

Seeing Spills:

Wastewater visual trend analysis for human vision and computer vision POC

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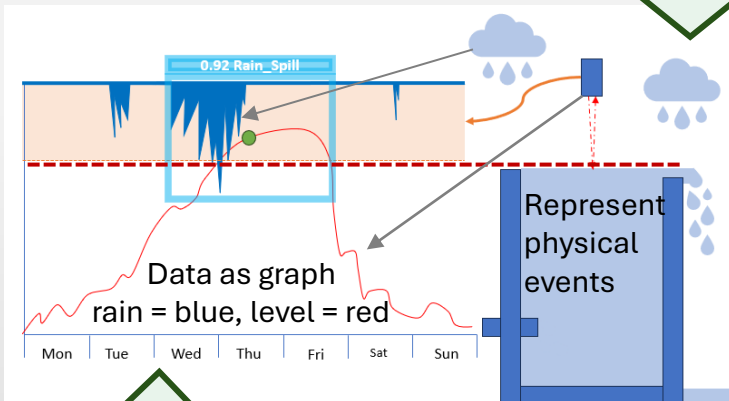
Introduction

Wastewater companies collect huge amounts of data. This project explored whether spill events could be categorised visually instead of numerically; by looking at line graphs, readable by humans and computer vision.

Aim: Classify wet or dry weather spill visually.

The project tested an existing deep-learning computer vision model called '**You Only Look Once**' (YOLOv11n), from Ultralytics, which normally detects 'objects' in photos.

Here it was used in a more unusual way: categorising the visual data patterns. Bounding boxes show classes and confidence score. The level should class as spill once it crosses the threshold, The presence of rain should result In a wet spill classification. Concept:



Experiment
Inputs

E1: straight lines test

E2: synthetic spills test

E3: raw level rain data

Using R: Graph
Generation

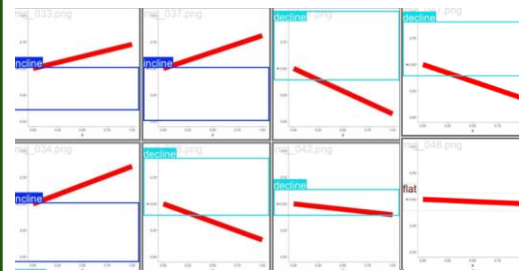
Train and Validate
Model YOLOv11n

Test Model on
unseen images

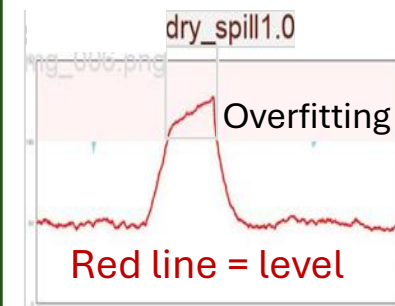
Process Flow Diagram

Increasing visual
complexity experiments

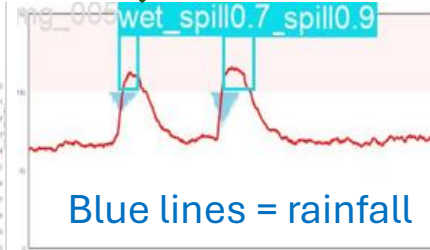
Experiment 1



Testing the concept,
software & hardware,
YOLO successfully
labelled straight lines
as **incline**, **decline** &
flatline



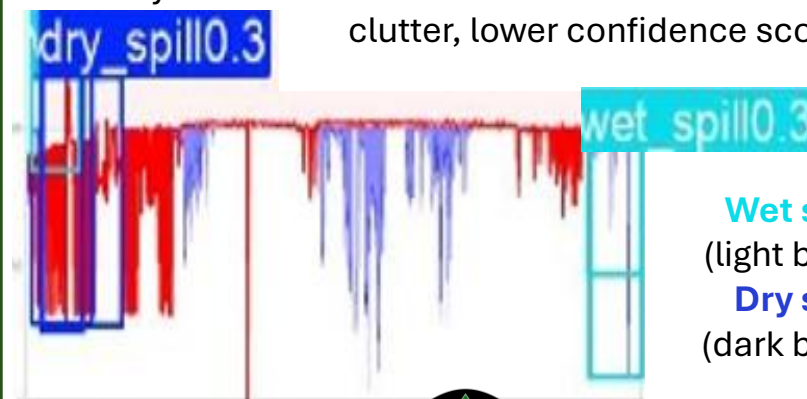
Experiment 2



Using code generated level & rain data to synthesise wet (blue) and dry (grey) spills; YOLO had good confidence scores. The pink shaded area represents spill threshold.

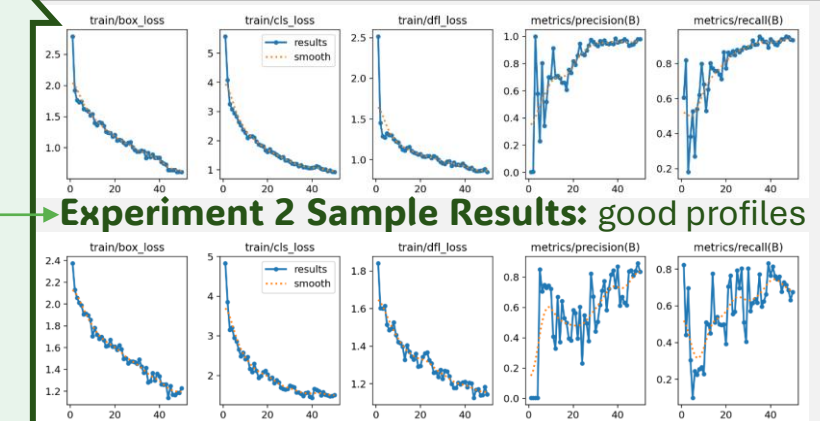
Experiment 3

Anonymised raw data was noisier with more visual clutter, lower confidence scores.



Conclusion

Results show potential; but larger training datasets, further development, and expertise input required. Good metrics from synthetically generated graphs but the model learnt the shapes too well. The raw data was harder to learn; dry spill events were rare and short-lived; wet spills were varied & visually cluttered.



Experiment 2 Sample Results: good profiles

Experiment 3 Sample Results: less stability

Key Reference: Ultralytics, "Ultralytics YOLO11," 30 September 2024. [Accessed March 2025] Available: <https://docs.ultralytics.com/models/yolo11#overview>.



Seeing Spills Prototype

Please select your interpretation below:

Escalate to Senior Analyst

True Positive: **Valid Spill**

False Positive: **Invalid Spill**

True Negative: **No Spill**

False Negative: **Missed Spill**

Additional Comments:

Please select an action:

Unsure - Escalate to Senior Analyst

Send Cancel

Screen overlay detect

Labelled static images

Wireframe concept

Potential
Outputs