

精读

ThermoWwave: A New Paradigm of Wireless Passive Temperature Monitoring via mmWave Sensing (MobiCom'20)

First Author

Baicheng Chen

Summary

- This paper presents a tag-based method for thermo measurement.
- The temperature-induced molecular pattern of the ThermoTag (Cholesteryl material) can be modulated and sensed by the scattered mmWave signals.
- System components: ThermoTag (Cholesteryl material), ThermoScanner (mmWave radar), and ThermoSense (model-based, data-driven).
- High thermal detection accuracy (99%), thermal image generation.

Challenge

No challenge is emphasized.

Strength

- Low cost tag.
- Penetrating occlusion for temperature measurement (IR camera will measure the temperature of occlusion in a NLoS scenario).

Weakness

- dataset constructed at one time (3:1 for training:testing). 对于静态放置的tag（温度可以认为是基本不变？取决于实验采集的具体时间间隔？），多次采集得到的mmWave和thermal数据相关性应该是非常强的（甚至是一样的）。假设静止采集得到的subset为{S}，因此如果训练集里包含了一部分{S}，测试集里也包含了一部分{S}，那么ThermalNet（类似于Encoder-decoder结构）由mmWave spectrogram生成得到的thermal image很可能是 over-fitting 的结果，或者对于位置的鲁棒性非常差（tag或者mmwave雷达移动一小段距离就gg）
- The thermal image consists of the information of position (i.e., x and y) and the temperature. But what the spectrogram derived from the one dimension signal contains is the time, frequency, and power, without any information about the position. So I think the spectrogram generated from the ThermNet is likely the result of over-fitting.
- Robustness analysis: lack of details about the experimental setting. e.g., Did it recollect the data for training and testing or just use the pretrained model? (It is doubt that the system is robust against different angles if only using the pretrained model before.)

- Although the Section 9.5 Permanence analysis contains experiment across several days (training data are collected the first week and testing data the following two weeks), there is only evaluation about the ThermalDot (prediction about the temperature) without evaluation about the ThermalNet (temperature image reconstruction) which is very important to verify the aforementioned over-fitting.

Inspiration: Tag-based mmWave Sensing

薄膜压电材料(PVDF) as the tag + mmWave sensing (120GHz) --> pixel-level fingerprint/palmprint reconstruction

泛读

OcuLock: Exploring Human Visual System for Authentication in Virtual Reality Head-mounted Display

Solved Problem

- Proposed a novel biometric authentication system for VR platforms based on HVS biostructure and unique features (eyelid, extraocular muscles, cells, and surrounding nerves).
- Low equal error rate (3.55%) compared with previous work. Stable performance over two months.

Main Idea

- Take HVS as a whole (previous work only use the eye globe) to build a stable and unobservable VR authentication system. In addition to the eye globe, other components in the HVS (e.g., eyelid, extraocular muscles, cells and surrounding nerves) can contribute to the user authentication.

PDLens: Smartphone Knows Drug Effectiveness among Parkinson's via Daily-Life Activity Fusion

Solved Problem

Proposed a smartphone-based system to detect drug effectiveness among Parkinson's in daily life. It can model the PD symptom severity on drug treatment and detects the change of severity scores before and after the drug intake.

Main Idea

- Even measuring symptom severity at a given time is challenging, acquiring comparison of symptom severity at two different times is easy.
- Leverage built-in sensors to collect PD biomarkers (e.g., gait, balance and voice from user activities) to estimate the PD symptom severity.