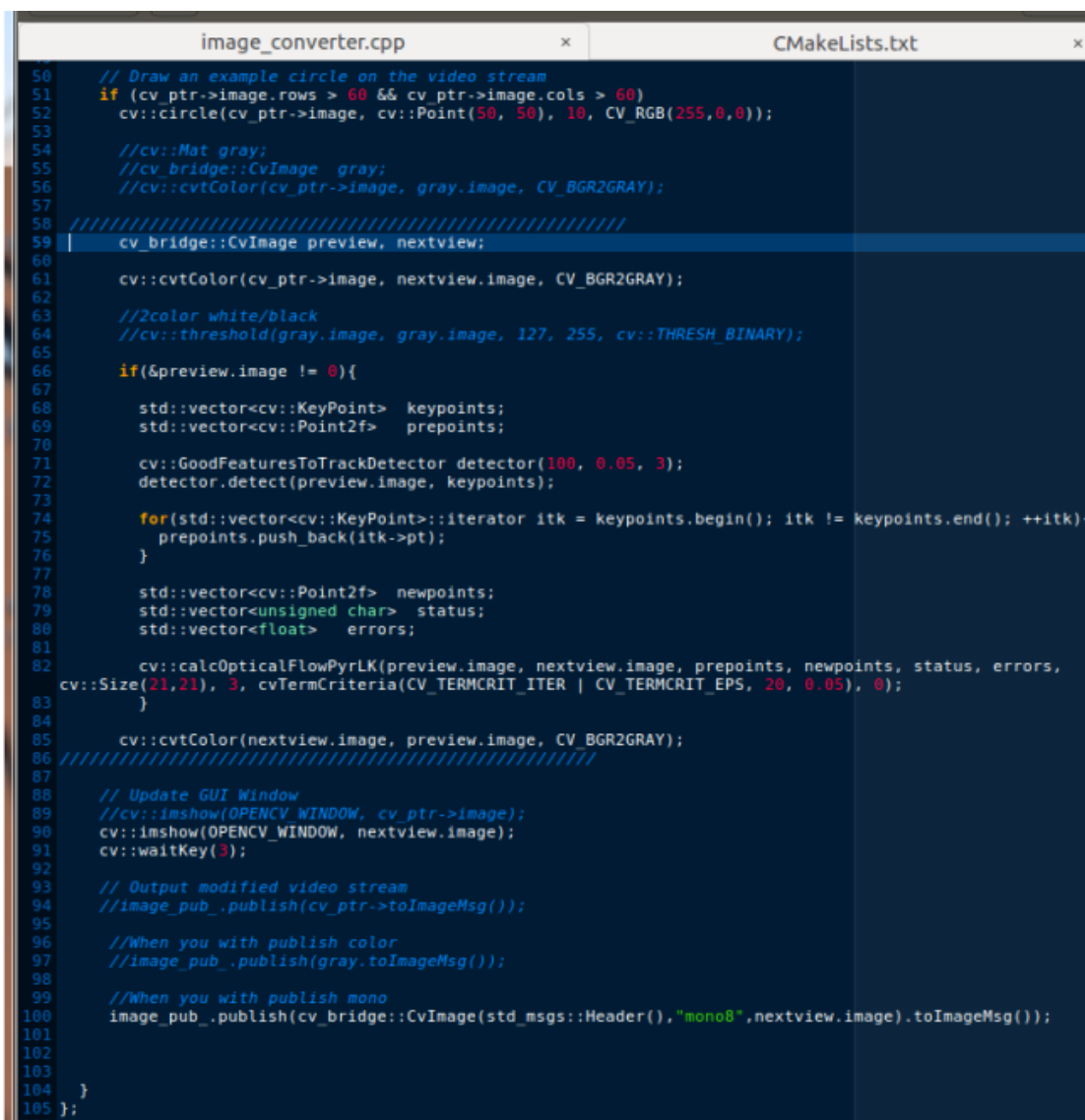


講義で作成したプログラムに加えた変更点と実装過程

講義中に実装した `Imageconverter.cpp` に、オプティカルフローを算出するプログラムを書き加える方法で、動体検出するプログラムの作成を目指した。下記の(1)、(2)を参考に、`Imageconverter.cpp` の 59～100 行目にオプティカルフローを算出するプログラムを下記のように書き加え、変更した変数名を書き換えた。



```

50 // Draw an example circle on the video stream
51 if (cv_ptr->image.rows > 60 && cv_ptr->image.cols > 60)
52   cv::circle(cv_ptr->image, cv::Point(50, 50), 10, CV_RGB(255,0,0));
53
54 //cv::Mat gray;
55 //cv_bridge::CvImage gray;
56 //cv::cvtColor(cv_ptr->image, gray.image, CV_BGR2GRAY);
57
58 ///////////////////////////////////////////////////
59 cv_bridge::CvImage preview, nextview;
60
61 cv::cvtColor(cv_ptr->image, nextview.image, CV_BGR2GRAY);
62
63 //2color white/black
64 //cv::threshold(gray.image, gray.image, 127, 255, cv::THRESH_BINARY);
65
66 if(&preview.image != 0){
67     std::vector<cv::KeyPoint> keypoints;
68     std::vector<cv::Point2f> prepoints;
69
70     cv::GoodFeaturesToTrackDetector detector(100, 0.05, 3);
71     detector.detect(preview.image, keypoints);
72
73     for(std::vector<cv::KeyPoint>::iterator itk = keypoints.begin(); itk != keypoints.end(); ++itk){
74         prepoints.push_back(itk->pt);
75     }
76
77     std::vector<cv::Point2f> newpoints;
78     std::vector<unsigned char> status;
79     std::vector<float> errors;
80
81     cv::calcOpticalFlowPyrLK(preview.image, nextview.image, prepoints, newpoints, status, errors,
82                             cv::Size(21,21), 3, cvTermCriteria(CV_TERMCRIT_ITER | CV_TERMCRIT_EPS, 20, 0.05), 0);
83 }
84
85 cv::cvtColor(nextview.image, preview.image, CV_BGR2GRAY);
86 ///////////////////////////////////////////////////
87
88 // Update GUI Window
89 //cv::imshow(OPENCV_WINDOW, cv_ptr->image);
90 cv::imshow(OPENCV_WINDOW, nextview.image);
91 cv::waitKey(3);
92
93 // Output modified video stream
94 //image_pub_.publish(cv_ptr->toImageMsg());
95
96 //When you with publish color
97 //image_pub_.publish(gray.toImageMsg());
98
99 //When you with publish mono
100 image_pub_.publish(cv_bridge::CvImage(std_msgs::Header(), "mono8", nextview.image).toImageMsg());
101
102
103 }
104
105 };

```

上記のように書き換えた後、`catkin_make` を実行してみると、

```
Terminal File Edit View Search Terminal Help
shimizulab@shimizulab-USB:~/sample$ catkin_make
Base path: /home/shimizulab/sample
Source space: /home/shimizulab/sample/src
Build space: /home/shimizulab/sample/build
Devel space: /home/shimizulab/sample/devel
Install space: /home/shimizulab/sample/install
###
#### Running command: "make cmake_check_build_system" in "/home/shimizulab/sample/build"
####
####
#### Running command: "make -j8 -l8" in "/home/shimizulab/sample/build"
####
Scanning dependencies of target my_1st_opencv
[ 33%] Built target usb_cam
[ 50%] Building CXX object my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o
[ 83%] Built target usb_cam_node
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp: In member function 'void ImageConverter::imageCb(const ImageConstPtr&)':
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp:71:8: error: 'GoodFeaturesToTrackDetector' is not a member of 'cv'
    cv::GoodFeaturesToTrackDetector detector(100, 0.05, 3);
    ^
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp:72:8: error: 'detector' was not declared in this scope
    detector.detect(preview.image, keypoints);
    ^
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp:82:5: error: 'calcOpticalFlowPyrLK' is not a member of 'cv'
    cv::calcOpticalFlowPyrLK(preview.image, nextview.image, prepoints, newpoint
    ^
my_opencv/CMakeFiles/my_1st_opencv.dir/build.make:62: recipe for target 'my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o' failed
make[2]: *** [my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o] Error 1
CMakeFiles/Makefile2:353: recipe for target 'my_opencv/CMakeFiles/my_1st_opencv.dir/all' failed
make[1]: *** [my_opencv/CMakeFiles/my_1st_opencv.dir/all] Error 2
Makefile:138: recipe for target 'all' failed
make: *** [all] Error 2
Invoking "make -j8 -l8" failed
shimizulab@shimizulab-USB:~/sample$
```

上記のようなエラーがでる。1、3つ目のエラーは、「cvのメンバーにそのような名前はない」という内容で、2つ目のエラーは、1つ目のエラーが原因で変数が宣言できなかったと考えられる。

エラー内容・講義内で Opencv の実装時に利用した(4)のサイトを見直し、GoodFeatureToTrack や、calcOpticalFlowPyrLK を使うには、他に必要なパッケージがあると考えた。調べてみたが、Windows 向けのものや、Python で書かれたものしか見つからず、動体検出するプログラムの作成には至らなかった。

そこで、GoodFeatureToTrack や、calcOpticalFlowPyrLK の実装例(6),(7)を参考にプログラムを下記のように書き換えた。

```

9 static const std::string OPENCV_WINDOW = "Image window";
10
11 /// Global variables
12
13 int maxCorners = 23;
14 int maxTrackbar = 100;
15
16 class ImageConverter
17 {
18     ros::NodeHandle nh ;
19     image_transport::ImageTransport it ;
20     image_transport::Subscriber image_sub_ ;
21     image_transport::Publisher image_pub_ ;
22
23 public:
24     ImageConverter()
25         : it (nh )

```

```

29 void goodFeaturesToTrack_Demo( int, void* ,cv_bridge::CvImage gray, std::vector<cv::Point2f> corners) //[1]
30 {
31     if( maxCorners < 1 ) {
32         maxCorners = 1;
33     }
34
35     /// Parameters for Shi-Tomasi algorithm
36     ///std::vector<cv::Point2f> corners;    //[2]
37     double qualityLevel = 0.01;
38     double minDistance = 10;
39     int blockSize = 3;
40     bool useHarrisDetector = false;
41     double k = 0.04;
42
43     /// Copy the source image
44
45     /// Apply corner detection
46     goodFeaturesToTrack( gray.image,
47         corners,
48         maxCorners,
49         qualityLevel,
50         minDistance,
51         cv::Mat(),
52         blockSize,
53         useHarrisDetector,
54         k );
55
56     /// Draw corners detected
57     // cout<<"* Number of corners detected: "<<corners.size()<<endl;
58     // int r = 4;
59     //for( size_t i = 0; i < corners.size(); i++ )

```

161 v 838 v 24 RDD 8/8 88 % 111.68 KB / 2.07 MB 2017/08/05 / 06:23:07

```

90
91 // Draw an example circle on the video stream
92 if (cv_ptr->image.rows > 60 && cv_ptr->image.cols > 60)
93   cv::circle(cv_ptr->image, cv::Point(50, 50), 10, CV_RGB(255,0,0));
94
95   //cv::Mat gray;
96   //cv_bridge::CvImage gray;
97   //cv::cvtColor(cv_ptr->image, gray.image, CV_BGR2GRAY);
98
99   cv_bridge::CvImage preview, nextview;
100   std::vector<cv::Point2f> points;
101   std::vector<cv::Point2f> newpoints;
102
103   cv::cvtColor(cv_ptr->image, nextview.image, CV_BGR2GRAY);
104
105   // goodFeaturesToTrack_Demo( 0, 0, nextview );
106
107   //2color white/black
108   //cv::threshold(gray.image, gray.image, 127, 255, cv::THRESH_BINARY);
109
110   //////////////////////////////////////
111   if(!preview.image != 0){
112
113     //std::vector<cv::KeyPoint> keypoints;
114     // std::vector<cv::Point2f> prepoints;
115
116     //cv::GoodFeaturesToTrackDetector detector(100, 0.05, 3);
117     //detector.detect(preview.image, keypoints);
118
119     //for(std::vector<cv::KeyPoint>::iterator itk = keypoints.begin(); itk != keypoints.end(); ++itk){
120     //prepoints.push_back(itk->pt);
121     //}
122
123     std::vector<unsigned char> status;
124     std::vector<float> errors;
125
126
127     calcOpticalFlowPyrLK(preview.image, nextview.image, points, newpoints, status, errors, cv::Size(21,21), 3,
128     cvTermCriteria(CV_TERMCRIT_ITER | CV_TERMCRIT_EPS, 20, 0.05), 0, 0.001);
129
130   }
131
132   cv::cvtColor(nextview.image, preview.image, CV_BGR2GRAY);
133   goodFeaturesToTrack_Demo( 0, 0, preview, points );
134
135
136   //////////////////////////////////////
137
138   // Update GUI Window
139   //cv::imshow(OPENCV_WINDOW, cv_ptr->image);
140   cv::imshow(OPENCV_WINDOW, nextview.image);
141   cv::waitKey(3);
142
143   // Output modified video stream
144   //image_pub_.publish(cv_ptr->toImageMsg());

```

上記のように書き換えた後、catkin_make を実行してみると、

```
Terminal File Edit View Search Terminal Help
Build space: /home/shimizulab/sample/build
Devel space: /home/shimizulab/sample/devel
Install space: /home/shimizulab/sample/install
####
#### Running command: "make cmake_check_build_system" in "/home/shimizulab/sample/build"
####
####
#### Running command: "make -j8 -l8" in "/home/shimizulab/sample/build"
####
Scanning dependencies of target my_1st_opencv
[ 33%] Built target usb_cam
[ 50%] Building CXX object my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o
[ 83%] Built target usb_cam_node
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp: In member function 'void ImageConverter::imageCb(const ImageConstPtr&)':
/home/shimizulab/sample/src/my_opencv/src/image_converter.cpp:127:183: error: 'calcOpticalFlowPyrLK' was not declared in this scope
    1), 3, cvTermCriteria(CV_TERMCRIT_ITER | CV_TERMCRIT_EPS, 20, 0.05), 0, 0.001);
                                                                    ^
my_opencv/CMakeFiles/my_1st_opencv.dir/build.make:62: recipe for target 'my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o' failed
make[2]: *** [my_opencv/CMakeFiles/my_1st_opencv.dir/src/image_converter.cpp.o] Error 1
CMakeFiles/Makefile2:353: recipe for target 'my_opencv/CMakeFiles/my_1st_opencv.dir/all' failed
make[1]: *** [my_opencv/CMakeFiles/my_1st_opencv.dir/all] Error 2
Makefile:138: recipe for target 'all' failed
make: *** [all] Error 2
Invoking "make -j8 -l8" failed
shimizulab@shimizulab-USB:~/sample$
```

上記のようなエラーが出た。調べてもわからなかったため、最終的にオプティカルフローの算出を実装することはできなかったが、オプティカルフローの算出に関わる部分をコメントアウトし、GoodFeatureToTrack の動作確認を行ったところ、特徴抽出は問題なくできていた。calcOpticalFlowPyrLK を動かせるようになれば、オプティカルフローを算出し、動体検出が出来るようになると考えられる。

【参考にしたサイト】

(1)C++版 OpenCV のオプティカルフローで物体追跡

http://opencv.blog.jp/cpp/opticalflow_lucaskanade

検索ワード：オプティカルフロー c++

(2)OpenCV 備忘録：OpenCV で OpticalFlow を試してみた

<https://iwaki2009.blogspot.jp/2012/12/opencvopticalflow.html>

検索：(1)のリンク「OpenCV で OpticalFlow を試してみた」から

(3)モーション解析と物体追跡—opencv2.2

http://opencv.jp/opencv-2svn/cpp/motion_analysis_and_object_tracking.html#cv-calcopticalflowpyrllk

検索 : (1)のリンク「cv::calcOpticalFlowPyrLK 日本語ドキュメント」から

(4)cv_bridge/Tutorials/UsingCvBridgeToConvertBetweenROSImagesAndOpenCVImages – ROS Wiki

http://wiki.ros.org/cv_bridge/Tutorials/UsingCvBridgeToConvertBetweenROSImagesAndOpenCVImages

検索ワード : ros opencv

(5)opencv_apps – ROS Wiki

http://wiki.ros.org/opencv_apps

検索ワード : ros opencv opticalflow

(6) opencv/ goodFeaturesToTrack_Demo.cpp at master · opencv/opencv · GiyHub

https://github.com/opencv/opencv/blob/master/samples/cpp/tutorial_code/TrackingMotion/goodFeaturesToTrack_Demo.cpp

検索 : (5)の 5.Motion Analysis Nodes の 5.1goodfeature_track にあるリンク
goodFeaturesToTrack_Demo.cpp から

(7)opencv/lkdemo.cpp at 2.4 · opencv/opencv · GiyHub

<https://github.com/opencv/opencv/blob/2.4/samples/cpp/lkdemo.cpp>

検索 : (5)の 5.Motion Analysis Nodes の 5.4lk_flow にあるリンク lkdemo.cpp から