[0006]

Embodiments of the present disclosure provide, for example, a configuration or a method which can contribute to at least one of increase in coding efficiency, increase in image quality, reduction in processing amount, reduction in circuit scale, appropriate selection of an element or an operation, etc. It is to be noted that embodiments of the present disclosure may encompass possible configurations or methods which can contribute to advantages other than the above advantages.

[Solution to Problem]

[0007]

For example, a decoder according to a first aspect of the present disclosure includes memory and circuitry coupled to the memory, in which, in operation, the circuitry: decodes, from one or more streams, (i) a fundamental image that is an image including a face, (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera, and (iii) background information regarding a background image; and generates a synthesized face video using a generative model from the fundamental image, the geometric information, and the background information, the synthesized face video being a video including the face and synthesized with the background image.

[0007a]

According to a second aspect of the present disclosure, there is provided a decoder including: memory; and circuitry coupled to the memory, wherein in operation, the circuitry: decodes, from one or more streams, (i) a fundamental image that is an image including a face and (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera; inputs the fundamental image and the geometric information to the generative model to obtain an intermediate face video from the generative model, the intermediate face video being a video including the face; and generates a synthesized face video by embedding, into a background region in the intermediate face video, a corresponding region in the fundamental image.

[0007b]

According to a third aspect of the present disclosure, there is provided an encoder including: memory; and circuitry coupled to the memory, wherein in operation, the circuitry: encodes, into one or more streams, (i) a fundamental image that is an image including a face, (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera, and (iii) background information regarding a background image, (i) the fundamental image, (ii) the geometric information, and (iii) the background information being for generating a synthesized face video that is a video including a face and synthesized with the background image.

[0007c]

According to a fourth aspect of the present disclosure, there is provided an encoder including: memory; and circuitry coupled to the memory, wherein in operation, the circuitry: encodes, into one or more streams, (i) a fundamental image that is an image including a face and (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera, (i) the fundamental image and (ii) the geometric information being for generating a synthesized face video, and in generating the synthesized face video, the fundamental image and the geometric information are used to obtain an intermediate face video from a generative model by inputting the fundamental image and the geometric information to the generative model, and the fundamental image is further used to generate the synthesized face video by embedding, into a background region in the intermediate face video, a corresponding region in the fundamental image, the intermediate face video being a video including the face.

[0007d]

According to a fifth aspect of the present disclosure, there is provided a bitstream generator including: memory; and circuitry coupled to the memory, wherein in operation, the circuitry: generates a bitstream including: (i) a fundamental image that is an image including a face; (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera; and (iii) background information regarding a background image, (i) the fundamental image, (ii) the

geometric information, and (iii) the background information being for generating a synthesized face video that is a video including a face and synthesized with the background image.

[0007e]

According to a sixth aspect of the present disclosure, there is provided a decoding method including: decoding, from one or more streams, (i) a fundamental image that is an image including a face, (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera, and (iii) background information regarding a background image; and generating a synthesized face video using a generative model from the fundamental image, the geometric information, and the background information, the synthesized face video being a video including the face and synthesized with the background image.

[0007f]

According to a seventh aspect of the present disclosure, there is provided an encoding method including: encoding, into one or more streams, (i) a fundamental image that is an image including a face, (ii) geometric information indicating geometric attributes of a subject and corresponding to each of frames of a captured video by a camera, and (iii) background information regarding a background image, (i) the fundamental image, (ii) the geometric information, and (iii) the background information being for generating a synthesized face video that is a video including a face and synthesized with the background image.

[0008]

Each of embodiments, or each of part of constituent elements and methods in the present disclosure enables, for example, at least one of the following: improvement in coding efficiency, enhancement in image quality, reduction in processing amount of encoding/decoding, reduction in circuit scale, improvement in processing speed of encoding/decoding, etc. Alternatively, each of embodiments, or each of part of constituent elements and methods in the present disclosure enables, in encoding and decoding, appropriate selection of an element or an operation. The element is, for example, a filter, a block, a size, a motion vector, a reference picture, or a reference block. It is to be noted that the present disclosure includes disclosure regarding configurations and methods

which may provide advantages other than the above-described ones. Examples of such configurations and methods include a configuration or method for improving coding efficiency while reducing increase in processing amount.

[0009]

Additional benefits and advantages according to embodiments of the present disclosure will become apparent from the specification and drawings. The benefits and/or advantages may be individually obtained by the various embodiments and features of the specification and drawings, and not all of which need to be provided in order to obtain one or more of such benefits and/or advantages.

[0010]

It is to be noted that these general or specific aspects may be implemented using a system, an integrated circuit, a computer program, or a computer readable medium (recording medium) such as a CD-ROM, or any combination of systems, methods, integrated circuits, computer programs, and media.

[Advantageous Effects of Invention]

[0011]

Embodiments of the present disclosure enable, for example, at least one of the following: improvement in coding efficiency, enhancement in image quality, reduction in processing amount, reduction in circuit scale, improvement in processing speed, appropriate selection of an element or an operation, etc. It is to be noted that the embodiments of the present disclosure may provide advantages other than the above-described ones.

[Brief Description of Drawings]

[0012]

[FIG. 1]

FIG. 1 is a block diagram illustrating the configuration of an encoding and decoding system according to a reference example.

[FIG. 2]

FIG. 2 is a block diagram illustrating the configuration of an encoder according to the reference example.

[FIG. 3]

FIG. 3 is a block diagram illustrating the configuration of a decoder according to the reference example.

[FIG. 4]

FIG. 4 is a conceptual diagram illustrating an example of a fundamental image.

[FIG. 5]