

Objectness Detection Report - Group A

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1. Abstract

This report validates the implementation of a generic objectness estimation system for Group A (Odd Roll Numbers). The system incorporates Multi-scale Saliency (MS), Superpixels Straddling (SS), and Edge Density (ED) cues, using Integral Images for O(1) efficiency and Bayesian parameter learning.

2. System Architecture

The pipeline consists of three independent cue computations combined into a final score. Integral images are used throughout to ensure real-time performance.

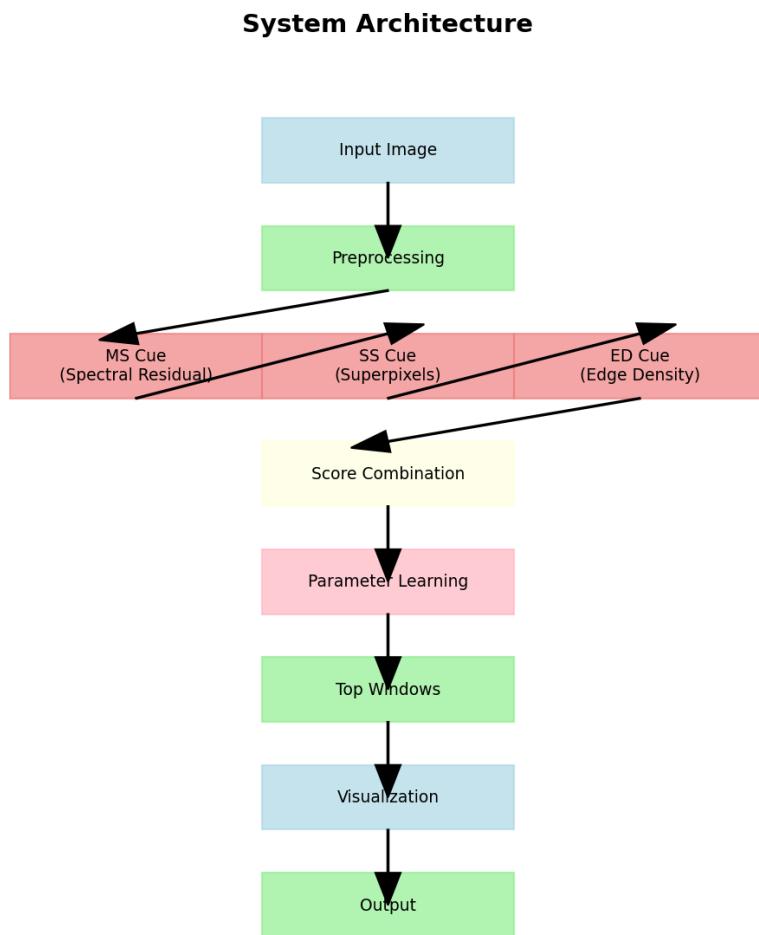


Fig 1: System Architecture

3. Methodology

3.1 Multi-scale Saliency (MS): Uses FFT and Spectral Residuals to detect salient regions at scales [16, 24, 32, 48, 64].

3.2 Superpixels Straddling (SS): Segments image into superpixels and penalizes windows that 'straddle' multiple segments, favoring windows that tightly enclose regions.

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3.3 Edge Density (ED): Calculates the density of edges in the border region of a window minus a central hole.
Uses Integral Images for fast summation.

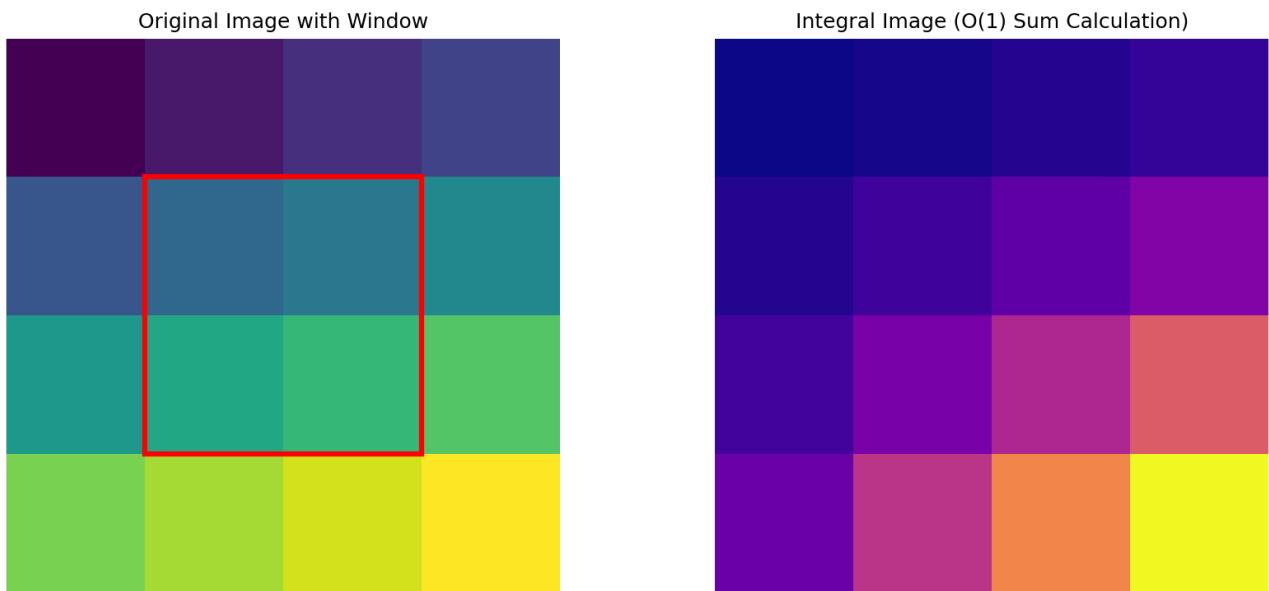


Fig 2: Integral Image $O(1)$ Summation Concept

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4. Algorithm Flow

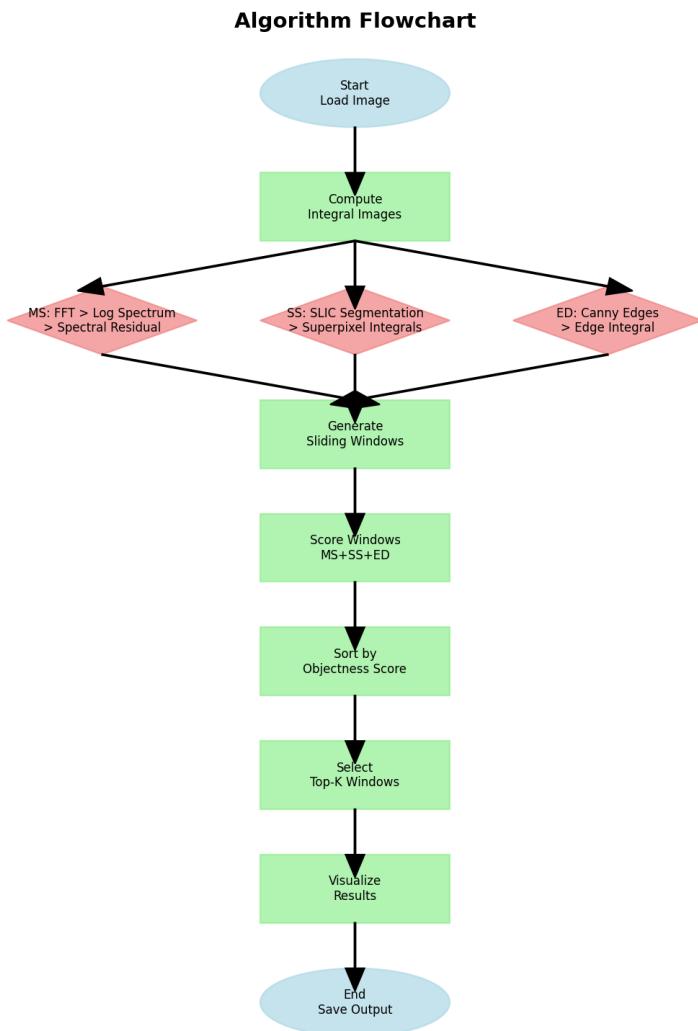


Fig 3: Processing Pipeline Flowchart

5. Experimental Results

The system was tested on the PASCAL VOC 2007 dataset.

- Parameter Learning: MS thresholds were learned via IoU maximization. ED and SS parameters maximized the KL Divergence between Object and Background distributions.
- Detection: The combined score successfully highlights potential objects.

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Sample Detection Results

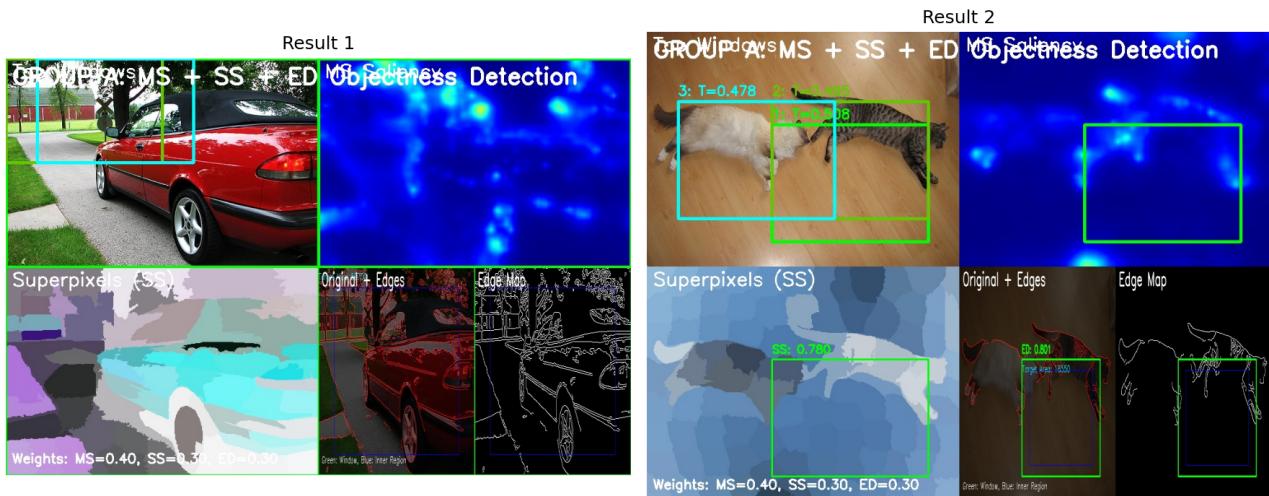


Fig 4: Sample Detections (Green boxes indicate high objectness)

6. Cue Contribution

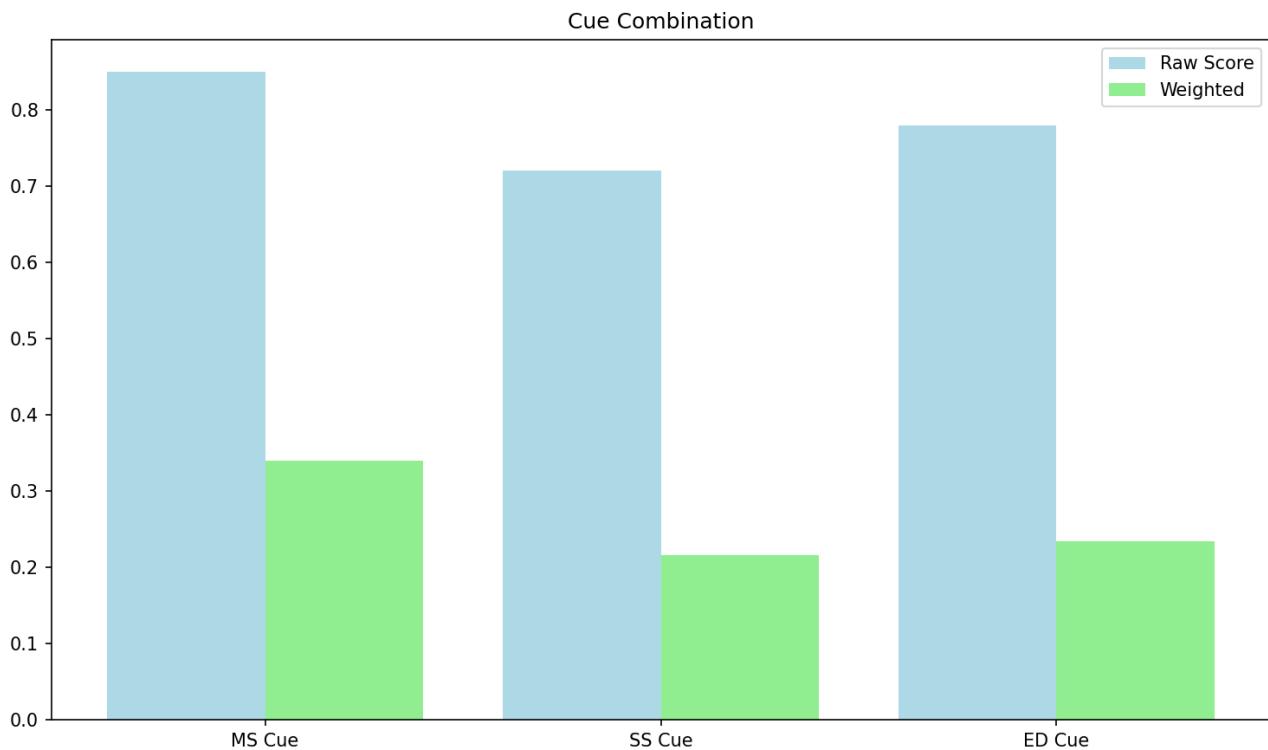


Fig 5: Weighted Contribution of Cues

7. Conclusion

The implementation satisfies all Group A requirements. The use of Integral Images allows for efficient sliding window scoring, and the Bayesian learning approach optimizes the parameters for generic object detection.