

ADVANCED VIDEO SEGMENTATION TOOL USING PyQt5 AND OpenCV

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ABSTRACT

This paper presents the development of an advanced video segmentation tool leveraging PyQt5 for the graphical user interface and OpenCV for real-time object detection. The system enables users to load videos, detect blue and white objects, and adjust detection sensitivity through an intuitive interface. Key features include live object counting, real-time playback, and robust error handling. The methodology employs HSV color space filtering and multithreaded processing to ensure smooth user experience and accurate detection. Experimental results demonstrate approximately 90% detection accuracy for clear colors at real-time speeds of 30 FPS, with multithreading achieving up to 13x performance improvements. The tool provides a practical solution for surveillance, research, and industrial applications.

Keywords: *Video segmentation, PyQt5, OpenCV, real-time object detection, HSV filtering, multithreading*

1. INTRODUCTION

Real-time video segmentation and object detection have become crucial technologies in computer vision, with applications spanning surveillance systems, sports analytics, industrial inspection, and educational demonstrations. The increasing demand for efficient video processing tools has highlighted the need for solutions that balance computational performance with user accessibility. Traditional approaches often suffer from limited usability, lack of real-time feedback, or computational inefficiency when processing high-resolution video streams. This paper introduces a comprehensive Python-based graphical tool that addresses these limitations by combining the robust interface capabilities of PyQt5 with the powerful image processing functions of OpenCV. The system architecture prioritizes responsive performance through advanced multithreading techniques, making it suitable for real-world applications requiring both accuracy and speed. The tool's primary objective is to provide an intuitive platform for detecting blue and white objects in video streams while offering live feedback and adjustable sensitivity controls. The significance of this work lies in its contribution to accessible video processing solutions that bridge the gap between complex computer vision algorithms and practical user applications. Unlike existing solutions that often require extensive technical knowledge, this tool provides a user-friendly interface while maintaining professional-grade performance capabilities.

2. LITERATURE REVIEW

Video object detection has evolved significantly from traditional computer vision approaches to deep learning methodologies. Early methods relied on background subtraction and color thresholding, which were effective in controlled environments but struggled with complex scenarios. The introduction of YOLO and SSD models revolutionized real-time detection but often require substantial computational resources.

PyQt5 has established itself as a leading framework for cross-platform desktop applications, particularly in scientific computing environments. Performance analysis demonstrates that multithreading implementations in PyQt5 can achieve significant improvements in video processing pipelines, with proper thread management resulting in performance gains of up to 379%. The