Anomaly sound detection for predictive maintenance

Problem Statement:
Detecting anomalies in machine sounds is a critical task across industries for ensuring safety, minimizing downtime, and preventing costly breakdowns. Challenges include dealing with diverse sound profiles, real-time detection needs, large data volumes, limited labeled datasets, robustness to changing conditions, noise and interference, and the requirement for generalization across different machine types and industries. Effective anomaly detection solutions for machine sounds are essential to address these challenges and enhance operational efficiency.

Dataset:
We suggest the use of the following datasets, although other options are also possible:
- IDMA-ISA-ELECTRIC-ENGINE: Accessible at https://www.idmt.fraunhofer.de/en/publications/datasets/isa-electric-engine.html.
- MIMII Dataset: Designed for Malfunctioning Industrial Machine Investigation and Inspection, available at https://zenodo.org/record/338438.

Suggested Resources:
- "Sounding Industry: Challenges and Datasets for Industrial Sound Analysis": A comprehensive resource on industrial sound analysis, available at https://ieeexplore.ieee.org/document/8902941.
- "Acoustic Anomaly Detection for Machine Sounds based on Image Transfer Learning": A research paper detailing a methodology for anomaly detection, available at https://www.scitepress.org/Papers/2021/101858/101858.pdf.

Additional Resources:
- "How to Apply Machine Learning and Deep Learning Methods to Audio Analysis": A guide on using machine learning and deep learning for audio analysis, accessible at https://towardsdatascience.com/how-to-apply-machine-learning-and-deep-learning-methods-to-audio-analysis-615e286fcbbc.
- "Audio Data Analysis Using Deep Learning with Python": A practical tutorial on audio data analysis with deep learning in Python, found at

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Project Submission Requirements and Evaluation:

- **Project Report**: Prepare a comprehensive project report in the form of PowerPoint slides. Your report should include sections on Motivation, Introduction, Objectives, Dataset, Model Selection/Implementation, Hardware Implementation, Results, Conclusions, and References.
- **Project Source Code**: The project source code is a critical component of your submission. Organize your code in a modular manner with descriptive comments to enhance readability. You must upload the code to a designated GitHub repository and share access with the designated Teaching Assistant (TA) for evaluation purposes.
- **"Read me" Document**: Include a "Read me" document that provides clear instructions for installation and usage of your project. This document should enable others to replicate your work effectively.
- **Video Demonstration**: Alongside your submission, you are expected to provide a video demonstrating the functionality of your project. This video should showcase the key aspects of your system, including data acquisition, model implementation, and real-time road condition analysis. The video will be instrumental in comprehensively assessing your project's performance.
- **Midterm and Final Evaluations**: The project will undergo two evaluation phases: midterm and final evaluations. These evaluations will assess the progress and outcomes of your work at key milestones. Feedback and guidance will be provided to help you refine and improve your project as it evolves.
- **Discussion with TAs**: Should you have any clarifications, doubts, or require additional guidance during the project, you are encouraged to engage in discussions with the Teaching Assistants (TAs). They are available to provide support, address questions, and help as needed.
- **Timeline and Milestones**: To facilitate your project's success, adhere to the established timeline and milestones. Consistent progress and timely communication with TAs will contribute to a smoother and more productive project development process.

For any further inquiries, clarifications, or detailed instructions, please do not hesitate to contact the following individuals:
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