Leakage Detection on Infrared Images of Under Pipes

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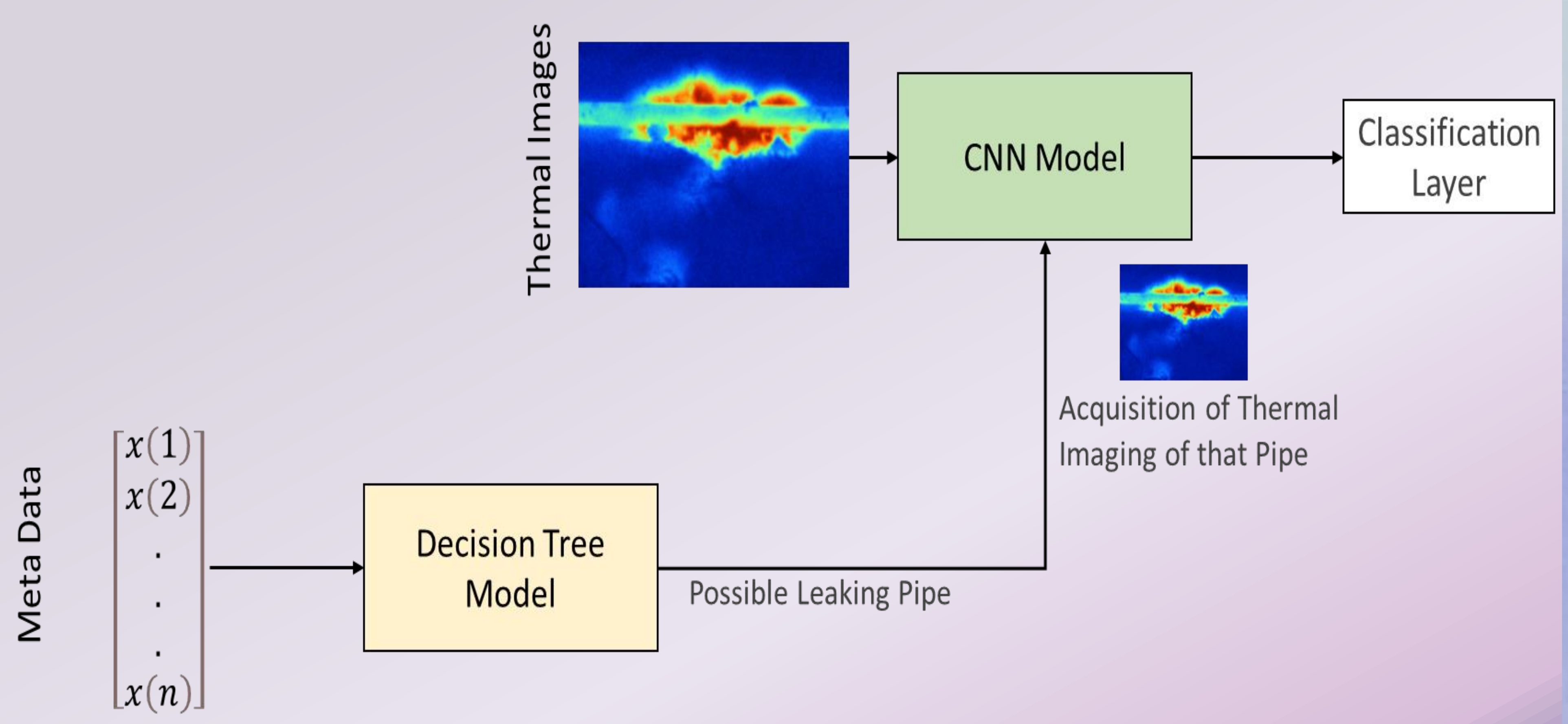
INTRODUCTION

Leakage in pipelines carrying water or hydrocarbon fluids is one of the risks that can result in serious injuries, environmental disasters, and a significant economic effect. A preventive, non-destructive inspection method can help to avoid a situation like this.

OBJECTIVE

Infrared technology (thermal imaging technology) is a non-destructive assessment for detecting and assessing the severity of a leak by employing sensors to identify the wavelength of infrared light emitted from an object's surface.

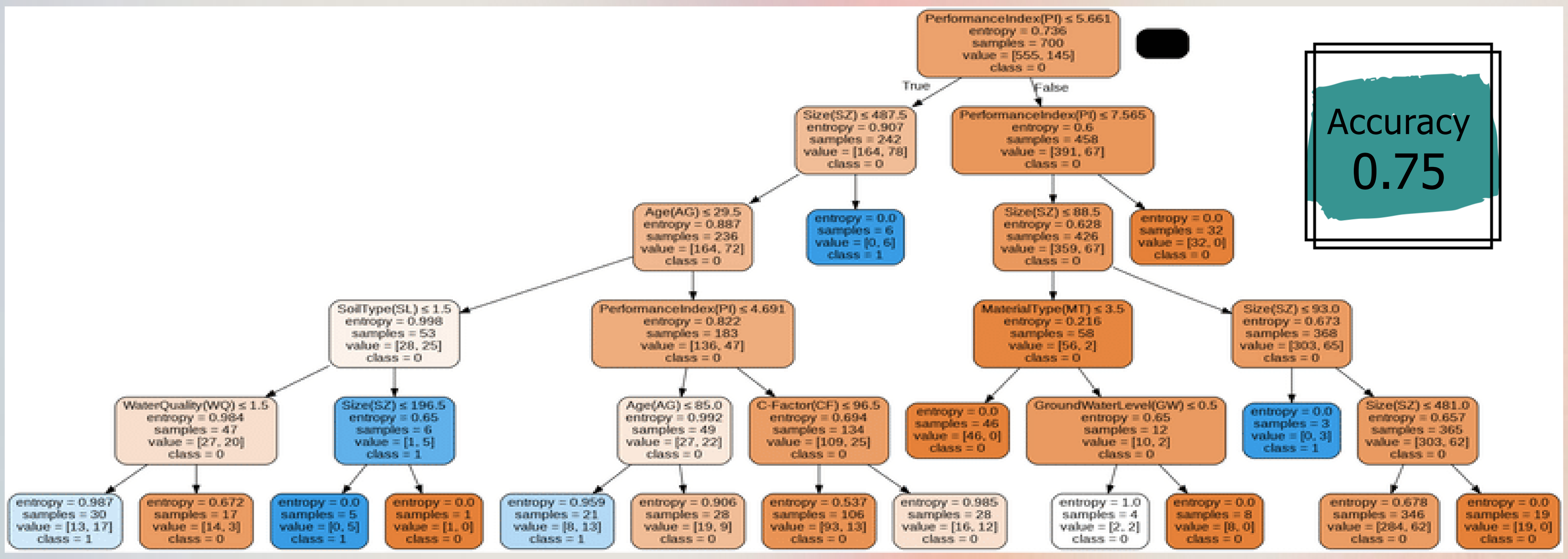
METHODOLOGY



A hybrid model is developed to identify leakages in 2 phase to increase the performance of the system. In the first phase, the metadata of the pipes is being tested on the decision tree and then if the pipe is classified as 'Failure' then the thermal image of that pipe is acquired and sent to the CNN model to detect the leakage.

RESULTS

	Age (AG)	MaterialType (MT)	Size (SZ)	Installation Quality (IQ)	SurfaceType (SR)	Ground WaterLevel (GW)	SoilType (SL)	C-Factor (CF)	BreakRate (BR)	WaterQuality (WQ)	Performance Index (PI)	FailureProb (FP)	Failure (F)
pipe1	43	Concrete	184	Good	Asphalt	Moderate	Non-aggressive	106	0.340569	Fair	6.6031	0.288634	N
pipe2	11	Concrete	370	Good	Unpaved	Deep	Non-aggressive	58	0.036081	Good	8.83205	0.035437	N
pipe3	64	PVC	123	Poor	Asphalt	Deep	Aggressive	159	0.05535	Fair	6.01225	0.053846	N
pipe4	53	Asbestos	420	Poor	Unpaved	Deep	Moderate	196	0.556447	Fair	6.0593	0.426758	N
pipe5	47	Asbestos	403	Fair	Foot path	Moderate	Aggressive	19	0.35507	Good	5.6138	0.298876	N



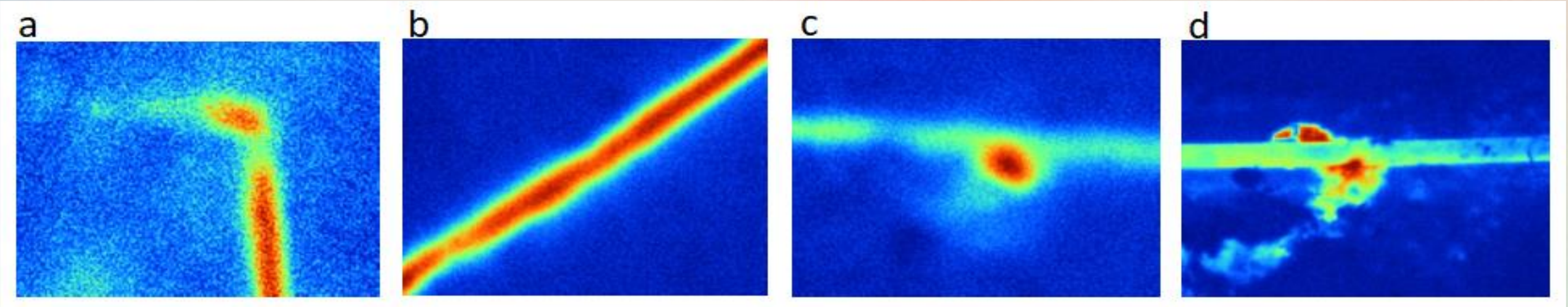


Figure 8: Example Thermal Image data. a-b is No Leak, c-d Leak cases

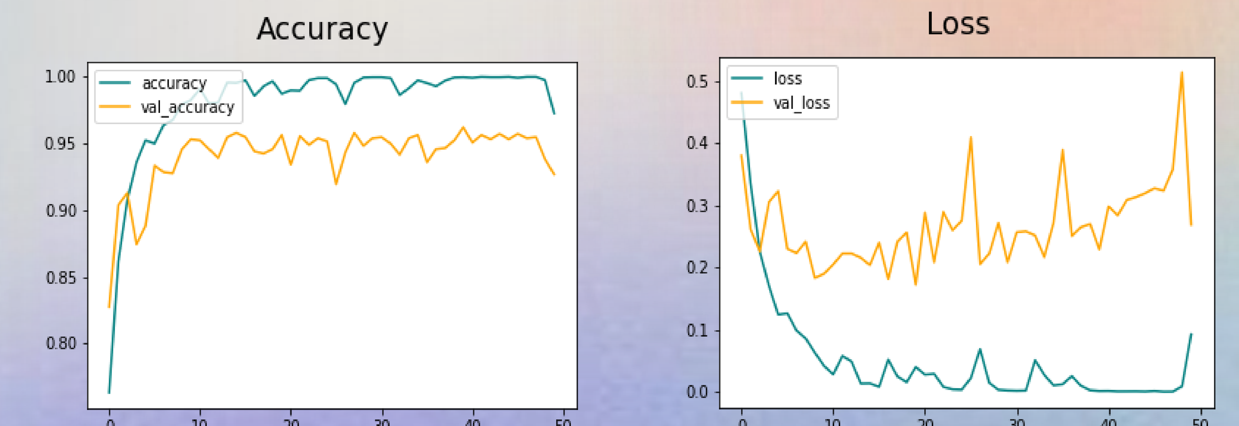


Figure 10: Accuracy and Loss Plot for 50 epochs

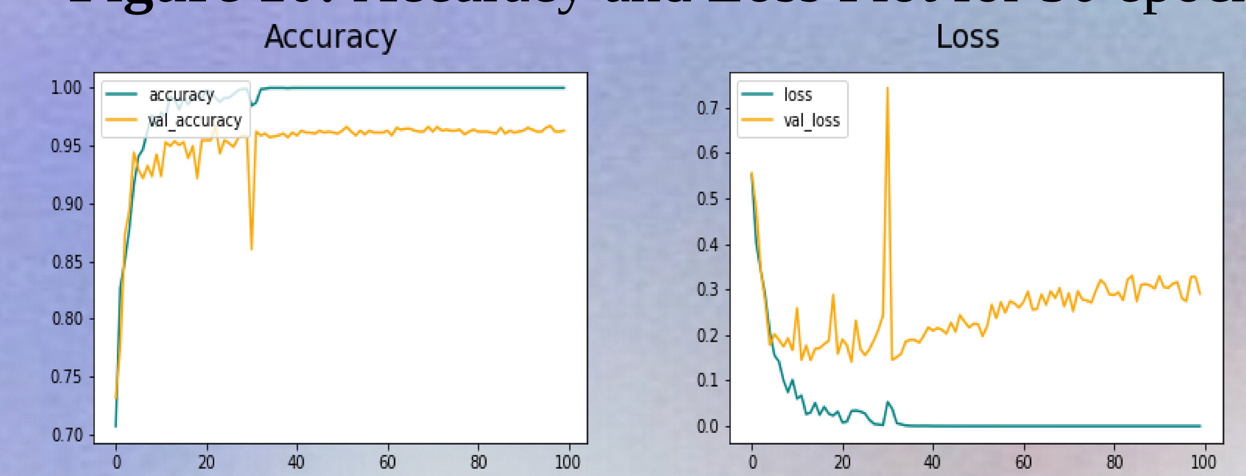


Figure 11: Accuracy and Loss Plot for 100 epochs

Accuracy 96.7%

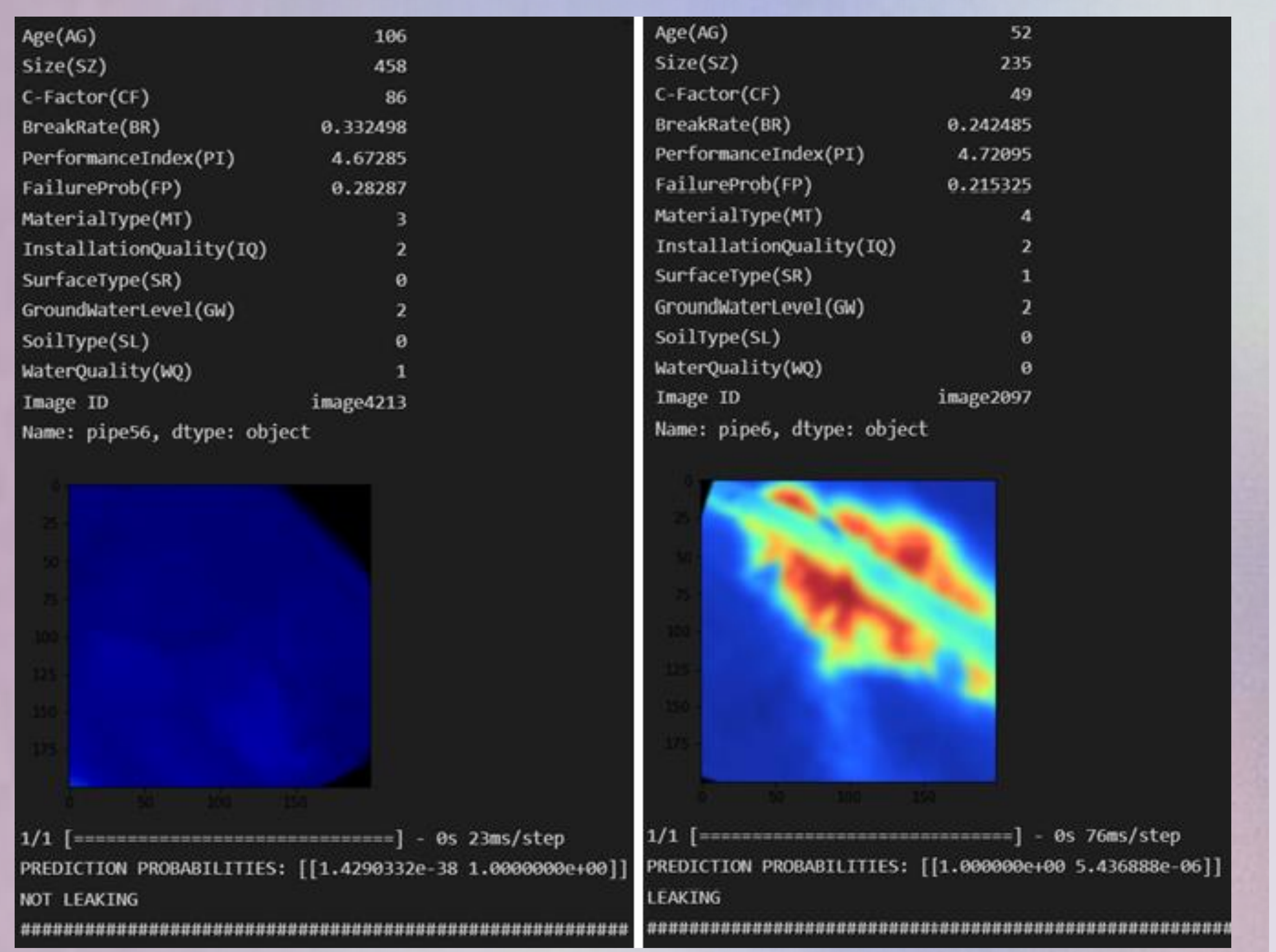


Figure 13: Sample output of leaking and not leaking case

CONCLUSION

If this project could be adapted to real world water, gas and other hydrocarbon fluid networks, it will not only contribute economically (reducing the cost for digging and changing, repairing the pipes), to several institutions that operate and control buried pipes, but also ensure that leaks in pipes are detected early, without the need for open inspection and before they become harmful to the environment and humanity.

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