# Tracker

Generated by Doxygen 1.8.11

# Contents

# 1 Tracker

Particle tracking trajectory connector using a sparse LAP solver.

#### Documentation

The Tracker Doxygen documentation can be build with the `OPT_DOC` CMake option and is also available on online:

- `Tracker HTML Manual`
- `Tracker PDF Manual`
- `Tracker github repository`

# 2 Namespace Index

## 2.1 Namespace List

Here is a list of all namespaces with brief descriptions:

# 3 Hierarchical Index

## 3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:



# 4 Class Index

## 4.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:



# 5 File Index

## 5.1 File List

Here is a list of all files with brief descriptions:

# 6 Namespace Documentation

## 6.1 tracker Namespace Reference

### Classes

- class LAP_JVSparse
- class LAPTrack
- struct LogicalError

  *Parameter value is not valid.*
- struct ParameterValueError

  *Parameter value is not valid.*
- class Tracker

### Typedefs

- using TrackerError = backtrace_exception::BacktraceException

### 6.1.1 Typedef Documentation

#### 6.1.1.1 using tracker::TrackerError = typedef backtrace_exception::BacktraceException

Definition at line 28 of file Tracker.h.

# 7 Class Documentation

## 7.1 tracker::LAP_JVSparse< FloatT > Class Template Reference

`#include </home/travis/build/markjolah/Tracker/include/Tracker/LAP_JVSparse.h>`

**Static Public Member Functions**

- static IVecT solve (const SpMatT &C)
- static void solveLAP_orig (const SpMatT &C, IVecT &x, IVecT &y, VecT &u, VecT &v)
- static VecT computeCost (const SpMatT &C, const IVecT &row_sol)
- static bool checkCosts (const SpMatT &C)
- static bool checkSolution (const SpMatT &C, const IVecT &x, const IVecT &y, const VecT &u, const VecT &v)

### 7.1.1 Detailed Description

**template<class FloatT>**
**class tracker::LAP_JVSparse< FloatT >**

Definition at line 21 of file LAP_JVSparse.h.

### 7.1.2 Member Function Documentation

#### 7.1.2.1 template<class FloatT > bool tracker::LAP_JVSparse< FloatT >::checkCosts ( const SpMatT & *C* ) [static]

Definition at line 95 of file LAP_JVSparse.cpp.

#### 7.1.2.2 template<class FloatT > bool tracker::LAP_JVSparse< FloatT >::checkSolution ( const SpMatT & *C*, const IVecT & *x*, const IVecT & *y*, const VecT & *u*, const VecT & *v* ) [static]

Definition at line 118 of file LAP_JVSparse.cpp.

#### 7.1.2.3 template<class FloatT > LAP_JVSparse< FloatT >::VecT tracker::LAP_JVSparse< FloatT >::computeCost ( const SpMatT & *C*, const IVecT & *row_sol* ) [static]

Compute the total cost of a solution

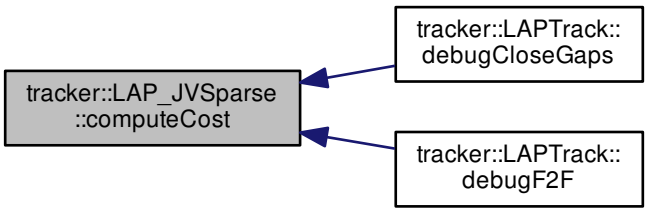
**Parameters**

| | | |
|---|---|---|
| in | *row_sol* | This is the 'x' output from the solver giving the col assignment for each row in order |

Definition at line 85 of file LAP_JVSparse.cpp.

Referenced by tracker::LAPTrack::debugCloseGaps(), and tracker::LAPTrack::debugF2F().

Here is the caller graph for this function:

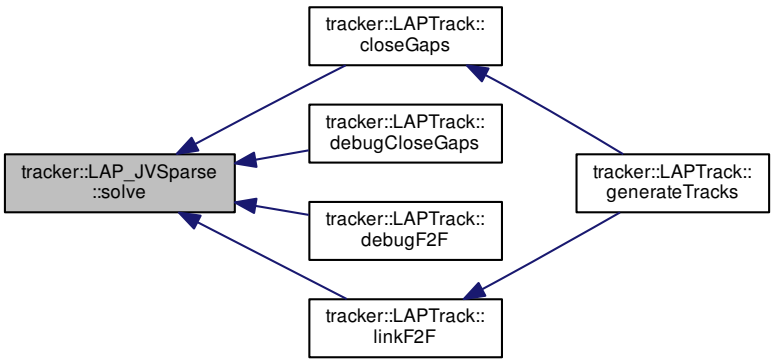



#### 7.1.2.4 template<class FloatT > LAP_JVSparse< FloatT >::lVecT tracker::LAP_JVSparse< FloatT >::solve ( const SpMatT & *C* ) [static]

Definition at line 21 of file LAP_JVSparse.cpp.

Referenced by tracker::LAPTrack::closeGaps(), tracker::LAPTrack::debugCloseGaps(), tracker::LAPTrack::debugF2F(), and tracker::LAPTrack::linkF2F().

Here is the caller graph for this function:




#### 7.1.2.5 template<class FloatT > void tracker::LAP_JVSparse< FloatT >::solveLAP_orig ( const SpMatT & *C*, lVecT & *x*, lVecT & *y*, VecT & *u*, VecT & *v* ) [static]

This wraps the original sparse lap implementation that for some reason uses 1-based indexing, which we correct with some pointer arrithmetic and adjusting of appropriate indicies in the sparse matrix implementation.

Furthermore because the lap_orig code assumes a compressed-row format, but we pass it the internal datastore of a compressed-col format sparse metrix. We invert x/y and u/v on the call to lap_orig to effectively let the transformation work easily with the legacy code.

This means x is the row sol and y is the col sol, as it normally would be.

**Parameters**

| | | |
|---|---|---|
| in | *C* | costs sparse matrix |
| out | *x* | - row assignments |
| out | *y* | - col assignments |
| out | *u* | - reduced row costs |
| out | *v* | - reduced column costs |

Definition at line 50 of file LAP_JVSparse.cpp.

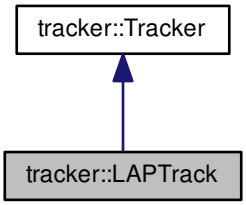
The documentation for this class was generated from the following files:

- LAP_JVSparse.h
- LAP_JVSparse.cpp

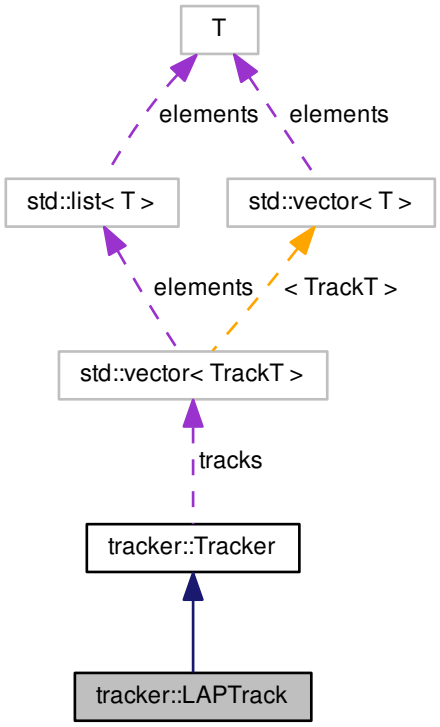
## 7.2 tracker::LAPTrack Class Reference

`#include </home/travis/build/markjolah/Tracker/include/Tracker/LAPTrack.h>`

Inheritance diagram for tracker::LAPTrack:



Collaboration diagram for tracker::LAPTrack:




**Public Types**

- using SpMatT = arma::SpMat< FloatT >
- using UVecT = arma::Col< arma::uword >
- using UMatT = arma::umat
- using FloatT = double
- using IdxT = int32_t
- using VecT = arma::Col< FloatT >
- using MatT = arma::Mat< FloatT >
- using IVecT = arma::Col< IdxT >
- using IMatT = arma::Mat< IdxT >
- using IVecFieldT = arma::field< IVecT >
- using IndexVectorT = std::vector< IdxT >
- using TrackT = std::list< IdxT >
- using TrackVecT = std::vector< TrackT >
- using ParamT = std::map< std::string, FloatT >
- using VecParamT = std::map< std::string, VecT >

### Public Member Functions

- LAPTrack (const VecParamT &param)
- VecParamT getStats () const
- void initializeTracks (const IVecT &frameIdx_, const MatT &position_, const MatT &SE_position_)
- void initializeTracks (const IVecT &frameIdx_, const MatT &position_, const MatT &SE_position_, const MatT &feature_, const MatT &SE_feature_)
- void linkF2F ()
- void closeGaps ()
- SpMatT computeF2FCostMat (int curFrame, int nextFrame) const
- void debugF2F (int frameIdx, IVecT &cur_locs, IVecT &next_locs, SpMatT &cost, IMatT &connections, VecT &conn_costs) const
- void debugCloseGaps (SpMatT &cost, IMatT &connections, VecT &conn_costs) const
- SpMatT computeGapCloseMatrix () const
- void generateTracks ()
- void checkFrameIdxs ()
- void printTracks () const

### Public Attributes

- FloatT D
- FloatT kon
- FloatT koff
- FloatT rho
- VecT featureVar
- FloatT maxSpeed = 0
- FloatT maxPositionDisplacementSigma = 5.0
- VecT maxFeatureDisplacementSigma
- IdxT maxGapCloseFrames = 20
- IdxT minGapCloseTrackLength = 1
- IdxT minFinalTrackLength = 1
- const FloatT cost_epsilon = std::numeric_limits<FloatT>::epsilon()
- IdxT N = 0
- IdxT nDims = 0
- IdxT nFeatures = 0
- IVecT frameIdx
- MatT position
- MatT SE_position
- MatT feature
- MatT SE_feature
- IdxT firstFrame = 0
- IdxT lastFrame = 0
- IdxT nFrames = 0
- IVecT nFrameLocs
- IVecFieldT frameLocIdx
- TrackVecT tracks

### Protected Types

- enum StateT { UNTRACKED, F2F_LINKED, GAPS_CLOSED }

**Protected Attributes**

- FloatT minCost = 1e-6
- FloatT log1mkoff
- FloatT log1mkon
- FloatT logrho
- FloatT logkon
- FloatT logkoff
- StateT state
- IndexVectorT birthFrameIdx
- IVecT frameBirthStartIdx
- IVecT trackAssignment

**Static Protected Attributes**

- static const FloatT log2pi = log(2∗arma::Datum<Tracker::FloatT>::pi)

### 7.2.1 Detailed Description

Definition at line 16 of file LAPTrack.h.

### 7.2.2 Member Typedef Documentation

#### 7.2.2.1 using tracker::Tracker::FloatT = double [inherited]

Definition at line 47 of file Tracker.h.

#### 7.2.2.2 using tracker::Tracker::IdxT = int32_t [inherited]

Definition at line 48 of file Tracker.h.

#### 7.2.2.3 using tracker::Tracker::IMatT = arma::Mat<IdxT> [inherited]

Definition at line 52 of file Tracker.h.

#### 7.2.2.4 using tracker::Tracker::IndexVectorT = std::vector<IdxT> [inherited]

Definition at line 54 of file Tracker.h.

#### 7.2.2.5 using tracker::Tracker::IVecFieldT = arma::field<IVecT> [inherited]

Definition at line 53 of file Tracker.h.

#### 7.2.2.6 using tracker::Tracker::IVecT = arma::Col<IdxT> [inherited]

Definition at line 51 of file Tracker.h.

#### 7.2.2.7 using tracker::Tracker::MatT = arma::Mat<FloatT> [inherited]

Definition at line 50 of file Tracker.h.

#### 7.2.2.8 using tracker::Tracker::ParamT = std::map<std::string,FloatT> [inherited]

A convenient form for reporting dictionaries of named FP data to matlab

Definition at line 57 of file Tracker.h.

#### 7.2.2.9 using tracker::LAPTrack::SpMatT = arma::SpMat<FloatT>

Definition at line 18 of file LAPTrack.h.

#### 7.2.2.10 using tracker::Tracker::TrackT = std::list<IdxT> [inherited]

A type for an individual track

Definition at line 55 of file Tracker.h.

#### 7.2.2.11 using tracker::Tracker::TrackVecT = std::vector<TrackT> [inherited]

A type for a vector of tracks

Definition at line 56 of file Tracker.h.

#### 7.2.2.12 using tracker::LAPTrack::UMatT = arma::umat

Definition at line 20 of file LAPTrack.h.

#### 7.2.2.13 using tracker::LAPTrack::UVecT = arma::Col<arma::uword>

Definition at line 19 of file LAPTrack.h.

#### 7.2.2.14 using tracker::Tracker::VecParamT = std::map<std::string,VecT> [inherited]

A convenient form for reporting dictionaries of named FP data to matlab

Definition at line 58 of file Tracker.h.

#### 7.2.2.15 using tracker::Tracker::VecT = arma::Col<FloatT> [inherited]

Definition at line 49 of file Tracker.h.

#### 7.2.3 Member Enumeration Documentation

##### 7.2.3.1 enum tracker::LAPTrack::StateT [protected]

**Enumerator**

***UNTRACKED***

***F2F_LINKED***

***GAPS_CLOSED***

Definition at line 58 of file LAPTrack.h.

#### 7.2.4 Constructor & Destructor Documentation

##### 7.2.4.1 tracker::LAPTrack::LAPTrack ( const VecParamT & *param* )

Definition at line 11 of file LAPTrack.cpp.

References D, featureVar, koff, kon, log1mkoff, log1mkon, logkoff, logkon, logrho, maxFeatureDisplacementSigma, maxGapCloseFrames, maxPositionDisplacementSigma, maxSpeed, minFinalTrackLength, minGapCloseTrackLength, and rho.

#### 7.2.5 Member Function Documentation

##### 7.2.5.1 void tracker::LAPTrack::checkFrameIdxs ( )

Definition at line 335 of file LAPTrack.cpp.

References F2F_LINKED, tracker::Tracker::firstFrame, frameBirthStartIdx, tracker::Tracker::frameIdx, tracker::Tracker::lastFrame, state, and tracker::Tracker::tracks.

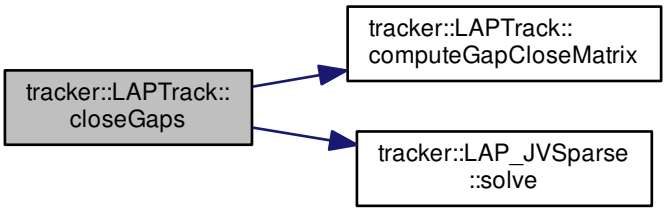
##### 7.2.5.2 void tracker::LAPTrack::closeGaps ( )

Definition at line 376 of file LAPTrack.cpp.

References birthFrameIdx, computeGapCloseMatrix(), F2F_LINKED, frameBirthStartIdx, GAPS_CLOSED, minFinalTrackLength, tracker::LAP_JVSparse< FloatT >::solve(), state, tracker::Tracker::trackAssignment, and tracker::Tracker::tracks.

Referenced by generateTracks().

Here is the call graph for this function:




Here is the caller graph for this function:

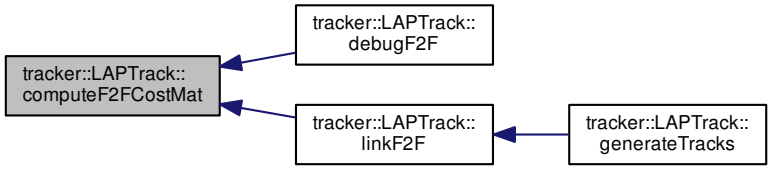

#### 7.2.5.3 LAPTrack::SpMatT tracker::LAPTrack::computeF2FCostMat ( int *curFrame,* int *nextFrame* ) const

Definition at line 231 of file LAPTrack.cpp.

References cost_epsilon, D, tracker::Tracker::feature, featureVar, tracker::Tracker::firstFrame, tracker::Tracker::frame↩LocIdx, log1mkoff, tracker::Tracker::log2pi, logkoff, logkon, logrho, maxFeatureDisplacementSigma, maxPosition↩DisplacementSigma, maxSpeed, tracker::Tracker::nDims, tracker::Tracker::nFeatures, tracker::Tracker::nFrameLocs, tracker::Tracker::position, tracker::Tracker::SE_feature, and tracker::Tracker::SE_position.

Referenced by debugF2F(), and linkF2F().

Here is the caller graph for this function:



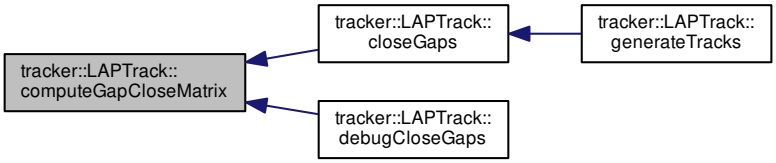
#### 7.2.5.4 LAPTrack::SpMatT tracker::LAPTrack::computeGapCloseMatrix ( ) const

Definition at line 415 of file LAPTrack.cpp.

References birthFrameIdx, cost_epsilon, D, tracker::Tracker::feature, featureVar, tracker::Tracker::firstFrame, frameBirthStartIdx, tracker::Tracker::frameIdx, tracker::Tracker::lastFrame, tracker::Tracker::log2pi, logkoff, logkon, logrho, maxFeatureDisplacementSigma, maxGapCloseFrames, maxPositionDisplacementSigma, maxSpeed, minGapCloseTrackLength, tracker::Tracker::nDims, tracker::Tracker::nFeatures, tracker::Tracker::position, tracker::Tracker::SE_feature, tracker::Tracker::SE_position, and tracker::Tracker::tracks.

Referenced by closeGaps(), and debugCloseGaps().

Here is the caller graph for this function:

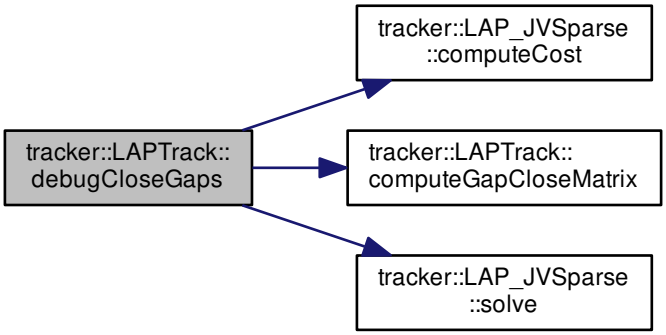



#### 7.2.5.5 void tracker::LAPTrack::debugCloseGaps ( SpMatT & *cost,* IMatT & *connections,* VecT & *conn_costs* ) const

Definition at line 351 of file LAPTrack.cpp.

References tracker::LAP_JVSparse< FloatT >::computeCost(), computeGapCloseMatrix(), cost_epsilon, F2F_LINKED, tracker::LAP_JVSparse< FloatT >::solve(), state, and tracker::Tracker::tracks.

Here is the call graph for this function:

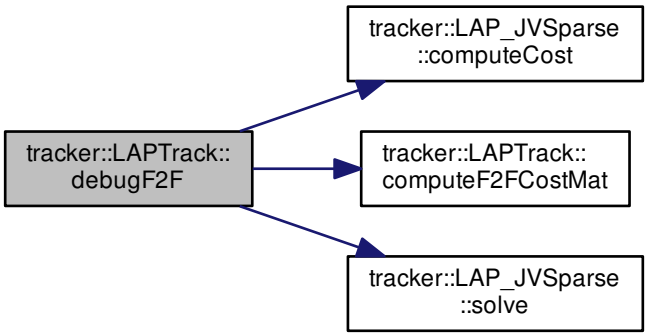


#### 7.2.5.6 void tracker::LAPTrack::debugF2F ( int *frameIdx,* IVecT & *cur_locs,* IVecT & *next_locs,* SpMatT & *cost,* IMatT & *connections,* VecT & *conn_costs* ) const

Definition at line 92 of file LAPTrack.cpp.

References tracker::LAP_JVSparse< FloatT >::computeCost(), computeF2FCostMat(), cost_epsilon, tracker::Tracker::firstFrame, tracker::Tracker::frameLocIdx, tracker::Tracker::lastFrame, tracker::Tracker::nFrameLocs, and tracker::LAP_JVSparse< FloatT >::solve().

Here is the call graph for this function:



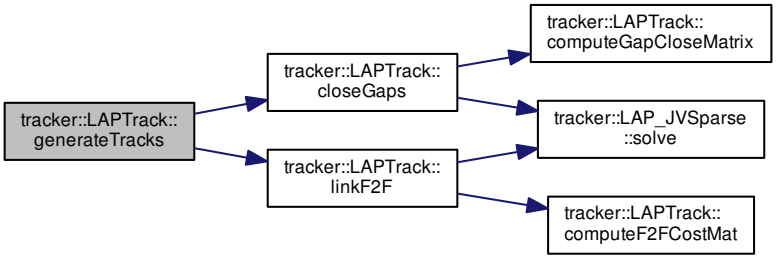

#### 7.2.5.7 void tracker::LAPTrack::generateTracks ( ) [virtual]

Implements tracker::Tracker.

Definition at line 77 of file LAPTrack.cpp.

References closeGaps(), F2F_LINKED, GAPS_CLOSED, linkF2F(), state, and UNTRACKED.

Here is the call graph for this function:



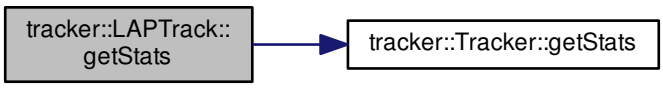
#### 7.2.5.8 LAPTrack::VecParamT tracker::LAPTrack::getStats ( ) const [virtual]

Reimplemented from tracker::Tracker.

Definition at line 46 of file LAPTrack.cpp.

References D, featureVar, tracker::Tracker::getStats(), koff, kon, maxFeatureDisplacementSigma, maxGapCloseFrames, maxPositionDisplacementSigma, maxSpeed, minFinalTrackLength, minGapCloseTrackLength, and rho.

Here is the call graph for this function:




#### 7.2.5.9 void tracker::LAPTrack::initializeTracks ( const IVecT & *frameIdx_*, const MatT & *position_*, const MatT & *SE_position_* ) [virtual]

Reimplemented from tracker::Tracker.

Definition at line 63 of file LAPTrack.cpp.

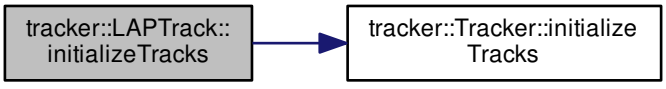
#### 7.2.5.10 void tracker::LAPTrack::initializeTracks ( const IVecT & *frameIdx_*, const MatT & *position_*, const MatT & *SE_position_*, const MatT & *feature_*, const MatT & *SE_feature_* ) [virtual]

Reimplemented from tracker::Tracker.

Definition at line 69 of file LAPTrack.cpp.

References birthFrameIdx, frameBirthStartIdx, tracker::Tracker::initializeTracks(), state, and UNTRACKED.

Here is the call graph for this function:



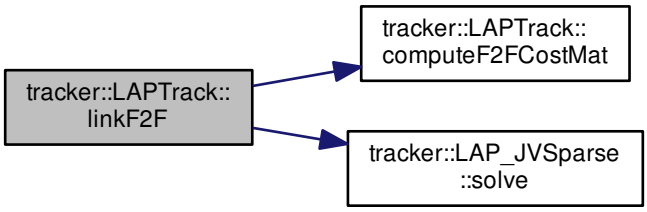
#### 7.2.5.11 void tracker::LAPTrack::linkF2F ( )

Definition at line 130 of file LAPTrack.cpp.

References birthFrameIdx, computeF2FCostMat(), F2F_LINKED, tracker::Tracker::firstFrame, frameBirthStartIdx, tracker::Tracker::frameLocIdx, tracker::Tracker::lastFrame, tracker::Tracker::nFrameLocs, tracker::Tracker::nFrames, tracker::LAP_JVSparse< FloatT >::solve(), state, tracker::Tracker::trackAssignment, tracker::Tracker::tracks, and UNTRACKED.

Referenced by generateTracks().

Here is the call graph for this function:




Here is the caller graph for this function:


#### 7.2.5.12 void tracker::Tracker::printTracks ( ) const [inherited]

Definition at line 126 of file Tracker.cpp.

References tracker::Tracker::frameIdx, and tracker::Tracker::tracks.

### 7.2.6 Member Data Documentation

#### 7.2.6.1 IndexVectorT tracker::LAPTrack::birthFrameIdx [protected]

Definition at line 62 of file LAPTrack.h.

Referenced by closeGaps(), computeGapCloseMatrix(), initializeTracks(), and linkF2F().

#### 7.2.6.2 const FloatT tracker::LAPTrack::cost_epsilon = std::numeric_limits<FloatT>::epsilon()

Definition at line 35 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), debugCloseGaps(), and debugF2F().

#### 7.2.6.3 FloatT tracker::LAPTrack::D

Definition at line 22 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.4 MatT tracker::Tracker::feature [inherited]

Definition at line 66 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and tracker::Tracker::initializeTracks().

#### 7.2.6.5 VecT tracker::LAPTrack::featureVar

Definition at line 26 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.6 IdxT tracker::Tracker::firstFrame = 0 [inherited]

Definition at line 68 of file Tracker.h.

Referenced by checkFrameIdxs(), computeF2FCostMat(), computeGapCloseMatrix(), debugF2F(), tracker::Tracker↩
::getStats(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.7 IVecT tracker::LAPTrack::frameBirthStartIdx [protected]

Definition at line 63 of file LAPTrack.h.

Referenced by checkFrameIdxs(), closeGaps(), computeGapCloseMatrix(), initializeTracks(), and linkF2F().

#### 7.2.6.8 IVecT tracker::Tracker::frameIdx [inherited]

Definition at line 63 of file Tracker.h.

Referenced by checkFrameIdxs(), computeGapCloseMatrix(), tracker::Tracker::initializeTracks(), and tracker::Tracker↩
::printTracks().

#### 7.2.6.9 IVecFieldT tracker::Tracker::frameLocIdx [inherited]

Definition at line 74 of file Tracker.h.

Referenced by computeF2FCostMat(), debugF2F(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.10 FloatT tracker::LAPTrack::koff

Definition at line 24 of file LAPTrack.h.

Referenced by getStats(), and LAPTrack().

#### 7.2.6.11 FloatT tracker::LAPTrack::kon

Definition at line 23 of file LAPTrack.h.

Referenced by getStats(), and LAPTrack().

#### 7.2.6.12 IdxT tracker::Tracker::lastFrame = 0 [inherited]

Definition at line 69 of file Tracker.h.

Referenced by checkFrameIdxs(), computeGapCloseMatrix(), debugF2F(), tracker::Tracker::getStats(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.13 FloatT tracker::LAPTrack::log1mkoff [protected]

Definition at line 52 of file LAPTrack.h.

Referenced by computeF2FCostMat(), and LAPTrack().

#### 7.2.6.14 FloatT tracker::LAPTrack::log1mkon [protected]

Definition at line 53 of file LAPTrack.h.

Referenced by LAPTrack().

#### 7.2.6.15 const Tracker::FloatT tracker::Tracker::log2pi = log(2*arma::Datum<Tracker::FloatT>::pi) [static], [protected], [inherited]

Definition at line 92 of file Tracker.h.

Referenced by computeF2FCostMat(), and computeGapCloseMatrix().

#### 7.2.6.16 FloatT tracker::LAPTrack::logkoff [protected]

Definition at line 56 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and LAPTrack().

#### 7.2.6.17 FloatT tracker::LAPTrack::logkon [protected]

Definition at line 55 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and LAPTrack().

#### 7.2.6.18 FloatT tracker::LAPTrack::logrho [protected]

Definition at line 54 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and LAPTrack().

#### 7.2.6.19 VecT tracker::LAPTrack::maxFeatureDisplacementSigma

Definition at line 29 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.20 IdxT tracker::LAPTrack::maxGapCloseFrames = 20

Definition at line 30 of file LAPTrack.h.

Referenced by computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.21 FloatT tracker::LAPTrack::maxPositionDisplacementSigma = 5.0

Definition at line 28 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.22 FloatT tracker::LAPTrack::maxSpeed = 0

Definition at line 27 of file LAPTrack.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.23 FloatT tracker::LAPTrack::minCost = 1e-6 [protected]

Definition at line 51 of file LAPTrack.h.

#### 7.2.6.24 IdxT tracker::LAPTrack::minFinalTrackLength = 1

Definition at line 32 of file LAPTrack.h.

Referenced by closeGaps(), getStats(), and LAPTrack().

#### 7.2.6.25 IdxT tracker::LAPTrack::minGapCloseTrackLength = 1

Definition at line 31 of file LAPTrack.h.

Referenced by computeGapCloseMatrix(), getStats(), and LAPTrack().

#### 7.2.6.26 IdxT tracker::Tracker::N = 0 [inherited]

Definition at line 60 of file Tracker.h.

Referenced by tracker::Tracker::getStats(), and tracker::Tracker::initializeTracks().

#### 7.2.6.27 IdxT tracker::Tracker::nDims = 0 [inherited]

Definition at line 61 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), tracker::Tracker::getStats(), and tracker::Tracker::initializeTracks().

#### 7.2.6.28 IdxT tracker::Tracker::nFeatures = 0 [inherited]

Definition at line 62 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), tracker::Tracker::getStats(), and tracker::Tracker::initializeTracks().

#### 7.2.6.29 IVecT tracker::Tracker::nFrameLocs [inherited]

Definition at line 73 of file Tracker.h.

Referenced by computeF2FCostMat(), debugF2F(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.30 IdxT tracker::Tracker::nFrames = 0 [inherited]

Definition at line 70 of file Tracker.h.

Referenced by tracker::Tracker::getStats(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.31 MatT tracker::Tracker::position [inherited]

Definition at line 64 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and tracker::Tracker::initializeTracks().

#### 7.2.6.32 FloatT tracker::LAPTrack::rho

Definition at line 25 of file LAPTrack.h.

Referenced by getStats(), and LAPTrack().

#### 7.2.6.33 MatT tracker::Tracker::SE_feature [inherited]

Definition at line 67 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and tracker::Tracker::initializeTracks().

#### 7.2.6.34 MatT tracker::Tracker::SE_position [inherited]

Definition at line 65 of file Tracker.h.

Referenced by computeF2FCostMat(), computeGapCloseMatrix(), and tracker::Tracker::initializeTracks().

#### 7.2.6.35 StateT tracker::LAPTrack::state [protected]

Definition at line 59 of file LAPTrack.h.

Referenced by checkFrameIdxs(), closeGaps(), debugCloseGaps(), generateTracks(), initializeTracks(), and linkF2F().

#### 7.2.6.36 IVecT tracker::Tracker::trackAssignment [protected], [inherited]

Definition at line 93 of file Tracker.h.

Referenced by closeGaps(), tracker::Tracker::getStats(), tracker::Tracker::initializeTracks(), and linkF2F().

#### 7.2.6.37 TrackVecT tracker::Tracker::tracks [inherited]

Definition at line 77 of file Tracker.h.

Referenced by checkFrameIdxs(), closeGaps(), computeGapCloseMatrix(), debugCloseGaps(), tracker::Tracker::get↩ Stats(), tracker::Tracker::initializeTracks(), linkF2F(), and tracker::Tracker::printTracks().

The documentation for this class was generated from the following files:

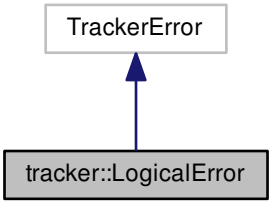
- LAPTrack.h
- LAPTrack.cpp

## 7.3 tracker::LogicalError Struct Reference

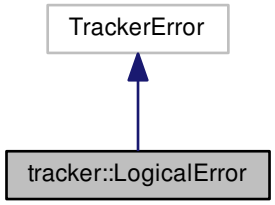
Parameter value is not valid.

`#include </home/travis/build/markjolah/Tracker/include/Tracker/Tracker.h>`

Inheritance diagram for tracker::LogicalError:



Collaboration diagram for tracker::LogicalError:




#### Public Member Functions

- LogicalError (std::string message)

### 7.3.1 Detailed Description

Parameter value is not valid.

Definition at line 40 of file Tracker.h.

### 7.3.2 Constructor & Destructor Documentation

#### 7.3.2.1 tracker::LogicalError::LogicalError ( std::string *message* ) [inline]

Definition at line 42 of file Tracker.h.

The documentation for this struct was generated from the following file:

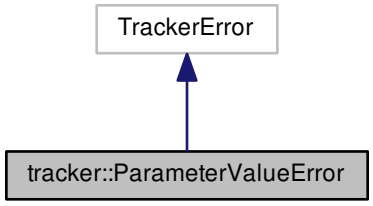
- Tracker.h

## 7.4 tracker::ParameterValueError Struct Reference

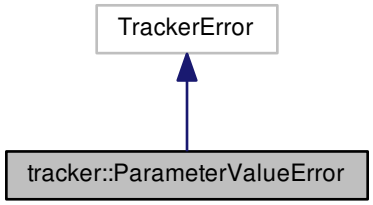
Parameter value is not valid.

`#include </home/travis/build/markjolah/Tracker/include/Tracker/Tracker.h>`

Inheritance diagram for tracker::ParameterValueError:




Collaboration diagram for tracker::ParameterValueError:




### Public Member Functions

- ParameterValueError (std::string message)

### 7.4.1 Detailed Description

Parameter value is not valid.

Definition at line 33 of file Tracker.h.

#### 7.4.2 Constructor & Destructor Documentation

##### 7.4.2.1 tracker::ParameterValueError::ParameterValueError ( std::string *message* ) [inline]

Definition at line 35 of file Tracker.h.

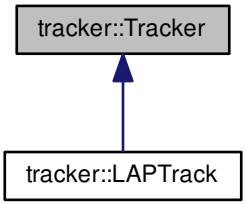
The documentation for this struct was generated from the following file:

- Tracker.h

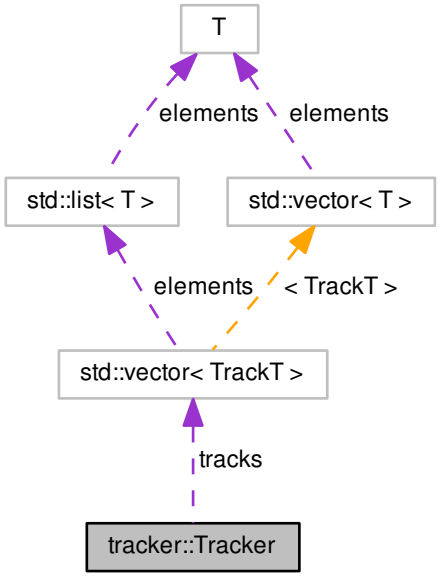
### 7.5 tracker::Tracker Class Reference

`#include </home/travis/build/markjolah/Tracker/include/Tracker/Tracker.h>`

Inheritance diagram for tracker::Tracker:



Collaboration diagram for tracker::Tracker:




**Public Types**

- using FloatT = double
- using IdxT = int32_t
- using VecT = arma::Col< FloatT >
- using MatT = arma::Mat< FloatT >
- using IVecT = arma::Col< IdxT >
- using IMatT = arma::Mat< IdxT >
- using IVecFieldT = arma::field< IVecT >
- using IndexVectorT = std::vector< IdxT >
- using TrackT = std::list< IdxT >
- using TrackVecT = std::vector< TrackT >
- using ParamT = std::map< std::string, FloatT >
- using VecParamT = std::map< std::string, VecT >

**Public Member Functions**

- Tracker (const VecParamT &param)
- virtual ~Tracker ()
- virtual VecParamT getStats () const
- virtual void initializeTracks (const IVecT &frameIdx_, const MatT &position_, const MatT &SE_position_)
- virtual void initializeTracks (const IVecT &frameIdx_, const MatT &position_, const MatT &SE_position_, const MatT &feature_, const MatT &SE_feature_)
- virtual void generateTracks ()=0
- void printTracks () const

#### Public Attributes

- IdxT N = 0
- IdxT nDims = 0
- IdxT nFeatures = 0
- IVecT frameIdx
- MatT position
- MatT SE_position
- MatT feature
- MatT SE_feature
- IdxT firstFrame = 0
- IdxT lastFrame = 0
- IdxT nFrames = 0
- IVecT nFrameLocs
- IVecFieldT frameLocIdx
- TrackVecT tracks

#### Protected Attributes

- IVecT trackAssignment

#### Static Protected Attributes

- static const FloatT log2pi = log(2∗arma::Datum<Tracker::FloatT>::pi)

### 7.5.1 Detailed Description

Definition at line 45 of file Tracker.h.

### 7.5.2 Member Typedef Documentation

#### 7.5.2.1 using tracker::Tracker::FloatT = double

Definition at line 47 of file Tracker.h.

#### 7.5.2.2 using tracker::Tracker::IdxT = int32_t

Definition at line 48 of file Tracker.h.

#### 7.5.2.3 using tracker::Tracker::IMatT = arma::Mat<IdxT>

Definition at line 52 of file Tracker.h.

#### 7.5.2.4 using tracker::Tracker::IndexVectorT = std::vector<IdxT>

Definition at line 54 of file Tracker.h.

#### 7.5.2.5 using tracker::Tracker::IVecFieldT = arma::field<IVecT>

Definition at line 53 of file Tracker.h.

#### 7.5.2.6 using tracker::Tracker::IVecT = arma::Col<IdxT>

Definition at line 51 of file Tracker.h.

#### 7.5.2.7 using tracker::Tracker::MatT = arma::Mat<FloatT>

Definition at line 50 of file Tracker.h.

#### 7.5.2.8 using tracker::Tracker::ParamT = std::map<std::string,FloatT>

A convenient form for reporting dictionaries of named FP data to matlab

Definition at line 57 of file Tracker.h.

#### 7.5.2.9 using tracker::Tracker::TrackT = std::list<IdxT>

A type for an individual track

Definition at line 55 of file Tracker.h.

#### 7.5.2.10 using tracker::Tracker::TrackVecT = std::vector<TrackT>

A type for a vector of tracks

Definition at line 56 of file Tracker.h.

#### 7.5.2.11 using tracker::Tracker::VecParamT = std::map<std::string,VecT>

A convenient form for reporting dictionaries of named FP data to matlab

Definition at line 58 of file Tracker.h.

#### 7.5.2.12 using tracker::Tracker::VecT = arma::Col<FloatT>

Definition at line 49 of file Tracker.h.

#### 7.5.3 Constructor & Destructor Documentation

##### 7.5.3.1 tracker::Tracker::Tracker ( const VecParamT & *param* )

param - A dictionary of floating point values to pass in. This is a flexible interface to the higher-level matlab code allowing each subclass to take in arbitrary floating point arguments.

Definition at line 15 of file Tracker.cpp.

##### 7.5.3.2 virtual tracker::Tracker::~Tracker ( ) [inline], [virtual]

Definition at line 84 of file Tracker.h.

#### 7.5.4 Member Function Documentation

##### 7.5.4.1 virtual void tracker::Tracker::generateTracks ( ) [pure virtual]

Implemented in tracker::LAPTrack.

##### 7.5.4.2 Tracker::VecParamT tracker::Tracker::getStats ( ) const [virtual]

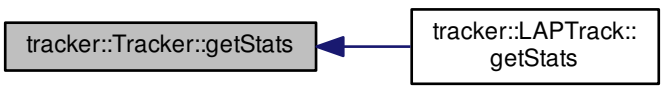
Reimplemented in tracker::LAPTrack.

Definition at line 19 of file Tracker.cpp.

References firstFrame, lastFrame, N, nDims, nFeatures, nFrames, trackAssignment, and tracks.

Referenced by tracker::LAPTrack::getStats().

Here is the caller graph for this function:



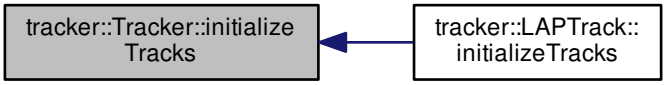
#### 7.5.4.3 void tracker::Tracker::initializeTracks ( const IVecT & *frameIdx_*, const MatT & *position_*, const MatT & *SE_position_* ) [virtual]

Reimplemented in tracker::LAPTrack.

Definition at line 33 of file Tracker.cpp.

Referenced by tracker::LAPTrack::initializeTracks().

Here is the caller graph for this function:




#### 7.5.4.4 void tracker::Tracker::initializeTracks ( const IVecT & *frameIdx_*, const MatT & *position_*, const MatT & *SE_position_*, const MatT & *feature_*, const MatT & *SE_feature_* ) [virtual]

Reimplemented in tracker::LAPTrack.

Definition at line 39 of file Tracker.cpp.

References feature, firstFrame, frameIdx, frameLocIdx, lastFrame, N, nDims, nFeatures, nFrameLocs, nFrames, position, SE_feature, SE_position, trackAssignment, and tracks.

#### 7.5.4.5 void tracker::Tracker::printTracks ( ) const

Definition at line 126 of file Tracker.cpp.

References frameIdx, and tracks.

### 7.5.5 Member Data Documentation

#### 7.5.5.1 MatT tracker::Tracker::feature

Definition at line 66 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), and initializeTracks().

#### 7.5.5.2 IdxT tracker::Tracker::firstFrame = 0

Definition at line 68 of file Tracker.h.

Referenced by tracker::LAPTrack::checkFrameIdxs(), tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), tracker::LAPTrack::debugF2F(), getStats(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.3 IVecT tracker::Tracker::frameIdx

Definition at line 63 of file Tracker.h.

Referenced by tracker::LAPTrack::checkFrameIdxs(), tracker::LAPTrack::computeGapCloseMatrix(), initializeTracks(), and printTracks().

#### 7.5.5.4 IVecFieldT tracker::Tracker::frameLocIdx

Definition at line 74 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::debugF2F(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.5 IdxT tracker::Tracker::lastFrame = 0

Definition at line 69 of file Tracker.h.

Referenced by tracker::LAPTrack::checkFrameIdxs(), tracker::LAPTrack::computeGapCloseMatrix(), tracker::LAPTrack::debugF2F(), getStats(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.6 const Tracker::FloatT tracker::Tracker::log2pi = log(2∗arma::Datum<Tracker::FloatT>::pi) [static], [protected]

Definition at line 92 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), and tracker::LAPTrack::computeGapCloseMatrix().

#### 7.5.5.7 IdxT tracker::Tracker::N = 0

Definition at line 60 of file Tracker.h.

Referenced by getStats(), and initializeTracks().

#### 7.5.5.8 IdxT tracker::Tracker::nDims = 0

Definition at line 61 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), getStats(), and initializeTracks().

#### 7.5.5.9 IdxT tracker::Tracker::nFeatures = 0

Definition at line 62 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), getStats(), and initializeTracks().

#### 7.5.5.10 IVecT tracker::Tracker::nFrameLocs

Definition at line 73 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::debugF2F(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.11 IdxT tracker::Tracker::nFrames = 0

Definition at line 70 of file Tracker.h.

Referenced by getStats(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.12 MatT tracker::Tracker::position

Definition at line 64 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), and initialize↩ Tracks().

#### 7.5.5.13 MatT tracker::Tracker::SE_feature

Definition at line 67 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), and initialize↩ Tracks().

#### 7.5.5.14 MatT tracker::Tracker::SE_position

Definition at line 65 of file Tracker.h.

Referenced by tracker::LAPTrack::computeF2FCostMat(), tracker::LAPTrack::computeGapCloseMatrix(), and initialize↩ Tracks().

#### 7.5.5.15 IVecT tracker::Tracker::trackAssignment [protected]

Definition at line 93 of file Tracker.h.

Referenced by tracker::LAPTrack::closeGaps(), getStats(), initializeTracks(), and tracker::LAPTrack::linkF2F().

#### 7.5.5.16 TrackVecT tracker::Tracker::tracks

Definition at line 77 of file Tracker.h.

Referenced by tracker::LAPTrack::checkFrameIdxs(), tracker::LAPTrack::closeGaps(), tracker::LAPTrack::compute↩ GapCloseMatrix(), tracker::LAPTrack::debugCloseGaps(), getStats(), initializeTracks(), tracker::LAPTrack::linkF2F(), and printTracks().

The documentation for this class was generated from the following files:

- Tracker.h
- Tracker.cpp

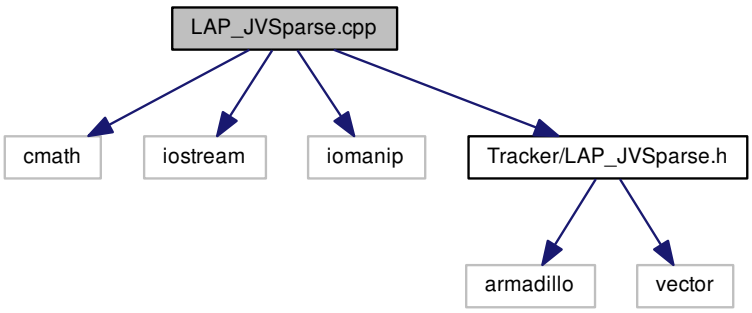
# 8 File Documentation

## 8.1 LAP_JVSparse.cpp File Reference

The member definitions for the LAP Jonker Volgenant algorithm.

```
#include <cmath>
#include <iostream>
#include <iomanip>
#include "Tracker/LAP_JVSparse.h"
```

Include dependency graph for LAP_JVSparse.cpp:




### Namespaces

- tracker

#### 8.1.1 Detailed Description

The member definitions for the LAP Jonker Volgenant algorithm.

**Author**

Mark J. Olah (mjo at cs.unm.edu)

**Date**

05-2015 This is a modern dense/sparse C++ implementation of Jonker Volgenant algoirthm using armadillo and presenting C++ and Matlab interface.

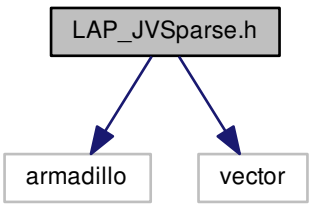
Adapted from text of Jonker and Volgenant. Computing 38, 324-340 (1986)

### 8.2 LAP_JVSparse.h File Reference

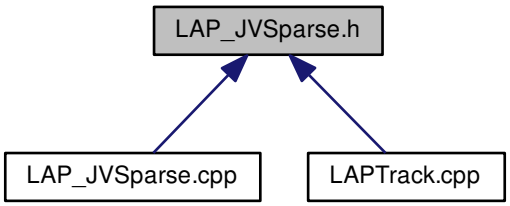
The class declaration for the LAP Jonker Volgenant algorithm.

```
#include <armadillo>
#include <vector>
```

Include dependency graph for LAP_JVSparse.h:




This graph shows which files directly or indirectly include this file:



#### Classes

- class tracker::LAP_JVSparse< FloatT >

#### Namespaces

- tracker

### 8.2.1 Detailed Description

The class declaration for the LAP Jonker Volgenant algorithm.

#### Author

Mark J. Olah (mjo@cs.unm.edu)

#### Date

05-2015 This is a modern dense/sparse C++ implementation of Jonker Volgenant algoirthm using armadillo and presenting C++ and Matlab interface.

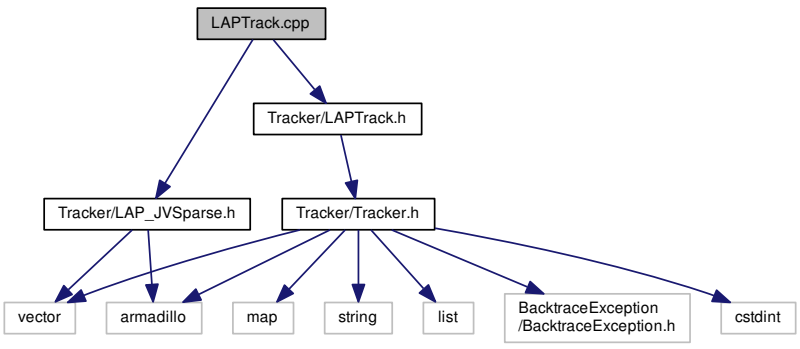
Adapted from text of Jonker and Volgenant. Computing 38, 324-340 (1986)

## 8.3 LAPTrack.cpp File Reference

The member definitions for LAPTrack.

```
#include "Tracker/LAPTrack.h"
#include "Tracker/LAP_JVSparse.h"
```

Include dependency graph for LAPTrack.cpp:



**Namespaces**

- tracker

### 8.3.1 Detailed Description

The member definitions for LAPTrack.

**Author**

Mark J. Olah (mjo at cs.unm.edu)

**Date**

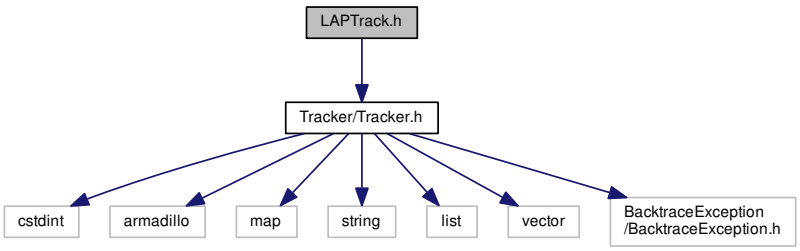
04-2015

## 8.4 LAPTrack.h File Reference

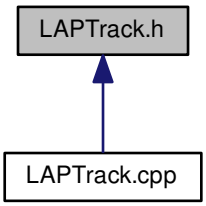
The class declaration and inline and templated functions for LAPTrack.

```
#include "Tracker/Tracker.h"
```

Include dependency graph for LAPTrack.h:




This graph shows which files directly or indirectly include this file:



#### Classes

- class tracker::LAPTrack

#### Namespaces

- tracker

### 8.4.1 Detailed Description

The class declaration and inline and templated functions for LAPTrack.

#### Author

Mark J. Olah (mjo@cs.unm.edu)

#### Date

02-2015 A simple LAP/Jaquman based tracker

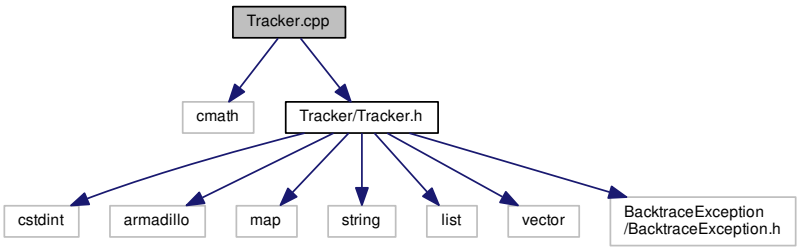
## 8.5 README.md File Reference

## 8.6 Tracker.cpp File Reference

The member definitions for Tracker.

```
#include <cmath>
#include "Tracker/Tracker.h"
```

Include dependency graph for Tracker.cpp:




#### Namespaces

- tracker

### 8.6.1 Detailed Description

The member definitions for Tracker.

**Author**

Mark J. Olah (mjo at cs.unm.edu)

**Date**

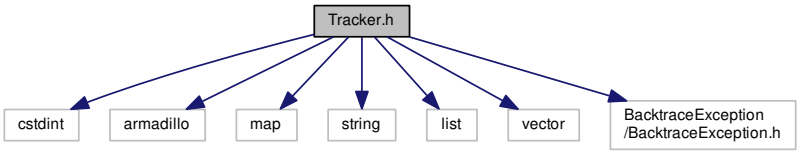
04-2015

## 8.7 Tracker.h File Reference

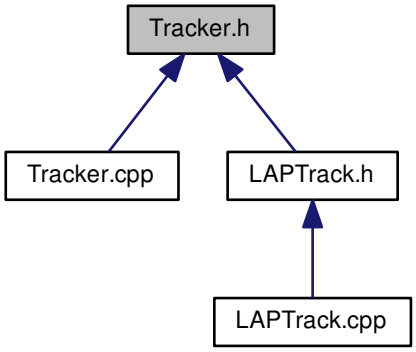
The class declaration and inline and templated functions for Tracker.

```
#include <cstdint>
#include <armadillo>
#include <map>
#include <string>
#include <list>
#include <vector>
#include "BacktraceException/BacktraceException.h"
```

Include dependency graph for Tracker.h:



This graph shows which files directly or indirectly include this file:




### Classes

- struct tracker::ParameterValueError

  *Parameter value is not valid.*
- struct tracker::LogicalError

  *Parameter value is not valid.*
- class tracker::Tracker

### Namespaces

- tracker

### Typedefs

- using tracker::TrackerError = backtrace_exception::BacktraceException

#### 8.7.1 Detailed Description

The class declaration and inline and templated functions for Tracker.

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02-2015 The base class for all Tracking models

Insted of templating on the FloatT type, which is problematic for inheritance hierarchies of templated base classes. Instead wuse a typedef to allow configuration of use with either float/double. Default is double.

# Index