

Tennis Assistant - Computer Vision

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Contents

1	Namespace Index	1
1.1	Namespace List	1
2	Hierarchical Index	3
2.1	Class Hierarchy	3
3	Class Index	5
3.1	Class List	5
4	File Index	7
4.1	File List	7
5	Namespace Documentation	9
5.1	basket Namespace Reference	9
5.1.1	Function Documentation	9
5.1.1.1	basket_image_filter	9
5.1.1.2	is_basket_middle	9
5.1.1.3	run	9
5.1.1.4	run_middle	9
5.1.2	Variable Documentation	10
5.1.2.1	base_filename	10
5.1.2.2	image_half_size	10
5.1.2.3	particle_filter	10
5.1.2.4	save_count	10
5.2	basket_test Namespace Reference	10
5.2.1	Function Documentation	10
5.2.1.1	basketMissing	10
5.2.1.2	basketPresent	10
5.2.1.3	unitTest	10
5.3	experiment Namespace Reference	10
5.3.1	Detailed Description	10
5.3.2	Function Documentation	10
5.3.2.1	binary_mask	10

5.3.2.2	blobs_by_mask	10
5.3.2.3	dilation_and_blur	10
5.3.2.4	experiment	10
5.3.2.5	hard_threshold	11
5.4	image_support Namespace Reference	11
5.4.1	Function Documentation	11
5.4.1.1	external_init_particle_filter	11
5.4.1.2	get_best_blob	11
5.4.1.3	get_hue_blobs	11
5.4.1.4	image_hue_filter	11
5.4.1.5	is_blob_in_middle_helper	11
5.4.2	Variable Documentation	12
5.4.2.1	bcolor	12
5.5	particlefilter Namespace Reference	12
5.6	prquadtree Namespace Reference	12
5.6.1	Detailed Description	12
5.7	prquadtree_test Namespace Reference	12
5.8	prquadtree_test_example Namespace Reference	12
5.8.1	Detailed Description	13
5.8.2	Variable Documentation	13
5.8.2.1	b	13
5.8.2.2	b2	13
5.8.2.3	c	13
5.8.2.4	nearby	13
5.8.2.5	pt	13
5.8.2.6	qt	13
5.9	tennis_ball Namespace Reference	13
5.9.1	Detailed Description	13
5.9.2	Function Documentation	13
5.9.2.1	is_ball_middle	13
5.9.2.2	run	13
5.9.3	Variable Documentation	13
5.9.3.1	particle_filter	13
5.10	tennis_ball_test Namespace Reference	13
5.10.1	Function Documentation	14
5.10.1.1	ballMissing	14
5.10.1.2	ballPresent	14
5.10.1.3	unitTest	14

6.1	prquadtree.Box Class Reference	15
6.1.1	Detailed Description	15
6.1.2	Constructor & Destructor Documentation	15
6.1.2.1	__init__	15
6.1.3	Member Function Documentation	15
6.1.3.1	contains_point	15
6.1.3.2	intersect	16
6.1.4	Member Data Documentation	16
6.1.4.1	center	16
6.1.4.2	half_size	16
6.2	prquadtree.Particle Class Reference	16
6.2.1	Constructor & Destructor Documentation	16
6.2.1.1	__init__	16
6.2.2	Member Data Documentation	16
6.2.2.1	score	16
6.2.2.2	x	16
6.2.2.3	y	16
6.3	particlefilter.ParticleFilter Class Reference	17
6.3.1	Constructor & Destructor Documentation	17
6.3.1.1	__init__	17
6.3.2	Member Function Documentation	17
6.3.2.1	clear_scores	17
6.3.2.2	iterate	17
6.3.2.3	score	17
6.3.3	Member Data Documentation	17
6.3.3.1	image_box	17
6.3.3.2	iterations	17
6.3.3.3	iterations_before_clearing	17
6.3.3.4	pr_tree	17
6.4	prquadtree.Point Class Reference	18
6.4.1	Detailed Description	18
6.4.2	Constructor & Destructor Documentation	18
6.4.2.1	__init__	18
6.4.3	Member Function Documentation	18
6.4.3.1	__repr__	18
6.4.3.2	__str__	18
6.4.4	Member Data Documentation	18
6.4.4.1	x	18
6.4.4.2	y	18
6.5	prquadtree.PRQuadTree Class Reference	19

6.5.1	Detailed Description	19
6.5.2	Constructor & Destructor Documentation	19
6.5.2.1	__init__	19
6.5.3	Member Function Documentation	19
6.5.3.1	__str__	19
6.5.3.2	insert	20
6.5.3.3	print_all_points	20
6.5.3.4	query_k_nearest	20
6.5.3.5	query_range	20
6.5.3.6	size	20
6.5.4	Member Data Documentation	20
6.5.4.1	box	20
6.5.4.2	ne	20
6.5.4.3	nw	21
6.5.4.4	points	21
6.5.4.5	QT_NODE_CAPACITY	21
6.5.4.6	se	21
6.5.4.7	sw	21
6.6	prquadtree_test.TestBox Class Reference	21
6.6.1	Member Function Documentation	21
6.6.1.1	test_box_contains	21
6.6.1.2	test_box_insert	21
6.7	prquadtree_test.TestParticle Class Reference	21
6.7.1	Member Function Documentation	22
6.7.1.1	test_particle_insert	22
6.8	prquadtree_test.TestPoint Class Reference	22
6.8.1	Member Function Documentation	22
6.8.1.1	test_point_insert	22
6.9	prquadtree_test.TestPrQuadTree Class Reference	22
6.9.1	Member Function Documentation	23
6.9.1.1	test_insert	23
6.9.1.2	test_nearby	23
7	File Documentation	25
7.1	basket.py File Reference	25
7.2	basket_test.py File Reference	25
7.3	experiment.py File Reference	26
7.4	image_support.py File Reference	26
7.5	particlefilter.py File Reference	26
7.6	prquadtree.py File Reference	26

7.7	prquadtree_test.py File Reference	27
7.8	prquadtree_test_example.py File Reference	27
7.9	tennis_ball.py File Reference	27
7.10	tennis_ball_test.py File Reference	28
7.11	visual.h File Reference	28
7.11.1	Function Documentation	28
7.11.1.1	get_objects	28
7.11.1.2	set_objects	28
7.11.1.3	start_visual	28
7.11.1.4	stop_visual	28
Index		29

Chapter 1

Namespace Index

1.1 Namespace List

Here is a list of all namespaces with brief descriptions:

basket	9
basket_test	10
experiment	10
image_support	11
particlefilter	12
prquadtree	12
prquadtree_test	12
prquadtree_test_example	12
tennis_ball	13
tennis_ball_test	13

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

prquadtree.Box	15
particlefilter.ParticleFilter	17
prquadtree.Point	18
prquadtree.Particle	16
prquadtree.PRQuadTree	19
TestCase	
prquadtree_test.TestBox	21
prquadtree_test.TestParticle	21
prquadtree_test.TestPoint	22
prquadtree_test.TestPrQuadTree	22

Chapter 3

Class Index

3.1 Class List

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

prquadtree.Box	15
prquadtree.Particle	16
particlefilter.ParticleFilter	17
prquadtree.Point	18
prquadtree.PRQuadTree	19
prquadtree_test.TestBox	21
prquadtree_test.TestParticle	21
prquadtree_test.TestPoint	22
prquadtree_test.TestPrQuadTree	22

Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

basket.py	25
basket_test.py	25
experiment.py	26
image_support.py	26
particlefilter.py	26
prquadtree.py	26
prquadtree_test.py	27
prquadtree_test_example.py	27
tennis_ball.py	27
tennis_ball_test.py	28
visual.h	28

Chapter 5

Namespace Documentation

5.1 basket Namespace Reference

Functions

- def `basket_image_filter` (img)
- def `is_basket_middle` (img)
- def `run_middle` ()
- def `run`

Variables

- `particle_filter` = None
- int `image_half_size` = -1
- int `save_count` = 1
- tuple `base_filename` = datetime.now()

5.1.1 Function Documentation

5.1.1.1 `def basket.basket_image_filter (img)`

Image filter which removes colors out of basket color range. (Deprecated)
@param img SimpleCV.Image
@return img SimpleCV.Image The image with filtered colors turned to black

5.1.1.2 `def basket.is_basket_middle (img)`

Single entry function returning True/False if basket is in the middle of the screen

5.1.1.3 `def basket.run (bestBlobCallback = False)`

5.1.1.4 `def basket.run_middle ()`

Runs continuously and prints if the best detected blob is in the middle

5.1.2 Variable Documentation

5.1.2.1 `tuple basket.base_filename = datetime.now()`

5.1.2.2 `int basket.image_half_size = -1`

5.1.2.3 `basket.particle_filter = None`

5.1.2.4 `int basket.save_count = 1`

5.2 `basket_test` Namespace Reference

Functions

- def `unitTest` (actual, expected, name)
- def `basketPresent` ()
- def `basketMissing` ()

5.2.1 Function Documentation

5.2.1.1 `def basket_test.basketMissing ()`

5.2.1.2 `def basket_test.basketPresent ()`

5.2.1.3 `def basket_test.unitTest (actual, expected, name)`

5.3 `experiment` Namespace Reference

Functions

- def `experiment`
- def `hard_threshold` (img)
- def `binary_mask` (img)
- def `dilation_and_blur` (img)
- def `blobs_by_mask` (img)

5.3.1 Detailed Description

A utility file for testing out computer vision techniques on preset images. The purpose of this is to avoid using the webcam, and test on consistent test cases.

5.3.2 Function Documentation

5.3.2.1 `def experiment.binary_mask (img)`

5.3.2.2 `def experiment.blobs_by_mask (img)`

5.3.2.3 `def experiment.dilation_and_blur (img)`

5.3.2.4 `def experiment.experiment (image_function = None, blob_function = None, directory = " . / ")`

5.3.2.5 `def experiment.hard_threshold (img)`

5.4 image_support Namespace Reference

Functions

- `def external_init_particle_filter (img)`
- `def image_hue_filter`
- `def get_hue_blobs (img)`
- `def get_best_blob (blobs, particle_filter)`
- `def is_blob_in_middle_helper (img, blob)`

Variables

- `int bcolor = 0`

5.4.1 Function Documentation

5.4.1.1 `def image_support.external_init_particle_filter (img)`

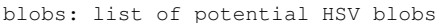
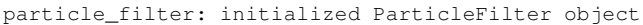
Initializes particle filter.

Args:
 : SimpleCV captured image

Returns:
 A ParticleFilter object

5.4.1.2 `def image_support.get_best_blob (blobs, particle_filter)`

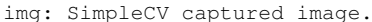
Returns the best blob out of the provided set and particle filter.

Args:
 : list of potential HSV blobs
 : initialized ParticleFilter object

Returns:
 The largest blob found or None.

5.4.1.3 `def image_support.get_hue_blobs (img)`

Gets basket blobs after hue distance filtering.

Args:
 : SimpleCV captured image.

Returns:
 Set of 'black' potential blobs.

5.4.1.4 `def image_support.image_hue_filter (img, ball = True)`

5.4.1.5 `def image_support.is_blob_in_middle_helper (img, blob)`

Determines whether the given blob is in ceter of image.

Args:

```
img: SimpleCV caputed image  
blob: SimpleCV Blob object
```

Returns:

True if blob in middle of image, false otherwise.

5.4.2 Variable Documentation

5.4.2.1 `int image_support.bcolor = 0`

5.5 particlefilter Namespace Reference

Classes

- class [ParticleFilter](#)

5.6 prquadtree Namespace Reference

Classes

- class [Box](#)
- class [Particle](#)
- class [Point](#)
- class [PRQuadTree](#)

5.6.1 Detailed Description

Implementation of a Point Range Quadtree.

Author: Pawel Szczurko

5.7 prquadtree_test Namespace Reference

Classes

- class [TestBox](#)
- class [TestParticle](#)
- class [TestPoint](#)
- class [TestPrQuadTree](#)

5.8 prquadtree_test_example Namespace Reference

Variables

- tuple `b` = [Box](#)([Point](#)(5,5), 50)
- tuple `b2` = [Box](#)([Point](#)(50,50), 50)
- tuple `qt` = [PRQuadTree](#)(`b2`)
- tuple `pt` = [Point](#)(2,2)
- tuple `nearby` = `qt.query_k_nearest(pt, 20)`
- int `c` = 1

5.8.1 Detailed Description

File testing the capabilities of the PRQuadTree.

Author: Pawel Szczurko

5.8.2 Variable Documentation

5.8.2.1 tuple prquadtree_test_example.b = Box(Point(5,5), 50)

5.8.2.2 tuple prquadtree_test_example.b2 = Box(Point(50,50), 50)

5.8.2.3 int prquadtree_test_example.c = 1

5.8.2.4 tuple prquadtree_test_example.nearby = qt.query_k_nearest(pt, 20)

5.8.2.5 tuple prquadtree_test_example.pt = Point(2,2)

5.8.2.6 tuple prquadtree_test_example.qt = PRQuadTree(b2)

5.9 tennis_ball Namespace Reference

Functions

- def [is_ball_middle](#) (img)
- def [run](#) ()

Variables

- [particle_filter](#) = None

5.9.1 Detailed Description

Simple detection of ball using SimpleCV (much easier than OpenCV). The run method identifies a tennis ball in the camera stream image. 'is_ball_middle' function can be used to determine whether a ball is horizontally centered based on a specified threshold.

-Pawel Szczurko

5.9.2 Function Documentation

5.9.2.1 def tennis_ball.is_ball_middle (*img*)

5.9.2.2 def tennis_ball.run ()

5.9.3 Variable Documentation

5.9.3.1 tennis_ball.particle_filter = None

5.10 tennis_ball_test Namespace Reference

Functions

- def `unitTest` (actual, expected, name)
- def `ballPresent` ()
- def `ballMissing` ()

5.10.1 Function Documentation

5.10.1.1 `def tennis_ball_test.ballMissing ()`

5.10.1.2 `def tennis_ball_test.ballPresent ()`

5.10.1.3 `def tennis_ball_test.unitTest (actual, expected, name)`

Chapter 6

Class Documentation

6.1 prquadtree.Box Class Reference

Public Member Functions

- def `__init__` (self, `center`, `half_size`)
- def `contains_point` (self, point)
- def `intersect` (self, other_box)

Public Attributes

- `center`
- `half_size`

6.1.1 Detailed Description

Class defining a square on the coordinate system via a center point and half of square width.

6.1.2 Constructor & Destructor Documentation

6.1.2.1 `def prquadtree.Box.__init__ (self, center, half_size)`

Construct a Box object.

Args:

`center`: a Point type specifying the center of the square
`half_size`: half the length of the square

6.1.3 Member Function Documentation

6.1.3.1 `def prquadtree.Box.contains_point (self, point)`

Verifies that the given point is within this square.

Args:

`point`: a Point type to check if it's in the square

Returns:

A boolean indicating whether the point is within the square

6.1.3.2 `def prquadtree.Box.intersect (self, other_box)`

Checks if the provided box/square intersects with this square.

Args:

`other_box`: another Box object

Returns:

A boolean indicating if the two intersect anywhere

6.1.4 Member Data Documentation

6.1.4.1 `prquadtree.Box.center`

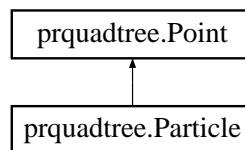
6.1.4.2 `prquadtree.Box.half_size`

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

- [prquadtree.py](#)

6.2 `prquadtree.Particle` Class Reference

Inheritance diagram for `prquadtree.Particle`:



Public Member Functions

- `def __init__ (self, x, y)`

Public Attributes

- `x`
- `y`
- `score`

6.2.1 Constructor & Destructor Documentation

6.2.1.1 `def prquadtree.Particle.__init__ (self, x, y)`

6.2.2 Member Data Documentation

6.2.2.1 `prquadtree.Particle.score`

6.2.2.2 `prquadtree.Particle.x`

6.2.2.3 `prquadtree.Particle.y`

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

- [prquadtree.py](#)

6.3 particlefilter.ParticleFilter Class Reference

Public Member Functions

- `def __init__ (self, box)`
- `def iterate (self, blobs)`
- `def score (self, blob)`
- `def clear_scores (self)`

Public Attributes

- [pr_tree](#)
- [image_box](#)
- [iterations](#)
- [iterations_before_clearing](#)

6.3.1 Constructor & Destructor Documentation

6.3.1.1 `def particlefilter.ParticleFilter.__init__ (self, box)`

6.3.2 Member Function Documentation

6.3.2.1 `def particlefilter.ParticleFilter.clear_scores (self)`

Resets all scores of blobs
This should be used when changing the webcam view

6.3.2.2 `def particlefilter.ParticleFilter.iterate (self, blobs)`

For each blob, it updates the points in the tree increasing the score of those which are within the bounding square of the blob

6.3.2.3 `def particlefilter.ParticleFilter.score (self, blob)`

Returns the sum of the scores of the points found within this blob

6.3.3 Member Data Documentation

6.3.3.1 `particlefilter.ParticleFilter.image_box`

6.3.3.2 `particlefilter.ParticleFilter.iterations`

6.3.3.3 `particlefilter.ParticleFilter.iterations_before_clearing`

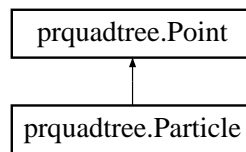
6.3.3.4 `particlefilter.ParticleFilter.pr_tree`

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

- [particlefilter.py](#)

6.4 prquadtree.Point Class Reference

Inheritance diagram for prquadtree.Point:



Public Member Functions

- `def __init__(self, x, y)`
- `def __str__(self)`
- `def __repr__(self)`

Public Attributes

- `x`
- `y`

6.4.1 Detailed Description

Represents an (x,y) coordinate point on a grid.

6.4.2 Constructor & Destructor Documentation

6.4.2.1 `def prquadtree.Point.__init__(self, x, y)`

Constructs a coordinate Point.

Args:

`x`: x-position
`y`: y-position

6.4.3 Member Function Documentation

6.4.3.1 `def prquadtree.Point.__repr__(self)`

6.4.3.2 `def prquadtree.Point.__str__(self)`

Overwriting the default to string method of the Point class.

6.4.4 Member Data Documentation

6.4.4.1 `prquadtree.Point.x`

6.4.4.2 `prquadtree.Point.y`

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

- [prquadtree.py](#)

6.5 prquadtree.PRQuadTree Class Reference

Public Member Functions

- def `__init__` (self, box)
- def `insert` (self, point)
- def `query_range` (self, rng)
- def `query_k_nearest` (self, point, k)
- def `print_all_points` (self, root)
- def `__str__` (self)

Static Public Member Functions

- def `size` (prtree)

Public Attributes

- `box`
- `points`
- `nw`
- `ne`
- `sw`
- `se`

Static Public Attributes

- int `QT_NODE_CAPACITY` = 20

6.5.1 Detailed Description

Class representing a Point Range Quadtree.

6.5.2 Constructor & Destructor Documentation

6.5.2.1 def prquadtree.PRQuadTree.__init__ (self, box)

Constructs a PR Quadtree given an initial square.

Args:

box: a Box representing initial square

6.5.3 Member Function Documentation

6.5.3.1 def prquadtree.PRQuadTree.__str__ (self)

Prints the points of the nw,ne,sw,se blocks of the given PRQuadTree node.

Returns:

A string of points in the blocks

6.5.3.2 `def prquadtree.PRQuadTree.insert (self, point)`

Inserts a point into the PRQuadtree.

Args:

point: An instance of Point

Returns:

A boolean returning true on success, false on failure.

6.5.3.3 `def prquadtree.PRQuadTree.print_all_points (self, root)`

Prints all points stored in the PRQuadtree.

Args:

root: start point, or the root of the Quadtree

Returns:

out: a string with coordinates

6.5.3.4 `def prquadtree.PRQuadTree.query_k_nearest (self, point, k)`

Returns k points closest to the provided point.

Args:

point: a Point from which to search for other points.

k: number of closest points to return

Returns:

A list of k closest points

6.5.3.5 `def prquadtree.PRQuadTree.query_range (self, rng)`

Returns the points in the provided range.

Args:

rng: a Box range from which to retrieve points

Returns:

A list of points within the provided range

6.5.3.6 `def prquadtree.PRQuadTree.size (prtree)` [static]

Static method that determines the size of the given tree.
Keeping an insertion count in the client code would be preferred to this due to heavy recursion.

Args:

prtree: instance of PRQuadTree

Returns:

An integer representing the number of points in the given tree.

6.5.4 Member Data Documentation

6.5.4.1 `prquadtree.PRQuadTree.box`

6.5.4.2 `prquadtree.PRQuadTree.ne`

6.5.4.3 prquadtree.PRQuadTree.nw

6.5.4.4 prquadtree.PRQuadTree.points

6.5.4.5 int prquadtree.PRQuadTree.QT_NODE_CAPACITY = 20 [static]

6.5.4.6 prquadtree.PRQuadTree.se

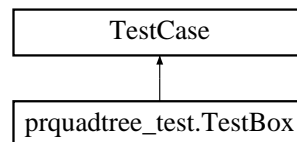
6.5.4.7 prquadtree.PRQuadTree.sw

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

- [prquadtree.py](#)

6.6 prquadtree_test.TestBox Class Reference

Inheritance diagram for prquadtree_test.TestBox:



Public Member Functions

- def [test_box_insert](#) (self)
- def [test_box_contains](#) (self)

6.6.1 Member Function Documentation

6.6.1.1 def prquadtree_test.TestBox.test_box_contains (self)

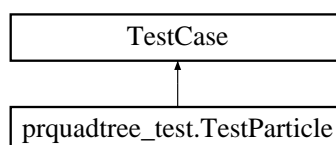
6.6.1.2 def prquadtree_test.TestBox.test_box_insert (self)

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

- [prquadtree_test.py](#)

6.7 prquadtree_test.TestParticle Class Reference

Inheritance diagram for prquadtree_test.TestParticle:



Public Member Functions

- def [test_particle_insert](#) (self)

6.7.1 Member Function Documentation

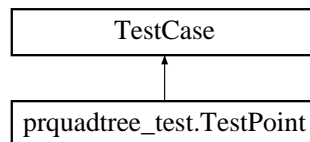
6.7.1.1 def prquadtree_test.TestParticle.test_particle_insert (*self*)

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

- [prquadtree_test.py](#)

6.8 prquadtree_test.TestPoint Class Reference

Inheritance diagram for prquadtree_test.TestPoint:



Public Member Functions

- def [test_point_insert](#) (self)

6.8.1 Member Function Documentation

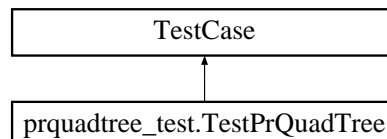
6.8.1.1 def prquadtree_test.TestPoint.test_point_insert (*self*)

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

- [prquadtree_test.py](#)

6.9 prquadtree_test.TestPrQuadTree Class Reference

Inheritance diagram for prquadtree_test.TestPrQuadTree:



Public Member Functions

- def [test_insert](#) (self)
- def [test_nearby](#) (self)

6.9.1 Member Function Documentation

6.9.1.1 `def prquadtree_test.TestPrQuadTree.test_insert (self)`

6.9.1.2 `def prquadtree_test.TestPrQuadTree.test_nearby (self)`

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

- [prquadtree_test.py](#)

Chapter 7

File Documentation

7.1 basket.py File Reference

Namespaces

- [basket](#)

Functions

- def [basket.basket_image_filter](#) (img)
- def [basket.is_basket_middle](#) (img)
- def [basket.run_middle](#) ()
- def [basket.run](#)

Variables

- [basket.particle_filter](#) = None
- int [basket.image_half_size](#) = -1
- int [basket.save_count](#) = 1
- tuple [basket.base_filename](#) = datetime.now()

7.2 basket_test.py File Reference

Namespaces

- [basket_test](#)

Functions

- def [basket_test.unitTest](#) (actual, expected, name)
- def [basket_test.basketPresent](#) ()
- def [basket_test.basketMissing](#) ()

7.3 experiment.py File Reference

Namespaces

- [experiment](#)

Functions

- `def experiment.experiment`
- `def experiment.hard_threshold (img)`
- `def experiment.binary_mask (img)`
- `def experiment.dilation_and_blur (img)`
- `def experiment.blobs_by_mask (img)`

7.4 image_support.py File Reference

Namespaces

- [image_support](#)

Functions

- `def image_support.external_init_particle_filter (img)`
- `def image_support.image_hue_filter`
- `def image_support.get_hue_blobs (img)`
- `def image_support.get_best_blob (blobs, particle_filter)`
- `def image_support.is_blob_in_middle_helper (img, blob)`

Variables

- `int image_support.bcolor = 0`

7.5 particlefilter.py File Reference

Classes

- `class particlefilter.ParticleFilter`

Namespaces

- [particlefilter](#)

7.6 prquadtree.py File Reference

Classes

- `class prquadtree.Point`
- `class prquadtree.Particle`
- `class prquadtree.Box`
- `class prquadtree.PRQuadTree`

Namespaces

- [prquadtree](#)

7.7 prquadtree_test.py File Reference

Classes

- class [prquadtree_test.TestPoint](#)
- class [prquadtree_test.TestParticle](#)
- class [prquadtree_test.TestBox](#)
- class [prquadtree_test.TestPrQuadTree](#)

Namespaces

- [prquadtree_test](#)

7.8 prquadtree_test_example.py File Reference

Namespaces

- [prquadtree_test_example](#)

Variables

- tuple [prquadtree_test_example.b](#) = Box(Point(5,5), 50)
- tuple [prquadtree_test_example.b2](#) = Box(Point(50,50), 50)
- tuple [prquadtree_test_example.qt](#) = PRQuadTree(b2)
- tuple [prquadtree_test_example.pt](#) = Point(2,2)
- tuple [prquadtree_test_example.nearby](#) = qt.query_k_nearest(pt, 20)
- int [prquadtree_test_example.c](#) = 1

7.9 tennis_ball.py File Reference

Namespaces

- [tennis_ball](#)

Functions

- def [tennis_ball.is_ball_middle](#) (img)
- def [tennis_ball.run](#) ()

Variables

- [tennis_ball.particle_filter](#) = None

7.10 tennis_ball_test.py File Reference

Namespaces

- [tennis_ball_test](#)

Functions

- def [tennis_ball_test.unitTest](#) (actual, expected, name)
- def [tennis_ball_test.ballPresent](#) ()
- def [tennis_ball_test.ballMissing](#) ()

7.11 visual.h File Reference

Functions

- int [start_visual](#) (void)
- void [set_objects](#) (object_t *objs)
- void [get_objects](#) (object_t *objs, point_t *locations)
- void [stop_visual](#) (void)

7.11.1 Function Documentation

7.11.1.1 void [get_objects](#) (object_t * *objs*, point_t * *locations*)

7.11.1.2 void [set_objects](#) (object_t * *objs*)

7.11.1.3 int [start_visual](#) (void)

7.11.1.4 void [stop_visual](#) (void)

Index

- `__init__`
 - `particlefilter::ParticleFilter`, 17
 - `prquadtree::Box`, 15
 - `prquadtree::PRQuadTree`, 19
 - `prquadtree::Particle`, 16
 - `prquadtree::Point`, 18
 - `__repr__`
 - `prquadtree::Point`, 18
 - `__str__`
 - `prquadtree::PRQuadTree`, 19
 - `prquadtree::Point`, 18
- b
 - `prquadtree_test_example`, 13
- b2
 - `prquadtree_test_example`, 13
- `ballMissing`
 - `tennis_ball_test`, 14
- `ballPresent`
 - `tennis_ball_test`, 14
- `base_filename`
 - `basket`, 10
- `basket`, 9
 - `base_filename`, 10
 - `basket_image_filter`, 9
 - `image_half_size`, 10
 - `is_basket_middle`, 9
 - `particle_filter`, 10
 - `run`, 9
 - `run_middle`, 9
 - `save_count`, 10
- `basket.py`, 25
- `basket_image_filter`
 - `basket`, 9
- `basket_test`, 10
 - `basketMissing`, 10
 - `basketPresent`, 10
 - `unitTest`, 10
- `basket_test.py`, 25
- `basketMissing`
 - `basket_test`, 10
- `basketPresent`
 - `basket_test`, 10
- `bcolor`
 - `image_support`, 12
- `binary_mask`
 - `experiment`, 10
- `blobs_by_mask`
 - `experiment`, 10
- box
 - `prquadtree::PRQuadTree`, 20

c

- `prquadtree_test_example`, 13

center

- `prquadtree::Box`, 16

clear_scores

- `particlefilter::ParticleFilter`, 17

contains_point

- `prquadtree::Box`, 15

dilation_and_blur

- `experiment`, 10

experiment, 10

- `binary_mask`, 10
- `blobs_by_mask`, 10
- `dilation_and_blur`, 10
- `experiment`, 10
- `hard_threshold`, 10

- `experiment.py`, 26
- `external_init_particle_filter`
- `image_support`, 11
- `get_best_blob`
- `image_support`, 11
- `get_hue_blobs`
- `image_support`, 11
- `get_objects`
- `visual.h`, 28
- half_size
- `prquadtree::Box`, 16
- `hard_threshold`
- `experiment`, 10
- `image_box`
- `particlefilter::ParticleFilter`, 17
- `image_half_size`
- `basket`, 10
- `image_hue_filter`
- `image_support`, 11
- `image_support`, 11
- `bcolor`, 12
- `external_init_particle_filter`, 11
- `get_best_blob`, 11
- `get_hue_blobs`, 11
- `image_hue_filter`, 11
- `is_blob_in_middle_helper`, 11
- `image_support.py`, 26
- insert

- prquadtree::PRQuadTree, 19
- intersect
 - prquadtree::Box, 15
- is_ball_middle
 - tennis_ball, 13
- is_basket_middle
 - basket, 9
- is_blob_in_middle_helper
 - image_support, 11
- iterate
 - particlefilter::ParticleFilter, 17
- iterations
 - particlefilter::ParticleFilter, 17
- iterations_before_clearing
 - particlefilter::ParticleFilter, 17
- ne
 - prquadtree::PRQuadTree, 20
- nearby
 - prquadtree_test_example, 13
- nw
 - prquadtree::PRQuadTree, 20
- particle_filter
 - basket, 10
 - tennis_ball, 13
- particlefilter, 12
- particlefilter.ParticleFilter, 17
- particlefilter.py, 26
- particlefilter::ParticleFilter
 - __init__, 17
 - clear_scores, 17
 - image_box, 17
 - iterate, 17
 - iterations, 17
 - iterations_before_clearing, 17
 - pr_tree, 17
 - score, 17
- points
 - prquadtree::PRQuadTree, 21
- pr_tree
 - particlefilter::ParticleFilter, 17
- print_all_points
 - prquadtree::PRQuadTree, 20
- prquadtree, 12
- prquadtree.Box, 15
- prquadtree.PRQuadTree, 19
- prquadtree.Particle, 16
- prquadtree.Point, 18
- prquadtree.py, 26
- prquadtree::Box
 - __init__, 15
 - center, 16
 - contains_point, 15
 - half_size, 16
 - intersect, 15
- prquadtree::PRQuadTree
 - __init__, 19
 - __str__, 19
 - box, 20
 - insert, 19
 - ne, 20
 - nw, 20
 - points, 21
 - print_all_points, 20
 - QT_NODE_CAPACITY, 21
 - query_k_nearest, 20
 - query_range, 20
 - se, 21
 - size, 20
 - sw, 21
- prquadtree::Particle
 - __init__, 16
 - score, 16
 - x, 16
 - y, 16
- prquadtree::Point
 - __init__, 18
 - __repr__, 18
 - __str__, 18
 - x, 18
 - y, 18
- prquadtree_test, 12
- prquadtree_test.py, 27
- prquadtree_test.TestBox, 21
- prquadtree_test.TestParticle, 21
- prquadtree_test.TestPoint, 22
- prquadtree_test.TestPrQuadTree, 22
- prquadtree_test::TestBox
 - test_box_contains, 21
 - test_box_insert, 21
- prquadtree_test::TestParticle
 - test_particle_insert, 22
- prquadtree_test::TestPoint
 - test_point_insert, 22
- prquadtree_test::TestPrQuadTree
 - test_insert, 23
 - test_nearby, 23
- prquadtree_test_example, 12
 - b, 13
 - b2, 13
 - c, 13
 - nearby, 13
 - pt, 13
 - qt, 13
- prquadtree_test_example.py, 27
- pt
 - prquadtree_test_example, 13
- QT_NODE_CAPACITY
 - prquadtree::PRQuadTree, 21
- qt
 - prquadtree_test_example, 13
- query_k_nearest
 - prquadtree::PRQuadTree, 20
- query_range
 - prquadtree::PRQuadTree, 20

run
 basket, [9](#)
 tennis_ball, [13](#)
run_middle
 basket, [9](#)

save_count
 basket, [10](#)
score
 particlefilter::ParticleFilter, [17](#)
 prquadtree::Particle, [16](#)
se
 prquadtree::PRQuadTree, [21](#)
set_objects
 visual.h, [28](#)
size
 prquadtree::PRQuadTree, [20](#)
start_visual
 visual.h, [28](#)
stop_visual
 visual.h, [28](#)
sw
 prquadtree::PRQuadTree, [21](#)

tennis_ball, [13](#)
 is_ball_middle, [13](#)
 particle_filter, [13](#)
 run, [13](#)
tennis_ball.py, [27](#)
tennis_ball_test, [13](#)
 ballMissing, [14](#)
 ballPresent, [14](#)
 unitTest, [14](#)
tennis_ball_test.py, [28](#)
test_box_contains
 prquadtree_test::TestBox, [21](#)
test_box_insert
 prquadtree_test::TestBox, [21](#)
test_insert
 prquadtree_test::TestPrQuadTree, [23](#)
test_nearby
 prquadtree_test::TestPrQuadTree, [23](#)
test_particle_insert
 prquadtree_test::TestParticle, [22](#)
test_point_insert
 prquadtree_test::TestPoint, [22](#)

unitTest
 basket_test, [10](#)
 tennis_ball_test, [14](#)

visual.h, [28](#)
 get_objects, [28](#)
 set_objects, [28](#)
 start_visual, [28](#)
 stop_visual, [28](#)

x
 prquadtree::Particle, [16](#)
 prquadtree::Point, [18](#)
y
 prquadtree::Particle, [16](#)
 prquadtree::Point, [18](#)