双目区域视差快速计算及测距算法

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摘要：目的双目测距对水面无人艇自主避障以及视觉侦察具有重要意义，但视觉传感器成像易受光照环境及运动模糊等因素的影响，基于经典 Census 变换的立体匹配代价计算方法耗时长，且视差获取精度差，影响测距精度。为了提高测距精度并保证算法运行速度，提出一种用于双目测距的快速立体匹配算法。**方法**基于传统 Census 变换，提出一种新的比特串生成方法，在匹配点正方形支持窗口的各边分别等距选 3 个像素点，共选出 8 个像素点。8 像素点两两比较生成一个字节的比特串。将左右视场中匹配点与待匹配点的比特串进行异或，得到两点的汉明距离，改变待匹配点的位置并记录汉明距离。在各汉明距离中找到距离最小的像素点作为匹配像素点，两像素点的横坐标差为视差。本文采用区域视差计算的方法，在左右视场确定同一目标区域后进行视差提取和滤波，利用平均视差计算目标的距离。**结果**本文所提算法和基于传统 Census 变换的立体匹配视差获取方法相比，在运算速度方面优势明显，时间稳定在 0.4s 左右，用时仅为传统 Census 变换算法的 1/5。在 teddy 和 cones 数据集上进行的算法运行时间对比实验中，本文基于 Census 变换改进的算法比已有的基于 Census 变换的匹配算法在运行时间上快了近 20 秒。在实际双目测距实验中，采用本文所提算法在 10~20m 范围内测距误差在 5%以内，根据无人艇的运动特点和避障要求通过分析可知该算法的测距精度可以满足低速无人艇的避障需求。**结论**本文给出的基于改进 Census 变换的匹配算法在立体匹配速度上有大幅提高，提取目标视差用于测距，实际测距结果表明所给出的算法能够满足水面无人艇的视觉避障要求。

关键词：测距；双目视觉；改进 Census 变换；立体匹配；区域视差提取

Fast calculation and ranging algorithm based onbinocular region parallax

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Abstract:Objective The image-based ranging method is more concealment than the traditional ranging methods such as ultrasonic, radar. Ranging based on binocular vision forreconnaissance and obstacle avoiding is one of the important means for USV (Unmanned Surface Vehicle).But visual sensor imaging is easily affected by illumination changing and motion blur, etc. Calculation of stereo matching cost based on classical Census transform is too high and the stereo parallax accuracy is poor, which affects the ranging productiveness and accuracy. In order to improve the ranging accuracy and ensure the speed of the ranging, a fast stereo matching and parallax computation algorithm based on improved Census transform for binocular ranging is proposed.**Method**Firstly, a new bit string generation method used in the Census transform is proposed. The method selects 3 pixels at equal intervals on each edge of the square supporting window of the matching point. There are total 8 pixels selected on the square supporting window edges around the

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