

Group Detection

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Chapter 1

Data Structure Documentation

1.1 annotationsHandle::ANNOTATION Struct Reference

A structure that stores a single annotation for a specific person.

Data Fields

- short int **id**
- cv::Point2f **location**
- std::deque< unsigned int > **poses**

1.2 annotationsHandle Class Reference

Class for annotating both positions and poses of the people in the images.

Data Structures

- struct [ANNOTATION](#)
A structure that stores a single annotation for a specific person.
- struct [ASSIGNED](#)
Shows which id from the old annotations is assigned to which id from the new annotations based on what minimal distance.
- struct [FULL_ANNOTATIONS](#)
Structure containing a vector of annotations for each image.

Public Types

- enum [POSE](#) {
SITTING, STANDING, BENDING, LONGITUDE,
LATITUDE }

All considered poses.

Static Public Member Functions

- static void [mouseHandlerAnn](#) (int event, int x, int y, int flags, void *param)
Mouse handler for annotating people's positions and poses.
- static void [showMenu](#) (cv::Point2f center)
Draws the "menu" of possible poses for the current position.
- static void [plotHull](#) (IplImage *img, std::vector< cv::Point2f > &hull)
Plots the hull indicated by the parameter `hull` on the given image.
- static int [runAnn](#) (int argc, char **argv, unsigned step, std::string usedImages, int imgIndex=-1)
Starts the annotation of the images.
- static void [trackbar_callback](#) (int position, void *param)
The "on change" handler for the track-bars.
- static void [trackBarHandleFct](#) (int position, void *param)
A function that starts a new thread which handles the track-bar event.
- static void [loadAnnotations](#) (char *filename, std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > &loadedAnno)
Load annotations from file.
- static void [annoDifferences](#) (std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > &train, std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > &test, float &avgDist, float &Ndiff, float &ssdLongDiff, float &ssdLatDiff, float &poseDiff)
Computes the average distance from the predicted location and the annotated one, the number of unpredicted people in each image and the differences in the pose estimation.
- static void [correlateLocs](#) (std::deque< [annotationsHandle::ANNOTATION](#) > &annoOld, std::deque< [annotationsHandle::ANNOTATION](#) > &annoNew, std::deque< [annotationsHandle::ASSIGNED](#) > &idAssignedTo)
Correlate annotations' from locations in `annoOld` to locations in `annoNew` through IDs.
- static bool [canBeAssigned](#) (std::deque< [annotationsHandle::ASSIGNED](#) > &idAssignedTo, short int id, float newDist, short int to)
Checks to see if a location can be assigned to a specific ID given the new distance.
- static void [displayFullAnns](#) (std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > &fullAnns)
Displays the complete annotations for all images.
- static int [runEvaluation](#) (int argc, char **argv)
Starts the annotation of the images.
- static void [drawOrientation](#) (cv::Point2f center, unsigned int orient, [annotationsHandle::POSE](#) pose)
Shows how the selected orientation looks on the image.

- static void [drawLatitude](#) (cv::Point2f head, cv::Point2f feet, unsigned int orient, [annotationsHandle::POSE](#) pose)
Shows how the selected orientation looks on the image.
- static cv::Mat [rotateWrtCamera](#) (cv::Point2f headLocation, cv::Point2f feetLocation, cv::Mat toRotate, cv::Point2f &borders)
Rotate matrix wrt to the camera location.
- static void [writeAnnoToFile](#) (std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > fullAnno, std::string fileName)
Writes a given [FULL_ANNOTATIONS](#) structure into a given file.
- static void [init](#) ()
Initializes all the values of the class variables.

Static Protected Attributes

- static `IpLImage *` [image](#)
The currently processed image.
- static `std::deque< annotationsHandle::ANNOTATION >` [annotations](#)
- static `char` [choice](#) = ' '
Indicates if the pose was defined for the current frame.
- static `boost::mutex` [trackbarMutex](#)
A mutex for controlling the access to the annotations.
- static `unsigned` [poseSize](#) = 5
The number of elements in the POSE enum.
- static `bool` [withPoses](#) = false
With poses or just orientation.
- static `std::deque< std::string >` [poseNames](#)
The strings corresponding to the names of the poses.

1.2.1 Member Function Documentation

1.2.1.1 `int runAnn (int argc, char ** argv, unsigned step, std::string usedImages, int imgIndex = -1) [static]`

The parameters that need to be indicated are:

- `step` -- every "step"^(th) image is opened for annotation
- `usedImages` -- the folder where the annotated images are moved

- `imgIndex` -- the image index from which to start
- `argv[1]` -- name of directory containing the images
- `argv[2]` -- the file contains the calibration data of the camera
- `argv[3]` -- the file in which the annotation data needs to be stored

1.2.1.2 `int runEvaluation (int argc, char ** argv) [static]`

The parameters that need to be indicated are:

- `argv[1]` -- train file with the correct annotations;
- `argv[2]` -- test file with predicted annotations;

1.2.2 Field Documentation

1.2.2.1 `image [static, protected]`

An instance of the structure `ANNOTATIONS` storing the annotations for each image.

1.3 `annotationsHandle::ASSIGNED` Struct Reference

Shows which id from the old annotations is assigned to which id from the new annotations based on what minimal distance.

Data Fields

- short int `id`
- short int `to`
- float `dist`

1.4 `cholesky` Class Reference

The `Cholesky` decomposition is used to solve $Ax = b$; if A is symmetric and positive definite \Rightarrow we can decompose $A = LL^*$ and instead of solving $Ax = b$, solve $Ly = b$ for y , and then solve $L^*x = y$ for x .

Public Member Functions

- void `init ()`
(Re)Initializes the class variables so the same instance of the class can be used for multiple decompositions.
- bool `checkDecomposition ()`
Checks to see if the decomposition was already done (returns true if it is done).
- int `decomposeCov (cv::Mat a)`

Decomposes the (covariance) matrix A into $A = LL^$.*

- void `solve` (cv::Mat b, cv::Mat &x)
Solves the general linear system: $Ax = b$ and returns x .
- void `solveL` (cv::Mat b, cv::Mat &y)
Solve the simplified equation $Ly = b$, and return y (where $A=LL^$).*
- void `solveLTranspose` (cv::Mat b, cv::Mat &y)
Solve the simplified equation $L'y = b$, and return y (where $A=LL^$).*
- void `inverse` (cv::Mat &ainv)
Returns the inverse of the covariance: A^{-1} .
- float `logDet` ()
Returns the log of the determiner of the (covariance) matrix, A .

Data Fields

- unsigned `n`
- cv::Mat `covar`

1.5 classifyImages Class Reference

Class used for classifying the training data.

Public Types

- enum `USES` { EVALUATE, BUILD_DICTIONARY, TEST }
All available uses of this class.

Public Member Functions

- `classifyImages` (int argc, char **argv, `classifyImages::USES` use=`classifyImages::EVALUATE`)
Constructor & destructor of the class.
- void `buildDictionary` (int colorSp=`CV_BGR2Lab`, bool toUseGT=true)
Build dictionary for vector quantization.
- void `trainGP` (`annotationsHandle::POSE` what)
Creates the training data (according to the options), the labels and trains the a GaussianProcess on the data.
- void `predictGP` (std::deque< `gaussianProcess::prediction` > &predictionsSin, std::deque< `gaussianProcess::prediction` > &predictionsCos, `annotationsHandle::POSE` what)
Creates the test data and applies GaussianProcess prediction on the test data.

- void `init` (float theNoise, float theLength, `featureExtractor::FEATURE` theFeature, `gaussianProcess::kernelFunction` theKFunction=`&gaussianProcess::sqexp`, bool fromFolder=true, bool store=true, bool toUseGT=false)
Initialize the options for the Gaussian Process regression.
- void `evaluate` (std::deque< `gaussianProcess::prediction` > predictionsSin, std::deque< `gaussianProcess::prediction` > predictionsCos, float &error, float &normError, float &meanDiff)
Evaluate one prediction versus its target.
- void `crossValidation` (unsigned k, unsigned fold, bool onTrain=false)
Do k-fold cross-validation by splitting the training folder into training-set and validation-set.
- float `runCrossValidation` (unsigned k, int colorSp=CV_BGR2Lab, bool onTrain=false)
Does the cross-validation and computes the average error over all folds.
- void `runTest` (int colorSp=CV_BGR2Lab)
Runs the final evaluation (test).
- float `optimizePrediction` (`gaussianProcess::prediction` predictionsSin, `gaussianProcess::prediction` predictionsCos)
Try to optimize the prediction of the angle considering the variance of sin and cos.
- void `resetFeatures` (std::string dir, std::string imStr, int colorSp)
Reset the features object when the training and testing might have different calibration, background models...

Protected Attributes

- `peopleDetector * features`
An instance of `peopleDetector` class.
- cv::Mat `trainData`
The training data matrix.
- cv::Mat `testData`
The test data matrix.
- std::string `trainFolder`
The folder containing the training images.
- std::string `testFolder`
The folder containing the test images.
- std::string `annotationsTrain`
The file contains the annotations for the training images.
- std::string `annotationsTest`
The file contains the annotations for the test images.

- cv::Mat [trainTargets](#)
The column matrix containing the train annotation data (targets).
- cv::Mat [testTargets](#)
The column matrix containing the test annotation data (targets).
- [gaussianProcess](#) [gpCos](#)
- [gaussianProcess](#) [gpSin](#)
- float [noise](#)
The noise level of the data.
- float [length](#)
The length in the Gaussian Process.
- [gaussianProcess::kernelFunction](#) [kFunction](#)
The kernel function in the Gaussian Process.
- [featureExtractor::FEATURE](#) [feature](#)
Feature to be extracted.
- bool [readFromFolder](#)
If the images are read from folder or from a file with image names.
- std::deque< std::string > [imageList](#)
All images are stored in this list for cross-validation.
- std::deque< std::string > [annoList](#)
All annotations for all images are stored in this list for cross-validation.
- unsigned [foldSize](#)
The size of one fold in cross-validation.
- bool [storeData](#)
If data is stored locally or not.
- std::string [modelName](#)
The name of the model the be loaded/saved.
- [classifyImages::USES](#) [what](#)
What should the class be used for.
- std::string [testDir](#)
Directory in which to look for the test images & other files.
- std::string [testImgString](#)
The letters in the image names for the test data.
- std::string [trainDir](#)
Directory in which to look for the train images & other files.

- `std::string` [trainImgString](#)
The letters in the image names for the train data.
- `bool` [useGroundTruth](#)
Use the annotations' positions or use the tracker.

1.6 compareImg Struct Reference

Checks the image name (used to find the corresponding labels for each image).

Public Member Functions

- `compareImg` (`std::string` image)
- `bool operator()` ([annotationsHandle::FULL_ANNOTATIONS](#) anno) const

Data Fields

- `std::string` `imgName`

1.7 featureExtractor Class Reference

Extracts the actual features from the images and stores them in data matrix.

Data Structures

- `struct` [keyDescr](#)
Structure for storing keypoints and descriptors.
- `struct` [people](#)
Structure containing images of the size of the detected people.
- `struct` [templ](#)
Structure to store templates so they don't get recomputed all the time.

Public Types

- `enum` [FEATURE](#) {
IPOINTS, EDGES, SIFT_DICT, SURF,
SIFT, GABOR, PIXELS, HOG }
All available feature types.
- `enum` [ROTATE](#) { MATRIX, TEMPLATE, KEYS }
What needs to be rotated.

Public Member Functions

- void `init` (`featureExtractor::FEATURE` fType, std::string featFile)
Initializes the class elements.
- void `reset` ()
Resets the variables to the default values.
- void `initSIFT` (std::string dictName, unsigned means=500, unsigned size=128)
Creates a data matrix for each image and stores it locally.
- void `extractFeatures` (cv::Mat image, std::string sourceName, int colorspaceCode)
Creates a data matrix for each image and stores it locally.
- cv::Mat `extractPointsGrid` (cv::Mat image)
Extract the interest points in a grid and returns them.
- cv::Mat `extractEdges` (cv::Mat image)
Extract edges from the whole image.
- cv::Mat `extractGabor` (cv::Mat image)
Convolves the whole image with some Gabors wavelets and then stores the results.
- cv::Mat `extractSIFT` (cv::Mat image, std::vector< cv::Point2f > `templ`=std::vector< cv::Point2f >(), cv::Rect roi=cv::Rect())
Extracts SIFT features from the image and stores them in a matrix.
- cv::Mat `extractSURF` (cv::Mat image)
Extracts all the surf descriptors from the whole image and writes them in a matrix.
- cv::Mat `getPixels` (cv::Mat image, `featureExtractor::templ` aTempl, cv::Rect roi)
Gets the plain pixels corresponding to the upper part of the body.
- cv::Mat `getHOG` (cv::Mat pixels, `featureExtractor::templ` aTempl, cv::Rect roi)
Gets the HOG descriptors over an image.
- cv::Mat `getEdges` (cv::Mat feature, cv::Mat thresholded, cv::Rect roi, `featureExtractor::templ` aTempl, float rotAngle)
Gets the edges in an image.
- cv::Mat `getSURF` (cv::Mat feature, std::vector< cv::Point2f > `templ`, std::vector< cv::Point2f > &indices, cv::Rect roi, cv::Mat test=cv::Mat())
SURF descriptors (Speeded Up Robust Features).
- cv::Mat `getSIFT` (cv::Mat feature, std::vector< cv::Point2f > `templ`, std::vector< cv::Point2f > &indices, cv::Rect roi, cv::Mat test=cv::Mat())
Compute the features from the SIFT descriptors by doing vector quantization.
- cv::Mat `getPointsGrid` (cv::Mat feature, cv::Rect roi, `featureExtractor::templ` aTempl, cv::Mat test=cv::Mat())

Creates a "histogram" of interest points + number of blobs.

- `cv::Mat` [getGabor](#) (`cv::Mat` feature, `cv::Mat` thresholded, `cv::Rect` roi, `cv::Size` foregrSize, `float` rotAngle)

Convolves an image with a Gabor filter with the given parameters and returns the response image.

- `cv::Mat` [createGabor](#) (`float` *params=NULL)

Creates a gabor with the parameters given by the parameter vector.

- `cv::Mat` [getDataRow](#) (`cv::Mat` image, [featureExtractor::templ](#) aTempl, `cv::Rect` roi, [featureExtractor::people](#) person, `cv::Mat` thresholded, `cv::vector< cv::Point2f >` &keys, `std::string` imgName, `cv::Point2f` absRotCenter, `cv::Point2f` rotBorders, `float` rotAngle)

Returns the row corresponding to the indicated feature type.

- `cv::Mat` [rotate2Zero](#) (`float` rotAngle, `cv::Mat` toRotate, `cv::Point2f` &rotBorders, `cv::Point2f` rotCenter, [featureExtractor::ROTATE](#) what, `std::vector< cv::Point2f >` &pts)

Rotate a matrix/a template/keypoints wrt to the camera location.

- `unsigned` [readNoMeans](#) ()

Return number of means.

- `std::string` [readDictName](#) ()

Return name of the SIFT dictionary.

Static Public Member Functions

- `static bool` [compareDescriptors](#) (`const` [featureExtractor::keyDescr](#) k1, `const` [featureExtractor::keyDescr](#) k2)

Compares SURF 2 descriptors and returns the boolean value of their comparison.

- `static bool` [isInTemplate](#) (`unsigned` pixelX, `unsigned` pixelY, `std::vector< cv::Point2f >` templ)

Checks to see if a given pixel is inside a template.

1.7.1 Member Function Documentation

1.7.1.1 `void` [initSIFT](#) (`std::string` dictName, `unsigned` means = 500, `unsigned` size = 128)

Initializes the settings for the SIFT dictionary.

1.8 `annotationsHandle::FULL_ANNOTATIONS` Struct Reference

Structure containing a vector of annotations for each image.

Data Fields

- `std::string` `imgFile`
- `std::deque< annotationsHandle::ANNOTATION >` `annos`

1.9 gaussianProcess Class Reference

Class implementing the Gaussian Process Regression.

Data Structures

- struct [prediction](#)
A structure used to define predictions.

Public Types

- enum [DISTRIBUTION](#) {
BETA, GAUSS, GAUSS2D, GAUSSnD,
LOGGAUSSnD }
All available distributions for the functions.
- typedef float(gaussianProcess::* [kernelFunction](#))(cv::Mat, cv::Mat, float)
Define a pointer to the kernel function.

Public Member Functions

- float [distribution](#) (cv::Mat x, [gaussianProcess::DISTRIBUTION](#) distrib, cv::Mat mu=cv::Mat(), cv::Mat cov=cv::Mat(), float a=0, float b=0, float s=0)
Generates a selected distribution of the functions given the parameters (the mean: mu, the covariance: cov, the data x).
- void [train](#) (cv::Mat X, cv::Mat y, float(gaussianProcess::*fFunction)(cv::Mat, cv::Mat, float), float sigmasq, float length)
Trains the Gaussian process.
- void [predict](#) (cv::Mat x, [gaussianProcess::prediction](#) &predi, float length)
Returns the prediction for the test data, x (only one test data point).
- void [sampleGaussND](#) (cv::Mat mu, cv::Mat cov, cv::Mat &smpl)
Samples an N-dimensional Gaussian.
- float [rand_normal](#) ()
Returns a random number from the normal distribution.
- void [sample](#) (cv::Mat inputs, cv::Mat &smpl)
Samples the process that generates the inputs.
- void [sampleGPPrior](#) (float(gaussianProcess::*fFunction)(cv::Mat, cv::Mat, float), cv::Mat inputs, cv::Mat &smpl)
Samples the Gaussian Process Prior.

- float **sqexp** (cv::Mat x1, cv::Mat x2, float l=1.0)
- float **matern05** (cv::Mat x1, cv::Mat x2, float l=1.0)
- float **expCovar** (cv::Mat x1, cv::Mat x2, float l=1.0)
- float **matern15** (cv::Mat x1, cv::Mat x2, float l=1.0)
- float **matern25** (cv::Mat x1, cv::Mat x2, float l=1.0)
- void **init** ([gaussianProcess::kernelFunction](#) theKFunction=&gaussianProcess::sqexp)

Initializes or re-initializes a Gaussian Process.

Protected Attributes

- [cholesky](#) **chlsky**
An instance of the class `cholesky`.
- cv::Mat **alpha**
A variable to chase the values of alpha from the algorithm.
- cv::Mat **data**
Data matrix used for training.
- unsigned **N**
Number of training data points (`data.rows`).
- [kernelFunction](#) **kFunction**
Pointer to the kernel function to be used.
- bool **_norm_fast**
- float **_norm_next**
- float **_norm_max**
- int **rand_x**
- int **rand_y**

1.10 featureExtractor::keyDescr Struct Reference

Structure for storing keypoints and descriptors.

Data Fields

- cv::KeyPoint **keys**
- std::deque< float > **descr**

1.11 onScanline Struct Reference

Checks to see if a pixel's x coordinate is on a scanline.

Public Member Functions

- **onScanline** (const unsigned pixelY)
- **bool operator()** (const scanline_t line) const

Data Fields

- unsigned pixelY

1.12 featureExtractor::people Struct Reference

Structure containing images of the size of the detected people.

Data Fields

- cv::Point2f **absoluteLoc**
- cv::Point2f **relativeLoc**
- std::deque< unsigned > **borders**
- cv::Mat_< cv::Vec3b > **pixels**

1.13 peopleDetector Class Reference

Class used for detecting useful features in the images that can be later used for training and classifying.

Public Types

- enum **FEATUREPART** { TOP, BOTTOM, WHOLE }
What values can be used for the feature part to be extracted.

Public Member Functions

- **peopleDetector** (int argc, char **argv, bool extract=false, bool buildBg=false)
- **bool doFindPerson** (unsigned imgNum, IplImage *src, const vn_vector< FLOAT > &imgVec, vn_vector< FLOAT > &bgVec, const FLOAT logBGProb, const vn_vector< FLOAT > &logSumPixelBGProb)
Overwrites the doFindPeople function from the Tracker class to make it work with the feature extraction.
- **bool imageProcessingMenu** ()
Simple "menu" for skipping to the next image or quitting the processing.
- **void allForegroundPixels** (std::deque< featureExtractor::people > &allPeople, std::deque< unsigned > existing, IplImage *bg, float threshold)
Get the foreground pixels corresponding to each person.

- float [getDistToTemplate](#) (int pixelX, int pixelY, std::vector< cv::Point2f > templ)
Gets the distance to the given template from a given pixel location.
- void [extractDataRow](#) (std::deque< unsigned > &existing, IpplImage *bg)
Creates on data row in the final data matrix by getting the feature descriptors.
- std::deque< unsigned > [fixLabels](#) (std::deque< unsigned > existing)
For each row added in the data matrix (each person detected for which we have extracted some features) find the corresponding label.
- void [templateWindow](#) (cv::Size imgSize, int &minX, int &maxX, int &minY, int &maxY, [featureExtractor::templ](#) aTempl, int tplBorder=100)
Returns the size of a window around a template centered in a given point.
- void [init](#) (std::string dataFolder, std::string theAnnotationsFile, [featureExtractor::FEATURE](#) feat, bool readFromFolder=true)
Initializes the parameters of the tracker.
- bool [canBeAssigned](#) (unsigned l, std::deque< float > &minDistances, unsigned k, float distance, std::deque< int > &assignment)
Checks to see if an annotation can be assigned to a detection.
- float [fixAngle](#) (cv::Point2f feetLocation, cv::Point2f cameraLocation, float angle)
Fixes the angle to be relative to the camera position with respect to the detected position.
- std::deque< float > [templateExtremes](#) (std::vector< cv::Point2f > templ, int minX=0, int minY=0)
Get template extremities (if needed, considering some borders -- relative to the ROI).
- void [templatePart](#) (cv::Mat &thresholded, int k, float offsetX, float offsetY)
If only a part needs to be used to extract the features then the threshold and the template need to be changed.
- float [motionVector](#) (cv::Point2f head, cv::Point2f center)
Computes the motion vector for the current image given the tracks so far.
- float [opticalFlow](#) (cv::Mat currentImg, cv::Mat nextImg, std::vector< cv::Point2f > keyPts, cv::Point2f head, cv::Point2f center, bool maxOrAvg)
Compute the dominant direction of the SIFT or SURF features.
- void [keepLargestBlob](#) (cv::Mat &thresh, cv::Point2f center, float tmplArea)
Keeps only the largest blob from the thresholded image.
- std::deque< unsigned > [readLocations](#) ()
Reads the locations at which there are people in the current frame (for the case in which we do not want to use the tracker or build a bgModel).
- void [start](#) (bool readFromFolder, bool useGT)
Starts running something (either the tracker or just mimics it).
- void [add2Templates](#) (std::deque< unsigned > existing)

Adds a templates to the vector of templates at detected positions.

- void [pixels2Templates](#) (int maxX, int minX, int maxY, int minY, int k, cv::Mat thresh, cv::Mat &colorRoi, float tmpHHeight)

Assigns pixels to templates based on proximity.

- cv::Point2f [headLocation](#) (cv::Point2f center)

Gets the location of the head given the feet location.

- float [rotationAngle](#) (cv::Point2f headLocation, cv::Point2f feetLocation)

Return rotation angle given the head and feet position.

Data Fields

- bool [print](#)

To print some feature values or not.

- bool [plot](#)

If it is true it displays the tracks of the people in the images.

- cv::Mat [data](#)

The training data obtained from the feature descriptors.

- cv::Mat [targets](#)

- std::deque< [annotationsHandle::FULL_ANNOTATIONS](#) > [targetAnno](#)

- unsigned [lastIndex](#)

The previous size of the data matrix before adding new detections.

- int [colorspaceCode](#)

The colorspace code to be used before extracting the features.

- [peopleDetector::FEATUREPART](#) [featurePart](#)

Indicates if the part from the image to be used (feet, head, or both).

- unsigned [tracking](#)

If the data is sequential motion information can be used.

- cv::Mat [entireNext](#)

The the previous image.

- bool [onlyExtract](#)

If only the features need to be extracted or the data.

- bool [useGroundTruth](#)

Use ground truth to detect the people instead.

- [featureExtractor](#) * [extractor](#)

An instance of the class [featureExtractor](#).

- `std::string` [datasetPath](#)
The path to the dataset to be used.
- `std::string` [imageString](#)
The string that appears in the name of the images.
- `std::vector< featureExtractor::templ >` **templates**

1.13.1 Field Documentation

1.13.1.1 data

The targets/labels of the data.

1.14 gaussianProcess::prediction Struct Reference

A structure used to define predictions.

Data Fields

- `std::deque< float >` **mean**
- `std::deque< float >` **variance**

1.15 featureExtractor::templ Struct Reference

Structure to store templates so they don't get recomputed all the time.

Public Member Functions

- **templ** (`cv::Point` theCenter)

Data Fields

- `cv::Point2f` **center**
- `cv::Point2f` **head**
- `std::deque< float >` **extremes**
- `std::vector< cv::Point2f >` **points**

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