right eye in the right area. In SBS, a resolution of each side is half of a normal resolution. In detail, in an environment of Full HD with a resolution of 1920 pixels × 1080 pixels, each side in SBS has half of the resolution of Full HD.

[0011]

The conventional SVC and the conventional MVC have no function of coding an image using the SBS video format so that the base layer provides half of the resolution of Full HD and the enhancement layer provides the resolution of Full HD.

[0012]

Suppose an image is coded in the SBS video format according to the conventional MVC or the conventional SVC. It is difficult to distinguish a bit stream obtained using SBS and a bit stream obtained without using SBS, from each other. In more detail, it is difficult to determine the difference between the video formats, in a system layer in NPL 1 (ITU-T Rec. H.222.0 | ISO/IEC 13818-1) and the like. An image decoding apparatus needs a complex structure to determine such a difference.

[0013]

Embodiments of~~In view of this,~~ the present invention ~~has an object of~~ providinge an image coding method and an image decoding method that can properly handle a 3D video format including a base layer and an enhancement layer.

[Solution to Problem]

[0014]

A~~To solve the stated problem, an image coding method a~~ccording to a first aspect of the present invention, there is provided an image coding method including: a video layer of generating a coded stream by coding an image composed of one or more pictures; and a system layer of generating a system stream for transmitting or storing the coded stream, the video layer including coding the image to generate the coded stream, and the system layer including multiplexing the coded stream generated in the coding and an identifier to generate the system stream, the identifier indicating whether or not a format of the image is a left-right mixed format that includes a base layer and an enhancement layer for

providing a plurality of degrees of accuracy and that has a left view image area and a right view image area in each picture, wherein the coding includes, in the case where the format of the image is the left-right mixed format, coding the image that includes the base layer and the enhancement layer and that has the left view image area and the right view image area in each picture, to generate the coded stream.

[0015]

Thus, the image coding method according to embodiments of the present invention can generate the system stream that enables determination in the system layer on the decoding side whether or not the image has the left-right mixed format. The image coding method according to embodiments of the present invention can therefore properly handle the 3D video format including the base layer and the enhancement layer.

[0016]

Moreover, the system layer may be compliant with MPEG-2 Systems, wherein the video layer is compliant with a multiview video coding scheme, the coding includes coding the image according to the multiview video coding scheme to generate the coded stream, and the multiplexing includes inserting the identifier in a descriptor for the multiview video coding scheme, and multiplexing the coded stream and the descriptor that includes the identifier, to generate the system stream.

[0017]

Thus, the image is coded according to the multiview video coding scheme, and the identifier is inserted in the descriptor for the multiview video coding scheme. The image coding method according to embodiments of the present invention can therefore generate the proper system stream using the descriptor.

[0018]

Moreover, the video layer may be compliant with H.264 MVC, wherein the descriptor for the multiview video coding scheme is an MVC descriptor for H.264 MVC, the coding includes coding the image according to H.264 MVC to generate the coded stream, and the multiplexing includes inserting the identifier in the MVC descriptor for

H.264 MVC, and multiplexing the coded stream and the MVC descriptor that includes the identifier, to generate the system stream.

[0019]

Thus, the image is coded according to H.264 MVC, and the identifier is inserted in the MVC descriptor for H.264 MVC. The image coding method according to the present invention can therefore generate the proper system stream using the MVC descriptor.

[0020]

Moreover, an embodiment of the coding may include: coding the image of the left-right mixed format in the case where the format of the image is the left-right mixed format; and coding the image of a left-right independent format in the case where the format of the image is not the left-right mixed format, the left-right independent format being a format that includes a picture of a left view and a picture of a right view as separate pictures.

[0021]

Thus, the image coding method according to embodiments of the present invention can code the image of the left-right mixed format or the image of the left-right independent format.

[0022]

Moreover, the system layer may be compliant with MPEG-2 Systems, wherein the video layer is compliant with a scalable video coding scheme, the coding includes coding the image according to the scalable video coding scheme to generate the coded stream, and the multiplexing includes inserting the identifier in a descriptor for the scalable video coding scheme, and multiplexing the coded stream and the descriptor that includes the identifier, to generate the system stream.

[0023]

Thus, the image is coded according to the scalable video coding scheme, and the identifier is inserted in the descriptor for the scalable video coding scheme. The image coding method according to embodiments of the present invention can therefore generate the proper system stream using the descriptor.

[0024]

Moreover, the video layer may be compliant with H.264 SVC, wherein the descriptor for the scalable video coding scheme is an SVC descriptor for H.264 SVC, the coding includes coding the image according to H.264 SVC to generate the coded stream, and the multiplexing includes inserting the identifier in the SVC descriptor for H.264 SVC, and multiplexing the coded stream and the SVC descriptor that includes the identifier, to generate the system stream.

[0025]

Thus, the image is coded according to H.264 SVC, and the identifier is inserted in the SVC descriptor for H.264 SVC. The image coding method according to embodiments of the present invention can therefore generate the proper system stream using the SVC descriptor.

[0026]

Moreover, an embodiment of the coding may include: coding the image for stereoscopic display in the case where the format of the image is the left-right mixed format; and coding the image for monoscopic display in the case where the format of the image is not the left-right mixed format.

[0027]

Thus, the image coding method according to embodiments of the present invention can code the image for stereoscopic display or the image for monoscopic display.

[0028]

Moreover, an embodiment of the image coding method may further include generating the image in the left-right mixed format by (i) generating, as a picture of the base layer, a picture in which a first portion of a left picture that is a picture of a left view is included in the left view image area and a second portion of a right picture that is a picture of a right view is included in the right view image area, and (ii) generating, as a picture of the enhancement layer, a picture in which a third portion of the left picture is included in the left view image area and a fourth portion of the right picture is included in the right view image area, the third portion being different from the first portion, and the fourth portion being different from the second portion, wherein the coding includes coding the image generated in the generating to generate the

coded stream, when coding the image of the left-right mixed format.

[0029]

Thus, the picture of the enhancement layer is generated from the portion different from the portion that corresponds to the picture of the base layer. Such picture of the base layer and picture of the enhancement layer achieve graduated accuracy.

[0030]

Moreover, an embodiment of the image coding method may further include generating the image in the left-right mixed format by (i) generating, as a picture of the base layer, a picture in which a first portion of a left picture that is a picture of a left view is included in the left view image area and a second portion of a right picture that is a picture of a right view is included in the right view image area, and (ii) generating, as a picture of the enhancement layer, a picture in which the whole left picture or a third portion of the left picture is included in the left view image area and the whole right picture or a fourth portion of the right picture is included in the right view image area, the third portion including the first portion, and the fourth portion including the second portion, wherein the coding includes coding the image generated in the generating to generate the coded stream, when coding the image of the left-right mixed format.

[0031]

Thus, the picture of the enhancement layer is generated from the portion including the portion that corresponds to the picture of the base layer. Such picture of the base layer and picture of the enhancement layer achieve graduated accuracy.

[0032]

According to a second aspect, there is provided ~~An image decoding method according to the present invention may be~~ an image decoding method including: a system layer of obtaining, from a system stream for transmitting or storing a coded stream that includes an image composed of one or more pictures, the coded stream; and a video layer of decoding the image included in the coded stream, the system layer including demultiplexing the system stream into the coded stream and an identifier to obtain the coded stream and the identifier, the identifier indicating whether or not a

format of the image is a left-right mixed format that includes a base layer and an enhancement layer for providing a plurality of degrees of accuracy and that has a left view image area and a right view image area in each picture, the video layer including decoding the image included in the coded stream obtained in the demultiplexing, and the image decoding method further including outputting the image decoded in the decoding, in an output mode specified according to the identifier obtained in the demultiplexing, wherein the decoding includes, in the case where the format of the image is the left-right mixed format, decoding the image that includes the base layer and the enhancement layer and that has the left view image area and the right view image area in each picture.

[0033]

Thus, the image decoding method according to embodiments of the present invention can switch the output mode of the image according to the identifier indicating whether or not the image has the left-right mixed format. The image decoding method according to embodiments of the present invention can therefore properly handle the 3D video format including the base layer and the enhancement layer.

[0034]

Moreover, the system layer may be compliant with MPEG-2 Systems, wherein the video layer is compliant with a multiview video coding scheme, the demultiplexing includes demultiplexing the system stream into the coded stream and a descriptor for the multiview video coding scheme, to obtain the coded stream and the identifier included in the descriptor, and the decoding includes decoding the image coded according to the multiview video coding scheme.

[0035]

Thus, the image decoding method according to embodiments of the present invention can decode the image coded according to the multiview video coding scheme, and obtain the identifier from the descriptor for the multiview video coding scheme. The image decoding method according to the present invention can therefore properly handle the left-right mixed format.

[0036]

Moreover, the video layer may be compliant with H.264 MVC, wherein the descriptor for the multiview video coding scheme is an MVC descriptor for H.264 MVC, the demultiplexing includes demultiplexing the system stream into the coded stream and the MVC descriptor for H.264 MVC, to obtain the coded stream and the identifier included in the MVC descriptor, and the decoding includes decoding the image coded according to H.264 MVC.

[0037]

Thus, the image decoding method according to embodiments of the present invention can decode the image coded according to H.264 MVC, and obtain the identifier from the MVC descriptor for H.264 MVC. The image decoding method according to the present invention can therefore properly handle the left-right mixed format.

[0038]

Moreover, an embodiment of the decoding may include: decoding the image of the left-right mixed format in the case where the format of the image is the left-right mixed format; and decoding the image of a left-right independent format in the case where the format of the image is not the left-right mixed format, the left-right independent format being a format that includes a picture of a left view and a picture of a right view as separate pictures.

[0039]

Thus, the image decoding method according to embodiments of the present invention can decode the image of the left-right mixed format or the image of the left-right independent format.

[0040]

Moreover, the system layer may be compliant with MPEG-2 Systems, wherein the video layer is compliant with a scalable video coding scheme, the demultiplexing includes demultiplexing the system stream into the coded stream and a descriptor for the scalable video coding scheme, to obtain the coded stream and the identifier included in the descriptor, and the decoding includes decoding the image coded according to the scalable video coding scheme.

[0041]

Thus, the image decoding method according to embodiments of the present invention can decode the image coded according to the scalable video coding scheme, and obtain the identifier from the descriptor for the scalable video coding scheme. The image decoding method according to the present invention can therefore properly handle the left-right mixed format.

[0042]

Moreover, the video layer may be compliant with H.264 SVC, wherein the descriptor for the scalable video coding scheme is an SVC descriptor for H.264 SVC, the demultiplexing includes demultiplexing the system stream into the coded stream and the SVC descriptor for H.264 SVC, to obtain the coded stream and the identifier included in the SVC descriptor, and the decoding includes decoding the image coded according to H.264 SVC.

[0043]

Thus, the image decoding method according to embodiments of the present invention can decode the image coded according to H.264 SVC, and obtain the identifier from the SVC descriptor for H.264 SVC. The image decoding method according to the present invention can therefore properly handle the left-right mixed format.

[0044]

Moreover, an embodiment of the decoding may include: decoding the image for stereoscopic display in the case where the format of the image is the left-right mixed format; and decoding the image for monoscopic display in the case where the format of the image is not the left-right mixed format.

[0045]

Thus, the image decoding method according to embodiments of the present invention can decode the image for stereoscopic display or the image for monoscopic display.

[0046]

Moreover, an embodiment of the image decoding method may further include generating a left picture that is a picture of a left view and a right picture that is a picture of a right view, in the case where the format of the image is the left-right mixed format, wherein the generating

includes: obtaining a first portion of the left picture from the left view image area in a base layer picture, the base layer picture being a picture of the base layer and being included in the image decoded in the decoding; obtaining a second portion of the right picture from the right view image area in the base layer picture; obtaining a third portion of the left picture from the left view image area in an enhancement layer picture, the enhancement layer picture being a picture of the enhancement layer and being included in the image decoded in the decoding, the third portion being different from the first portion; obtaining a fourth portion of the right picture from the right view image area in the enhancement layer picture, the fourth portion being different from the second portion; generating the left picture from the obtained first portion and the obtained third portion; and generating the right picture from the obtained second portion and the obtained fourth portion, and the outputting includes outputting, as the image, the left picture and the right picture generated in the generating, in the case where the format of the image is the left-right mixed format.

[0047]

Thus, the image decoding method according to embodiments of the present invention can generate the high-resolution left picture and the high-resolution right picture by combining the picture of the base layer and the picture of the enhancement layer.

[0048]

Moreover, an embodiment of the image decoding method may further include generating, in the case where the format of the image is the left-right mixed format, a left picture from the left view image area in a decoded picture and a right picture from the right view image area in the decoded picture, the left picture being a picture of a left view, the right picture being a picture of a right view, and the decoded picture being a picture of one of the base layer and the enhancement layer and being included in the image decoded in the decoding, wherein the outputting includes outputting, as the image, the left picture and the right picture generated in the generating, in the case where the format of the image is the left-right mixed format.

[0049]

Thus, the image decoding method according to embodiments of the present invention can generate the left picture and the right picture from any of the picture of the base layer and the picture of the enhancement layer. The image decoding method according to the present invention can therefore generate the image having any of the plurality of degrees of accuracy.

[0050]

According to a third aspect, there is provided~~An image coding apparatus according to the present invention may be~~ an image coding apparatus including: a video layer unit that generates a coded stream by coding an image composed of one or more pictures; and a system layer unit that generates a system stream for transmitting or storing the coded stream, the video layer unit including a coding unit that codes the image to generate the coded stream, and the system layer unit including a multiplexing unit that multiplexes the coded stream generated by the coding unit and an identifier to generate the system stream, the identifier indicating whether or not a format of the image is a left-right mixed format that includes a base layer and an enhancement layer for providing a plurality of degrees of accuracy and that has a left view image area and a right view image area in each picture, wherein the coding unit, in the case where the format of the image is the left-right mixed format, codes the image that includes the base layer and the enhancement layer and that has the left view image area and the right view image area in each picture, to generate the coded stream.

[0051]

Thus, the image coding method according to embodiments of the present invention is implemented as an image coding apparatus.

[0052]

According to a fourth aspect, there is provided~~An image decoding apparatus according to the present invention may be~~ an image decoding apparatus including: a system layer unit that obtains, from a system stream for transmitting or storing a coded stream that includes an image composed of one or more pictures, the coded stream; and a video layer unit that decodes the image included in the coded stream, the system layer unit

including a demultiplexing unit that demultiplexes the system stream into the coded stream and an identifier to obtain the coded stream and the identifier, the identifier indicating whether or not a format of the image is a left-right mixed format that includes a base layer and an enhancement layer for providing a plurality of degrees of accuracy and that has a left view image area and a right view image area in each picture, the video layer unit including a decoding unit that decodes the image included in the coded stream obtained by the demultiplexing unit, and the image decoding apparatus further including an output unit that outputs the image decoded by the decoding unit, in an output mode specified according to the identifier obtained by the demultiplexing unit, wherein the decoding unit, in the case where the format of the image is the left-right mixed format, decodes the image that includes the base layer and the enhancement layer and that has the left view image area and the right view image area in each picture.

[0053]

Thus, the image decoding method according to embodiments of the present invention is implemented as an image decoding apparatus.

[Advantageous Effects of Invention]

[0054]

According to embodiments of the present invention, it is possible to determine in the system layer whether or not the image has the left-right mixed format. The image coding method and the image decoding method according to embodiments of the present invention can therefore properly handle the 3D video format including the base layer and the enhancement layer.

[Brief Description of Drawings]

[0055]

[FIG. 1]

FIG. 1 is a block diagram showing an example of an image coding apparatus according to Embodiment 1 of the present invention.

[FIG. 2]

FIG. 2 is a block diagram showing an example of an image decoding apparatus according to Embodiment 1 of the present invention.

[FIG. 3]