Paper Review 1

1. Paper summary.

   This paper introduces **OPTICS**, an optical wireless communication that is integrated with a sensing system. The motivation of this system is the fundamental limitation of OWC: it is highly vulnerable to human blockage. At the same time, optical sensing can be used for activity recognition, but prior approaches often require many sensors or complex setups, and communication and sensing are usually studied separately.

   OPTICS proposes to merge them by the error patterns. Communication signals caused by human movement serve as clues for activity recognition, while the recognition helps transmitters to dynamically adapt transmission parameters to maintain the link reliable.

   The system integrates a hybrid recognition model capable of handling both known and unknown activities, an adaptive control loop that tunes pulse widths in response to environmental changes, an modulation and demodulation scheme that is aware of activity to mitigate head and tail blocking issues, and a synchronization method that addresses interruptions.

   The results show that it can recognize human activities with up to 99.1% accuracy, while maintaining robust communication even under frequent blockage, reducing bit error rates from around 77% in baseline OWC to about 4% with OPTICS.

2. Analyze the result figure(s).

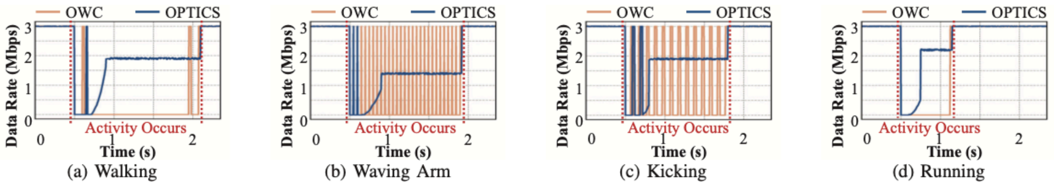

Fig. 11: Data Rates vs. Different Activities

   The authors aim to show that OPTICS can maintain stable communication performance in the presence of human activities that cause blockage. The hypothesis is that, unlike conventional OWC which suffers severe throughput inference when people move in front of the link, OPTICS can adapt and keep the data rate steady.

   The experiment measures communication performance over time while human activities intermittently block the path. Both baseline OWC and OPTICS are tested under identical conditions. The key metric is data rate (throughput). The figure plots how the throughput evolves during events including walking, waving arm, kicking, and running.

In the figure, the X-axis represents the time (seconds), while the Y-axis represents the data rate (Mbps). The red line shows baseline OWC performance, while the blue line shows OPTICS performance. We can see that the baseline OWC fluctuates rapidly and becomes zero when human blockage occurs. In contrast, OPTICS maintains a relatively flat curve after several fluctuations.

According to the figure, we can make two conclusions. First, OPTICS does improve communication robustness. By dynamically adjusting pulse width and using adaptive demodulation, OPTICS present steady throughput in a short time. Second, the pattern of the blockage implies human activity. For example, in Fig.11.a, the red line oscillates for a short time, then collapses to zero for a while, and finally returns to 3Mbps after another short oscillation. This indicates that there is a person walking through, causing oscillation at the beginning and the end of the blockage, and zero throughput during his full blockage. Similar reasoning can be used on other figures, too.

3. Strengths and weaknesses of this paper.

   Strength:

   - This work is an innovative integration of OWC with human activity recognition. Instead of treating communication and sensing as separate functions, the authors leveraged communication errors caused by human blockage as features for activity recognition, and the recognition results in turn guide adaptive modulation and control. This interaction between communication and sensing is an interesting approach that goes beyond conventional research.

   Weakness:

   - The authors claimed that OPTICS is the first system to integrate OWC with sensing. However, the related work in their reference, 2024 JLT article *"Experimental Demonstration of Integrated Optical Wireless Sensing and Communication"* had already conducted similar work. While the sensing targets differ (positioning vs. activity recognition), both works clearly belong to the same category. The authors neither acknowledge this close precedent nor compare the difference. Thus, the authors **overstated the novelty of their work**.

   - The authors themselves highlight that human activities are highly **unpredictable and diverse**. On the other hand, their experiment only contains several simple human activities. This is a direct inconsistency since their experiment did not overcome the challenges they identify. Moreover, although they reported a one-month long deployment in uncontrolled environments, this primarily focuses on communication stability (BER/throughput), rather than validating the robustness of human activity recognition. Therefore, the work is **not feasible for the real world issue proposed by themselves**.

- The hybrid HAR model relies on the **assumption that human blockage is intermittent**, producing error patterns that can be used for activity recognition and adaptive adjustment. Unfortunately, this is highly idealized and unrealistic because people may remain stationary and block the link continuously, or multiple people may lead to overlapping blockages. In such cases, the system would neither maintain communication nor recognize activities. As a result, this is an obvious contradiction between the problem statement and the proposed solution.

4. Recommendation
   Overall recommendation: reject.

5. AI Tools
   Use AI tools to explain the confusing part and summarize the points in the paper, including the problems, challenges, approaches, and the result.