

Erythroblast Cells: ML Models for Multiclass Classification in Single Image and Mixed Magnification.

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Overview

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Task Overview & Parameters

Task Overview

- Test the trained model on images from an external dataset.
- Vary parameters—color, scale (magnification), rotation, etc.—and evaluate performance.

Parameter Settings

| Parameter | Description |
|-------------------------|-----------------------------------|
| Original | No transformation |
| Grayscale | Remove color (preserve α) |
| Light Blur | Gaussian kernel 5×5 |
| Heavy Blur | Gaussian kernel 15×15 |
| Brightness \uparrow | $\alpha = 1.3, \beta = +30$ |
| Brightness \downarrow | $\alpha = 0.7, \beta = -30$ |
| Contrast \uparrow | $\alpha = 1.5$ |
| Contrast \downarrow | $\alpha = 0.7$ |
| Noise | Mixed Gaussian + Poisson |
| Scale \downarrow | $0.8 \times$ original size |
| Scale \uparrow | $1.2 \times$ original size |
| Rotation | Random $\pm 45^\circ$ |

Findings and Results

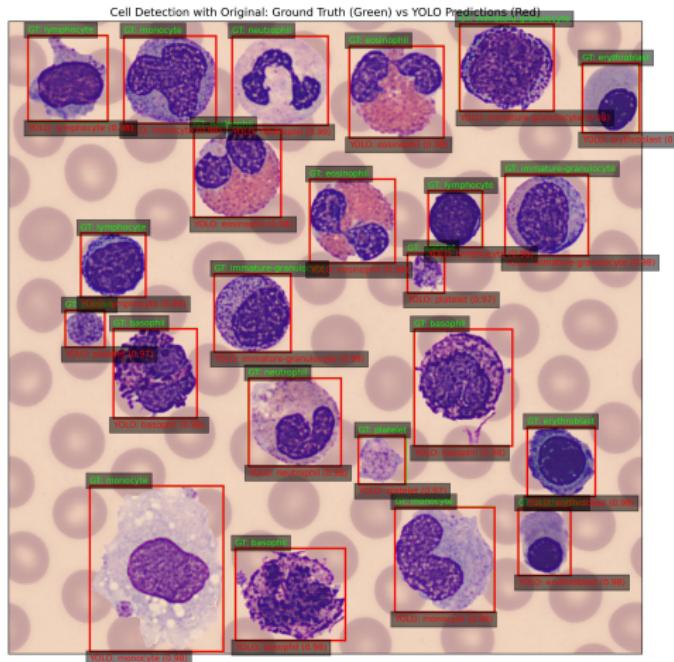


Figure: Detection results on an image synthesized from test segments

Findings and Results

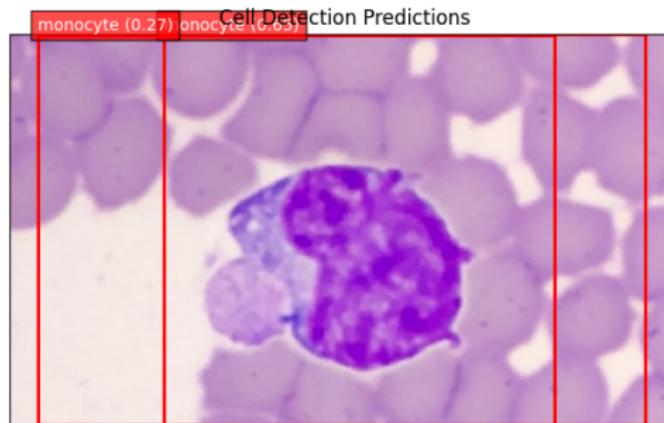


Figure: Detection results on a sample image from a different dataset

Ground truth: Monocytes. Bounding boxes are incorrect, indicating poor model performance on external datasets.

Findings and Results

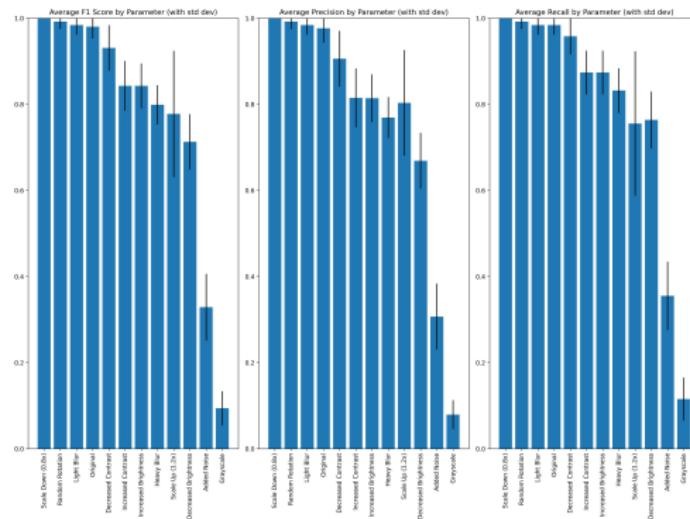


Figure: Summary of parameter effects on detection performance

This plot shows that predictions on grayscale images perform the worst, demonstrating that color is a more critical parameter than magnification or blur.

Findings and Results

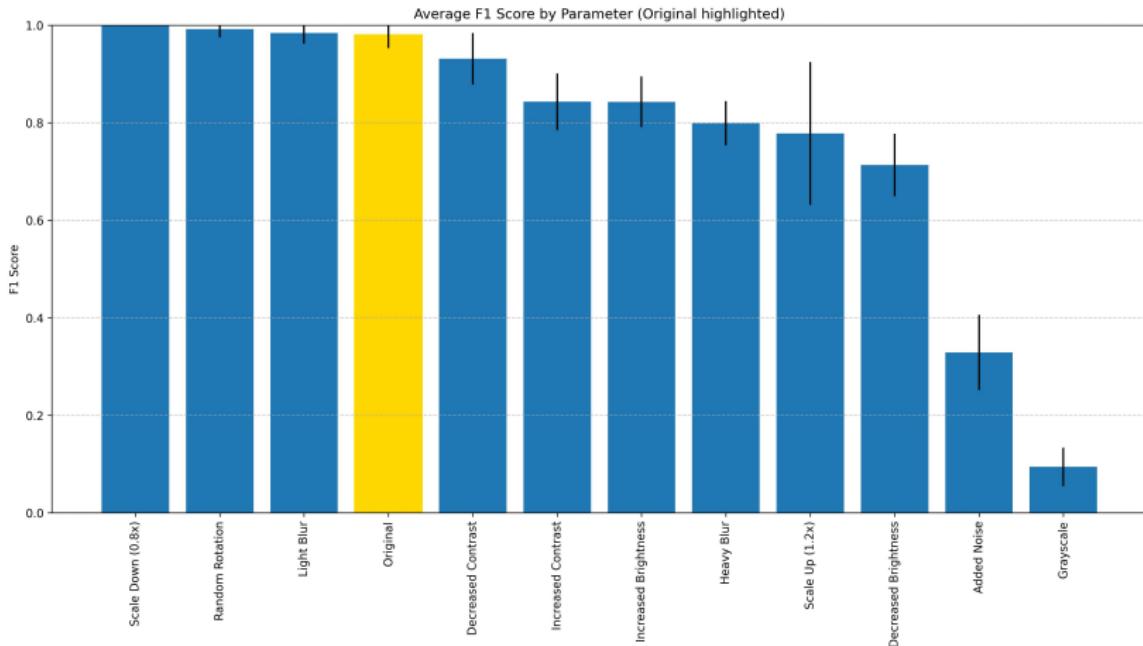


Figure: Summary of parameter effects on detection performance

Findings and Results

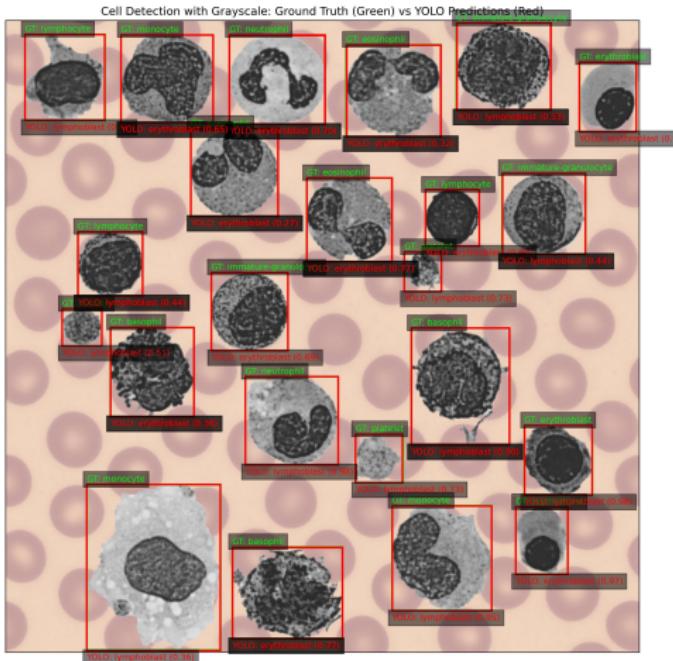


Figure: Detection on an image created with grayscale segments

Findings and Results

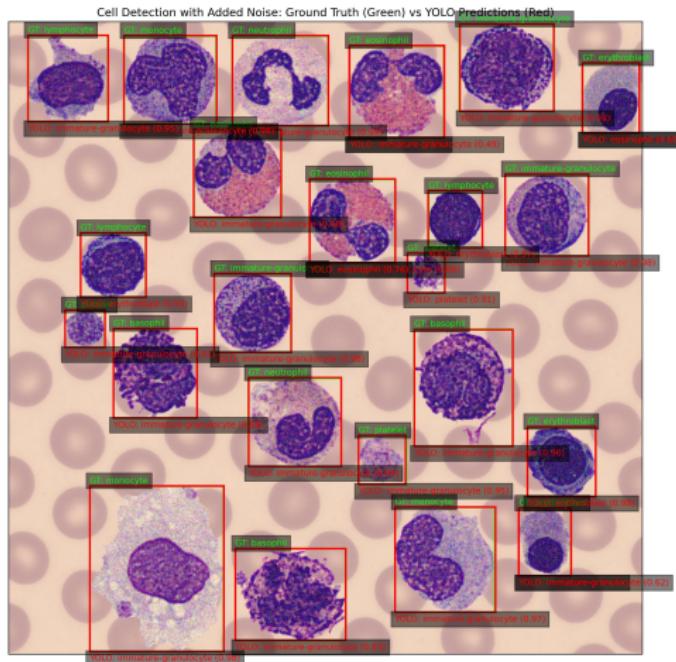


Figure: Detection on an image created with noisy segments

Findings and Results

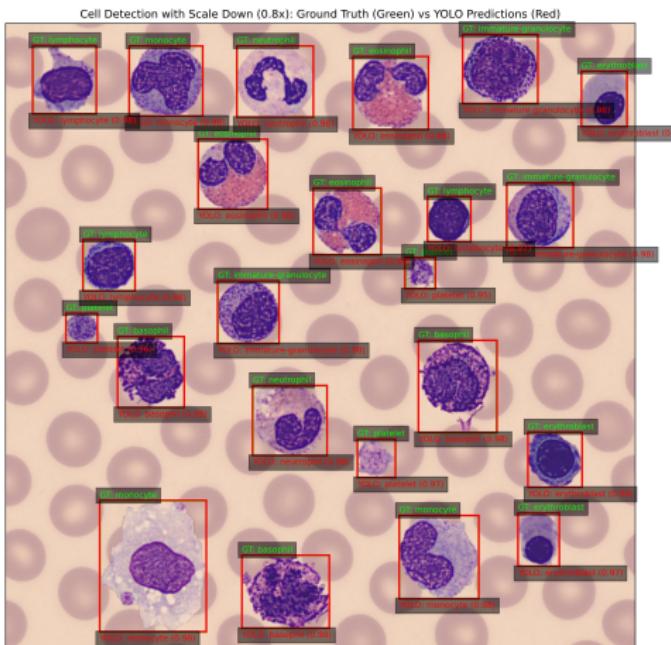


Figure: Detection on an image created with scaled down segments

Findings and Results

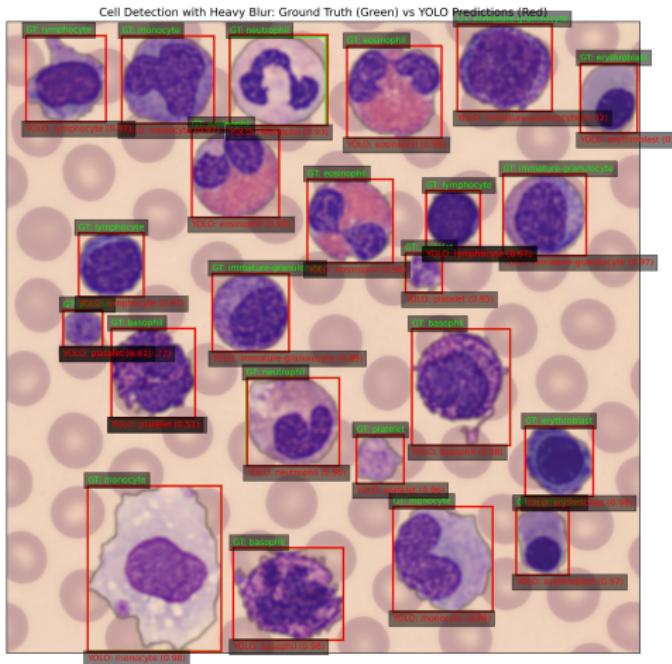


Figure: Detection on an image created with heavily blurred segments

Findings and Results

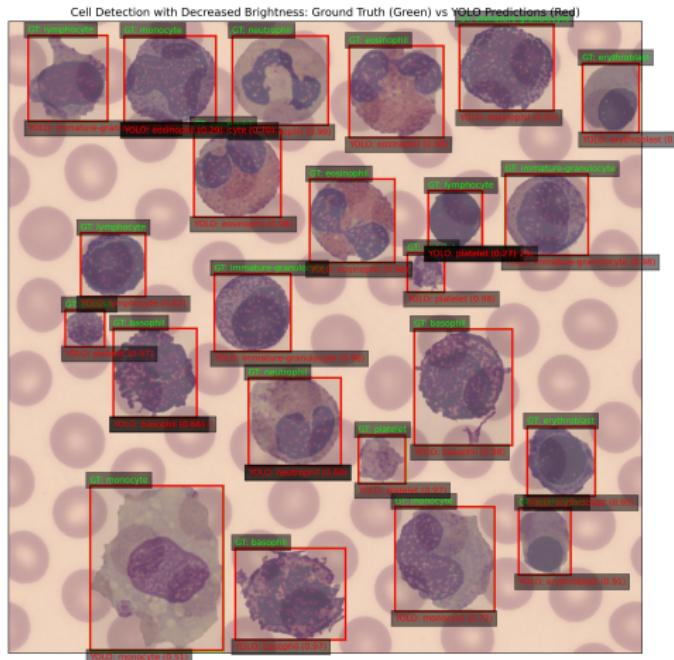


Figure: Detection on an image created with low brightness segments

Conclusions

- **Color-based variations** (grayscale conversion, contrast and brightness adjustments, realistic noise) caused the largest performance degradation.
- **Geometric transforms** (scaling, rotation, light/heavy blur) had comparatively smaller effects on F1, precision, and recall.
- Preserving natural color information is critical for robust YOLO-based cell detection.
- *Implication:* Incorporate richer color augmentations during training to improve generalization on varied datasets.