

GEARBOX AUDIO QUALITY DETECTION

The goal of this project is to develop an automated system that can accurately and efficiently assess the sound recorded during the gearbox quality test.

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PROBLEM STATEMENT

Can lead to malfunctions, reduced efficiency, and costly breakdowns (time and money).

Irregularities can be faults, defects, or wear and tear.

Detects irregularities within gearboxes during quality testing.



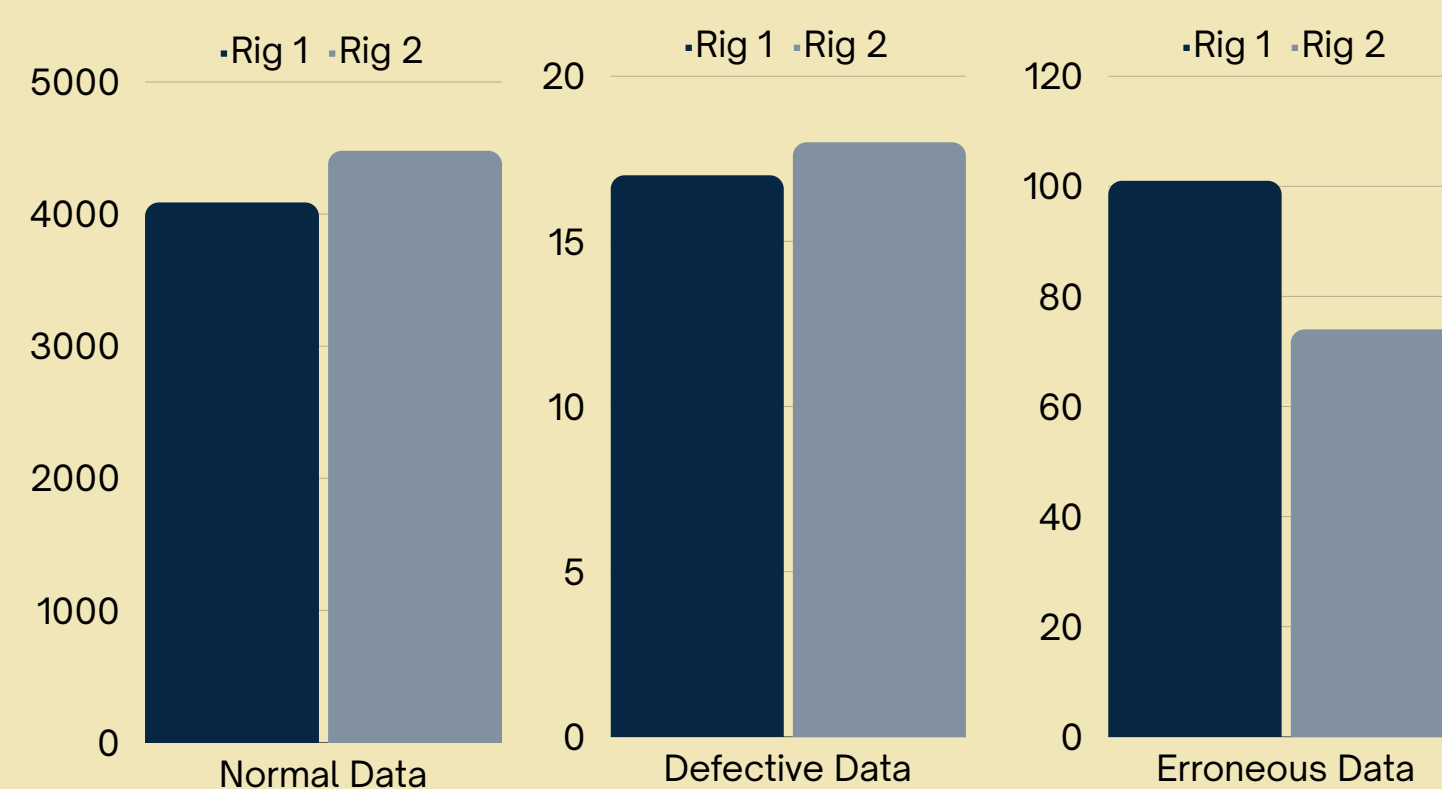
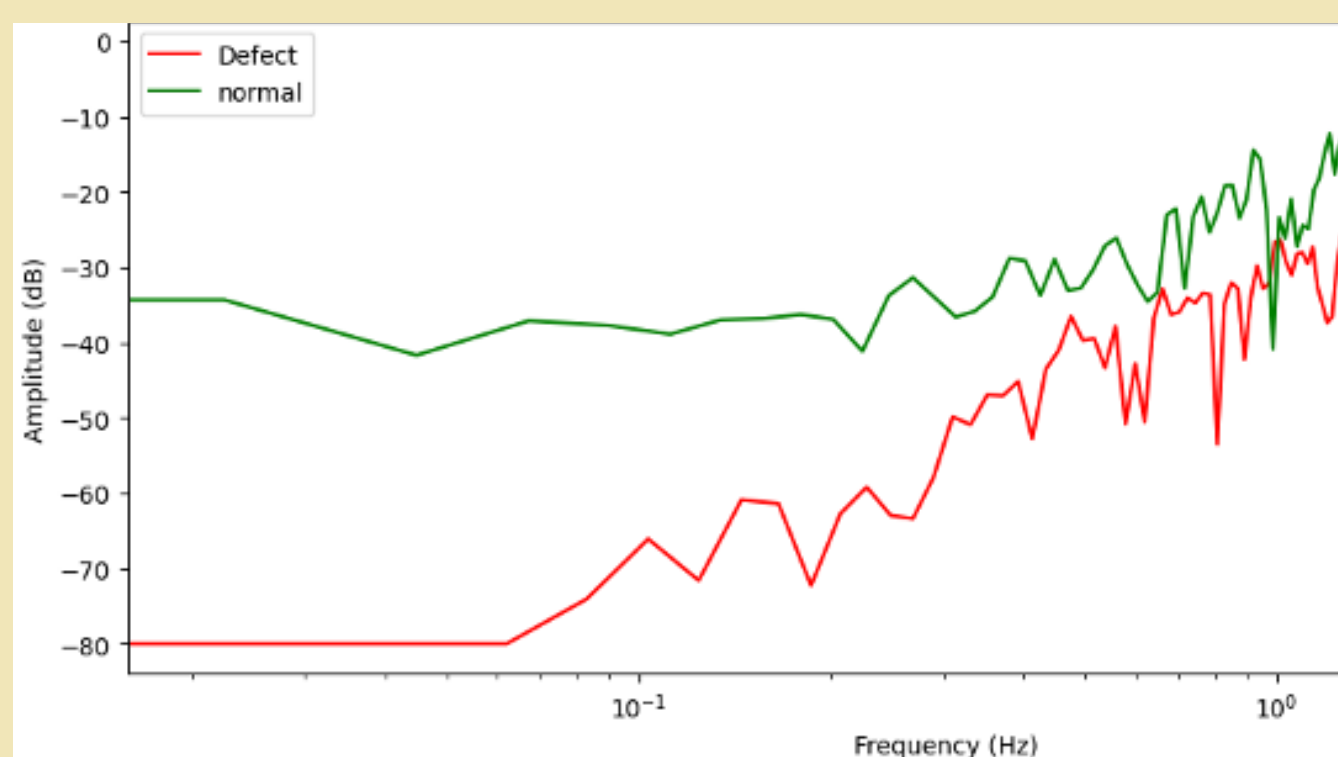
Develop an anomaly detection model that can identify defective gearbox sounds.

The system should be able to differentiate the normal and abnormal sounds.

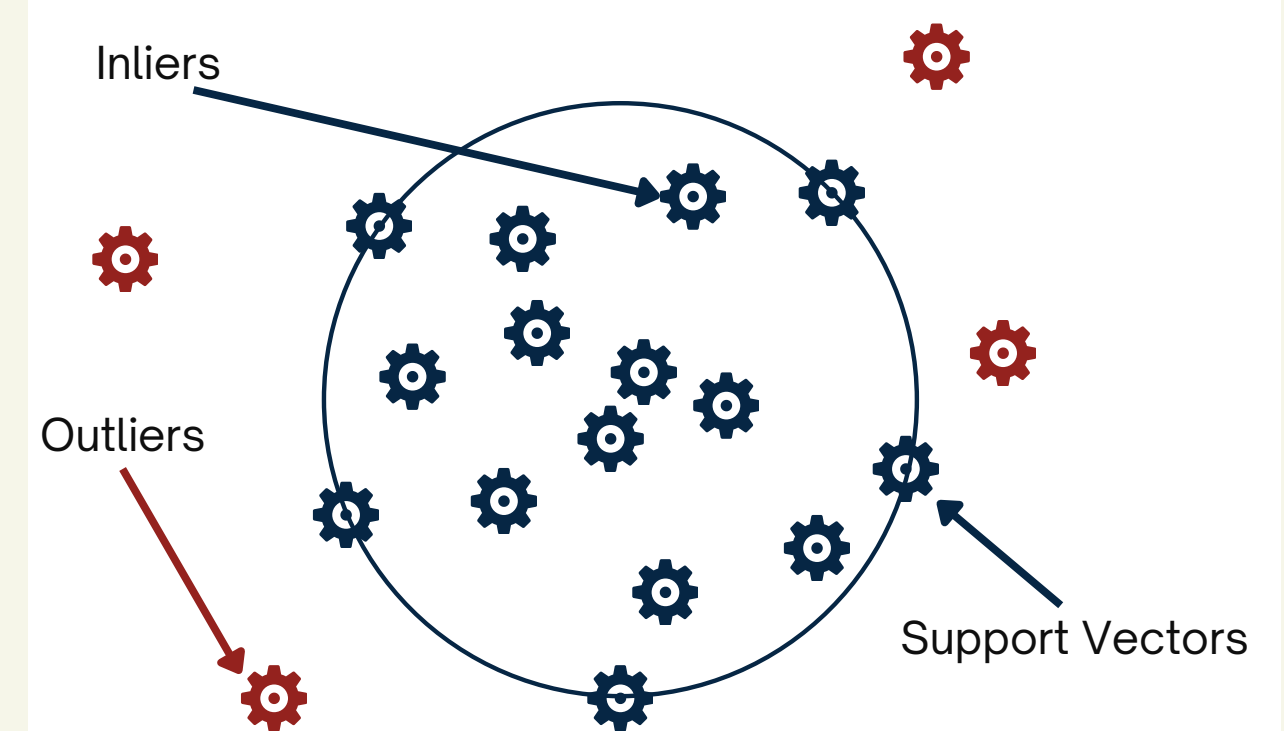
OBJECTIVE

- To determine if a sound file is from a defective or non-defective gearbox.
- To provide the confidence level or anomaly score of the prediction.
- To deploy an API that consists of the trained model and outputs the prediction and the anomaly score or confidence level.
- To do this without training the system on specific abnormal sounds. Instead, the system should recognize these unusual sounds by understanding what a gearbox's normal, healthy operation sounds like.

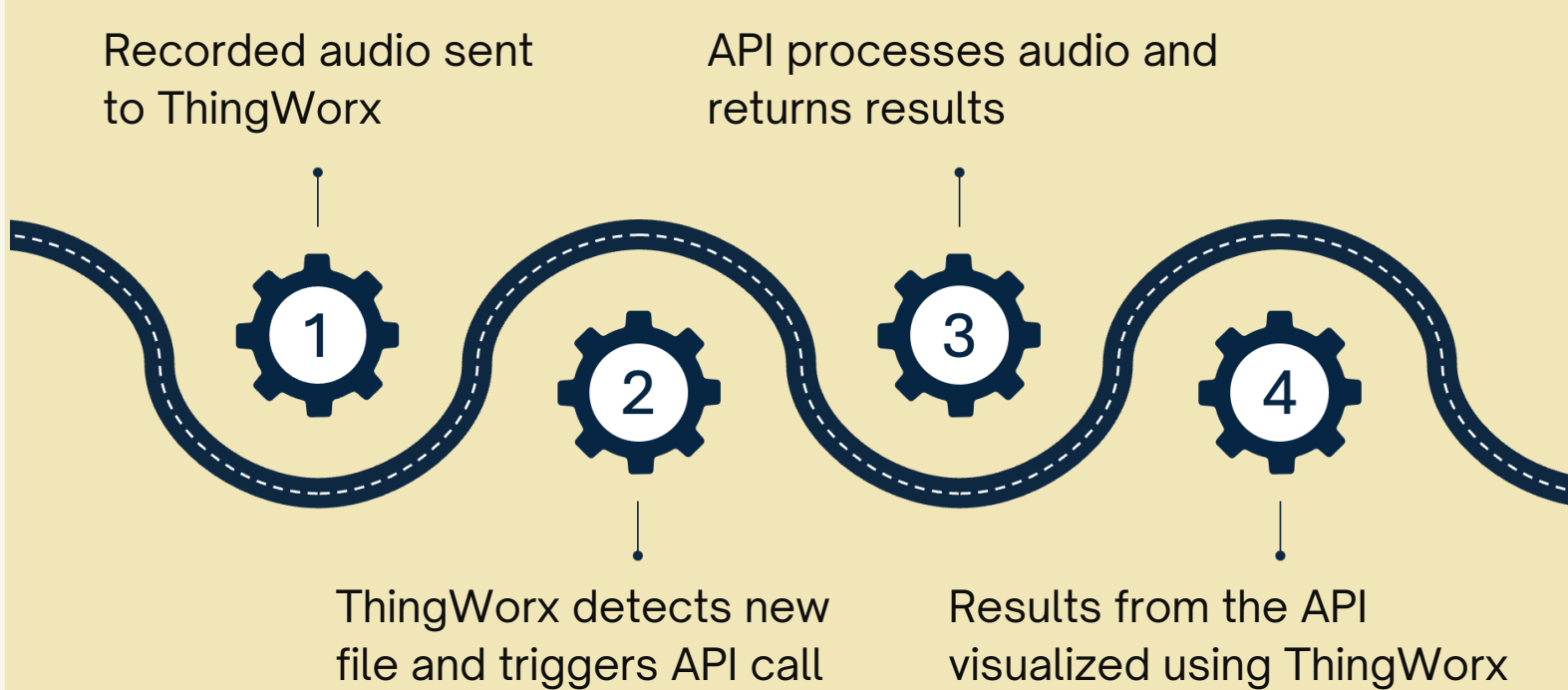
DATASET



OC-SVM MODEL



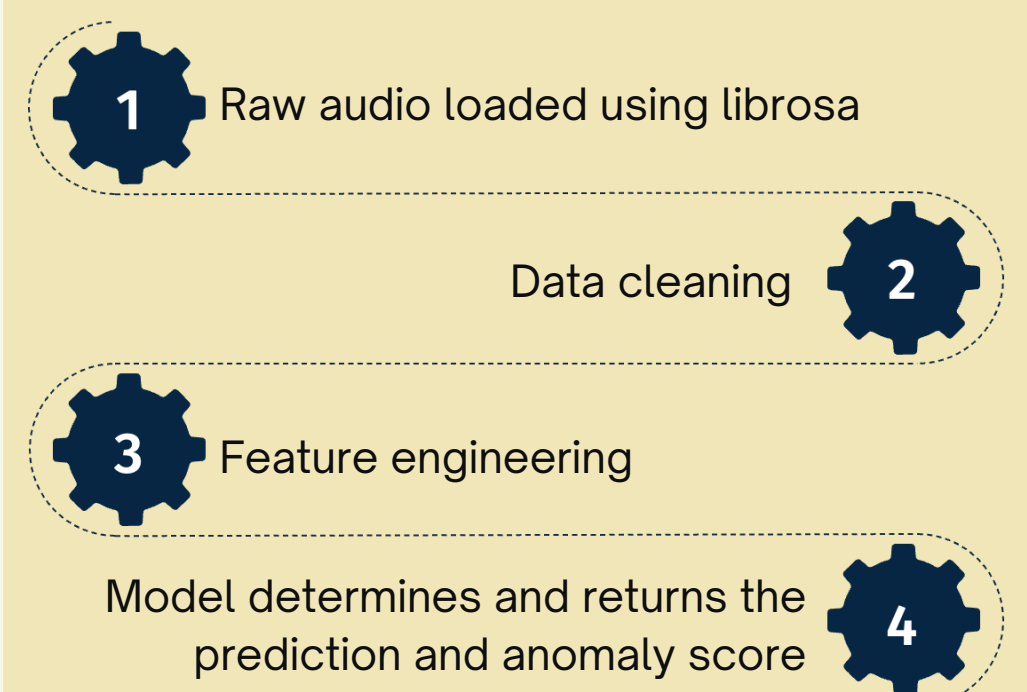
DEPLOYMENT PIPELINE



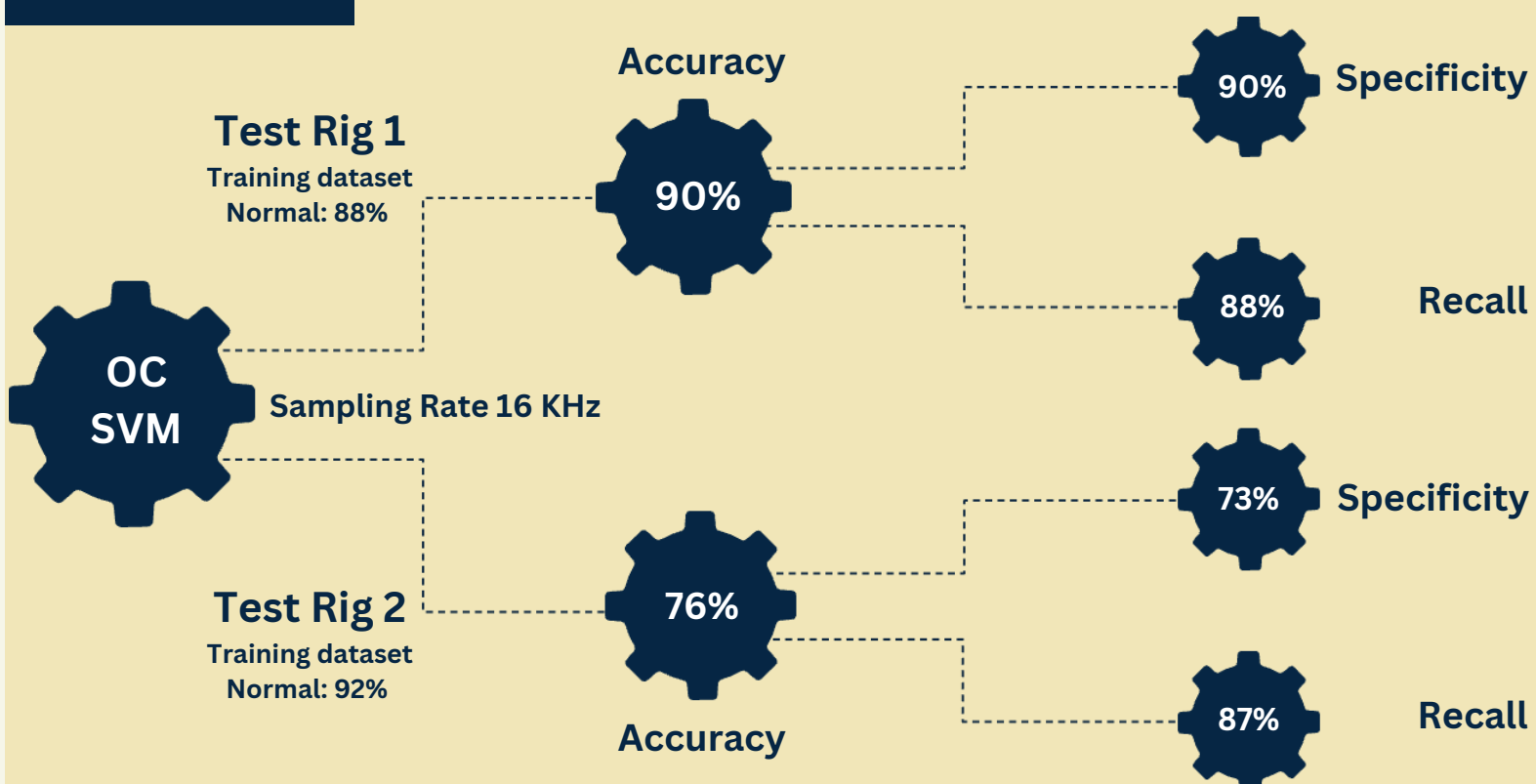
OUTPUT

Product Number	Serial Number	Test Date	Test Result	Test Cell	Score
22757	12232	2024-01-26 07:51:30	█	10422	0.13
22743	11308	2024-01-26 07:29:32	█	10421	0.01
22756	16010	2024-01-26 07:09:14	█	10422	0.02
22744	10506	2024-01-26 07:02:38	█	10421	0.00
22757	12229	2024-01-26 06:41:48	█	10422	-0.08
22744	10500	2024-01-26 06:32:55	█	10421	-0.01
22756	15996	2024-01-26 04:54:54	█	10422	-0.08

MODEL PIPELINE



RESULTS



CHALLENGES

- Data imbalance: more positive instances than negative.
- Lack of explainability, which will cause lack of trust.

FUTURE WORK

- Use data augmentation to create a more balanced dataset.
- Use Explainable AI to understand how the model works.

RESOURCES/TOOLS

- Puhti
- Research papers
- Datasets from Volvo
- The Sound of AI channel

REFERENCES

- L. Guo, Y. Wang, J. Ju, and Z. Liu, "Fault Diagnosis Method of Gearbox Based on Sound Pressure Signal Analysis," *J Phys Conf Ser*, vol. 1748, no. 4, p. 042044, Jan. 2021, doi: 10.1088/1742-6596/1748/4/042044.
- M. K. Singh, S. Kumar, and D. Nandan, "Faulty voice diagnosis of automotive gearbox based on acoustic feature extraction and classification technique," *Journal of Engineering Research*, vol. 11, no. 2, p. 100051, Jun. 2023, doi: 10.1016/j.jer.2023.100051.