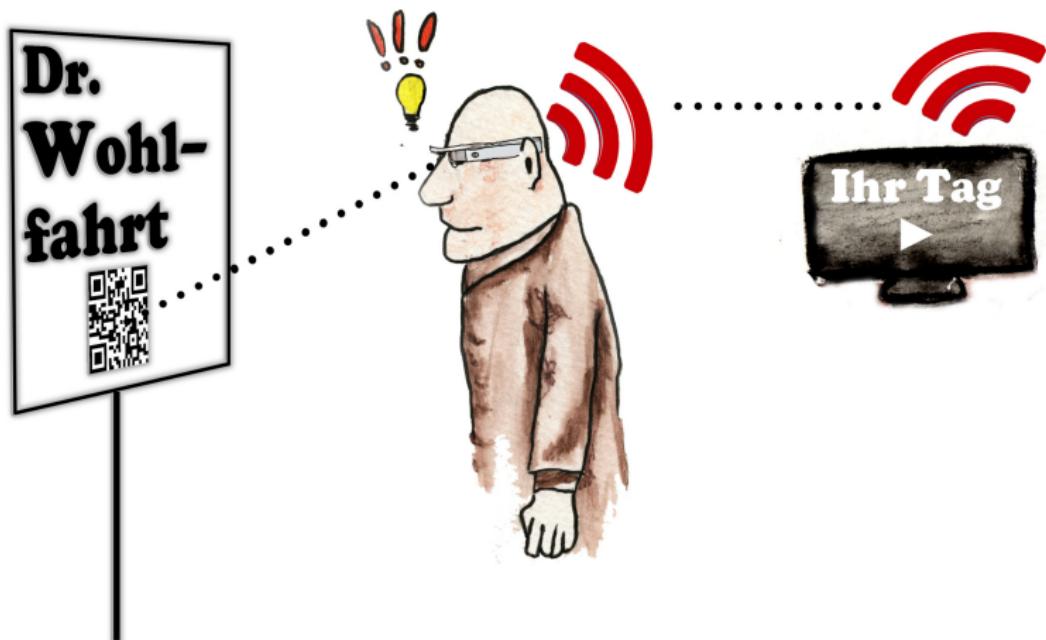


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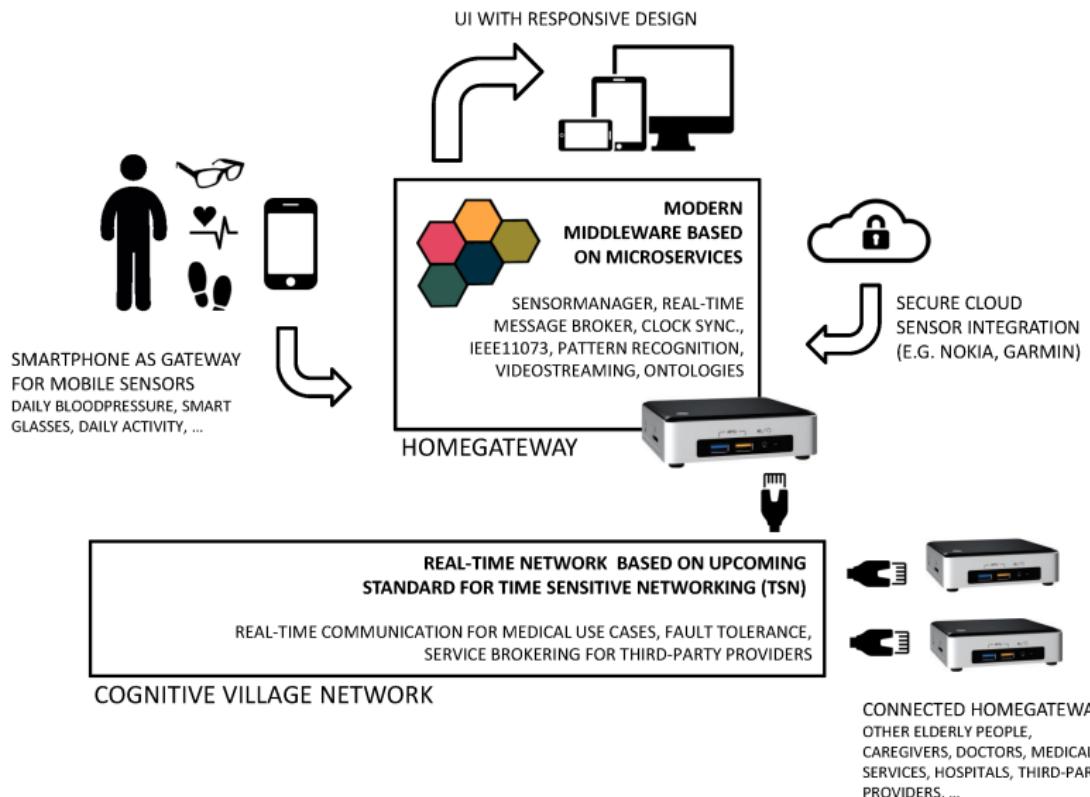
# Physical Activity Recognition for Elderly Assistance



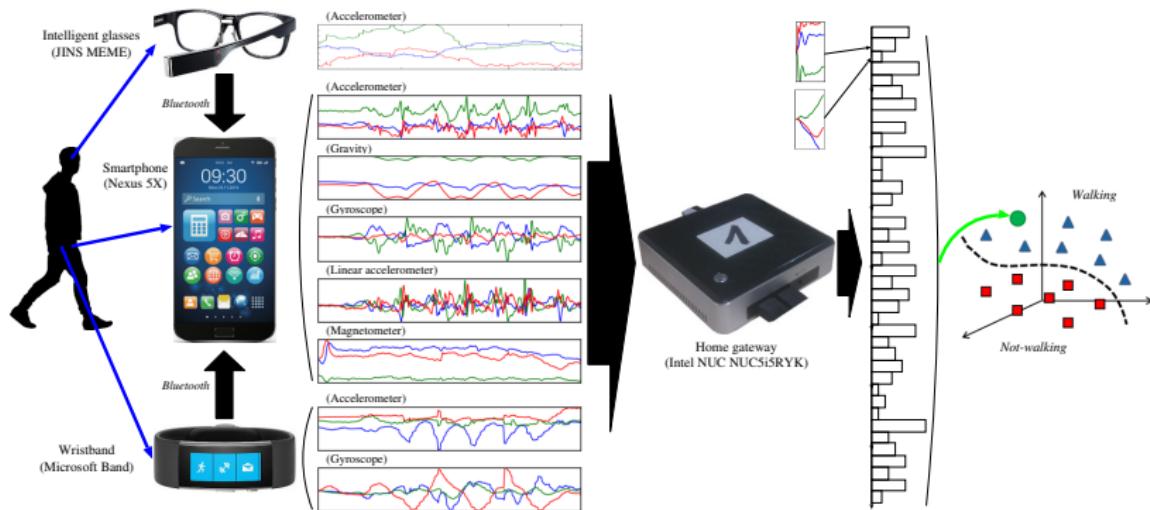
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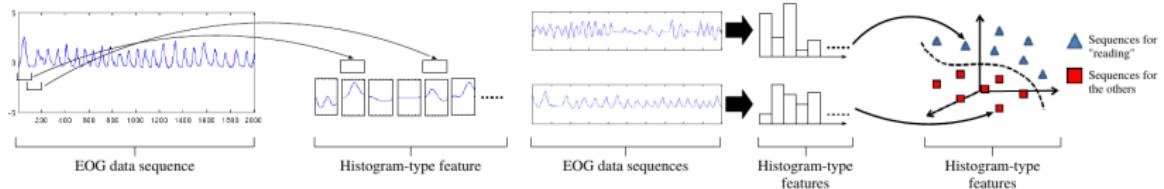
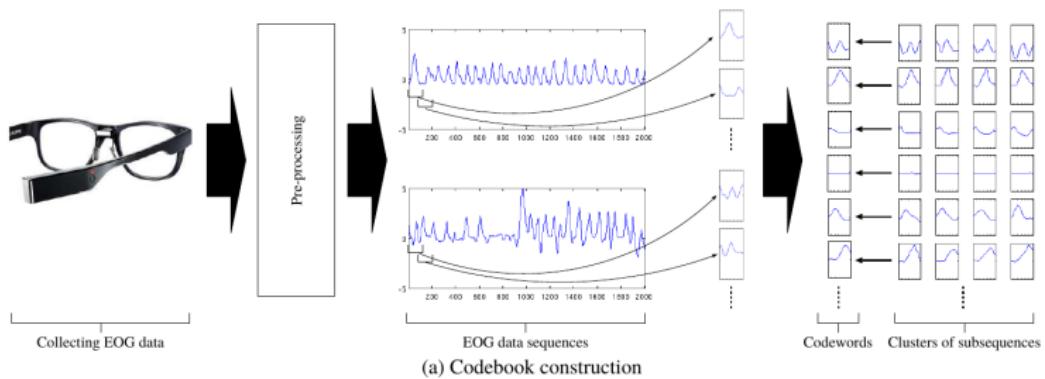


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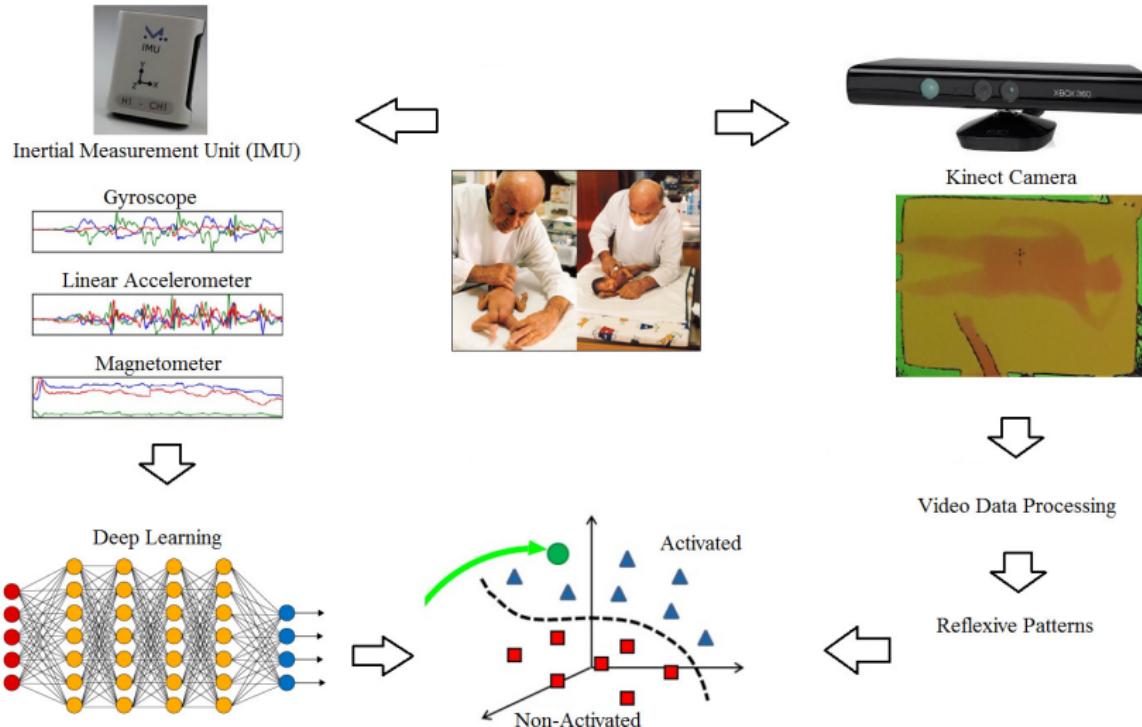
<https://www.youtube.com/watch?v=J6Wa07jFOtU>  
<https://www.youtube.com/watch?v=73qRIVP3kfU>

# Cognitive Activity Recognition



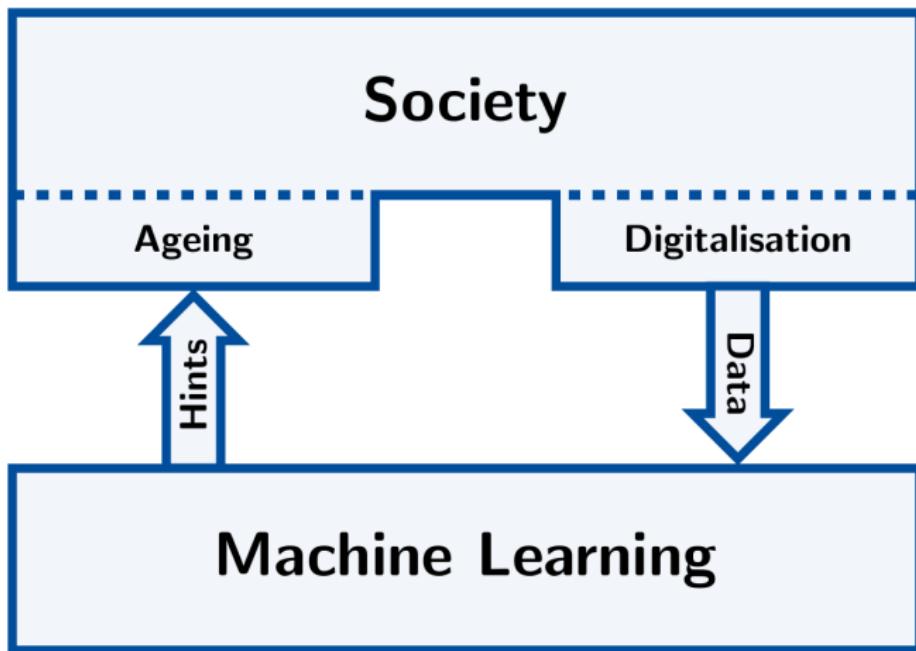
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# Physical Activity Recognition in Physiotherapy

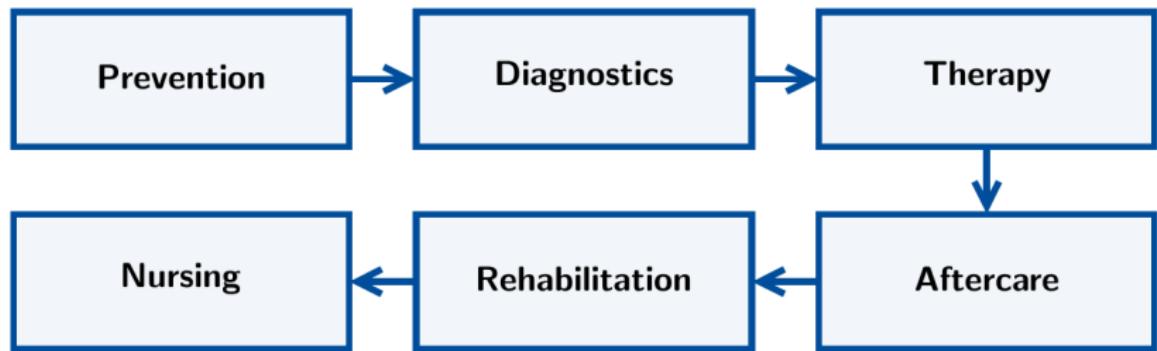


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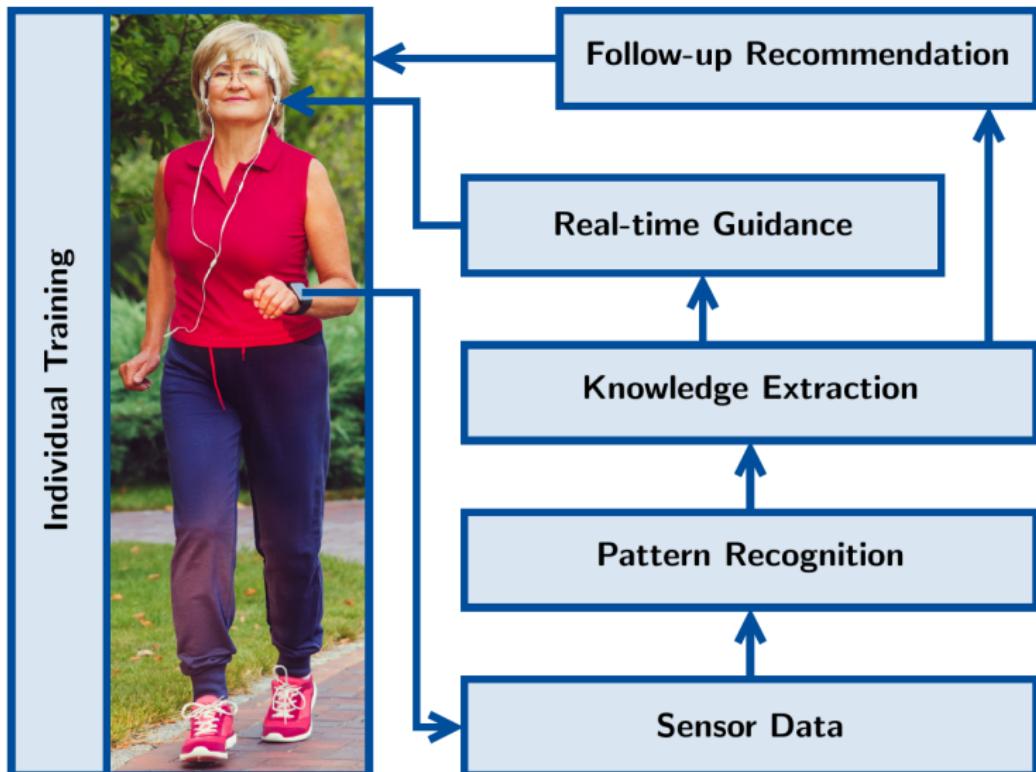
## Society and Machine Learning



# Steps of a Healthcare System



# Real-time Guidance and Individual Training



## Final Statement

*“ We live in a data-driven society and significantly contribute to this concept by voluntarily generating terabytes of data everyday. This societal transformation cannot be stopped anymore. Our objective should be to gain as much benefit as possible from this movement by limiting possible risks connected to it.”*

Marcin Grzegorzek. *Sensor Data Understanding*. Logos. 2017.