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DEVELOPMENT OF AN ARTIFICAL INTELLIGENCE-BASED WEB PLATFORM FOR COUNTING AND DETERMINING THE ASPECT RATIO OF MICROPLASTICS

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Introduction

Microplastics are emerging contaminants whose quantification and morphological characterization remain challenging due to the subjectivity of manual analysis and the high cost of conventional methods. In this context, the MAS (Microplastic Analysis System) platform uses artificial intelligence and computer vision to automate particle counting and aspect ratio determination, providing a more accessible, efficient, and reproducible approach to microplastic analysis.

Objectives

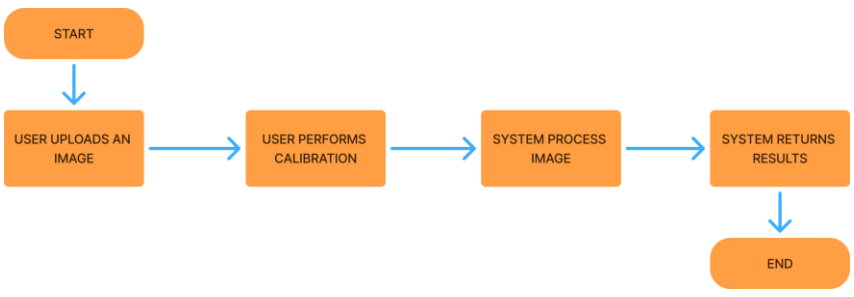


Figure 1 – Flowchart of the automated analysis process. The diagram represents the key stages of the system, from user interaction (image loading and calibration) to computational processing and the final generation of results.

Methodology

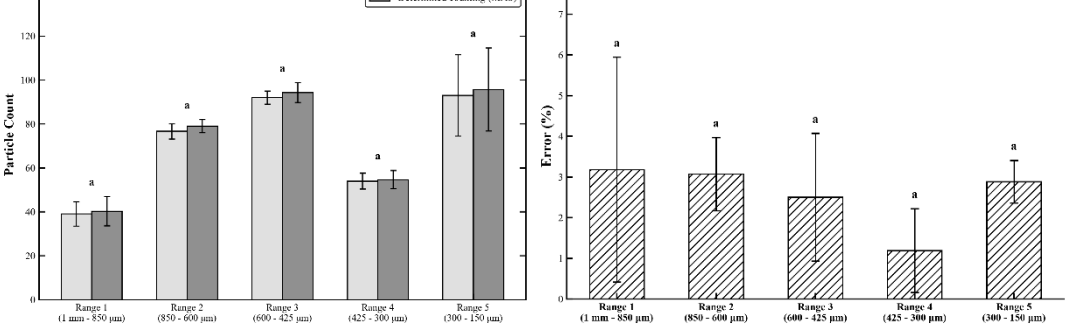


Figure 2. Comparison between manual and automated particle counting (a) and percentage counting error (b) across different particle size ranges.

(1)

$$S = \frac{\sqrt{\Delta x^2 + \Delta y^2}}{5mm}$$

Eq 1. Euclidean distance calculation used for spatial scale calibration (S) in pixels/mm based on a 5 mm reference line.

Results and Discussion

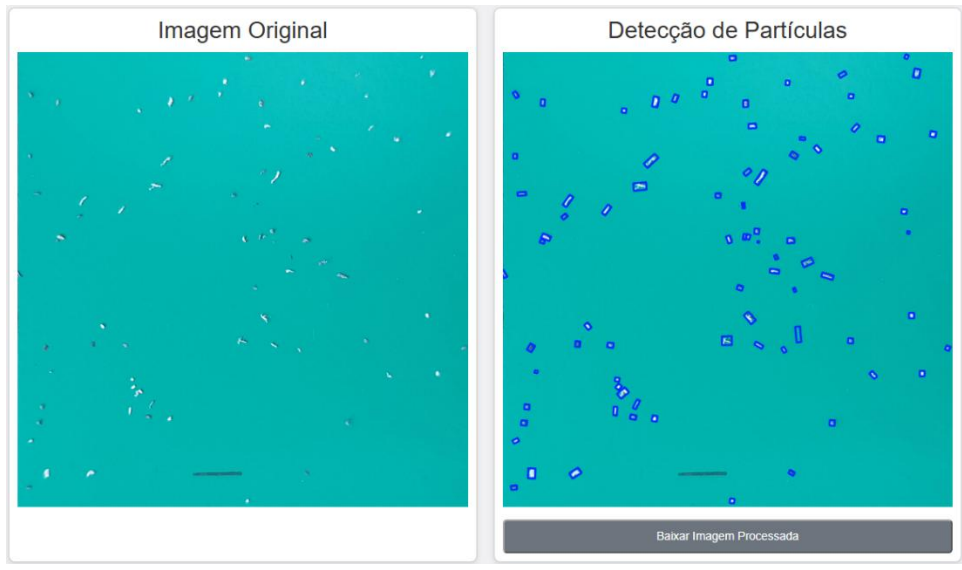


Figure 3. MAS web platform interface showing the original microplastic sample image (left) and automated particle detection using the YOLO model (right).

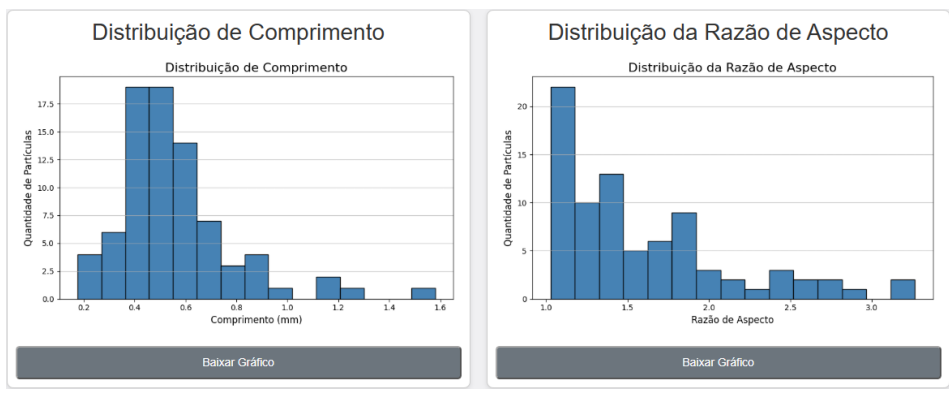


Figure 4. MAS web platform interface showing the length distribution (left) and aspect ratio distribution (right) histograms of the detected microplastic particles.

Conclusions

The MAS platform demonstrated high performance in automated microplastic counting and aspect ratio determination, achieving an average error of approximately 5% compared to manual inspection. The system provided reliable and reproducible measurements across all evaluated particle size ranges (150 μm to 1 mm) and exhibited high stability against lighting, shadow, and compression variations. These results highlight its potential as an accessible, web-based tool to improve efficiency, reproducibility, and standardization in microplastic characterization.

References and Acknowledgments

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