論　文　の　要　旨

題　目　　A Study on High-speed Stereo Multi-object Tracking Using Ultra-fast Active Vision

（超高速アクティブビジョンを用いた高速ステレオ複数物体追跡の研究）

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This doctoral dissertation research focuses on a novel stereo multi-object tracking method based on ultra-fast active vision. Traditional stereo multi-object tracking methods face challenges in achieving wide-range, high-definition multi-object tracking, as well as real-time stereo correspondence. The aim of this study is to propose a new stereo multi-object tracking method by introducing ultra-fast active vision technology. This method enables fast tracking of multiple moving objects and motion-based real-time stereo correspondence.

This study first introduces ultra-fast active vision, changing the viewing angle hundreds of times per second. Multiple virtual cameras are virtualized to observe multiple moving objects in a time-division multiplexing manner. In addition, this paper proposes a tracking method based on template matching and appearance model updates for problems such as visual occlusion, shape transformation, and illumination change. Experiments have proved that based on the ultra-fast active vision system, a maximum of 20 moving objects can be tracked simultaneously at a speed of 25fps per second.

Then, this paper proposes to introduce motion information-based correspondence methods in ultra-fast active stereo vision. It uses the short-term motion speed of objects in the active vision system to measure the similarity and realizes the real-time stereo correspondence of multiple moving objects. It is worth noting that although we tested the algorithm performance in fixed cameras, the proposed method can also be extended to active camera systems. Externally, in order to facilitate the installation and measurement of an ultra-fast active stereo vision system. We establish a general mathematical model and a flexible calibration method for Galvo-based camera systems.

After extensive experimental verification and performance evaluation, the method in this study has achieved remarkable results in multiple real scenarios. Compared with traditional methods, the algorithm proposed in this paper shows obvious advantages in the accuracy, robustness and real-time performance of object tracking. In addition, by comparing with existing methods, this study also demonstrates the effectiveness of the proposed method in dealing with complex scenes, fast motion and visual occlusion, etc.

To sum up, this doctoral thesis provides an innovative solution for the research and practice in the field of object tracking through the stereo multi-object tracking method based on ultra-fast active vision. This method has broad application prospects and can play an important role in the fields of automatic driving, intelligent monitoring and robot navigation.