

Motivations & Objectives

- Human Activity Recognition (HAR) has a wide range of real-world applications, such as health care and fitness tracking
- Device-based approaches for HAR (e.g. smart watches) have limitations due to cost and discomfort
- Many significant efforts have recently been made to explore device-free HAR that utilizes the information collected from wireless infrastructures (e.g. WiFi signals)
- Other existing wireless devices, such as cameras, can potentially leak and lead to privacy issues
- We propose a network, utilizing mmWave data that can accurately classify amongst different human activities, that is cheaper and user-friendly
- mmWave radar systems transmit short wavelength waves that are in the millimeter range, and thus have high frequencies

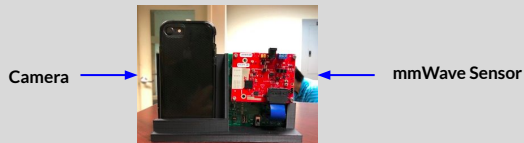


FIGURE 1

Figure 1 shows camera and mmWave sensor setup

References

- [1] Cao, Zhe & Hidalgo, Gines & Simon, Tomas & Wei, Shih-En & Sheikh, Yaser. (2018). "OpenPose: Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields".
 [2] Wang, Fei & Panev, Stanislav & Dai, Ziyi & Han, Jinsong & Huang, Dong. (2019). "Can WiFi Estimate Person Pose?".

Methodology

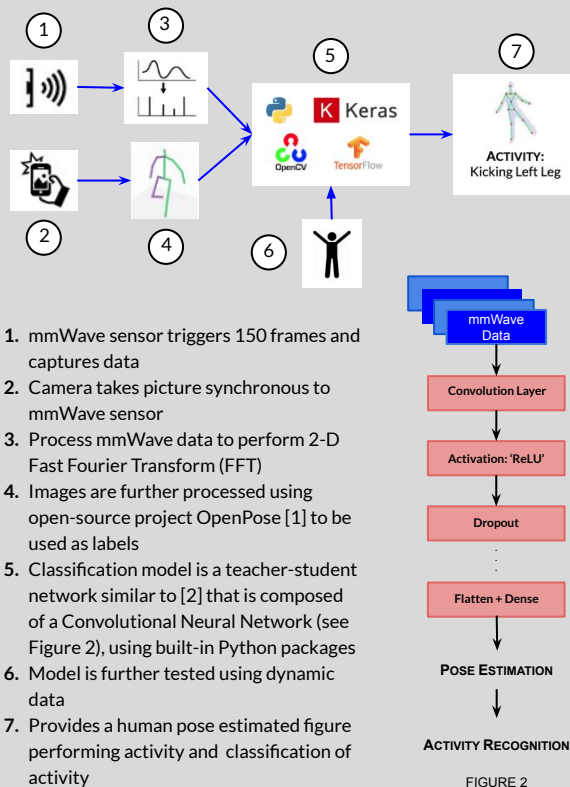
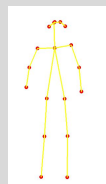


FIGURE 2

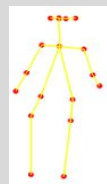
Results

We trained our classification model for 200 epochs with an Adam optimizer and a total of 1200 data samples. Our current model can classify amongst three different activities: stretching, kicking right leg, and sitting down. The experiments for these activities have 450, 450, and 300 samples respectively.

EXAMPLE RESULTS FOR SITTING



ACTIVITY: Sitting
FIGURE 3



ACTIVITY: Sitting
FIGURE 4

Figure 3 and Figure 4 lead up to a person sitting down respectively

Conclusion & Future Direction

- We explored a method of hands-free HAR with mmWave sensors by using signal processing and deep-learning techniques
- Future work consists of gathering more data and optimizing our model for better clarity and accuracy

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