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Multi-Objects Detection Using Thermal IMAGING

Dr. K.Chitra[1], Ms. Sharmitha Shree A S[2]

[1] Project guide

Department of Computer Science , Sri Krishna Adithya College of Arts and Science, kovaipudhur, Coimbatore .

ABSTRACT :

This paper discusses the work on detecting multi-objects such as person and car in thermal image captured during night time using deep learning architecture. Thermal images are superior to the visible images when it comes to the amount of useful information required to detect the objects during night time. Contrast to that, visible image does not provide useful information in darkness. Hence, it is better to use thermal images to detect objects present in darkness.

Introduction :

Object detection is a popular direction in Computer Vision and digital image processing, and is widely used in many fields such as autonomous driving, disaster rescue, robot navigation , intelligent video survillence, etc. Object detection is also a fundamental type of algorithm in the field of pan – identity recognition, and plays a crucial role in subsequent tasks such as face recognition, gait recognition ,crowd size assessment, and instance segmentation. However, for images taken at nigh time or those with insufficient illumination conditions.

Domain Specification

Domain: Image Processing .Here we use thermal imaging to detect the object while in night time.

Eg: Detect heat loss, poor insulation, and water leaks.

Existing System

Multi-object detection using thermal imaging involves identifying and classifying multiple objects within a scene captured by a thermal camera. It's commonly used in various applications such as surveillance, automotive safety systems, search and rescue operations,and industrial monitoring. Due to factors like temperature,environmental conditions (e.g., weather, lighting), occlusions, and background clutter, often requires robust algorithms and careful optimization of system parameters.

Disadvantages

- Limited dataset diversity
- Lack of real-time performance
- Sensitivity to environmental factors
- Difficulty in object discrimination
- Hardware dependency
- Limited robustness to occlusions

Proposed System :

The project tries to develop and combine algorithms which lead to an efficient system in terms of detection, tracking and classification of objects. The system should work in real time and for prerecorded videos as well. The main aim of the project is to build an Intelligent Traffic Analysis & Monitoring System. The detected objects should also be classified based on their type, using a robust selection of features. Like object detection, speed estimation, traffic flow direction determination also need to be implemented.

Advantages

- Improved Accuracy: The proposed system aims to achieve higher accuracy in object detection, especially in challenging conditions or complex scenes.
- Efficiency: By optimizing computational resources and implementing real-time processing techniques, the proposed system offers improved efficiency .
- Robustness: The robustness of the detection system, making it more reliable in various operating conditions.
- Cost-effectiveness: The proposed system offers a cost-effective solution for multi-object detection using thermal imaging.

System Requirements :

SOFTWARE REQUIREMENTS:

- Operating System: Compatible operating system (e.g., Windows, Linux) for running the detection algorithm
- Development Environment: Software development tools (e.g., Python, TensorFlow, OpenCV).
- Deep Learning Framework: Framework for training and for object detection (e.g., TensorFlow, PyTorch)
- Integrated Development Environment (IDE): IDE for code development, debugging, and testing (e.g., Visual Studio Code, PyCharm).

HARDWARE REQUIREMENTS:

- Thermal Imaging Camera: High-resolution thermal camera with a wide field of view and adequate thermal sensitivity.
- Computer or Embedded System: A powerful computing device with a CPU, sufficient RAM, and storage capacity to process thermal images.
- Power Supply: Reliable power source to ensure uninterrupted operation.
- Connectivity: Ethernet, Wi-Fi, or cellular connectivity for data transmission and remote monitoring.
- Enclosure and Mounting: Protective enclosure and mounting hardware for outdoor or rugged environments.

Module Description

- Data collection
- Data pre-processing
- Model Selection
- Model Training Evaluation
- Parameter tuning
- Performance analysis
- Real world testing
- Documentation and reporting

Conclusion :

The goal of this project is to develop an Multiple Objection using Thermal Imaging, which is capable of operating in real-time, as well as with pre-recorded video sequences, with a good performance rate. The proposed system provides an efficient and interesting object-based video indexing and retrieval approach. It was found that the accuracy was highest for Multi- SVM, 92%, followed by Adaptive Hierarchal Multi-SVM with 88% and then the Back-propagation Algorithm, 82%. Classification of objects is done in real time providing the count for each type of object.

Future Enhancement :

While this project exploits the manipulation of the various parameters, some features may affect the optimal classification of objects more than others. Furthermore, it would be worthwhile to run this system with a feed from a greater variety of cameras, as well as using moving cameras. Most likely, this would aid in complete handling of occlusion and would lead to improved detection and classification results. Data storage should be as efficient as possible, in spite of having a large number of training samples.