Optical KLT Tracking for Multiple Objects in a Given Scene

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***Abstract*— This project focuses on enhancing object tracking in dynamic scenes using the Kanade-Lucas-Tomasi (KLT) feature tracker. KLT tracking is a widely used method for tracking objects by focusing on detecting and tracking feature points in video sequences. This project aims to adapt and optimize KLT tracking for multiple objects in complex scenes, addressing challenges such as occlusions, varying object speeds, and background clutter.**

The core of this project involves implementing the KLT algorithm, enhancing its capabilities to track multiple objects simultaneously, and evaluating its performance in various real-world scenarios. This includes handling object occlusions, reappearance, and maintaining robustness across different lighting conditions and scene complexities.

Keywords—KLT Tracking, Multiple Object Tracking, Feature Points, Computer Vision, Motion Estimation, Real-time Processing

I. Objectives

This project aims to satisfy the below objectives:

1. **Implementation of KLT Tracker:** Develop and implement the KLT tracking algorithm for robust feature point tracking in video sequences.
2. **Multi-Object Tracking Enhancement:** Adapt the KLT algorithm to handle multiple objects, ensuring accurate tracking even when objects overlap or occlude each other.
3. **Performance Evaluation:** Evaluate the effectiveness of the KLT tracker in various scenarios, including varying object speeds, lighting conditions, and scene complexities.
4. **Real-Time Processing:** Optimize the tracking system for real-time performance, focusing on computational efficiency and processing speed.

II. Current State of the Art Methods

A. KLT Tracking Overview:

- **Kanade-Lucas-Tomasi (KLT) Tracker (1991):** Utilizes feature points detected by the Shi-Tomasi method and tracks these points using optical flow constraints. Known for its robustness and efficiency in tracking sparse feature points.

B. Advanced Tracking Methods:

- **Feature-Based Tracking:** Utilizes various feature detection and matching techniques to enhance tracking accuracy and robustness.
- **Deep Learning-Based Methods:** Recent advancements include integrating deep learning techniques to improve feature detection and tracking accuracy.

III. Importance of Proposed Project

- **Enhanced Object Tracking:** Improves tracking capabilities in complex scenes by addressing limitations of standard KLT tracking methods.
- **Real-World Applications:** Valuable for applications in surveillance, autonomous vehicles, and robotics where accurate multi-object tracking is crucial.
- **Handling Complex Scenarios:** Provides solutions for tracking in cluttered environments, occlusions, and dynamic backgrounds.
- **Performance Efficiency:** Focuses on achieving real-time performance while maintaining tracking accuracy.

IV. Work Plan

Week	Task	**Deliverables**
1	Data Collection and Preparation	-Data Collection and Preparation -Initial project setup and planning
2	KLT Algorithm Implementation	-Adapted KLT tracker for multi-object use -Initial test results on selected scenes
3	Optimization and Refinement	- Optimized KLT tracker for real-time use
4	Comprehensive Testing	Comprehensive evaluation on diverse scenes

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