

计算机视觉 课程实验报告

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实验题目：特征检测与匹配

实验过程中遇到和解决的问题：

（记录实验过程中遇到的问题，以及解决过程和实验结果。可以适当配以关键代码辅助说明，但不要大段贴代码。）

提取特征点使用 opencv 内部函数创建不同的 detector

```
Ptr<SIFT> detector = SIFT::create();
```

```
Ptr<xfeatures2d::SURF> detector = xfeatures2d::SURF::create();
```

```
Ptr<ORB> detector = ORB::create();
```

其中 SIFT 和 ORB 可以直接使用，而 SURF 需要下载 opencv_contrib 或者转为 opencv2.x 版本使用。

SIFT, SURF, ORB 仅检测的原理不同，但应用的流程相同。

使用 detectAndCompute 函数计算得到特征点和描述矩阵 keypoints 和 descriptorMat :

```
detector->detectAndCompute(Src, Mat(), keypoints, descriptorMat);
```

将特征点画在图像上：

```
drawKeypoints(Src, keypoints, dst, Scalar::all(-1),
```

```
DrawMatchesFlags::DRAW_RICH_KEYPOINTS);
```

使用暴力匹配方法 cv::BFMatcher matcher 对两图像的特征点进行匹配，并将其保存在数组 matches 中：

```
matcher.match(descriptorMat1, descriptorMat2, matches);
```

可以对匹配点再进行筛选获取好的匹配点，最后绘制匹配图像：

```
drawMatches(src1, keypoints1, src2, keypoints2, good_matches, img_matches,
```

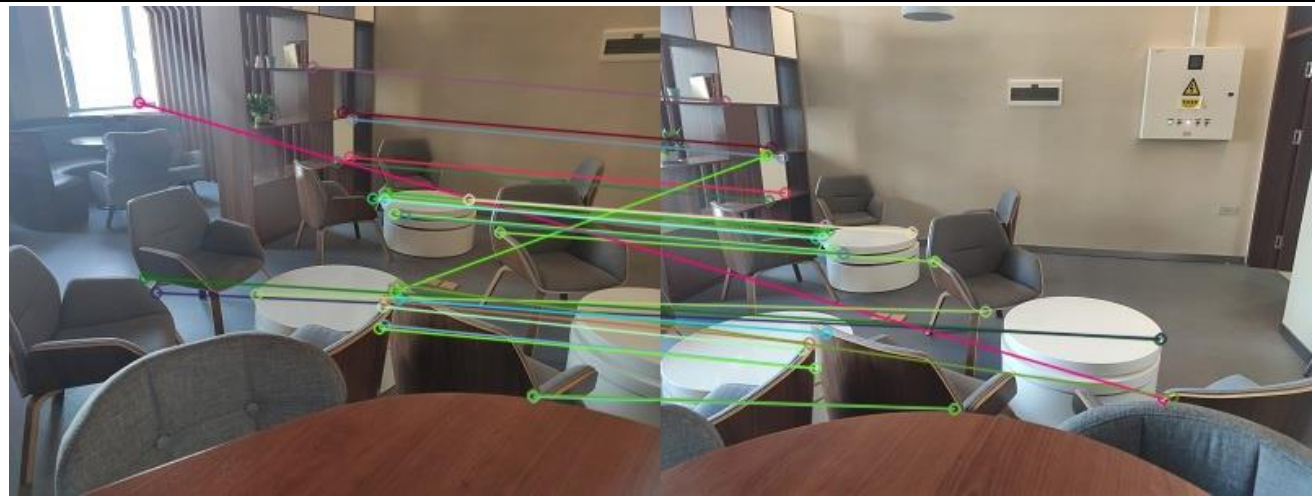
```
Scalar::all(-1), Scalar::all(-1), vector<char>(),
```

```
DrawMatchesFlags::NOT_DRAW_SINGLE_POINTS);
```

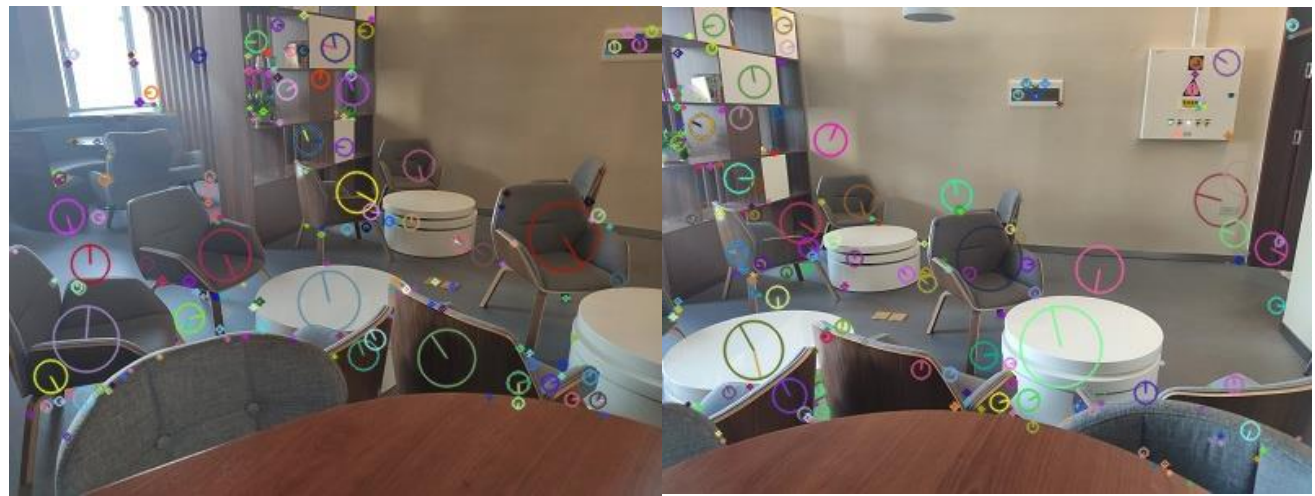
以下为结果图：



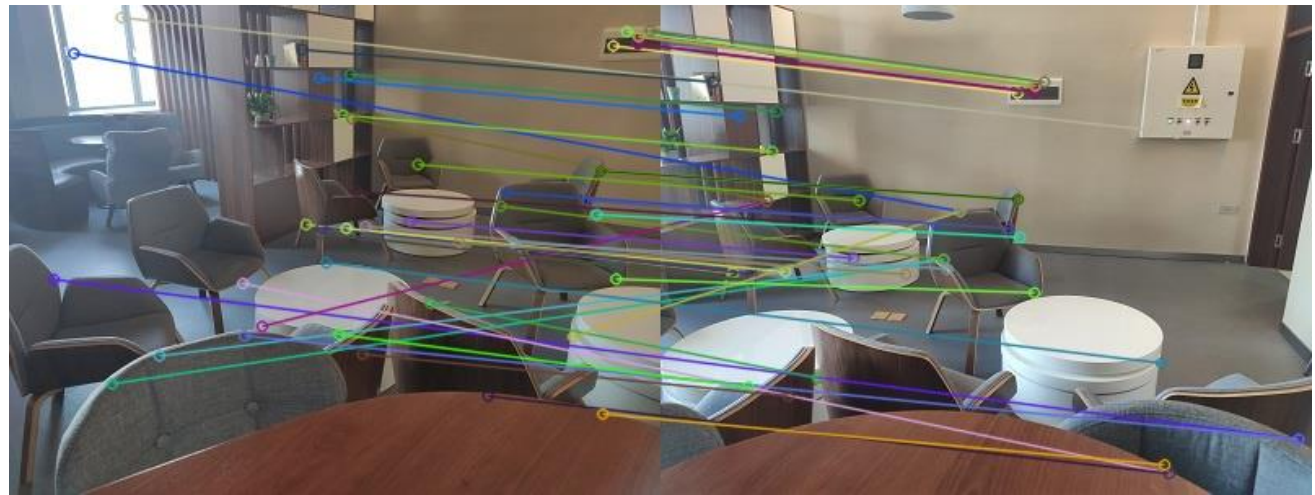
ORB 特征点绘制



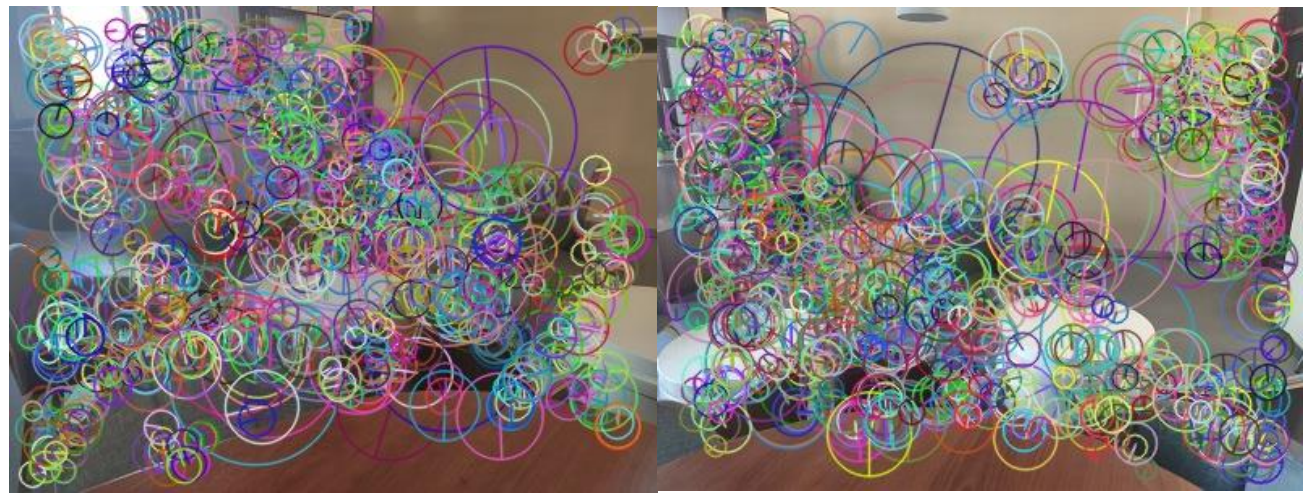
ORB 匹配结果



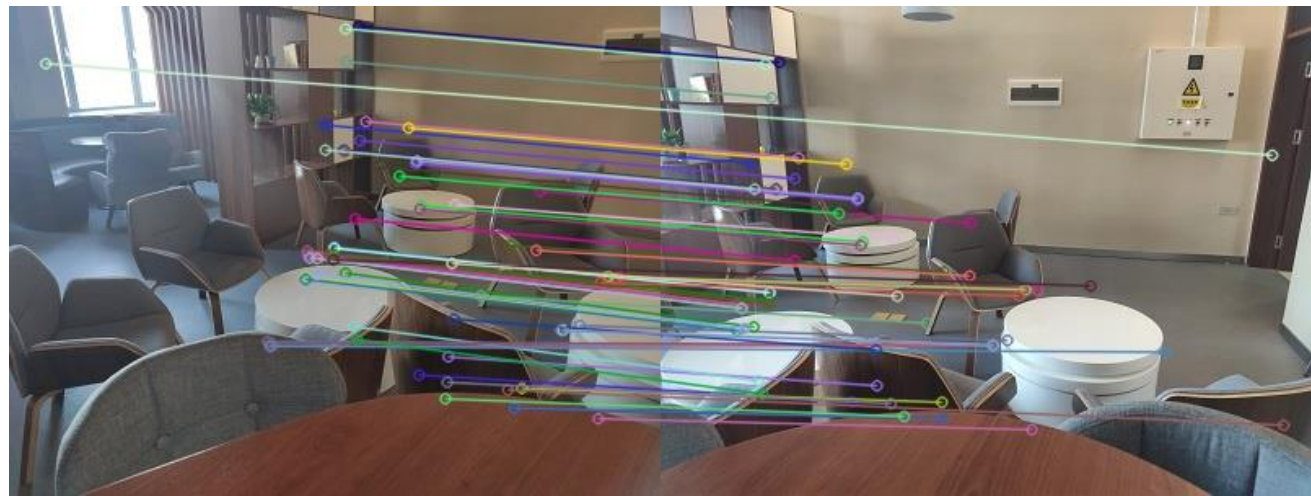
SIFT 特征点绘制



SIFT 匹配结果



SURF 特征点绘制



SURF 匹配结果

```

C:\Windows\system32\cmd.exe
SIFT-- Max dist :464.323
SIFT-- Min dist :55.9285
SIFT运行时间为0.343s
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (1172) cv::ocl::haveOpenCL Initialize OpenCL runtime...
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (1178) cv::ocl::haveOpenCL OpenCL: found 2 platforms
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (980) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: creating new execution context...
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (998) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: device=GeForce GTX 1050
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (5096) cv::ocl::Context::Impl::__init_buffer_pools OpenCL: Initializing buffer pool for context@0 with max capacity: poolSize=0 poolSizeHostPtr=0
ORB-- Max dist :468.505
ORB-- Min dist :100
ORB运行时间为1.787s
[ INFO:1] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:6] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:3] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:4] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:5] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:7] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
  
```

```
C:\Windows\system32\cmd.exe
[ INFO:4] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:5] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:7] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:8] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:9] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:10] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:11] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl
::getInitializedExecutionContext OpenCL: initializing thread execution context
SURF-- Max dist :0.608679
SURF-- Min dist :0.0368808
SURF运行时间为0.934s
请按任意键继续. . .
```

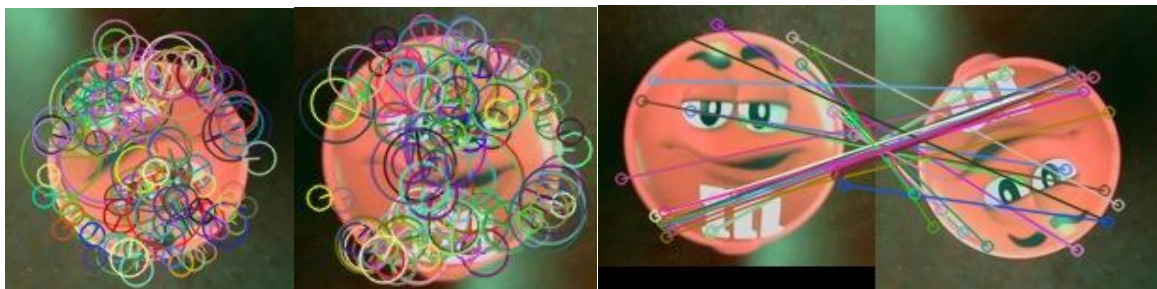
运行时间比较



ORB 结果



SIFT 结果



SURF 结果


```
C:\Windows\system32\cmd.exe
SIFT-- Max dist :473.711
SIFT-- Min dist :50.2593
SIFT运行时间为0.1s
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (1172) cv::ocl::haveOpenCL Initialize OpenCL runtime...
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (1178) cv::ocl::haveOpenCL OpenCL: found 2 platforms
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (980) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: creating new execution context...
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (998) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: device=GeForce GTX 1050
[ INFO:0] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (5096) cv::ocl::Context::Impl::__init_buffer_pools OpenCL: Initializing buffer pool for context@0 with max capacity: poolSize=0 poolSizeHostPtr=0
ORB-- Max dist :467.352
ORB-- Min dist :35.0428
ORB运行时间为1.687s
[ INFO:2] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:3] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:1] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:4] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:5] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:6] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:7] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:8] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:9] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:10] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
[ INFO:11] global E:\Programme\OpenCV\opencv\sources\modules\core\src\ocl.cpp (970) cv::ocl::OpenCLExecutionContext::Impl::getInitializedExecutionContext OpenCL: initializing thread execution context
SURF-- Max dist :0.601287
SURF-- Min dist :0.0453413
SURF运行时间为0.218s
请按任意键继续. . .
```

运行时间比较

从效果和效率对比上来看，SIFT 最好，然后是 SURF，最后 ORB。

结果分析与体会：

通过本次实验，测试了 OpenCV 中的 SIFT，SURF，ORB 等特征检测与匹配的方法，并将检测到的特征点和匹配关系进行可视化输出，比较不同方法的效率、效果之间的差异。