A FPGA-Based Low-Cost Real-Time Pipelined System to Extract Robust SIFT Features

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Research Contents

- **Scale Invariant Feature Transform (SIFT)**
  - A robust feature point detection algorithm proposed by David Lowe, being invariant to Scaling, Rotation, Viewpoint, Illumination changes.
  - Problem: High Computation Complexity; High Time Consumption; Redundant Computation.
  - Aim: Shorten computation time; Keeping similar performance quality.
  - Proposal: Full hardware implementation

- **Proposed Hardware Architecture**
  - 7 Round Parallel GDPC Accelerator

- **Dual-Pixel Processing FPD Accelerator**

- **Wide range of applications**
  - Object Recognition
  - Robot Localization and Mapping
  - Panorama Stitching
  - 3D Scene Modeling
  - Human Action Recognition

- **Experimental Results**

- **Implementation**
  - Implementable on FPGA
  - Reach near time processing
  - Affordable by Virtex-V
  - Using Dual-Port DDR2 memory
  - 98.9% high accuracy for 50 tested images
  - Up to 14.5 times acceleration

- **Features**
  - Stratified Gaussian Convolution
  - Variable Pixel Representation
  - Dual-pixel processing
  - LUT-based square root
  - Shifting-based bin selection

- **Object Tracking**

- **Panorama Stitching**

- **Object Recognition**