Leverage WiFi Channel State Information and Wearable Sensors for Human Monitoring

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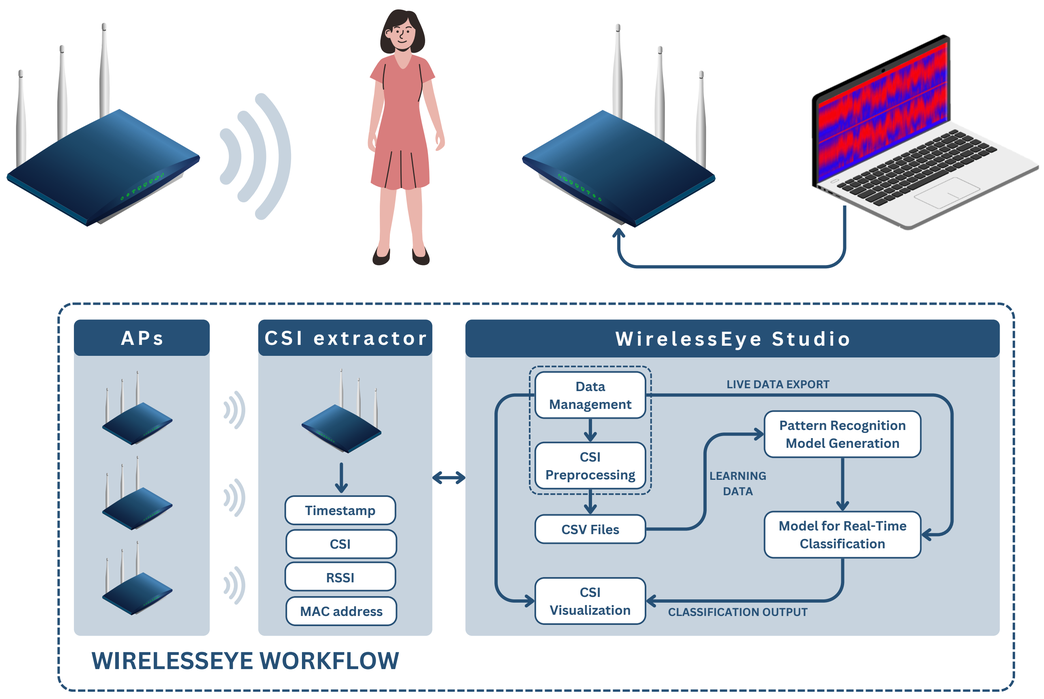
Motivations

Our research addresses the growing need for advanced remote **monitoring systems**, particularly in sensitive areas such as **healthcare** and **assisted living**. Unlike other monitoring techniques, which may introduce privacy concerns, wireless sensing offers a non-intrusive, privacy-preserving alternative. **Exploiting technologies like WiFi, and wearable sensor**s, enables continuous, unobtrusive monitoring. This approaches mitigate privacy issues and ensures consistent monitoring regardless of environmental conditions. .

Goals

We aim to **integrate WiFi CSI, mm-Wave and wearable sensors** to perform **person tracking, activity recognition, vital sign monitoring and pose estimation**. Addressing current limitations due to environmental interference, lack of generalisation in the machine or deep learning model in the context of wireless sensing, sensors synchronisation and data fusion between the different technologies.



WiFi Sensing

Wearable Sensing

Results

WiFi Sensing

- We developed **WirelessEye**, a real-time **CSI visualization too**l, comprising a WiFi emitters, CSI extractor, and management tool, enabling precise control over WiFi traffic and data collection.
- We propose a **people recognition system**, with accuracy of 98%, requiring a low training effort and negligible cost [1].
- In [3], we present deep learning-based **occupancy detection solution**, resilient to variations in humidity and temperature. The approach is tested in an environment where people are free to move and the furniture layout change. We obtained **97% accuracy in occupancy detection** and **2.39/4.62 MAE in temperature and humidity estimation**.
- In order to non-invasively monitoring Alzheimer's patients, we proposed a **system capable to recognize activities** performed in **4 different environments** with an accuracy > 97% [2].

Werarable Sensing

- We **introduced a cost-effective WBAN system** with a multi-layered architecture for efficient human activity recognition, featuring standalone sensing nodes, smartwatch integration, and edge computing capabilities [6]
- In [4], we exploit **wearable sensors and computer vision** to propose an automatic system **for monitoring human behaviours in a smart factory** in real time. The final goal is to feed cloud-based safety assessment tools that evaluate human errors and raise consequent alerts.
- In [5] we exploited the **WBAN proposed in [7]** to create a CNN **to perform human activity recognition** over a dataset of 12 persons performing 7 different human activities. The overall accuracy achieved is >90%.
- In [7] we introduced methodology to perform **tracking and identification of people through HPE and IMU data fusion**. We proposed a matching model that employs a geometric approach and a Convolutional Neural Network (CNN) .

Our research group

Our collaborations

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motivazioni ridondanti (modifca partedno da problematiche che si vogliono affrontare), sui goal dire le challenges tecnologiche che ho dovuto affrontare sottolineando aspetti tecnici. dire sia nei risultati e nei goal il data fusion, dicendo anche il paper di quest’anno di date.

negli obbiettivi dire anche delle cose che vogliamo fare con essex, traking e fingerprinting con wifi e mm-wave.