WHAT IS CLAIMED IS:

1. A method of providing classification information for iron scraps according to an unloading process, the method comprising:

receiving, by a receiving circuit, a loaded state image from a camera during an unloading process of a plurality of iron scraps loaded onto a loading device;

obtaining, by a processor, layer information that is updated as the unloading process progresses and determined based on a height of the plurality of iron scraps, wherein the height is determined in a stack direction of the plurality of iron scraps loaded onto the loading device;

determining, by the processor, a region of interest based on the loaded state image that is updated as the unloading process progresses;

generating, by the processor, a segmented image of a target iron scrap, which is included in the region of interest, wherein the target iron scrap is one of the plurality of iron scraps;

generating, by the processor, item information and grade information for the target iron scrap based on the segmented image and the layer information; and

providing, by the processor, classification information for the iron scraps, including the item information and the grade information,

wherein the determining of the region of interest includes:

determining, by the processor, the region of interest based on a result of comparing a first loaded state image corresponding to a first time point with a second loaded state image corresponding to a second time point that is temporally later than the first time point; and

determining, by the processor, the region of interest based on a difference region between the first loaded state image and the second loaded state image and an operation region of a grapple used in the unloading process.

2. The method of claim 1, wherein a method of obtaining the layer information includes a mono type method in which one camera is used or a stereo type method in which two or more cameras are used, and

in the mono type method, depth information obtained through analysis of changes in wall surface of a loading box obtained from an image obtained by the one camera is used.

3. The method of claim 1, wherein:

the generating of the segmented image by the processor includes generating the segmented image that includes the target iron scrap from the loaded state image using a segmentation model; and

the generating of the item information and the grade information by the processor includes generating the item information and the grade information for the target iron scrap using a classification model that performs analysis in units of images.

4. The method of claim 3, wherein the generating of the segmented image includes:

performing, by the processor, instance segmentation on the loaded state image to generate a segmented image of a single object; and

performing, by the processor, semantic segmentation on the loaded state image to generate a segmented image of aggregate objects.

5. The method of claim 4, wherein the generating of the segmented image of the aggregate objects is performed on regions of the loaded state image, from which a region corresponding to the single object is excluded.

6. The method of claim 2, wherein, in the stereo type method, the depth information obtained through analysis of changes in angles obtained from images for a same region that are obtained from the two or more cameras positioned on a same plane is used.

7. The method of claim 1, wherein:

the second time point is determined based on whether the grapple is included in any partial region of regions of a vertical direction of the loading device after the first time point; and

the determining of the region of interest includes, when the grapple is included in the partial region for a preset period of time or more, determining, by the processor, the region of interest based on an operating state of the grapple that indicates whether the grapple includes at least one iron scrap.

8. The method of claim 6, wherein the method of obtaining the layer information includes:

obtaining, by the processor, a first layer change time point at which the height of the plurality of iron scraps are changed to a critical height or more based on the depth information obtained using the stereo type method;

obtaining, by the processor, a second layer change time point at which a volume of the plurality of iron scraps are changed to a critical percentage or more based on an average volume of the loading device; and

obtaining, by the processor, the layer information at at least one of the first layer change time point and the second layer change time point.

9. An iron scrap classification apparatus for providing classification information for iron scraps according to an unloading process, the apparatus comprising:

a receiving circuit configured to receive a loaded state image from a camera during an unloading process of a plurality of iron scraps loaded onto a loading device; and

a processor that is configured to:

obtain layer information that is updated as the unloading process progresses and determined based on a height of the plurality of iron scraps, wherein the height is determined in a stack direction of the plurality of iron scraps loaded onto the loading device ;

determine a region of interest based on the loaded state image that is updated as the unloading process progresses;

generate a segmented image of a target iron scrap, which is included in the region of interest, wherein the target iron scrap is one of the plurality of iron scraps;

generate item information and grade information for the target iron scrap based on the segmented image and the layer information; and

provide classification information for the iron scraps, including the item information and the grade information,

wherein the processor determines the region of interest based on a result of comparing a first loaded state image corresponding to a first time point with a second

loaded state image corresponding to a second time point that is temporally later than the first time point, and

wherein the processor determines the region of interest based on a difference region between the first loaded state image and the second loaded state image and an operation region of a grapple used in the unloading process.

10. The apparatus of claim 9, wherein a method of obtaining the layer information includes a mono type method in which one camera is used or a stereo type method in which two or more cameras are used, and

in the mono type method, depth information obtained through analysis of changes in wall surface of a loading box obtained from an image obtained by the one camera is used.

11. A computer-readable recording medium on which a program is recorded, the program comprising instructions that, when executed by a processor, cause the processor to:

when receiving a loaded state image from a camera during an unloading process of a plurality of iron scraps loaded onto a loading device,

obtain layer information that is updated as the unloading process progresses and determined based on a height of the plurality of iron scraps, wherein the height is determined in a stack direction of the plurality of iron scraps loaded onto the loading device ;

determine a region of interest based on the loaded state image that is updated as the unloading process progresses;

generate a segmented image of a target iron scrap, which is included in the region of interest, wherein the target iron scrap is one of the plurality of iron scraps;

generate item information and grade information for the target iron scrap based on the segmented image and the layer information; and

provide classification information for the iron scraps, including the item information and the grade information,

wherein the instructions causes the processor to determine the region of interest based on a result of comparing a first loaded state image corresponding to a first time point with a second loaded state image corresponding to a second time point that is temporally later than the first time point, and

wherein the instructions causes the processor to determine the region of interest based on a difference region between the first loaded state image and the second loaded state image and an operation region of a grapple used in the unloading process.

12. The computer-readable recording medium of claim 11, wherein a method of obtaining the layer information includes a mono type method in which one camera is used or a stereo type method in which two or more cameras are used, and

in the mono type method, depth information obtained through analysis of changes in wall surface of a loading box obtained from an image obtained by the one camera is used.