**EXECUTIVE SUMMARY**

*Deep Learning for Malaria Parasite Detection and Classification*

**Key Highlights**

* [OK] Detection Accuracy: 93.10% mAP@50 using YOLO11
* [OK] Classification Accuracy: 98.80% for species identification (EfficientNet-B1)
* [OK] Real-time Capability: ~19 FPS on RTX 3060 GPU
* [OK] Efficiency: 70% storage reduction, 60% training time reduction vs traditional methods
* [OK] Dataset: MP-IDB (209 images per task, 4 classes each)
* [OK] Models Trained: 36 total (3 YOLO × 6 CNN × 2 datasets)

**Performance Summary**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Task** | **Best Model** | **Accuracy** | **Balanced Acc** | **Clinical Readiness** |
| Species ID | EfficientNet-B1 | 98.80% | 93.18% | High [OK] |
| Stage ID | EfficientNet-B0 | 94.31% | 69.21% | Moderate |
| Detection | YOLO11 | 93.10% mAP | N/A | High [OK] |

**Clinical Impact**  
This automated system can support: (1) High-throughput screening in endemic regions, (2) Training for novice microscopists, (3) Quality assurance in diagnostic labs, (4) Species-specific treatment guidance, and (5) Epidemiological surveillance.

**Immediate Next Steps**

* • External validation on independent datasets (NIH, local hospitals)
* • Improve minority class performance (gametocytes, P. ovale)
* • Clinical validation study with expert pathologists
* • Journal publication (target: IEEE Access, Scientific Reports)
* • Deployment as web application for field testing