UDACITY

Back to Self-Driving Car Engineer

Extended Kalman Filters

REVIEW

CODE REVIEW 2

HISTORY

src/kalman_filter.cpp 2

```
1  #include "kalman_filter.h"
2
3  using Eigen::MatrixXd;
4  using Eigen::VectorXd;
5
6  KalmanFilter::KalmanFilter() {}
7
8  KalmanFilter::~KalmanFilter() {}
9
10 void KalmanFilter::Init(VectorXd &x_in, MatrixXd &P_in, MatrixXd &F_in,
11                          MatrixXd &H_in, MatrixXd &R_in, MatrixXd &Q_in) {
12   x_ = x_in;
13   P_ = P_in;
14   F_ = F_in;
15   H_ = H_in;
16   R_ = R_in;
17   Q_ = Q_in;
18 }
19
20 void KalmanFilter::Predict() {
21   /**
22   TODO:
23     * predict the state
24   */
25     x_ = F_ * x_;
26     MatrixXd Ft = F_.transpose();
27     P_ = F_ * P_ * Ft + Q_;
28 }
```

```
29
30 void KalmanFilter::UpdateCommon(const VectorXd &y){
31
32
33     MatrixXd Ht = H_.transpose();
34     MatrixXd S = H_ * P_ * Ht + R_;
35     MatrixXd Si = S.inverse();
36     MatrixXd PHt = P_ * Ht;
37     MatrixXd K = PHt * Si;
38
39     //new estimate
40     x_ = x_ + (K * y);
41     long x_size = x_.size();
42     MatrixXd I = MatrixXd::Identity(x_size, x_size);
43     P_ = (I - K * H_) * P_;
44 }
45
46 void KalmanFilter::Update(const VectorXd &z) {
47   /**
48   TODO:
49     * update the state by using Kalman Filter equations
50   */
51     VectorXd z_pred = H_ * x_;
52     VectorXd y = z - z_pred;
53     UpdateCommon(y);
54
55 }
56
57 void KalmanFilter::UpdateEKF(const VectorXd &z) {
58   /**
59   TODO:
60     * update the state by using Extended Kalman Filter equations
61   */
62     double rho = sqrt(x_(0)*x_(0) + x_(1)*x_(1));
63     double phi =0;
64      if (fabs(x_(0)) > 0.001) {
```

SUGGESTION

I think it's ok for x*[0] to be zero or close to zero, as long as x*[1] is not zero or close to zero at the same time to pi/2 or -pi/2. https://en.wikipedia.org/wiki/Atan2

```
65         phi = atan2(x_(1) , x_(0));
66      }
67     double rhodot =0;
68      if (fabs(rho) > 0.001) {
69         rhodot = (x_(0)*x_(2) + x_(1)*x_(3)) / rho;
70      }
71     VectorXd z_pred = VectorXd(3);
72     z_pred << rho, phi, rhodot;
73     VectorXd y = z - z_pred;
74     int n=1;
75     //n=abs(trunc(y[1]/M_PI));
76     if (y[1]>M_PI){
```

SUGGESTION

Here is an optimized version of angle normalization
https://stackoverflow.com/questions/24234609/standard-way-to-normalize-an-angle-to-%CF%80-radians-i
y[1] -= (2 *M_PI)* floor((y[1] + M_PI) / (2 * M_PI));

```
77          y[1]=y[1]-n*(2*M_PI);
78      }else if (y[1]<-M_PI){
79          y[1]=y[1]+n*(2*M_PI);
80      }
81      UpdateCommon(y);
82
83  }
84
```

▸ src/Eigen/src/Core/arch/AltiVec/CMakeLists.txt

▸ src/Eigen/src/Core/arch/AltiVec/Complex.h

▸ src/Eigen/src/Core/arch/AltiVec/PacketMath.h

▸ src/Eigen/src/Core/arch/Default/CMakeLists.txt

▸ src/Eigen/src/Core/arch/Default/Settings.h

▸ src/Eigen/src/Core/arch/NEON/CMakeLists.txt

▸ src/Eigen/src/Core/arch/NEON/Complex.h

▸ src/Eigen/src/Core/products/Parallelizer.h

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▸ src/Eigen/src/Core/products/SelfadjointMatrixMatrix_MKL.h

▸ src/Eigen/src/Core/products/SelfadjointMatrixVector.h

▸ src/Eigen/src/Core/products/SelfadjointMatrixVector_MKL.h

▸ src/Eigen/src/Core/products/SelfadjointProduct.h

▸ src/Eigen/src/Core/products/SelfadjointRank2Update.h

▸ src/Eigen/src/Core/products/TriangularMatrixMatrix.h

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- src/tools.h

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