

软件、算法与仿真

基于FPGA的实时整数霍夫变换

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整数霍夫变换; 直线检测; 峰值检测; 现场可编程门阵列

摘要:

为了解决霍夫变换计算量大、难以实时实现及峰值检测不准确的问题, 提出一种适合在FPGA上实现的基于两阶段快速搜索算法的改进整数霍夫变换, 并将其在FPGA中实现。首先, 设计了一种基于该改进霍夫变换算法的流水线结构, 能够在单个时钟周期内完成霍夫空间的参数计算和累加; 接着, 设定3个参数阈值, 以寻找霍夫空间中的局部极值; 最后, 确定全局极值, 实现直线参数的提取。采用实际图像在FPGA中进行实验验证, 结果表明提出的算法占用硬件资源较少, 其准确率达到93%以上。

关键词: 整数霍夫变换; 直线检测; 峰值检测; 现场可编程门阵列

Real-time integer hough transform based on FPGA

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Abstract:

The Hough transform plays an important role in line detection, but its large amount of calculation makes it very difficult to be implemented on real-time systems. Another problem is the traditional peak detection of Hough transform is not accurate. In order to solve the problems, an improved integer Hough transform based on a fast two-step searching algorithm which can be implemented on FPGA is presented. Firstly, a pipeline structure is employed for Hough transform to calculate Hough space parameters and accumulate parameters in a single clock cycle. Secondly, local maxima are found by setting the thresholds of three parameters in Hough subspace. Finally, line parameters are extracted by determining global maxima. The algorithm is verified by actual image data, and the experimental results show that the proposed method occupies less hardware resources and the accuracy rate is as high as over 93%.

Keywords: integer Hough transform line detection peak detection field programmable gate array (FPGA)

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