

CLAIMS

1. A method of processing 360-degree video data, comprising:
obtaining 2-dimensional video data captured by an omnidirectional camera,
wherein the 2-dimensional video data includes an image of a scene, and wherein, in the image, the scene has been warped into a circular region of the image;
mapping the image to a 3-dimensional hemispherical representation, wherein
mapping the image includes mapping pixels in the circular region of the image to corresponding locations on the 3-dimensional hemispherical representation, wherein mapping the image corrects the warping of the scene by determining coordinates for a pixel in the 2-dimensional image using an adjusted radial value, and wherein the adjusted radial value corresponds to the non-linearity of the warping and using the determined coordinates in the mapping;
wherein the video data is obtained from an encoded bitstream, wherein the encoded bitstream includes one or more parameters that describe the warping, and wherein mapping the image includes using the one or more parameters; and
using the 3-dimensional hemispherical representation in a 360-degree video presentation.
2. The method of claim 1, wherein mapping the image includes using a polynomial equation to project a point in the image to a corresponding point on the 3-dimensional hemispherical representation, and wherein the point in the image provides a pixel to map to the point on the 3-dimensional hemispherical representation.
3. The method of claim 1, wherein the image includes a field of view that is greater than 180 degrees, and further comprising:
adjusting coordinates for a pixel in the 2-dimensional image using a radial value that has been scaled according to the field of view; and
using the adjusted coordinates in the mapping.
4. The method of claim 1, wherein the image includes a field of view of at least 180 degrees.
5. The method of claim 1, wherein the omnidirectional camera includes a fisheye lens.

6. The method of claim 1, wherein the one or more parameters are encoded in a supplemental enhancement information (SEI) message in the encoded bitstream.
7. The method of claim 1, wherein the encoded bitstream is included in a file formatted according to an ISO base media file format, and wherein the one or more parameters are encoded in a structure in the file.
8. The method of claim 1, wherein the one or more parameters include at least one or more of a polynomial order, a polynomial coefficient, a polynomial scaling parameter, or a mapping scaling parameter.
9. An apparatus for processing encoded 360-degree video data, comprising:
a memory configured to store 2-dimensional video data captured by an omnidirectional camera; and
a processor, configured to:
 obtain the 2-dimensional video data, wherein the 2-dimensional video data includes an image of a scene, and wherein, in the image, the scene has been warped into a circular region of the image;
 map the image to a 3-dimensional hemispherical representation, wherein mapping the image includes mapping pixels in the circular region of the image to corresponding locations on the 3-dimensional hemispherical representation, wherein mapping the image corrects the warping of the scene by determining coordinates for a pixel in the 2-dimensional image using an adjusted radial value, and wherein the adjusted radial value corresponds to the non-linearity of the warping and using the determined coordinates in the mapping;
 wherein the video data is obtained from an encoded bitstream, wherein the encoded bitstream includes one or more parameters that describe the warping, and wherein mapping the image includes using the one or more parameters; and
 use the 3-dimensional hemispherical representation in a 360-degree video presentation.
10. The apparatus of claim 9, wherein mapping the image includes using a polynomial equation to project a point in the image to a corresponding point on the 3-dimensional hemispherical representation, and wherein the point in the image provides a pixel to map to the point on the 3-dimensional hemispherical representation.

11. The apparatus of claim 9, wherein the image includes a field of view that is greater than 180 degrees, and wherein the processor is further configured to:

adjust coordinates for a pixel in the 2-dimensional image using a radial value that has been scaled according to the field of view; and

use the adjusted coordinates in the mapping.

12. The apparatus of claim 9, wherein the one or more parameters are encoded in a supplemental enhancement information (SEI) message in the encoded bitstream.

13. The apparatus of claim 9, wherein the encoded bitstream is included in an file formatted according to an ISO base media file format, and wherein the one or more parameters are encoded in a structure in the file.

14. The apparatus of claim 9, further comprising:

a mobile device, wherein the mobile device includes the omnidirectional camera.

15. A non-transitory computer-readable medium having stored thereon instructions that, when executed by one or more processors, cause the one or more processors to undertake the method of any of claims 1 to 8.