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Peer Review

Review of: "Large Models Enabled Ubiquitous Wireless Sensing"

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This work explores the novel application of large language models (LLMs) to wireless communication, particularly for channel state information (CSI) prediction in MIMO-OFDM systems. While the paper demonstrates significant potential, there are critical issues related to its structure, depth of analysis, and academic rigor that need to be addressed. Below are the detailed comments.

Strengths

1. **Innovative Perspective**: The proposal to apply GPT-2 and similar large models to CSI prediction introduces a novel and promising approach.
2. **Technical Experiments**: The use of tools like QuaDRiGa and WinProp for data generation and channel simulation is commendable, adding a practical dimension to the work.
3. **Real-World Relevance**: The discussion of applications in 5G and 6G networks aligns well with current industrial trends and research priorities.

Major Issues

Insufficient Articulation of Research Background and Objectives

- The introduction does not clearly establish the gap in existing methodologies for CSI prediction that this work seeks to address. While traditional and data-driven methods are briefly mentioned, their limitations are not elaborated on in a manner that justifies the proposed approach.
- The specific contributions of the paper are outlined but lack depth and a clear distinction from prior work, making it challenging to assess the novelty of the framework.

Weak Theoretical Foundation

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- The integration of large models with physical CSI prediction is an intriguing concept, but the paper fails to provide a robust theoretical explanation of why LLMs are well-suited for this task. Without this, the approach risks appearing as an experimental exploration rather than a method grounded in established principles.
- The mathematical formulation of the problem is incomplete. Key assumptions, such as the statistical correlation between uplink and downlink CSI, are briefly mentioned but not rigorously discussed or validated.

Experimental Design and Reporting

- The experimental methodology is described but lacks clarity in several areas:
    - The criteria for model selection (e.g., GPT-2 over other LLMs) are not sufficiently justified.
    - The preprocessing pipeline for CSI data, especially the geometric feature extraction, is described in technical terms but remains opaque without illustrative examples or diagrams.
- Performance metrics such as NMSE are used, but their implications for practical applications are not adequately analyzed. For instance, the difference in NMSE values across models is reported, but the practical significance of these differences is not discussed.

Limited Analysis of Results

- The results section lacks a critical evaluation of why certain models (e.g., VAE and diffusion models) perform better than others. A deeper analysis of model behaviors, strengths, and weaknesses would significantly enhance the paper.
- The discussion on limitations is superficial. The issue of statistical channel modeling randomness is mentioned but not explored in detail, leaving readers without a clear understanding of its impact on the findings.

Language and Presentation Issues

- The paper contains numerous grammatical and stylistic errors that detract from its readability and professionalism. For example:
    - "Meanwhile, the demand for more reliable and low-latency transmission is also increasing." This phrasing is redundant and could be revised for conciseness.
    - Sentences like "But remember that NLOS paths also exist..." adopt an overly casual tone inappropriate for a formal academic paper.

- Figures and tables are not consistently integrated with the text. Many are referenced but not critically discussed, which reduces their impact.

Suggestions for Improvement

Strengthen the Introduction and Related Work

- Clearly define the research gap and position this work in the context of existing literature. Highlight the novelty of using LLMs for CSI prediction and provide a stronger motivation for this approach.
- Expand the discussion of related works to include a more comprehensive review of AI-driven CSI prediction methods.

Enhance Theoretical Depth

- Provide a theoretical justification for using LLMs in CSI prediction, including their expected advantages over traditional and other machine learning methods.
- Rigorously validate the assumptions made in the mathematical formulation and discuss their impact on the proposed framework.

Refine Experimental Methodology

- Justify model selection and provide more details on the preprocessing steps, including examples or illustrations.
- Expand the dataset description and discuss how it reflects real-world scenarios.

Deepen the Analysis of Results

- Compare the proposed model's performance with benchmarks in a more meaningful way, including practical implications of NMSE improvements.
- Discuss failure cases and provide insights into potential improvements.

Improve Language and Presentation

- Revise the manuscript for grammatical accuracy, clarity, and conciseness. Adopt a more formal and professional tone throughout.
- Ensure all figures and tables are well-integrated into the narrative, with critical discussions of their relevance.

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Decision: Major Revision

While the paper demonstrates promise, significant revisions are necessary to address the outlined issues. With these improvements, the work could make a valuable contribution to the field of wireless communication and AI-driven network optimization.

Declarations

Potential competing interests: No potential competing interests to declare.

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