Colour - Checker Detection Documentation

Release 0.2.0

Colour Developers

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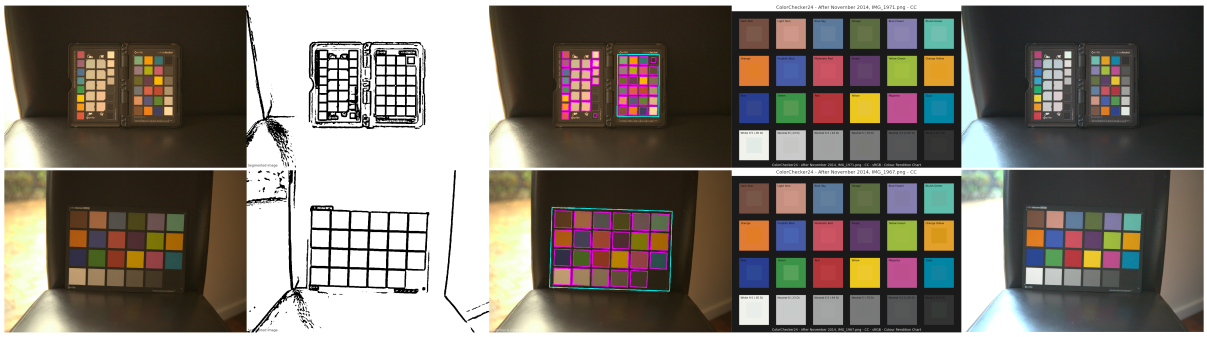
CONTENTS

A Python package implementing various colour checker detection algorithms and related utilities.

It is open source and freely available under the BSD-3-Clause terms.



CHAPTER

ONE

1.1 FEATURES

The following colour checker detection algorithms are implemented:

- Segmentation
- Machine learning inference via Ultralytics YOLOv8
  - The model is published on HuggingFace, and was trained on a purposely constructed dataset.
  - The model has only been trained on *ColorChecker Classic 24* images and will not work with *ColorChecker Nano* or *ColorChecker SG* images.
  - Inference is performed by a script licensed under the terms of the *GNU Affero General Public License v3.0* as it uses the *Ultralytics YOLOv8* API which is incompatible with the *BSD-3-Clause*.

1.1 1.1.1 Examples

Various usage examples are available from the examples directory.

CHAPTER

TWO

1.2 USER GUIDE

2.1 User Guide

The user guide provides an overview of **Colour - Checker Detection** and explains important concepts and features, details can be found in the API Reference.

2.1.1 Installation Guide

Because of their size, the resources dependencies needed to run the various examples and unit tests are not provided within the Pypi package. They are separately available as Git Submodules when cloning the repository.

Primary Dependencies

Colour - Checker Detection requires various dependencies in order to run:

- python >= 3.8, < 4
- colour-science >= 4.3
- imageio >= 2, < 3
- numpy >= 1.22, < 2
- opencv-python >= 4, < 5
- scipy >= 1.8, < 2

Secondary Dependencies

- ultralytics >= 8, < 9

Pypi

Once the dependencies are satisfied, **Colour - Checker Detection** can be installed from the Python Package Index by issuing this command in a shell:

```
pip install --user colour-checker-detection
```

The tests suite dependencies are installed as follows:

```
pip install --user 'colour-checker-detection[tests]'
```

The documentation building dependencies are installed as follows:

```
pip install --user 'colour-checker-detection[docs]'
```

The overall development dependencies are installed as follows:

```
pip install --user 'colour-checker-detection[development]'
```

2.1.2 Bibliography

CHAPTER

THREE

1.3 API REFERENCE

3.1 API Reference

3.1.1 Colour - Checker Detection

Detection

Inference

colour_checker_detection

SETTINGS_INFERENCE_COLORCHECKER_CLASSIC	Settings for the inference of the *X-Rite ColorChecker Classic*.
SETTINGS_INFERENCE_COLORCHECKER_CLASSIC_MINI	Settings for the inference of the *X-Rite ColorChecker Classic Mini*.
inferencer_default(image[, cctf_encoding, ...])	Predict the colour checker rectangles in given image using *Ultralytics YOLOv8*.
detect_colour_checkers_inference(image[, ...])	Detect the colour checkers swatches in given image using inference.

colour_checker_detection.SETTINGS_INFERENCE_COLORCHECKER_CLASSIC

colour_checker_detection.**SETTINGS_INFERENCE_COLORCHECKER_CLASSIC = {'aspect_ratio': 1.4285714285714286, 'inferred_class': 'ColorCheckerClassic24', 'inferred_confidence': 0.85, 'interpolation_method': 2, 'reference_values': array([[0.17355167, 0.07874029, 0.05326058], [0.55946176, 0.27734355, 0.21194777], [0.10509124, 0.18955202, 0.32693865], [0.10506442, 0.15021316, 0.05221047], [0.22885963, 0.21350031, 0.42346758], [0.11449231, 0.50663347, 0.41229432], [0.74499115, 0.20172072, 0.0325174], [0.0606182 , 0.10259253, 0.38373146], [0.56055825, 0.08072134, 0.11432307], [0.10983077, 0.04254067, 0.13682661], [0.32967574, 0.49495612, 0.04886544], [0.7689789 , 0.35655545, 0.02534346], [0.0225082 , 0.04870543, 0.28081679], [0.0444356 , 0.29068277, 0.06458335], [0.44636923, 0.03676343, 0.0406788], [0.83803037, 0.57175305, 0.01273052], [0.52392518, 0.07924915, 0.28656418], [-0.04308491, 0.23415773, 0.37506175], [0.87919095, 0.88476747, 0.8349529], [0.58443959, 0.59212352, 0.58458201], [0.35767777, 0.36706043, 0.36528718], [0.19008669, 0.19086038, 0.1898278], [0.08593528, 0.08873843, 0.08978779], [0.03135966, 0.03149993, 0.03231098]]), 'swatches': 24, 'swatches_achromatic_slice': slice(19, 23, 1), 'swatches_chromatic_slice': slice(1, 5, 1), 'swatches_horizontal': 6, 'swatches_vertical': 4, 'transform': {'rotation': 0, 'scale': array([1. , 1.05]), 'translation': array([0, 0])}, 'working_height': 1008, 'working_width': 1440}**

Settings for the inference of the *X-Rite ColorChecker Classic*.

colour_checker_detection.SETTINGS_INFERENCE_COLORCHECKER_CLASSIC_MINI

colour_checker_detection.**SETTINGS_INFERENCE_COLORCHECKER_CLASSIC_MINI = {'aspect_ratio': 1.7094017094017093, 'inferred_class': 'ColorCheckerSG', 'inferred_confidence': 0.85, 'interpolation_method': 2, 'reference_values': array([[0.17355167, 0.07874029, 0.05326058], [0.55946176, 0.27734355, 0.21194777], [0.10509124, 0.18955202, 0.32693865], [0.10506442, 0.15021316, 0.05221047], [0.22885963, 0.21350031, 0.42346758], [0.11449231, 0.50663347, 0.41229432], [0.74499115, 0.20172072, 0.0325174], [0.0606182 , 0.10259253, 0.38373146], [0.56055825, 0.08072134, 0.11432307], [0.10983077, 0.04254067, 0.13682661], [0.32967574, 0.49495612, 0.04886544], [0.7689789 , 0.35655545, 0.02534346], [0.0225082 , 0.04870543, 0.28081679], [0.0444356 , 0.29068277, 0.06458335], [0.44636923, 0.03676343, 0.0406788], [0.83803037, 0.57175305, 0.01273052], [0.52392518, 0.07924915, 0.28656418], [-0.04308491, 0.23415773, 0.37506175], [0.87919095, 0.88476747, 0.8349529], [0.58443959, 0.59212352, 0.58458201], [0.35767777, 0.36706043, 0.36528718], [0.19008669, 0.19086038, 0.1898278], [0.08593528, 0.08873843, 0.08978779], [0.03135966, 0.03149993, 0.03231098]]), 'swatches': 24, 'swatches_achromatic_slice': slice(19, 23, 1), 'swatches_chromatic_slice': slice(1, 5, 1), 'swatches_horizontal': 6, 'swatches_vertical': 4, 'transform': {'rotation': 0, 'scale': array([1.15, 1.]), 'translation': array([0, 0])}, 'working_height': 842, 'working_width': 1440}**

Settings for the inference of the *X-Rite ColorChecker Classic Mini*.

colour_checker_detection.inferencer_default

colour_checker_detection.**inferencer_default**(*image: str | ArrayLike*, *cctf_encoding: Callable = eotf_inverse_sRGB*, *apply_cctf_encoding: bool = True*, *show: bool = False*) → NDArrayInt | NDArrayFloat

Predict the colour checker rectangles in given image using *Ultralytics YOLOv8*.

Parameters

- **image** (str | ArrayLike) – Image (or image path to read the image from) to detect the colour checker rectangles from.
- **cctf_encoding** (Callable) – Encoding colour component transfer function / opto-electronic transfer function used when converting the image from float to 8-bit.
- **apply_cctf_encoding** (bool) – Apply the encoding colour component transfer function / opto-electronic transfer function.
- **show** (bool) – Whether to show various debug images.

Returns

Array of inference results as rows of confidence, class, and mask.

Return type

np.ndarray

Warning: This definition sub-processes to a script licensed under the terms of the *GNU Affero General Public License v3.0* as it uses the *Ultralytics YOLOv8* API which is incompatible with the *BSD-3-Clause*.

Examples

```
>>> import os
>>> from colour import read_image
>>> from colour_checker_detection import ROOT_RESOURCES_TESTS
>>> path = os.path.join(
...     ROOT_RESOURCES_TESTS,
...     "colour_checker_detection",
...     "detection",
...     "IMG_1967.png",
... )
>>> results = inferencer_default(path)
>>> results.shape
(1, 3)
>>> results[0][0]
array(0.9708795...)
>>> results[0][1]
array(0.0...)
>>> results[0][2].shape
(864, 1280)
```

colour_checker_detection.detect_colour_checkers_inference

colour_checker_detection.**detect_colour_checkers_inference**(*image: str | ArrayLike*, *samples: int = 32*, *cctf_decoding=eotf_sRGB*, *apply_cctf_decoding: bool = False*, *inferencer: Callable = inferencer_default*, *inferencer_kwargs: dict | None = None*, *show: bool = False*, *additional_data: bool = False*, ***kwargs: Any*) → Tuple[*DataDetectionColourChecker* | NDArrayFloat, ...]

Detect the colour checkers swatches in given image using inference.

Parameters

- **image** (str | ArrayLike) – Image (or image path to read the image from) to detect the colour checker rectangles from.
- **samples** (int) – Sample count to use to average (mean) the swatches colours. The effective sample count is $samples^2$.
- **cctf_decoding** – Decoding colour component transfer function / opto-electronic transfer function used when converting the image from 8-bit to float.
- **apply_cctf_decoding** (bool) – Apply the decoding colour component transfer function / opto-electronic transfer function.
- **inferencer** (Callable) – Callable responsible to make predictions on the image and extract the colour checker rectangles.
- **inferencer_kwargs** (dict | None) – Keyword arguments to pass to the inferencer.
- **show** (bool) – Whether to show various debug images.
- **additional_data** (bool) – Whether to output additional data.
- **aspect_ratio** – Colour checker aspect ratio, e.g. 1.5.

- **aspect_ratio_minimum** – Minimum colour checker aspect ratio for detection: projective geometry might reduce the colour checker aspect ratio.
- **aspect_ratio_maximum** – Maximum colour checker aspect ratio for detection: projective geometry might increase the colour checker aspect ratio.
- **swatches** – Colour checker swatches total count.
- **swatches_horizontal** – Colour checker swatches horizontal columns count.
- **swatches_vertical** – Colour checker swatches vertical row count.
- **swatches_count_minimum** – Minimum swatches count to be considered for the detection.
- **swatches_count_maximum** – Maximum swatches count to be considered for the detection.
- **swatches_chromatic_slice** – A *slice* instance defining chromatic swatches used to detect if the colour checker is upside down.
- **swatches_achromatic_slice** – A *slice* instance defining achromatic swatches used to detect if the colour checker is upside down.
- **swatch_minimum_area_factor** – Swatch minimum area factor f with the minimum area m_a expressed as follows: $m_a = image_w * image_h / s_c / f$ where $image_w$, $image_h$ and s_c are respectively the image width, height and the swatches count.
- **swatch_contour_scale** – As the image is filtered, the swatches area will tend to shrink, the generated contours can thus be scaled.
- **working_width** – Size the input image is resized to for detection.
- **fast_non_local_means_denoising_kwargs** – Keyword arguments for `cv2.fastNlMeansDenoising()` definition.
- **adaptive_threshold_kwargs** – Keyword arguments for `cv2.adaptiveThreshold()` definition.
- **interpolation_method** – Interpolation method used when resizing the images, *cv2.INTER_CUBIC* and *cv2.INTER_LINEAR* methods are recommended.
- **kwargs** (`Any`) –

Returns
Tuple of `DataDetectionColourChecker` class instances or colour checkers swatches.

Return type
class`tuple`

Examples

```
>>> import os
>>> from colour import read_image
>>> from colour_checker_detection import ROOT_RESOURCES_TESTS
>>> path = os.path.join(
...     ROOT_RESOURCES_TESTS,
...     "colour_checker_detection",
...     "detection",
...     "IMG_1967.png",
... )
>>> image = read_image(path)
>>> detect_colour_checkers_inference(image)
(array([[ 0.3602327 ,  0.22158547,  0.11813926],
       [ 0.62800723,  0.39357048,  0.24196433],
```

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```
       [ 0.3284166 ,  0.31669423,  0.28818974],
       [ 0.3072932 ,  0.2744136 ,  0.10451803],
       [ 0.4204691 ,  0.31953654,  0.30901137],
       [ 0.34471545,  0.44057423,  0.29297924],
       [ 0.678418  ,  0.35242617,  0.06670552],
       [ 0.27259055,  0.2535471 ,  0.32912973],
       [ 0.6190633 ,  0.27043283,  0.18543543],
       [ 0.30721852,  0.18180828,  0.19161244],
       [ 0.4858081 ,  0.46007228,  0.03085822],
       [ 0.6499356 ,  0.4018961 ,  0.01579806],
       [ 0.19425018,  0.18621376,  0.27193058],
       [ 0.27500305,  0.38600868,  0.1245231 ],
       [ 0.55459476,  0.21477987,  0.12434786],
       [ 0.71898675,  0.5149239 ,  0.00561224],
       [ 0.5787967 ,  0.25837064,  0.2693373 ],
       [ 0.1743919 ,  0.31709513,  0.29550385],
       [ 0.7383609 ,  0.60645705,  0.43850273],
       [ 0.62609893,  0.5172464 ,  0.36816722],
       [ 0.5117422 ,  0.4191487 ,  0.3013721 ],
       [ 0.36412936,  0.2987345 ,  0.20754097],
       [ 0.26675388,  0.21421173,  0.14176223],
       [ 0.15856811,  0.13483825,  0.07938566]], dtype=float32),)
```

Segmentation

colour_checker_detection

SETTINGS_SEGMENTATION_COLORCHECKER_CLASSIC	Settings for the segmentation of the *X-Rite ColorChecker Classic* and *X-Rite ColorChecker Passport*.
SETTINGS_SEGMENTATION_COLORCHECKER_SG	Settings for the segmentation of the *X-Rite ColorChecker SG**.
SETTINGS_SEGMENTATION_COLORCHECKER_NANO	Settings for the segmentation of the *X-Rite ColorChecker Nano**.
segmenter_default(image[, cctf_encoding, ...])	Detect the colour checker rectangles in given image $image$ using segmentation.
detect_colour_checkers_segmentation(image[, ...])	Detect the colour checkers swatches in given image using segmentation.

colour_checker_detection.SETTINGS_SEGMENTATION_COLORCHECKER_CLASSIC

colour_checker_detection.**SETTINGS_SEGMENTATION_COLORCHECKER_CLASSIC = {'aspect_ratio': 1.5, 'aspect_ratio_maximum': 1.6500000000000001, 'aspect_ratio_minimum': 1.35, 'interpolation_method': 2, 'reference_values': array([[0.17355167, 0.07874029, 0.05326058], [0.55946176, 0.27734355, 0.21194777], [0.10509124, 0.18955202, 0.32693865], [0.10506442, 0.15021316, 0.05221047], [0.22885963, 0.21350031, 0.42346758], [0.11449231, 0.50663347, 0.41229432], [0.74499115, 0.20172072, 0.0325174], [0.0606182 , 0.10259253, 0.38373146], [0.56055825, 0.08072134, 0.11432307], [0.10983077, 0.04254067, 0.13682661], [0.32967574, 0.49495612, 0.04886544], [0.7689789 , 0.35655545, 0.02534346], [0.0225082 , 0.04870543, 0.28081679], [0.0444356 , 0.29068277, 0.06458335], [0.44636923, 0.03676343, 0.0406788], [0.83803037, 0.57175305, 0.01273052], [0.52392518, 0.07924915, 0.28656418], [-0.04308491, 0.23415773, 0.37506175], [0.87919095, 0.88476747, 0.8349529], [0.58443959, 0.59212352, 0.58458201], [0.35767777, 0.36706043, 0.36528718], [0.19008669, 0.19086038, 0.1898278], [0.08593528, 0.08873843, 0.08978779], [0.03135966, 0.03149993, 0.03231098]]), 'swatch_contour_scale': 1.3333333333333333, 'swatch_minimum_area_factor': 200, 'swatches': 24, 'swatches_achromatic_slice': slice(19, 23, 1), 'swatches_chromatic_slice': slice(1, 5, 1), 'swatches_count_maximum': 30, 'swatches_count_minimum': 18, 'swatches_horizontal': 6, 'swatches_vertical': 4, 'transform': {}, 'working_height': 960, 'working_width': 1440}**

Settings for the segmentation of the *X-Rite ColorChecker Classic* and *X-Rite ColorChecker Passport*.

colour_checker_detection.SETTINGS_SEGMENTATION_COLORCHECKER_SG

colour_checker_detection.**SETTINGS_SEGMENTATION_COLORCHECKER_SG = {'aspect_ratio': 1.4, 'aspect_ratio_maximum': 1.54, 'aspect_ratio_minimum': 1.26, 'interpolation_method': 2, 'reference_values': None, 'swatch_contour_scale': 1.3333333333333333, 'swatch_minimum_area_factor': 200, 'swatches': 140, 'swatches_achromatic_slice': slice(115, 120, 1), 'swatches_chromatic_slice': slice(48, 53, 1), 'swatches_count_maximum': 210, 'swatches_count_minimum': 70, 'swatches_horizontal': 14, 'swatches_vertical': 10, 'transform': {}, 'working_height': 1028, 'working_width': 1440}**

Settings for the segmentation of the *X-Rite ColorChecker SG**.

colour_checker_detection.SETTINGS_SEGMENTATION_COLORCHECKER_NANO

colour_checker_detection.**SETTINGS_SEGMENTATION_COLORCHECKER_NANO = {'aspect_ratio': 1.5, 'aspect_ratio_maximum': 2.0999999999999996, 'aspect_ratio_minimum': 1.0499999999999998, 'interpolation_method': 2, 'reference_values': array([[0.17355167, 0.07874029, 0.05326058], [0.55946176, 0.27734355, 0.21194777], [0.10509124, 0.18955202, 0.32693865], [0.10506442, 0.15021316, 0.05221047], [0.22885963, 0.21350031, 0.42346758], [0.11449231, 0.50663347, 0.41229432], [0.74499115, 0.20172072, 0.0325174], [0.0606182 , 0.10259253, 0.38373146], [0.56055825, 0.08072134, 0.11432307], [0.10983077, 0.04254067, 0.13682661], [0.32967574, 0.49495612, 0.04886544], [0.7689789 , 0.35655545, 0.02534346], [0.0225082 , 0.04870543, 0.28081679], [0.0444356 , 0.29068277, 0.06458335], [0.44636923, 0.03676343, 0.0406788], [0.83803037, 0.57175305, 0.01273052], [0.52392518, 0.07924915, 0.28656418], [-0.04308491, 0.23415773, 0.37506175], [0.87919095, 0.88476747, 0.8349529], [0.58443959, 0.59212352, 0.58458201], [0.35767777, 0.36706043, 0.36528718], [0.19008669, 0.19086038, 0.1898278], [0.08593528, 0.08873843, 0.08978779], [0.03135966, 0.03149993, 0.03231098]]), 'swatch_contour_scale': 1.5, 'swatch_minimum_area_factor': 200, 'swatches': 24, 'swatches_achromatic_slice': slice(19, 23, 1), 'swatches_chromatic_slice': slice(1, 5, 1), 'swatches_count_maximum': 30, 'swatches_count_minimum': 18, 'swatches_horizontal': 6, 'swatches_vertical': 4, 'transform': {}, 'working_height': 960, 'working_width': 1440}**

Settings for the segmentation of the *X-Rite ColorChecker Nano**.

colour_checker_detection.segmenter_default

colour_checker_detection.**segmenter_default**(*image: ArrayLike*, *cctf_encoding: Callable = eotf_inverse_sRGB*, *apply_cctf_encoding: bool = True*, *additional_data: bool = False*, ***kwargs: Any*) → DataSegmentationColourCheckers | NDArrayInt

Detect the colour checker rectangles in given image $image$ using segmentation.

The process is a follows:

- Input image $image$ is converted to a grayscale image $image_g$ and normalised to range [0, 1].
- Image $image_g$ is denoised using multiple bilateral filtering passes into image $image_d$.
- Image $image_d$ is thresholded into image $image_t$.
- Image $image_t$ is eroded and dilated to cleanup remaining noise into image $image_k$.
- Contours are detected on image $image_k$
- Contours are filtered to only keep squares/swatches above and below defined surface area.
- Squares/swatches are clustered to isolate region-of-interest that are potentially colour checkers: Contours are scaled by a third so that colour checkers swatches are joined, creating a large rectangular cluster. Rectangles are fitted to the clusters.
- Clusters with an aspect ratio different to the expected one are rejected, a side-effect is that the complementary pane of the *X-Rite ColorChecker Passport* is omitted.
- Clusters with a number of swatches close to the expected one are kept.

Parameters

- **image** (ArrayLike) – Image to detect the colour checker rectangles from.
- **cctf_encoding** (Callable) – Encoding colour component transfer function / opto-electronic transfer function used when converting the image from float to 8-bit.
- **apply_cctf_encoding** (bool) – Apply the encoding colour component transfer function / opto-electronic transfer function.
- **additional_data** (bool) – Whether to output additional data.
- **adaptive_threshold_kwargs** – Keyword arguments for cv2.adaptiveThreshold() definition.
- **aspect_ratio** – Colour checker aspect ratio, e.g. 1.5.
- **aspect_ratio_minimum** – Minimum colour checker aspect ratio for detection: projective geometry might reduce the colour checker aspect ratio.
- **aspect_ratio_maximum** – Maximum colour checker aspect ratio for detection: projective geometry might increase the colour checker aspect ratio.
- **bilateral_filter_iterations** – Number of iterations to use for bilateral filtering.
- **bilateral_filter_kwargs** – Keyword arguments for cv2.bilateralFilter() definition.
- **convolution_iterations** – Number of iterations to use for the erosion / dilation process.
- **convolution_kernel** – Convolution kernel to use for the erosion / dilation process.
- **interpolation_method** – Interpolation method used when resizing the images, *cv2.INTER_CUBIC* and *cv2.INTER_LINEAR* methods are recommended.

- **reference_values** – Reference values for the colour checker of interest.
- **swatch_contour_scale** – As the image is filtered, the swatches area will tend to shrink, the generated contours can thus be scaled.
- **swatch_minimum_area_factor** – Swatch minimum area factor f with the minimum area m_a expressed as follows: $m_a = image_w * image_h / s_c / f$ where $image_w$, $image_h$ and s_c are respectively the image width, height and the swatches count.
- **swatches** – Colour checker swatches total count.
- **swatches_achromatic_slice** – A *slice* instance defining achromatic swatches used to detect if the colour checker is upside down.
- **swatches_chromatic_slice** – A *slice* instance defining chromatic swatches used to detect if the colour checker is upside down.
- **swatches_count_maximum** – Maximum swatches count to be considered for the detection.
- **swatches_count_minimum** – Minimum swatches count to be considered for the detection.
- **swatches_horizontal** – Colour checker swatches horizontal columns count.
- **swatches_vertical** – Colour checker swatches vertical row count.
- **transform** – Transform to apply to the colour checker image post-detection.
- **working_width** – Width the input image is resized to for detection.
- **working_height** – Height the input image is resized to for detection.
- **kwargs** (Any) –

Returns
Colour checker rectangles and additional data or colour checker rectangles only.

Return type
colour_checker_detection.DataSegmentationColourCheckers or np.ndarray

Notes

- Multiple colour checkers can be detected if present in image.

Examples

```
>>> import os
>>> from colour import read_image
>>> from colour_checker_detection import ROOT_RESOURCES_TESTS
>>> path = os.path.join(
...     ROOT_RESOURCES_TESTS,
...     "colour_checker_detection",
...     "detection",
...     "IMG_1967.png",
... )
>>> image = read_image(path)
>>> segmenter_default(image)
array([[[ 358,  691],
        [ 373,  219],
        [1086,  242],
        [1071,  713]]]...)
```

colour_checker_detection.detect_colour_checkers_segmentation

colour_checker_detection.**detect_colour_checkers_segmentation**(*image: str | ArrayLike*, *samples: int = 32*, *cctf_decoding: Callable = eotf_sRGB*, *apply_cctf_decoding: bool = False*, *segmenter: Callable = segmenter_default*, *segmenter_kwargs: dict | None = None*, *show: bool = False*, *additional_data: bool = False*, ***kwargs: Any*) → Tuple[*DataDetectionColourChecker* | NDArrayFloat, ...]

Detect the colour checkers swatches in given image using segmentation.

Parameters

- **image** (str | ArrayLike) – Image (or image path to read the image from) to detect the colour checkers swatches from.
- **samples** (int) – Sample count to use to average (mean) the swatches colours. The effective sample count is $samples^2$.
- **cctf_decoding** (Callable) – Decoding colour component transfer function / opto-electronic transfer function used when converting the image from 8-bit to float.
- **apply_cctf_decoding** (bool) – Apply the decoding colour component transfer function / opto-electronic transfer function.
- **segmenter** (Callable) – Callable responsible to segment the image and extract the colour checker rectangles.
- **segmenter_kwargs** (dict | None) – Keyword arguments to pass to the segmenter.
- **show** (bool) – Whether to show various debug images.
- **additional_data** (bool) – Whether to output additional data.
- **adaptive_threshold_kwargs** – Keyword arguments for cv2.adaptiveThreshold() definition.
- **aspect_ratio** – Colour checker aspect ratio, e.g. 1.5.
- **aspect_ratio_minimum** – Minimum colour checker aspect ratio for detection: projective geometry might reduce the colour checker aspect ratio.
- **aspect_ratio_maximum** – Maximum colour checker aspect ratio for detection: projective geometry might increase the colour checker aspect ratio.
- **bilateral_filter_iterations** – Number of iterations to use for bilateral filtering.
- **bilateral_filter_kwargs** – Keyword arguments for cv2.bilateralFilter() definition.
- **convolution_iterations** – Number of iterations to use for the erosion / dilation process.
- **convolution_kernel** – Convolution kernel to use for the erosion / dilation process.
- **interpolation_method** – Interpolation method used when resizing the images, *cv2.INTER_CUBIC* and *cv2.INTER_LINEAR* methods are recommended.
- **reference_values** – Reference values for the colour checker of interest.

- **swatch_contour_scale** – As the image is filtered, the swatches area will tend to shrink, the generated contours can thus be scaled.
- **swatch_minimum_area_factor** – Swatch minimum area factor f with the minimum area m_a expressed as follows: $m_a = image_w * image_h / s_c / f$ where $image_w$, $image_h$ and s_c are respectively the image width, height and the swatches count.
- **swatches** – Colour checker swatches total count.
- **swatches_achromatic_slice** – A *slice* instance defining achromatic swatches used to detect if the colour checker is upside down.
- **swatches_chromatic_slice** – A *slice* instance defining chromatic swatches used to detect if the colour checker is upside down.
- **swatches_count_maximum** – Maximum swatches count to be considered for the detection.
- **swatches_count_minimum** – Minimum swatches count to be considered for the detection.
- **swatches_horizontal** – Colour checker swatches horizontal columns count.
- **swatches_vertical** – Colour checker swatches vertical row count.
- **transform** – Transform to apply to the colour checker image post-detection.
- **working_width** – Width the input image is resized to for detection.
- **working_height** – Height the input image is resized to for detection.
- **kwargs** (Any) –

Returns
Tuple of DataDetectionColourChecker class instances or colour checkers swatches.

Return type
class`tuple`

Examples

```
>>> import os
>>> from colour import read_image
>>> from colour_checker_detection import ROOT_RESOURCES_TESTS
>>> path = os.path.join(
...     ROOT_RESOURCES_TESTS,
...     "colour_checker_detection",
...     "detection",
...     "IMG_1967.png",
... )
>>> image = read_image(path)
>>> detect_colour_checkers_segmentation(image)
(array([[ 0.360005  ,  0.22310828,  0.11760835],
       [ 0.6258309 ,  0.39448667,  0.24166533],
       [ 0.33198   ,  0.31600377,  0.28866866],
       [ 0.3046006 ,  0.273321  ,  0.10486555],
       [ 0.41751358,  0.31914026,  0.30789137],
       [ 0.34866226,  0.43934596,  0.29126382],
       [ 0.67983997,  0.35236534,  0.06997226],
       [ 0.27118555,  0.25352538,  0.33078724],
       [ 0.62091863,  0.27034152,  0.18652563],
       [ 0.3071613 ,  0.17978874,  0.19181632],
       [ 0.48547146,  0.4585586 ,  0.03294956],
```

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```
       [ 0.6507678 ,  0.40023172,  0.01607676],
       [ 0.19286253,  0.18585181,  0.27459183],
       [ 0.28054565,  0.38513032,  0.1224441 ],
       [ 0.5545431 ,  0.21436104,  0.12549178],
       [ 0.72068894,  0.51493925,  0.00548734],
       [ 0.5772921 ,  0.2577179 ,  0.2685553 ],
       [ 0.17289193,  0.3163792 ,  0.2950853 ],
       [ 0.7394083 ,  0.60953134,  0.4383072 ],
       [ 0.6281671 ,  0.51759964,  0.37215686],
       [ 0.51360977,  0.42048824,  0.2985709 ],
       [ 0.36953217,  0.30218402,  0.20827036],
       [ 0.26286703,  0.21493268,  0.14277342],
       [ 0.16102524,  0.13381621,  0.08047409]]...),)
```

Common Utilities

`colour_checker_detection.detection`

DTYPE_INT_DEFAULT	alias of int32
DTYPE_FLOAT_DEFAULT	alias of float32
SETTINGS_DETECTION_COLORCHECKER_CLASSIC	Settings for the detection of the *X-Rite ColorChecker Classic* and *X-Rite ColorChecker Passport*.
SETTINGS_DETECTION_COLORCHECKER_SG	Settings for the detection of the *X-Rite ColorChecker SG**.
SETTINGS_CONTOUR_DETECTION_DEFAULT	Settings for contour detection.
as_int32_array(a)	Convert given variable a to numpy.ndarray using *np.int32* numpy.dtype.
as_float32_array(a)	Convert given variable a to numpy.ndarray using *np.float32* numpy.dtype.
swatch_masks(width, height, swatches_h, ...)	Return swatch masks for given image width and height and swatches count.
swatch_colours(image, masks)	Extract the swatch colours from given image using given masks.
reformat_image(image, target_width[, ...])	Reformat given image so that it is horizontal and resizes it to given target width.
transform_image(image[, translation, ...])	Transform given image using given translation, rotation and scale values.
detect_contours(image[, additional_data])	Detect the contours of given image using given settings.
is_square(contour[, tolerance])	Return if given contour is a square.
contour_centroid(contour)	Return the centroid of given contour.
scale_contour(contour, factor)	Scale given contour by given scale factor.
approximate_contour(contour[, points, ...])	Approximate given contour to have given number of points.
quadrilateralise_contours(contours)	Convert given to quadrilaterals.
remove_stacked_contours(contours[, ...])	Remove amd filter out the stacked contours from given contours keeping either the smallest or the largest ones.
DataDetectionColourChecker(swatch_colours, ...)	Colour checker swatches data used for plotting, debugging and further analysis.
sample_colour_checker(image, quadrilateral, ...)	Sample the colour checker using the given source quadrilateral, i.e. detected colour checker in the image, and the given target rectangle.

colour_checker_detection.detection.DTYPE_INT_DEFAULT

colour_checker_detection.detection.**DTYPE_INT_DEFAULT**
alias of `int32`

colour_checker_detection.detection.DTYPE_FLOAT_DEFAULT

colour_checker_detection.detection.**DTYPE_FLOAT_DEFAULT**
alias of `float32`

colour_checker_detection.detection.SETTINGS_DETECTION_COLORCHECKER_CLASSIC

colour_checker_detection.detection.**SETTINGS_DETECTION_COLORCHECKER_CLASSIC** =
{'aspect_ratio': 1.5, 'interpolation_method': 2, 'reference_values': array([[0.17355167, 0.07874029, 0.05326058], [0.55946176, 0.27734355, 0.21194777], [0.10509124, 0.18955202, 0.32693865], [0.10506442, 0.15021316, 0.05221047], [0.22885963, 0.21350031, 0.42346758], [0.11449231, 0.50663347, 0.41229432], [0.74499115, 0.20172072, 0.0325174], [0.0606182 , 0.10259253, 0.38373146], [0.56055825, 0.08072134, 0.11432307], [0.10983077, 0.04254067, 0.13682661], [0.32967574, 0.49495612, 0.04886544], [0.7689789 , 0.35655545, 0.02534346], [0.0225082 , 0.04870543, 0.28081679], [0.0444356 , 0.29068277, 0.06458335], [0.44636923, 0.03676343, 0.0406788], [0.83803037, 0.57175305, 0.01273052], [0.52392518, 0.07924915, 0.28656418], [-0.04308491, 0.23415773, 0.37506175], [0.87919095, 0.88476747, 0.8349529], [0.58443959, 0.59212352, 0.58458201], [0.35767777, 0.36706043, 0.36528718], [0.19008669, 0.19086038, 0.1898278], [0.08593528, 0.08873843, 0.08978779], [0.03135966, 0.03149993, 0.03231098]]), 'swatches': 24, 'swatches_achromatic_slice': slice(19, 23, 1), 'swatches_chromatic_slice': slice(1, 5, 1), 'swatches_horizontal': 6, 'swatches_vertical': 4, 'transform': {}, 'working_height': 960, 'working_width': 1440}

Settings for the detection of the *X-Rite ColorChecker Classic* and *X-Rite ColorChecker Passport*.

colour_checker_detection.detection.SETTINGS_DETECTION_COLORCHECKER_SG

colour_checker_detection.detection.**SETTINGS_DETECTION_COLORCHECKER_SG** = **{'aspect_ratio': 1.4, 'interpolation_method': 2, 'reference_values': None, 'swatches': 140, 'swatches_achromatic_slice': slice(115, 120, 1), 'swatches_chromatic_slice': slice(48, 53, 1), 'swatches_horizontal': 14, 'swatches_vertical': 10, 'transform': {}, 'working_height': 1028, 'working_width': 1440}**

Settings for the detection of the *X-Rite ColorChecker SG**.

colour_checker_detection.detection.SETTINGS_CONTOUR_DETECTION_DEFAULT

colour_checker_detection.detection.**SETTINGS_CONTOUR_DETECTION_DEFAULT** =
{'adaptive_threshold_kwargs': {'C': 3, 'adaptiveMethod': 0, 'blockSize': 21, 'maxValue': 255, 'thresholdType': 0}, 'bilateral_filter_iterations': 5, 'bilateral_filter_kwargs': {'sigmaColor': 5, 'sigmaSpace': 5}, 'convolution_iterations': 1, 'convolution_kernel': array([[1, 1, 1], [1, 1, 1], [1, 1, 1]], dtype=uint8)}

Settings for contour detection.

colour_checker_detection.detection.as_int32_array

colour_checker_detection.detection.**as_int32_array**(*a: ArrayLike*) → NDArrayInt

Convert given variable a to numpy.ndarray using *np.int32* numpy.dtype.

Parameters
a (ArrayLike) – Variable a to convert.

Returns
Variable a converted to numpy.ndarray using *np.int32* numpy.dtype.

Return type
numpy.ndarray

Examples

```
>>> as_int32_array([1.5, 2.5, 3.5])
array([1, 2, 3]...)
```

colour_checker_detection.detection.as_float32_array

colour_checker_detection.detection.**as_float32_array**(*a: ArrayLike*) → NDArrayFloat

Convert given variable a to numpy.ndarray using *np.float32* numpy.dtype.

Parameters
a (ArrayLike) – Variable a to convert.

Returns
Variable a converted to numpy.ndarray using *np.float32* numpy.dtype.

Return type
numpy.ndarray

Examples

```
>>> as_float32_array([1, 2, 3])
array([...1...,...2...,...3...]...)
```

colour_checker_detection.detection.swatch_masks

colour_checker_detection.detection.**swatch_masks**(*width: int*, *height: int*, *swatches_h: int*, *swatches_v: int*, *samples: int*) → NDArrayInt

Return swatch masks for given image width and height and swatches count.

Parameters

- **width** (int) – Image width.
- **height** (int) – Image height.
- **swatches_h** (int) – Horizontal swatches count.
- **swatches_v** (int) – Vertical swatches count.
- **samples** (int) – Sample count.

Returns
Tuple of swatch masks.

Return type
tuple

Examples

```
>>> from pprint import pprint
>>> pprint(swatch_masks(16, 8, 4, 2, 1))
array([[ 1,  3,  1,  3],
       [ 1,  3,  5,  7],
       [ 1,  3,  9, 11],
       [ 1,  3, 13, 15],
       [ 5,  7,  1,  3],
       [ 5,  7,  5,  7],
       [ 5,  7,  9, 11],
       [ 5,  7, 13, 15]]...)
```

colour_checker_detection.detection.swatch_colours

colour_checker_detection.detection.**swatch_colours**(*image: ArrayLike*, *masks: ArrayLike*) → NDArrayFloat

Extract the swatch colours from given image using given masks.

Parameters

- **image** (ArrayLike) – Image to extract the swatch colours from.
- **masks** (ArrayLike) – Masks to use to extract the swatch colours from the image.

Returns
Extracted swatch colours.

Return type
numpy.ndarray

Examples

```
>>> from colour.utilities import tstack, zeros
>>> x = np.linspace(0, 1, 16)
>>> y = np.linspace(0, 1, 8)
>>> xx, yy = np.meshgrid(x, y)
>>> image = tstack([xx, yy, zeros(xx.shape)])
>>> swatch_colours(image, swatch_masks(16, 8, 4, 2, 1))
array([[...0.1...,...0.2142...,...0...],
       [...0.3...,...0.2142...,...0...],
       [...0.6...,...0.2142...,...0...],
       [...0.9...,...0.2142...,...0...],
       [...0.1...,...0.7857...,...0...],
       [...0.3...,...0.7857...,...0...],
       [...0.6...,...0.7857...,...0...],
       [...0.9...,...0.7857...,...0...]]...)
```

colour_checker_detection.detection.reformat_image

colour_checker_detection.detection.**reformat_image**(*image: ArrayLike*, *target_width: int*, *interpolation_method: Literal[cv2.INTER_AREA, cv2.INTER_CUBIC, cv2.INTER_LANCZOS4, cv2.INTER_LINEAR, cv2.INTER_LINEAR_EXACT, cv2.INTER_MAX, cv2.INTER_NEAREST, cv2.INTER_NEAREST_EXACT, cv2.WARP_FILL_OUTLIERS, cv2.WARP_INVERSE_MAP] = cv2.INTER_CUBIC*) → NDArrayInt | NDArrayFloat

Reformat given image so that it is horizontal and resizes it to given target width.

Parameters

- **image** (ArrayLike) – Image to reformat.
- **target_width** (int) – Width the image is resized to.
- **interpolation_method** (Literal[cv2.INTER_AREA, cv2.INTER_CUBIC, cv2.INTER_LANCZOS4, cv2.INTER_LINEAR, cv2.INTER_LINEAR_EXACT, cv2.INTER_MAX, cv2.INTER_NEAREST, cv2.INTER_NEAREST_EXACT, cv2.WARP_FILL_OUTLIERS, cv2.WARP_INVERSE_MAP]) – Interpolation method.

Returns

Reformatted image.

Return type

numpy.ndarray

Examples

```
>>> image = np.reshape(np.arange(24), (2, 4, 3))
>>> image
array([[[ 0,  1,  2],
        [ 3,  4,  5],
        [ 6,  7,  8],
        [ 9, 10, 11]],

       [[12, 13, 14],
        [15, 16, 17],
        [18, 19, 20],
        [21, 22, 23]]]...)
```

NOTE: Need to use *cv2.INTER_NEAREST_EXACT* or *cv2.INTER_LINEAR_EXACT* # for integer images.

```
>>> reformat_image(image, 6, interpolation_method=cv2.INTER_LINEAR_EXACT)
...
array([[[ 0,  1,  2],
        [ 2,  3,  4],
        [ 4,  5,  6],
        [ 5,  6,  7],
        [ 8,  9, 10],
        [ 9, 10, 11]],

       [[ 6,  7,  8],
```

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```
        [ 8,  9, 10],
        [10, 11, 12],
        [12, 13, 14],
        [14, 15, 16],
        [15, 16, 17]],

       [[12, 13, 14],
        [14, 15, 16],
        [16, 17, 18],
        [17, 18, 19],
        [20, 21, 22],
        [21, 22, 23]]]...)
```

colour_checker_detection.detection.transform_image

colour_checker_detection.detection.**transform_image**(*image*, *translation=np.array([0, 0])*, *rotation=0*, *scale=np.array([1, 1])*, *interpolation_method: Literal[cv2.INTER_AREA, cv2.INTER_CUBIC, cv2.INTER_LANCZOS4, cv2.INTER_LINEAR, cv2.INTER_LINEAR_EXACT, cv2.INTER_MAX, cv2.INTER_NEAREST, cv2.INTER_NEAREST_EXACT, cv2.WARP_FILL_OUTLIERS, cv2.WARP_INVERSE_MAP] = cv2.INTER_CUBIC*) → NDArrayInt | NDArrayFloat

Transform given image using given translation, rotation and scale values.

The transformation is performed relatively to the image center and in the following order:

1. Scale
2. Rotation
3. Translation

Parameters

- **image** – Image to transform.
- **translation** – Translation value.
- **rotation** – Rotation value in degrees.
- **scale** – Scale value.
- **interpolation_method** (Literal[cv2.INTER_AREA, cv2.INTER_CUBIC, cv2.INTER_LANCZOS4, cv2.INTER_LINEAR, cv2.INTER_LINEAR_EXACT, cv2.INTER_MAX, cv2.INTER_NEAREST, cv2.INTER_NEAREST_EXACT, cv2.WARP_FILL_OUTLIERS, cv2.WARP_INVERSE_MAP]) – Interpolation method.

Returns

Transformed image.

Return type

numpy.ndarray

Examples

```
>>> image = np.reshape(np.arange(24), (2, 4, 3))
>>> image
array([[[ 0,  1,  2],
        [ 3,  4,  5],
        [ 6,  7,  8],
        [ 9, 10, 11]],

       [[12, 13, 14],
        [15, 16, 17],
        [18, 19, 20],
        [21, 22, 23]]]...)
```

NOTE: Need to use *cv2.INTER_NEAREST* for integer images.

```
>>> transform_image(
...     image, translation=np.array([1, 0]), interpolation_method=cv2.INTER_NEAREST
... )
array([[[ 0,  1,  2],
        [ 0,  1,  2],
        [ 3,  4,  5],
        [ 6,  7,  8]],

       [[12, 13, 14],
        [12, 13, 14],
        [15, 16, 17],
        [18, 19, 20]]]...)
>>> transform_image(
...     image, rotation=90, interpolation_method=cv2.INTER_NEAREST
... )
array([[[15, 16, 17],
        [15, 16, 17],
        [15, 16, 17],
        [ 3,  4,  5]],

       [[18, 19, 20],
        [18, 19, 20],
        [18, 19, 20],
        [ 6,  7,  8]]]...)
>>> transform_image(
...     image, scale=np.array([2, 0.5]), interpolation_method=cv2.INTER_NEAREST
... )
array([[[ 3,  4,  5],
        [ 6,  7,  8],
        [ 6,  7,  8],
        [ 9, 10, 11]],

       [[15, 16, 17],
        [18, 19, 20],
        [18, 19, 20],
        [21, 22, 23]]]...)
```

colour_checker_detection.detection.detect_contours

colour_checker_detection.detection.**detect_contours**(*image: ArrayLike*, *additional_data: bool = False*, ***kwargs: Any*) → Tuple[NDArrayInt] | Tuple[Tuple[NDArrayInt], NDArrayInt | NDArrayFloat]

Detect the contours of given image using given settings.

The process is a follows:

- Input image $image$ is converted to a grayscale image $image_g$ and normalised to range [0, 1].
- Image $image_g$ is denoised using multiple bilateral filtering passes into image $image_d$.
- Image $image_d$ is thresholded into image $image_t$.
- Image $image_t$ is eroded and dilated to cleanup remaining noise into image $image_k$.
- Contours are detected on image $image_k$

Parameters

- **image** (ArrayLike) – Image to detect the contour of.
- **additional_data** (bool) – Whether to output additional data.
- **adaptive_threshold_kwargs** – Keyword arguments for cv2.adaptiveThreshold() definition.
- **bilateral_filter_iterations** – Number of iterations to use for bilateral filtering.
- **bilateral_filter_kwargs** – Keyword arguments for cv2.bilateralFilter() definition.
- **convolution_iterations** – Number of iterations to use for the erosion / dilation process.
- **convolution_kernel** – Convolution kernel to use for the erosion / dilation process.
- **kwargs** (Any) –

Returns

Detected image contours.

Return type

numpy.ndarray

Warning: The process and especially the default settings assume that the image has been resized to SETTINGS_DETECTION_COLORCHECKER_CLASSIC.working_width value!

Examples

```
>>> from colour.utilities import zeros
>>> image = zeros([240, 320, 3])
>>> image[150:190, 140:180] = 1
>>> len(detect_contours(image))
3
```

colour_checker_detection.detection.is_square

colour_checker_detection.detection.**is_square**(*contour: ArrayLike*, *tolerance: float = 0.015*) → bool

Return if given contour is a square.

Parameters

- **contour** (ArrayLike) – Shape to test whether it is a square.
- **tolerance** (float) – Tolerance under which the contour is considered to be a square.

Returns

Whether given contour is a square.

Return type

bool

Examples

```
>>> shape = np.array([[0, 0], [1, 0], [1, 1], [0, 1]])
>>> is_square(shape)
True
>>> shape = np.array([[0.5, 0], [1, 0], [1, 1], [0, 1]])
>>> is_square(shape)
False
```

colour_checker_detection.detection.contour_centroid

colour_checker_detection.detection.**contour_centroid**(*contour: ArrayLike*) → Tuple[float, float]

Return the centroid of given contour.

Parameters

contour (ArrayLike) – Contour to return the centroid of.

Returns

Contour centroid.

Return type

np.ndarray

Notes

- A tuple class is returned instead of a ndarray class for convenience with *OpenCV*.

Examples

```
>>> contour = np.array([[0, 0], [1, 0], [1, 1], [0, 1]])
>>> contour_centroid(contour)
(0.5, 0.5)
```

colour_checker_detection.detection.scale_contour

colour_checker_detection.detection.**scale_contour**(*contour: ArrayLike*, *factor: ArrayLike*) → NDArrayFloat

Scale given contour by given scale factor.

Parameters

- **contour** (ArrayLike) – Contour to scale.
- **factor** (ArrayLike) – Scale factor.

Returns
Scaled contour.

Return type
numpy.ndarray

Warning: This definition returns floating point contours!

Examples

```
>>> contour = np.array([[0, 0], [1, 0], [1, 1], [0, 1]])
>>> scale_contour(contour, 2)
array([[...-0.5, ...-0.5],
       [... 1.5, ...-0.5],
       [... 1.5, ... 1.5],
       [...-0.5, ... 1.5]]...)
```

colour_checker_detection.detection.approximate_contour

colour_checker_detection.detection.**approximate_contour**(*contour: ArrayLike*, *points: int = 4*, *iterations: int = 100*) → NDArrayInt

Approximate given contour to have given number of points.

The process uses binary search to find the best *epsilon* value producing a contour approximation with exactly `points`.

Parameters

- **contour** (ArrayLike) – Contour to approximate.
- **points** (int) – Number of points to approximate the contour to.
- **iterations** (int) – Maximal number of iterations to perform to approximate the contour.

Returns
Approximated contour.

Return type
numpy.ndarray

References

[Olf19]

Examples

```
>>> contour = np.array([[0, 0], [1, 0], [1, 1], [1, 2], [0, 1]])
>>> approximate_contour(contour, 4)
array([[0, 0],
       [1, 0],
       [1, 2],
       [0, 1]]...)
```

colour_checker_detection.detection.quadrilateralise_contours

colour_checker_detection.detection.**quadrilateralise_contours**(*contours: ArrayLike*) → Tuple[NDArrayInt, ...]

Convert given to quadrilaterals.

Parameters
contours (ArrayLike) – Contours to convert to quadrilaterals

Returns
Quadrilateralised contours.

Return type
tuple

Examples

```
>>> contours = np.array(
...     [
...         [[0, 0], [1, 0], [1, 1], [1, 2], [0, 1]],
...         [[0, 0], [1, 2], [1, 0], [1, 1], [0, 1]],
...     ]
... )
>>> quadrilateralise_contours(contours)
(array([[0, 0],
       [1, 0],
       [1, 2],
       [0, 1]]...), array([[0, 0],
       [1, 2],
       [1, 0],
       [1, 1]]...))
```

colour_checker_detection.detection.remove_stacked_contours

colour_checker_detection.detection.**remove_stacked_contours**(*contours: ArrayLike*, *keep_smallest: bool = True*) → Tuple[NDArrayInt, ...]

Remove amd filter out the stacked contours from given contours keeping either the smallest or the largest ones.

Parameters

- **contours** (ArrayLike) – Stacked contours to filter.
- **keep_smallest** (bool) – Whether to keep the smallest contours.

Returns
Filtered contours.

Return type
tuple

References

[Wal22]

Examples

```
>>> contours = np.array(
...     [
...         [[0, 0], [7, 0], [7, 7], [0, 7]],
...         [[0, 0], [8, 0], [8, 8], [0, 8]],
...         [[0, 0], [10, 0], [10, 10], [0, 10]],
...     ]
... )
>>> remove_stacked_contours(contours)
(array([[0, 0],
       [7, 0],
       [7, 7],
       [0, 7]]...)
>>> remove_stacked_contours(contours, False)
(array([[ 0,  0],
       [10,  0],
       [10, 10],
       [ 0, 10]]...)
```

colour_checker_detection.detection.DataDetectionColourChecker

class colour_checker_detection.detection.**DataDetectionColourChecker**(*swatch_colours: NDArrayFloat*, *swatch_masks: NDArrayInt*, *colour_checker: NDArrayFloat*, *quadrilateral: NDArrayFloat*)

Colour checker swatches data used for plotting, debugging and further analysis.

Parameters

- **swatch_colours** (NDArrayFloat) – Colour checker swatches colours.
- **swatch_masks** (NDArrayInt) – Colour checker swatches masks.
- **colour_checker** (NDArrayFloat) – Cropped and levelled Colour checker image.
- **quadrilateral** (NDArrayFloat) – Source quadrilateral where the colour checker has been detected.

__init__(*swatch_colours: NDArrayFloat*, *swatch_masks: NDArrayInt*, *colour_checker: NDArrayFloat*, *quadrilateral: NDArrayFloat*) → None

Parameters

- **swatch_colours** (NDArrayFloat) –
- **swatch_masks** (NDArrayInt) –
- **colour_checker** (NDArrayFloat) –
- **quadrilateral** (NDArrayFloat) –

Return type
None

Methods

__init__(swatch_colours, swatch_masks, ...)	

Attributes

fields	Getter property for the fields of the dataclass-like class.
items	Getter property for the dataclass-like class items, i.e. the field names and values.
keys	Getter property for the dataclass-like class keys, i.e. the field names.
values	Getter property for the dataclass-like class values, i.e. the field values.
swatch_colours	
swatch_masks	
colour_checker	
quadrilateral	

colour_checker_detection.detection.sample_colour_checker

colour_checker_detection.detection.**sample_colour_checker**(*image: ArrayLike*, *quadrilateral*, *rectangle*, *samples=32*, ***kwargs*) → *DataDetectionColourChecker*

Sample the colour checker using the given source quadrilateral, i.e. detected colour checker in the image, and the given target rectangle.

Parameters

- **image** (ArrayLike) – Image to sample from.
- **quadrilateral** – Source quadrilateral where the colour checker has been detected.
- **rectangle** – Target rectangle to warp the detected source quadrilateral onto.
- **samples** – Sample count to use to sample the swatches colours. The effective sample count is $samples^2$.
- **reference_values** – Reference values for the colour checker of interest.
- **swatches_horizontal** – Colour checker swatches horizontal columns count.
- **swatches_vertical** – Colour checker swatches vertical row count.
- **transform** – Transform to apply to the colour checker image post-detection.
- **working_width** – Width the input image is resized to for detection.
- **working_height** – Height the input image is resized to for detection.

Returns
Sampling process data.

Return type
colour_checker.DataDetectionColourChecker

References

[Dal24]

Examples

```
>>> import os
>>> from colour import read_image
>>> from colour_checker_detection import ROOT_RESOURCES_TESTS
>>> path = os.path.join(
...     ROOT_RESOURCES_TESTS,
...     "colour_checker_detection",
...     "detection",
...     "IMG_1967.png",
... )
>>> image = read_image(path)
>>> quadrilateral = np.array([[358, 691], [373, 219], [1086, 242], [1071, 713]])
>>> rectangle = np.array([[1440, 0], [1440, 960], [0, 960], [0, 0]])
>>> colour_checkers_data = sample_colour_checker(image, quadrilateral, rectangle)
>>> colour_checkers_data.swatch_colours
array([[ 0.75710917,  0.6763046 ,  0.47606474],
       [ 0.25871587,  0.21974973,  0.16204563],
       [ 0.15012611,  0.11881837,  0.07829906],
```

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```
       [ 0.14475887,  0.11828972,  0.0747117 ],
       [ 0.15182742,  0.12059662,  0.07984065],
       [ 0.15811475,  0.12584405,  0.07951307],
       [ 0.9996331 ,  0.827563  ,  0.5362377 ],
       [ 0.2615244 ,  0.22938406,  0.16862768],
       [ 0.1580963 ,  0.11951645,  0.0775518 ],
       [ 0.16762769,  0.13303326,  0.08851139],
       [ 0.17338796,  0.14148802,  0.08979498],
       [ 0.17304046,  0.1419515 ,  0.09080467],
       [ 1.        ,  0.9890205 ,  0.6780832 ],
       [ 0.25435534,  0.2206379 ,  0.1569271 ],
       [ 0.15027192,  0.12475526,  0.0784394 ],
       [ 0.3458355 ,  0.21429974,  0.1121798 ],
       [ 0.36254194,  0.2259509 ,  0.11665937],
       [ 0.62459683,  0.39099   ,  0.24112946],
       [ 0.97804743,  1.        ,  0.86419195],
       [ 0.25577253,  0.22349517,  0.1584489 ],
       [ 0.1595923 ,  0.12591116,  0.08147947],
       [ 0.35486832,  0.21910854,  0.11063413],
       [ 0.3630804 ,  0.22740598,  0.12138989],
       [ 0.62340593,  0.39334935,  0.24371558]]...)
>>> colour_checkers_data.swatch_masks.shape
(24, 4)
>>> colour_checkers_data.colour_checker.shape
(960, 1440, 3)
```

3.1.2 Indices and tables

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- search

CHAPTER

FOUR

1.4 CODE OF CONDUCT

The *Code of Conduct*, adapted from the Contributor Covenant 1.4, is available on the Code of Conduct page.

CHAPTER

FIVE

1.5 CONTACT & SOCIAL

The *Colour Developers* can be reached via different means:

- Email
- Facebook
- Github Discussions
- Gitter
- Twitter

CHAPTER

SIX

1.6 ABOUT

Colour - Checker Detection by Colour Developers

https://github.com/colour-science/colour-checker-detection

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