Qeios

Peer Review

Review of: "LangGas: Introducing Language in Selective Zero-Shot Background Subtraction for Semi-Transparent Gas Leak Detection with a New Dataset"

Shuwen Pan[1]

1. Zhejiang University, China

This paper makes a valuable contribution to gas leak detection by introducing a synthetic dataset and a robust zero-shot pipeline. The integration of VLMs with traditional CV techniques is innovative, and the environmental benefits are noteworthy. However, real-world validation and computational efficiency need deeper exploration. With revisions addressing these points, the work has strong potential for publication.

Weaknesses

Limited Real-World Validation:

Qualitative experiments on GasVid lack quantitative metrics (e.g., IoU), raising concerns about real-world applicability. Performance drops due to "real-world noise" are mentioned but not rigorously analyzed.

Synthetic Data Limitations:

While synthetic data avoids biases, it may not fully replicate real-world challenges (e.g., dynamic lighting, sensor noise). Cross-dataset evaluation (e.g., on IIG) is missing.

Hyperparameter Sensitivity:

Temporal filtering parameters (e.g., k_1=10$k1$=10, \tau_{\text{IoU}}=0.3τIoU=0.3) were not extensively tuned, risking suboptimal performance in unseen scenarios.

Prompt Dependency:

doi.org/10.32388/K4QTVS

Reliance on "white steam" may limit generalization to gases with different visual characteristics (e.g., colorless gases in IR). Alternative prompts or adaptive strategies are underexplored.

Computational Efficiency:

No discussion of inference speed or hardware requirements, critical for real-time deployment (e.g., industrial monitoring).

Recommendations

Expand Real-World Evaluation:

Quantify performance on GasVid/IIG with metrics like IoU. Include failure case analysis (e.g., missed leaks due to distance).

Cross-Dataset Testing:

Validate the method on IIG or other IR datasets to assess generalization.

Hyperparameter Optimization:

Conduct a systematic hyperparameter search for temporal filtering and enhancement factor \alpha$\alpha$.

Generalization of Prompts:

Explore prompt ensembling or adaptive prompting (e.g., dynamically adjusting prompts based on scene context).

Computational Analysis:

Report inference time, memory usage, and scalability for real-time applications.

Ethical Considerations:

Discuss the potential misuse of synthetic data (e.g., adversarial attacks) and mitigation strategies.

Declarations

Potential competing interests: No potential competing interests to declare.