基于WIFI CSI相关论文

人体在 WIFI 信号频段下，表现为反射体，即 WIFI 信号在遇到人体后，大多数能量会被反射回去。而其它物品或者墙面能够被穿透。

一、*

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MIT Open Access Articles

Through-Wall Human Pose Estimation Using Radio Signals

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Zhao_Through-Wall_Human_Pose_CVPR_2018_paper.pdf

二、*

DensePose From WiFi.pdf
10.84MB

这篇文章要点：

1. 利用 wifi进行人体姿态识别
2. CSI 采集频率为 100Hz
3. 对相位信息进行一系列预处理，提高了模型的识别能力

4. 结合了关键关节识别和 DensePose 两种技术，提高模型识别能力
5. 用了跨模态技术，将一维的 WiFi 信息转成二维的图像信息。
6. 利用迁移学习技术，从同步的图像中进行学习，得到模型，再用这个模型对 WiFi 信号进行监督学习，得到 WiFi 信号模型。

实验数据：

1. 相同场景下的识别能力，AP@50 和视觉方案比较接近
2. 新场景的识别能力很差，不可用

缺点：

1. 特征提取完全依赖机器学习，对CSI中人体特征进行预提取，这可能是识别率不高的原因

一些初步结论：

1. 要商用的话需要在客户空间进行学习后可用，可以解决新环境识别率的问题。
2. CSI可以用上信号处理的方法提取有用的特征。

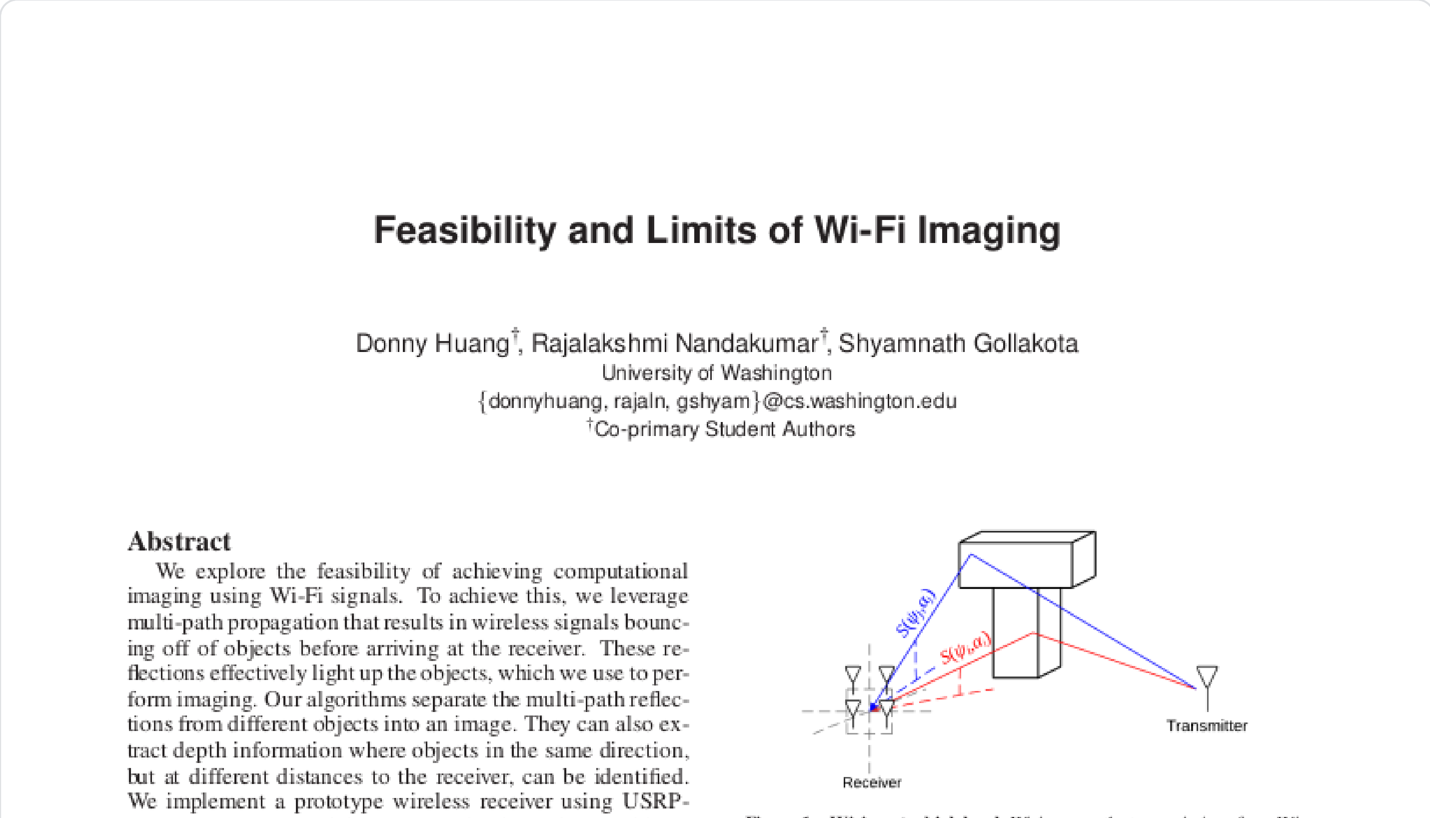
三、*

核心内容：

1. 分析 WiFi 的反射和折射信号，对空间进行成像
2. 8*8 的天线阵列获得的分辨率比 4*4 的高
3. 不同材质的物体所呈现的信号特性不同，金属反射能力最强，所以获得的图像强度最高
4. 非视距也有一定的成像能力

实验数据：

1. 理论上 2.4G 的 WiFi 信号波长为 12cm，5G波长为 6cm，具备更高的成像分辨率
2.



Feasibility and Limits of Wi-Fi Imaging

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Abstract
We explore the feasibility of achieving computational imaging using Wi-Fi signals. To achieve this, we leverage multi-path propagation that results in wireless signals bouncing off of objects before arriving at the receiver. These reflections effectively light up the objects, which we use to perform imaging. Our algorithms separate the multi-path reflections from different objects into an image. They can also extract depth information where objects in the same direction, but at different distances to the receiver, can be identified. We implement a prototype wireless receiver using USRP-

Feasibility and Limits of Wi-Fi Imaging(wision).pdf

四、

Person-in-WiFi: Fine-grained Person Perception using WiFi

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CV] 30 Mar 2019

Person-in-WiFi- Fine-grained Person Perception using WiFi.pdf

五、

See Through Walls with Wi-Fi!

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ABSTRACT

Wi-Fi signals are typically information carriers between a transmitter and a receiver. In this paper, we show that Wi-Fi can also extend our senses, enabling us to see moving objects through walls and behind closed doors. In particular, we can use such signals to identify the number of people in a closed room and their relative locations. We can also identify simple gestures made behind a wall, and combine a sequence of gestures to communicate messages to a wireless receiver without carrying any transmitting device. The paper introduces two main innovations. First, it shows how one can use MIMO interference nulling to eliminate reflections off static objects and focus the receiver on a moving target. Second, it shows how one can track a human by treating the motion of a human body as an antenna array and tracking the resulting RF beam. We demonstrate the validity of our design by building it into USRP software radios and testing it in office buildings.

Categories and Subject Descriptors C.2.2 [Computer

signal power after traversing the wall twice (in and out of the room) is reduced by three to five orders of magnitude [11]. Even more challenging are the reflections from the wall itself, which are much stronger than the reflections from objects inside the room [11, 27]. Reflections off the wall overwhelm the receiver's analog to digital converter (ADC), preventing it from registering the minute variations due to reflections from objects behind the wall. This behavior is called the "Flash Effect" since it is analogous to how a mirror in front of a camera reflects the camera's flash and prevents it from capturing objects in the scene.

So how can one overcome these difficulties? The radar community has been investigating these issues, and has recently introduced a few ultra-wideband systems that can detect humans moving behind a wall, and show them as blobs moving in a dim background [27, 41] (see the video at [6] for a reference). Today's state-of-the-art system requires 2 GHz of bandwidth, a large power source, and an 8-foot long antenna array (2.4 meters) [12, 27]. Apart from the bulkiness of the device, blasting power in such a

wivi-paper.pdf

六、

sensors MDPI

Article

LRF-WiVi: A WiFi and Visual Indoor Localization Method Based on Low-Rank Fusion

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Abstract: In this paper, a WiFi and visual fingerprint localization model based on low-rank fusion (LRF-WiVi) is proposed, which makes full use of the complementarity of heterogeneous signals by modeling both the signal-specific actions and interaction of location information in the two signals end-to-end. Firstly, two feature extraction subnetworks are designed to extract the feature vectors containing location information of WiFi channel state information (CSI) and multi-directional visual images respectively. Then, the low-rank fusion module efficiently aggregates the specific actions and interactions of the two feature vectors while maintaining low computational complexity. The fusion features obtained are used for position estimation; In addition, for the CSI feature extraction

A WiFi and Visual Indoor Localization Method Based on Low-Rank Fusion.pdf

七、

WiVi: WiFi-Video Cross-Modal Fusion based Multi-Path Gait Recognition System

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4/22/$31.00 ©2022 IEEE | DOI: 10.1109/IWQoS54832.2022.9812893

***Abstract*—WiFi-based gait recognition is an attractive method for device-free user identification, but path-sensitive Channel State Information (CSI) hinders its application in multi-path environments, which exacerbates sampling and deployment costs (i.e., large number of samples and multiple specially placed devices). On the other hand, although video-based ideal CSI generation is promising for dramatically reducing samples, the missing environment-related information in the ideal CSI makes it unsuitable for general indoor scenarios with multiple walking paths.**

In this paper, we propose WiVi, a WiFi-video cross-modal

defined special movement. Among different implementation strategies, WiFi-based gait recognition has received further attention due to the advantages of passive awareness and privacy protection.

In WiFi covered area, the collected CSI contains the Doppler shifts and multi-path distortions caused by human motion. Thus, the WiFi-based gait recognition system can obtain fine-grained gait features for human identification. However, the CSI signal is path sensitive, i.e., we will get completely differ-

WiVi_WiFi-Video_Cross-Modal_Fusion_based_Multi-Path_Gait_Recognition_System.pdf

核心内容：

1. 提出 WiVi 系统，核心技术是用 WiFi 信号和视频数据做跨模态融合
2. 主要用于步态识别，步态识别是生物特征识别的子领域，可用于远距离目标识别

实验数据：

作者们构建了一个原型系统，并通过广泛的实验评估了其性能。实验结果表明，WiVi系统在不同人数的识别准确率上有显著的表现，与单路径步态识别系统相比，平均性能提升了113.8%，并且与其他多路径步态识别系统相比，WiVi在保持类似或更好性能的同时，所需的样本数量减少了57.1-93.7%。

八、

中国计算机学会通讯 第10卷 第11期 2014年11月

Wi-Fi雷达：从RSSI到CSI

杨 铮 刘云浩
清华大学

关键词：RSSI CSI 无线感知

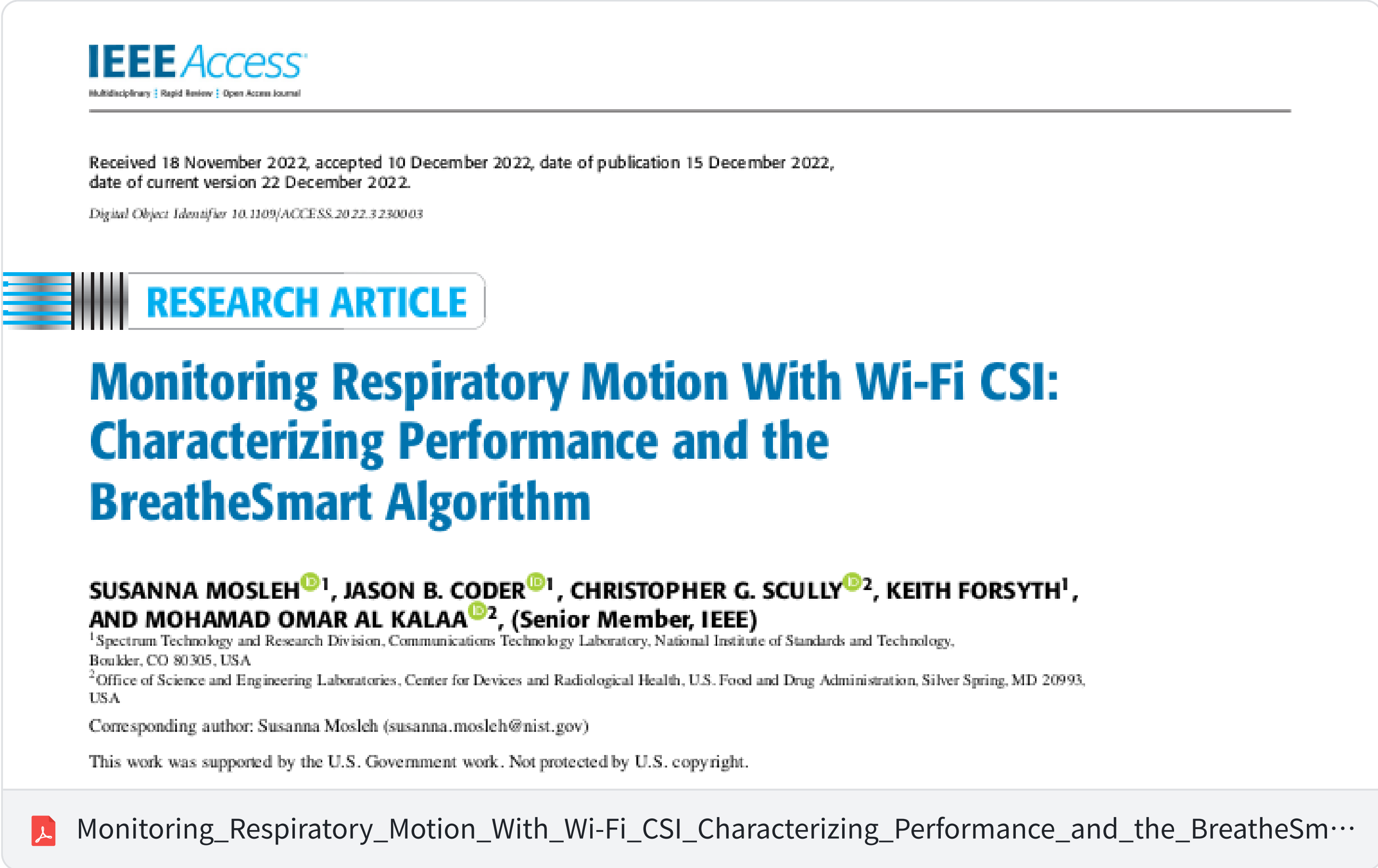
编者按：在本文中，清华大学杨铮和刘云浩介绍了一种利用普通无线设备实现环境感知的技术。通过分析无线信道状态信息，实现了被动式人员检测，包括识别人的位置、姿势、动作以及其他环境特征，可以应用于室内定位、安全监控、针对老人和小孩的家庭医疗监护、新型人机交互方式等。本年度 ACM MobiCom 将大会唯一最佳论文奖授予

Yang-WiFi-Radar-CCCF.pdf

核心内容：

1. 解释了CSI如何从频域上得到空间的信息，主要是利用了多径传播效应
2. 多径传播效应在频域上体现为频率的选择性衰落。WIFI的CSI信息中，包含了56个子载波的频率响应信息（商用路由器一般只能采集到30个子载波信息）

九、WIFI 监测人体呼吸



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RESEARCH ARTICLE

Monitoring Respiratory Motion With Wi-Fi CSI: Characterizing Performance and the BreatheSmart Algorithm

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Monitoring_Respiratory_Motion_With_Wi-Fi_CSI_Characterizing_Performance_and_the_BreatheSm…

核心内容：

1. BreatheSmart深度学习算法，正确的识别率达到 99.54%。
2. 修改路由器固件，CSI 采集频率为 10 次

十、

usenix
THE ADVANCED COMPUTING SYSTEMS ASSOCIATION

SLNet: A Spectrogram Learning Neural Network for Deep Wireless Sensing

Zheng Yang and Yi Zhang, *Tsinghua University;* Kun Qian, *University of California San Diego;* Chenshu Wu, *The University of Hong Kong*

https://www.usenix.org/conference/nsdi23/presentation/yang-zheng

nsdi23-yang-zheng.pdf

十、

Artifacts Evaluated Reusable V1.1 · Artifacts Evaluated Functional V1.1 · Artifacts Available V1.1 · Results Replicated V1.1

Check for updates

RF-Diffusion: Radio Signal Generation via Time-Frequency Diffusion

Guoxuan Chi[1], Zheng Yang[1✉], Chenshu Wu[2], Jingao Xu[1], Yuchong Gao[3], Yunhao Liu[1], Tony Xiao Han[4]
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ABSTRACT

Along with AIGC shines in CV and NLP, its potential in the wireless domain has also emerged in recent years. Yet, existing RF-oriented generative solutions are ill-suited for generating high-quality, time-series RF data due to limited representation capabilities. In this work, inspired by the stellar achievements of the diffusion model in CV and NLP, we adapt it to the RF domain and propose RF-Diffusion. To accommodate the unique characteristics of RF signals, we first introduce a novel *Time-Frequency Diffusion* theory to enhance the original diffusion model, enabling it to tap into the

KEYWORDS

RF Signal, Generative Model, Time-Frequency Diffusion, Wireless Sensing, Channel Estimation

ACM Reference Format:
Guoxuan Chi, Zheng Yang, Chenshu Wu, Jingao Xu, Yuchong Gao, Yunhao Liu, Tony Xiao Han. 2024. RF-Diffusion: Radio Signal Generation via Time-Frequency Diffusion. In *International Conference On Mobile Computing And Networking (ACM MobiCom '24), September 30–October 4, 2024, Washington D.C., DC, USA*. ACM, New York, NY, USA, 16 pages. https://doi.org/10.1145/3636534.3649348

RF-Diffusion_paper.pdf

- 核心内容

1. 利用扩散模型的思想，提出 RF-diffusion，用于高质量数据生成
2. 生成高质量合成数据，减少环境依赖

十一、

FallDeWideo: Vision-Aided Wireless Sensing Dataset for Fall Detection with Commodity Wi-Fi Devices

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ABSTRACT

Falling is one of the most dangerous events for the elderly and one of the most pressing public concern, which calls for an accurate, efficient, ubiquitous, cost-effective and privacy-preserving fall detection system to mitigate the negative consequences. Wi-Fi sensing-based method is considered as a potential technique to meet such needs. Existing solutions simply treat fall detection simply as a binary classification task, which leads to interpretability risks. To address this issue, we present FallDeWideo, the first multi-modal dataset dedicated to fall detection, comprising Wi-Fi CSI data and videos recorded during various kinds of events. We provide benchmark model for this dataset as well. Specifically, we

Devices. In *3rd ACM MobiCom Workshop on Integrated Sensing and Communication Systems for IoT (ISACom) (ISACom '23), October 6, 2023, Madrid, Spain.* ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3615984.3616501

1 INTRODUCTION

For people of age 65 and older, the major cause of injury is falling. Existing research shows that more than 1 in 4 elderly people falls each year, leading to 3 million emergency department visits and 1 million hospital stays[17]. Another study shows that for elderly people that are not treated after a fall and are not able to get up for more than one hour, half of them passed away within the following six months[27].

FallDeWideo.pdf

十二、*Wi-Fi-Based Location-Independent Human Activity Recognition with Attention Mechanism Enhanced Method

electronics

MDPI

Article

Wi-Fi-Based Location-Independent Human Activity Recognition with Attention Mechanism Enhanced Method

Xue Ding [1], Ting Jiang [1], Yi Zhong [2,*], Sheng Wu [1], Jianfei Yang [3] and Jie Zeng [4]

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Abstract: Wi-Fi-based human activity recognition is emerging as a crucial supporting technology for various applications. Although great success has been achieved for location-dependent recognition tasks, it depends on adequate data collection, which is particularly laborious and time-consuming,

electronics-11-00642-v2.pdf

科普学习

https://chiguoxuan.gitbook.io/wireless-sensing

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WiTrack

WiSee

Phaser

IMDEA

WiSH

WiMi

智能无线感知-特征算法数据集-杨铮.pdf

WIFI基础原理

频段

2.4 GHz和5 GHz是用于Wi-Fi通信的无线频段，它们支持不同的Wi-Fi标准和协议。以下是这两个频段常见的Wi-Fi协议：

2.4 GHz频段：

1. **802.11b**：

   最早的WiFi标准之一，最高速率为11 Mbps，使用1 Mbps和2 Mbps的DSSS（直接序列扩频）调制。

2. **802.11g**：

   继承了802.11b的兼容性，最高速率为54 Mbps，使用OFDM（正交频分复用）调制。

3. **802.11n**：

   高速WiFi标准，最高速率可达600 Mbps（在理想条件下），支持2.4 GHz和5 GHz频段，使用MIMO（多输入多输出）技术。

4. **802.11r**：

   快速漫游标准，主要针对802.11a/b/g/n，改善了移动设备在不同接入点之间的切换速度。

5. **802.11k**：

无线资源管理标准，提供更好的信道选择和传输功率控制。

5 GHz频段：

1. **802.11a**：

   早期的5 GHz标准，最高速率为54 Mbps，使用OFDM调制。

2. **802.11n**：

   同上，802.11n也支持5 GHz频段，提供更高的速率和更宽的信道带宽（最高160 MHz）。

3. **802.11ac**：

   也称为Wave 2，专为5 GHz频段设计，最高速率可达6.93 Gbps，使用更宽的信道（最高160 MHz）和更高阶的调制（如256-QAM）。

4. **802.11ax**（Wi-Fi 6）：

   最新一代的WiFi标准，旨在提供更高的数据速率、更低的延迟和更好的设备连接性。支持2.4 GHz和5 GHz频段，最高速率可达9.6 Gbps。

5. **802.11be**（Wi-Fi 7）：

   正在开发中的下一代WiFi标准，预计将提供更高的速率和更低的延迟，目前还未广泛商用。

参考

https://github.com/superstar1225/DensePose_from_WiFi

https://github.com/xyz38324/DensePose-from-WiFi