

Tennis Assistant - Computer Vision

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Chapter 1

Namespace Index

1.1 Packages

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Chapter 2

Hierarchical Index

2.1 Class Hierarchy

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

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Chapter 3

Class Index

3.1 Class List

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

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prquadtree.Particle	16
particlefilter.ParticleFilter	17
prquadtree.Point	18
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Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

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Chapter 5

Namespace Documentation

5.1 basket Namespace Reference

Functions

- def `is_basket_middle` (`img`)
Single entry function returning True/False if basket is in the middle of the screen.
- def `run_middle` ()
Runs continuously and prints if the best detected blob is in the middle.
- def `run`
Runs continuously outlines best matched blob if it is in the middle.

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.is_basket_middle (img)`

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

Parameters

<i>img</i>	SimpleCV.Image The image to test
------------	----------------------------------

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

Runs continuously outlines best matched blob if it is in the middle.

Parameters

<i>bestBlob↔ Callback</i>	function Callback called passing the best blob found
-------------------------------	------------------------------------------------------

5.1.1.3 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_runner Namespace Reference

5.3 basket_test Namespace Reference

Functions

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

5.3.1 Function Documentation

5.3.1.1 def basket_test.basketMissing ()

5.3.1.2 def basket_test.basketPresent ()

5.3.1.3 def basket_test.unitTest (*actual, expected, name*)

5.4 experiment Namespace Reference

Functions

- def [experiment](#)
- def [hard_threshold](#) (img)
- def [binary_mask](#) (img)
- def [dilation_and_blur](#) (img)
- def [blobs_by_mask](#) (img)

5.4.1 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.

5.4.2 Function Documentation

5.4.2.1 `def experiment.binary_mask (img)`

5.4.2.2 `def experiment.blobs_by_mask (img)`

5.4.2.3 `def experiment.dilation_and_blur (img)`

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

5.4.2.5 `def experiment.hard_threshold (img)`

5.5 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`

5.5.1 Function Documentation

5.5.1.1 `def image_support.external_init_particle_filter (img)`

Initializes particle filter.

Args:

`img`: SimpleCV captured image

Returns:

A ParticleFilter object

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

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

Args:

`blobs`: list of potential HSV blobs
`particle_filter`: initialized ParticleFilter object

Returns:

The largest blob found or None.

5.5.1.3 `def image_support.get_hue_blobs (img)`

Gets basket blobs after hue distance filtering.

Args:

`img`: SimpleCV captured image.

Returns:
Set of 'black' potential blobs.

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

5.5.1.5 `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.

5.5.2 Variable Documentation

5.5.2.1 `int image_support.bcolor = 0`

5.6 particlefilter Namespace Reference

Classes

- class [ParticleFilter](#)

5.7 prquadtree Namespace Reference

Classes

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

5.7.1 Detailed Description

Implementation of a Point Range Quadtree.

Author: Pawel Szczurko

5.8 prquadtree_test Namespace Reference

Classes

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

5.9 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

5.9.1 Detailed Description

File testing the capabilities of the PRQuadTree.

Author: Pawel Szczurko

5.9.2 Variable Documentation

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

5.9.2.2 tuple `prquadtree_test_example.b2` = `Box(Point(50,50), 50)`

5.9.2.3 int `prquadtree_test_example.c` = 1

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

5.9.2.5 tuple `prquadtree_test_example.pt` = `Point(2,2)`

5.9.2.6 tuple `prquadtree_test_example.qt` = `PRQuadTree(b2)`

5.10 tennis_ball Namespace Reference

Functions

- def `is_ball_middle` (img)
- def `run` ()

Variables

- `particle_filter` = None

5.10.1 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

5.10.2 Function Documentation

5.10.2.1 `def tennis_ball.is_ball_middle (img)`

5.10.2.2 `def tennis_ball.run ()`

5.10.3 Variable Documentation

5.10.3.1 `tennis_ball.particle_filter = None`

5.11 tennis_ball_runner Namespace Reference

5.12 tennis_ball_test Namespace Reference

Functions

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

5.12.1 Function Documentation

5.12.1.1 `def tennis_ball_test.ballMissing ()`

5.12.1.2 `def tennis_ball_test.ballPresent ()`

5.12.1.3 `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`

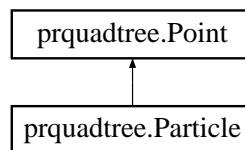
6.1.4.2 `prquadtree.Box.half_size`

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)
Constructor.
- def `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.
- def `score` (self, blob)
Returns the sum of the scores of the points found within this blob.
- def `clear_scores` (self)
Resets all scores of blobs This should be used when changing the webcam view.

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)

Constructor.

Parameters

<code>box</code>	Box the box representing the web cam view
------------------	-------------------------------------------

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.

Parameters

<code>blobs</code>	array An array of blob objects which were matched
--------------------	---------------------------------------------------

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

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

Parameters

<i>blob</i>	Blob A single blob
-------------	--------------------

Returns

int The score of the passed 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`

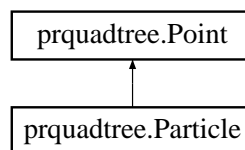
6.3.3.4 `particlefilter.ParticleFilter.pr_tree`

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)`

Overwritting 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.

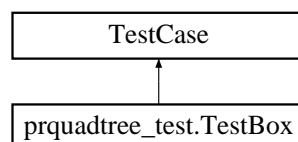
6.5.4 Member Data Documentation**6.5.4.1** `prquadtree.PRQuadTree.box`**6.5.4.2** `prquadtree.PRQuadTree.ne`**6.5.4.3** `prquadtree.PRQuadTree.nw`**6.5.4.4** `prquadtree.PRQuadTree.points`**6.5.4.5** `int prquadtree.PRQuadTree.QT_NODE_CAPACITY = 20 [static]`**6.5.4.6** `prquadtree.PRQuadTree.se`**6.5.4.7** `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)`

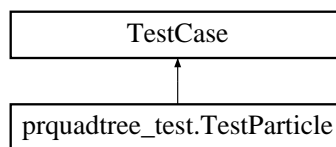
6.6.1.2 `def prquadtree_test.TestBox.test_box_insert (self)`

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

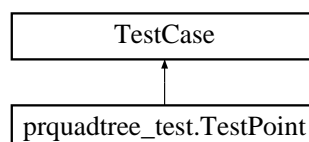
6.7.1.1 `def prquadtree_test.TestParticle.test_particle_insert (self)`

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

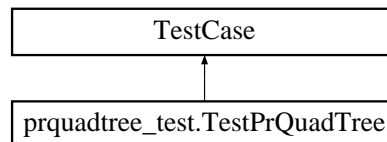
6.8.1.1 `def prquadtree_test.TestPoint.test_point_insert (self)`

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.is_basket_middle (img)`
Single entry function returning True/False if basket is in the middle of the screen.
- `def basket.run_middle ()`
Runs continuously and prints if the best detected blob is in the middle.
- `def basket.run`
Runs continuously outlines best matched blob if it is in the middle.

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_runner.py File Reference

Namespaces

- `basket_runner`

7.3 basket_test.py File Reference

Namespaces

- `basket_test`

Functions

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

7.4 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)

7.5 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

7.6 particlefilter.py File Reference

Classes

- class [particlefilter.ParticleFilter](#)

Namespaces

- [particlefilter](#)

7.7 prquadtree.py File Reference

Classes

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

Namespaces

- [prquadtree](#)

7.8 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](#)

7.9 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

7.10 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

7.11 tennis_ball_runner.py File Reference

Namespaces

- [tennis_ball_runner](#)

7.12 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](#) ()

7.13 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)

7.13.1 Function Documentation

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

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

7.13.1.3 int [start_visual](#) (void)

7.13.1.4 void [stop_visual](#) (void)

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