

180Augen ver1.3

User Guide



The **180Augen** is a Windows application that easily converts photos, which were taken by interchangeable lens cameras such as DSLR or mirrorless camera with a fisheye lens into a VR180 photo image. The name of this application "Augen" means German word "eyes".

Feature 1: Photos taken by ordinary cameras with a fisheye lens can **be converted into a ultra-high quality, for example 16k, VR180 photo image.**

Feature 2: It is possible **to perfectly match the distant view of the left and right images.** Because this application does not simply align the images, but it converts them to three-dimensional space and performs rotation adjustment.

As a result, even if the distance between the two cameras is large, comfortable VR180 image can be output.

When shooting, it is not necessary to strictly align the orientation of the two cameras. Even when you take two pictures with one camera, you can take them casually like snapshots.

Feature 3: 180Augen can correspond to various projection methods of fisheye lenses. For this reason, even if the left and right images are taken with different types of fisheye lenses and cameras, they can be converted correctly into a VR180 image by setting the parameters precisely.

Feature 4: Even if **the cameras were tilted** during shooting, **zenith correction** can be performed **in any direction.**

Workflow

(1) Take left and right photos (fisheye images) by cameras and fisheye lenses. Then take the images as large as possible. Also, if you shoot in RAW, convert it to jpg, png, tif, etc. with development software.

(2) When you set parameters, image radius, image center axis coordinate, projection method, etc. in "Camera and Lens Settings", the settings for each camera / lens are saved in a configuration file (180Augen.ini).

(3) On the main dialog, fill in the left and right fields of "Input Image File" (fisheye photo images) and click "Get A, B" button to get the coordinates of the corresponding points of the left and right images. And according to the parameters selected in "Camera and Lens Settings", an image file converted to VR180 format "equirectangular" is output.

The coordinates of the corresponding points "A, B" of the left and right fisheye images are automatically acquired by this application and adjusted to match the two points exactly, when you click the point of left image. However, if you want to enter the corresponding points manually, enter the coordinates of the two points directly.

How to start

This application does not require installation. Double-click on the executable program "180Augen.exe" to start the application. When starting this application, put the files "opencv_world341.dll", "180Augen.ini" and folders "input", "output" in the same folder as the executable file.

* When you start this application, you may receive a "vcruntime140.dll was not found" error. In that case, reinstall the runtime library of C++. For details, please check the Microsoft website.

Main Screen Description

The screenshot shows the '180Augen' application window. It is divided into several sections:

- Input Settings:** Contains 'Input Image File' with 'Left' (1) and 'Right' (1) fields, both containing 'L.jpg' and 'R.jpg' respectively.
- Corresponding coordinates Settings:** Includes a 'Separately Input' radio button (3) and a 'clear' button (3). Below are 'A Left' (2), 'A Right' (2), 'B Left' (2), and 'B Right' (2) input fields. A 'Get A,B' button (4) is to the right. There is also a 'comma separated input' radio button and an empty text field (5).
- Output Settings:** Shows 'Height' (6) as 4096 and 'Width' as 8192. It also has 'Zenith correction(degree)' (8) with a 'clear' button (8), and 'Roll' (7), 'Pitch' (7), and 'Yaw' (7) dropdown menus.
- Camera and Lens Settings:** Includes 'Output Image File' (9) with 'LROut.jpg'. Below are two lists for 'Camera and Lens of the Left Image' and 'Camera and Lens of the Right Image', each with a 'Camera Lens Registration' button (11). The lists contain: 'EM10mkIII & Meike 6.5mm L', 'EM10mkIII & Meike 6.5mm R' (10), 'Canon EOS 5DII & Tokina AT-X 107 DX Fis', and '5DII & Tokina 17mm'.
- Bottom Buttons:** 'Start Conversion !!!' (12) and 'Finish' (13).

Input Settings

(1) Input Image File

Enter the file names of the images file taken with the fisheye lenses. **Put the input image files in the "input" folder** and enter the input image file names “with extension” of left and right. The default file names are “L.jpg”, “R.jpg”, and you can change them. Image file types depend on OpenCV, for example jpg, png, tif etc.

(2) Corresponding coordinates Settings(Separately Input)



Enter the coordinates of the corresponding points on the left and right images. These coordinates can be got on the dialog displayed by clicking the "Get A, B" button. In this application, the image is automatically rotated in three-

dimensional space so that left point A and right point A match, and left point B and right point B match.

When entering manually, select "Separately Input" with the radio button, and input the coordinates of each corresponding point from left to right x coordinate, y coordinates in that order.

This application matches the corresponding two points in three-dimensional space converted from input images to three-dimensional Cartesian coordinates, so select two points with as little left and right parallax as possible, that is, **farthest from the camera** in the image.

However, when you shoot a subject that is close to you, such as a portrait shot, choose two points of the person (for example eyes and feet).

In addition, if you choose two points at the edge of the image, rotation errors around the two points are likely to occur, so select two points that are close to the center of the image and have an angle of about 60 ~ 90 degrees around the camera in real space.

You can check the coordinates of the corresponding points by opening the image file with image editor like Photoshop. Then the origin of the coordinates is the upper left of the image. In addition, if you enter the same coordinates for the corresponding points of the left and right images, this application cannot output normally.

(3) clear

Set the coordinates to 0 in the field of the "Corresponding coordinates Settings - Separately input".

(4) Get A, B

When you click the "Get A, B" button, the "Left and Right Point" dialog opens, and by clicking on the left image, the coordinates of point A or B of the left image are automatically got, and the coordinates of corresponding point of right image are also automatically got. This function is described in detail in the "Left and Right Point" dialog.

(5) Corresponding coordinates Settings(comma separated input)

In consideration of converting one image many times with different parameters, it is also possible to input correspondence points with comma-separated input. Select the "Comma-separated input" radio button, and enter the coordinate data separated by commas in the following order: A left x, B left x, A right x, B right x, A left y, B left y, A right y, B right y. For example, enter the following data "1884,3281,1928,3328,1657,1582,1766,1754".

(6) Output Settings(dots)

Enter the dots number of the Height (vertical size) of the VR180 output image. The default is set it to 4096(8k in both eyes), and you can change it to the size you want, for example 8192(16k in both eyes). However, if it exceeds the specifications of the PC or the limit of OpenCV, this application cannot output normally. In addition, Width (horizontal size) is automatically set to twice the vertical size.

(7) Zenith correction (degree)

You can make zenith corrections for images after shooting. This rotation correction is performed around x y z axis converted to three-dimensional Cartesian coordinates.

Enter the correction angles (degrees) for "Roll", "Pitch", and "Yaw" to correct the rotation of the left image. The right image is automatically corrected to match the correction angle of the left image.

(8) clear

Reset the zenith correction data to 0.

(9) Output Image File

Enter the file names (with extension) of the VR180 output image. The default file name is LROut.jpg, and you can change it. Image file types “jpg, png, tif, etc.” depends on OpenCV. **The output file will be output to the "output" folder.**

(10) Camera and Lens of the Left/Right Image

Select the left and right camera/lens settings registered from the “Camera and Lens” dialog. It does not matter if the left and right cameras and lenses are different. And nothing will be displayed when there is no registered camera or lens.

(11) Camera Lens Registration

When you click the “Camera Lens Registration” button, the “Camera and Lens” dialog opens. You can set and register each parameter of the camera and lens in the dialog. The registered data is saved in the setting file “180Augen.ini”.

(12) Start Conversion !!!

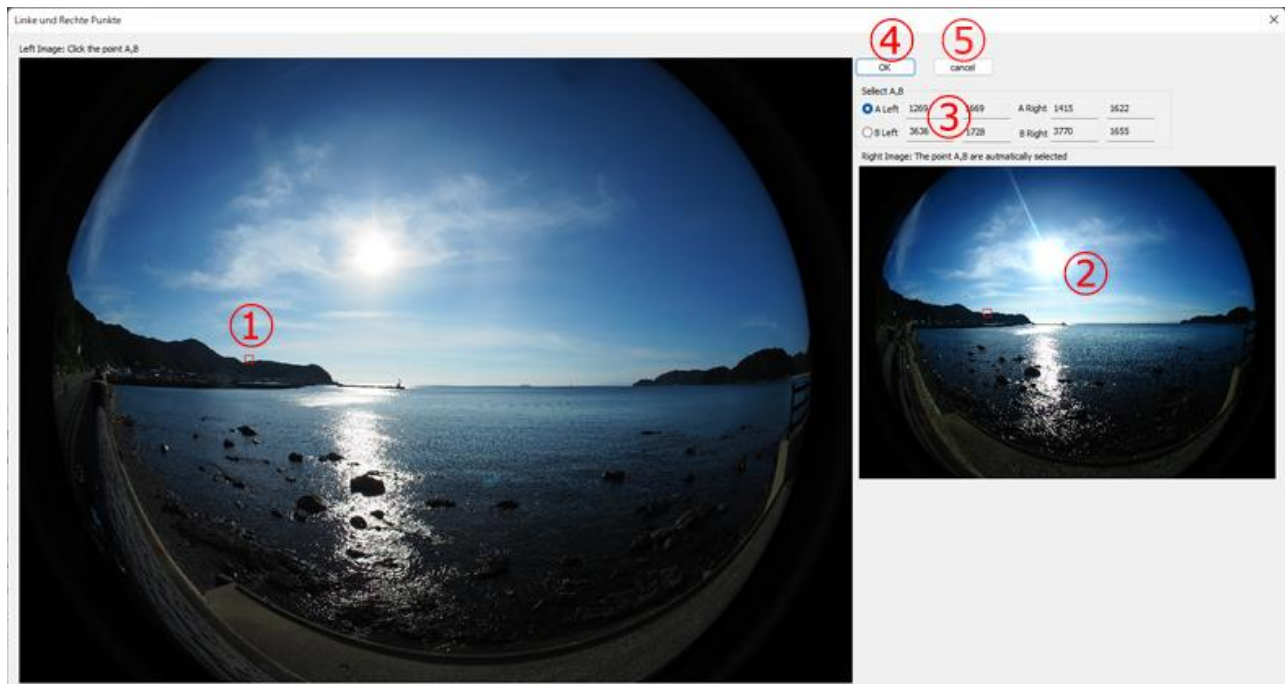
Start converting from fisheye images to VR180 images (Equirectangular).

(13) Finish

Finish the application.

The corresponding coordinate setting Dialog

(Click the "Get A, B" button on the main dialog to open)



(1) How to select the left image coordinates

The left image is displayed in large size on the left. And click one point in this image that is as far away from the camera as possible. Then choose a point with high contrast or a unique shape. When you select it, it is bounded by a red rectangle.

Select point "A" or point "B" with the radio button.

When you shoot a person instead of a landscape, getting the coordinates of the person instead of the far point will make the photo more comfortable to watch.

(2) The coordinates of the right image are automatically selected

The right image is displayed in a small size on the right, and when you click the left image, the corresponding point in the right image is automatically bounded by a red rectangle. If the non-corresponding point is bounded, click the image on the left again.

(3) Radio button for selecting points A, B and coordinate display

Before clicking the image, check the radio button "point A" or "point B" to decide which point to get the coordinates of. Click on the image and the coordinates will be displayed when they are obtained correctly.

(4) OK button

When the left and right images are selected with red rectangles and the coordinates of points A and B are obtained correctly, click the "OK" button. Then the coordinates of the selected points are obtained and return to the main dialog.

(5) cancel button

Cancel the operation and return to the main screen.

Camera and Lens Settings

(Click the "Camera Lens Registration" button on the main dialog to open)

Kamera und Objektiv

Camera and Lens Settings

Image Radius(180degrees)

☐ Circular fisheye ① ☐ Diagonal fisheye

☐ Magnification input ☒ Dots Input

times of height/2 2282 dots

Optical axis Coordinates

☐ Center of the Image ② ☒ Input the Coordinates

x 2787 y 1872

Mapping function

☐ Orthographic $\sin(1.0\theta)$ ☐ Equisolid angle $\sin(0.5\theta)$ ☐ k of $\sin(k\theta)$ k= 0.84

☒ Approximation by a quadratic function $a\theta^2+b\theta+c$, $\theta(\text{rad})$ ③

$0 < \theta <$	0.5052728	-0.031905336	$\theta^2 +$	0.7248316875	$\theta +$	0
$0.5052728 < \theta <$	1.0288716	-0.050061464	$\theta^2 +$	0.7524151255	$\theta +$	-0.009301890
$1.0288716 < \theta <$	1.290671	-0.018296430	$\theta^2 +$	0.6301410100	$\theta +$	0.0828767457
$1.290671 < \theta < \pi/2$		-0.371564801	$\theta^2 +$	1.5426391635	$\theta +$	-0.506372530

registered name(Camera Lens etc.)

Canon EOS 5DII & Tokina AT-X 107 DX Fisheye ④

Register ⑦

Correction or Delete the registered content

Delete ⑤

EM10mkIII & Meike 6.5mm L
EM10mkIII & Meike 6.5mm R
Canon EOS 5DII & Tokina AT-X 107 DX Fisheye
5DII & Tokina 17mm ⑤

Overwrite ⑧

Return ⑨

(1) Image Radius (180degrees)

For fisheye images, set the image radius that covers the range of 180° . When you select "Circular fisheye" with the radio button, the vertical half of the fisheye image will be set as the image radius. And when you select "Diagonal fisheye", half of the diagonal line of the fisheye image will be set as the image radius.

When the "Magnification input" is selected, the value obtained by multiplying half the vertical size of the image by this magnification is set as the image radius (Set "1", when you use a circular fisheye). When "Dots Input" is selected, the number of dots you set will be set as the image radius.

(2) Optical axis Coordinates

Selecting "Center of the Image" radio button sets the coordinates of the optical center of the fisheye image. If you know relatively accurate values by performing camera calibration, select "Input the Coordinates" and enter "x" and "y" coordinates.

(3) Mapping function / projection method

There are various projection methods for fisheye lenses, such as orthographic projection " $y=f\sin\theta$ " and equisolid angle projection " $y=2f\sin(\theta/2)$ ", but real lenses cannot always be represented exactly by each projection method. In this application, the projection method for each lens can be expressed relatively accurately by entering the parameter k of $y=A\sin(k\theta)$. Measure the lens parameter " k ", for example by using a rotating head with an angle scale.

If the projection function of the lens is different from these projection methods, enter the parameters of the approximation formula by the quadratic function.

When you select the radio button "Orthographic $\sin(1.0\theta)$ ", " k " of $y=A\sin(k\theta)$ is set to "1", and when you select "Equisolid angle $\sin(0.5\theta)$ ", " k " is set to "0.5".

When you select "k of $\sin(k\theta)$ ", you can enter the value of "k".

If you select the radio button "Approximation by a quadratic function", the projection function can be set by entering the coefficients "a", "b" and "c" of " $y=a\theta^2+b\theta+c$ " for each interval of θ (rad).

And set " $y=0$ " when $\theta=0$ and " $y=1$ " when $\theta=\pi/2$ in this function.

If you do not have knowledge of the projection method, try "orthographic projection" or "equisolid angle projection" first.

(4) Registered name (Camera Lens etc.)

Enter the setting name of the "camera/lens settings" associated with a camera and lens to select on the main dialog. Use setting names that you can recognize easily.

(5) Correction or delete the registered content

The setting names of the camera/lens that have already been registered in the setting file will be displayed. To delete or modify the registered contents, click the registered setting name to select it.

(6) Delete

Click to select the camera and lens setting name displayed in the list, and click the "Delete" button to delete its registration from the setting file.

(7) Register

After entering each parameter, click the "Register" button to save the contents of the new camera / lens registration to the setting file. If you select a registered setting name from the list, modify the contents, and click the "Register" button, the modified registration contents are newly saved in the configuration file.

(8) Overwrite

If you modify a part of the contents of the camera / lens registration and click

the "Overwrite" button, you can modify the registered contents and save it overwritten in the setting file.

(9) Return

Return to the main dialog.

This application displays the parameters of items that you have not checked in the radio buttons or saves them to a file, but it does not affect the operation.

In this application you can set each parameter relatively freely. Therefore, if you enter an extreme large or small value, there is a possibility that it will operate unexpectedly. Then, in preparation for a situation such as a configuration file being destroyed, save the setting file "180Augen.ini" after input.

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