wireless IC (RFID) tag to each chip to recognize the amount of the chip.

[0005]

In a card game monitoring system disclosed in WO 2015/107902 A, fraud monitoring is performed by determining through image analysis of movement of chips whether or not the chips placed on a gaming table are collected or redeemed in accordance with a win or lose result.

SUMMARY

[0006]

Embodiments of the present disclosure seek to provide a new system for detecting fraud in a game in a casino or an error or fraud at the time of wagering chips or doing settlement.

[0007]

According to an aspect, there is provided a system utilizing deep learning used at a gaming table for playing a game by wagering chips, the system comprising: a camera configured to obtain a captured image by capturing a predetermined area of the gaming table on which a plurality of betting areas are laid out, wherein the camera is arranged diagonally above the gaming table and captures from diagonally above the gaming table a plurality of stacks of wagered chips on the betting areas; and a control device configured to identify a position, type, and number of the chips wagered on the gaming table based on the captured image obtained,

wherein the chips are configured capable of being identified of the type at least by color information or a pattern on a side surface, the control device is configured to identify the position, type, and/or number of the chips by recognizing targets including the chips in the captured image by utilizing a convolutional neural network as the deep learning that performs image recognition by extracting features in the captured image in which color information or a pattern is appearing, and the convolutional neural network is a neural network having performed learning by a scheme in which the neural network learns learning images including types of chips used in the gaming table as the targets, and in a case where a plurality of the targets exist in a learning image, the neural network performs the learning by giving labels to areas corresponding to the targets.

There is also disclosed a fraud detection system in a casino having a plurality of gaming tables, including: a game recording apparatus which records a progress of a game played in the gaming table as an image; an image analyzing apparatus which performs image analysis on the image of the recorded progress of the game; a win/lose result determining apparatus which determines a win or lose result of each game in the gaming table; and a control device which detects fraud practiced in the gaming table by using a result of the image analysis by the image analyzing apparatus and the win or lose result determined by the win/lose result determining apparatus,

determining apparatus may be a card distribution device which distributes the cards in the gaming table or a control device which determines the win or lose result of each game from information of the image analyzing apparatus reading the cards distributed in the gaming table by using a camera.

[0021]

According to the fraud detection system as disclosed, it is possible to detect fraud in collection and redemption of chips in accordance with a win or lose result of a game.

[0022]

In addition, according to the disclosure, although the cards are slanted by "card squeegee" frequently performed by players in a baccarat game or the like, the rank and suit of the cards can be determined by image analysis, so that the total amount of chips being overlapped or being in a blind spot together with the positions can be recognized. In addition, fraud at the time of exchanging cash and chips can be detected.

BRIEF DESCRIPTION OF DRAWINGS

[0023]

FIG. 1 is a diagram illustrating an overview of a fraud detection system in a casino having a plurality of gaming tables according to a first embodiment of the invention;

FIG. 2A is a perspective diagram of chips illustrating an example of different overlapped states of chips recognized in the first embodiment of the invention;

What is claimed is:

1. A system utilizing deep learning used at a gaming table for playing a game by wagering chips, the system comprising:

a camera configured to obtain a captured image by capturing a predetermined area of the gaming table on which a plurality of betting areas are laid out, wherein the camera is arranged diagonally above the gaming table and captures from diagonally above the gaming table a plurality of stacks of wagered chips on the betting areas; and

a control device configured to identify a position, type, and number of the chips wagered on the gaming table based on the captured image obtained,

wherein the chips are configured capable of being identified of the type at least by color information or a pattern on a side surface,

the control device is configured to identify the position, type, and/or number of the chips by recognizing targets including the chips in the captured image by utilizing a convolutional neural network as the deep learning that performs image recognition by extracting features in the captured image in which color information or a pattern is appearing, and

the convolutional neural network is a neural network having performed learning by a scheme in which the neural network learns learning images including types of chips used in the gaming table as the targets, and in a case where a plurality of the targets exist in a learning image, the neural

network performs the learning by giving labels to areas corresponding to the targets.

2. The system according to claim 1,

wherein the control device is configured to identify the type of the chips by utilizing the deep learning, extracting and classifying candidate areas from a target image, and obtaining a classified candidate with the highest degree of certainty as a recognition result.

3. The system according to claim 1,

wherein the control device is configured capable of accurately identifying the position, type, and number even when a portion of the chips is concealed due to a blind spot.

4. The system according to claim 1,

where in the control device is configured to recognize a target including the chips from the captured image including a plurality of the stacks of the chips in the same betting area to identify the position, type, and number of the chips.

5. The system according to claim 1, further comprising:

a plurality of the cameras,

wherein the plurality of the cameras are configured to capture the gaming table from different angles from each other, and

the control device is configured to use a plurality of

the captured images captured by the plurality of the cameras, and is configured to accurately identify the position and type even when an entirety of the chips is concealed due to a blind spot in the captured images of some of the cameras.

6. The system according to claim 1,

wherein the control device is capable of identifying the position, type, and/or number of the chips from the captured image including the chips entering into a shadow by utilizing the convolutional neural network.

7. The system according to claim 1,

wherein the control device is capable of identifying the position, type, and/or number of the chips from the captured image including a chip stack in which the chips are deviated and overlapped by utilizing the convolutional neural network.

8. The system according to claim 1,

wherein the control device is capable of identifying the position, type, and number of the chips that are placed in a plurality of areas with different distances and angles from the camera by utilizing the convolutional neural network.

9. The system according to claim 1,

wherein the control device is capable of identifying the position, type, and number of the chips bet on any one of a plurality of the gaming tables.

10. The system according to claim 1,

wherein the control device is further configured capable of recognizing a total sum of bills as the target, and is configured capable of comparing the total sum of the bills placed on the gaming table by a player and a total amount of the chips corresponding to the type of chips which a dealer gave out, and determining whether or not the sums match.

11. The system according to claim 1,

wherein the deep learning multilayers the neural network and is configured to recognize the targets by overlapping multiple stages of layers in intermediate layers between an input layer and an output layer.

12. The system according to claim 1,

wherein the control device is configured to record and monitor a history of chip information wagered at each play position based on the identified position, type, and number of the chips.

13. The system according to claim 12,

wherein the history of chip information is a total amount of the chips wagered at each play position or the number of each type of the chips.

14. The system according to claim 12,

wherein the control device is configured capable of

specifying a player at each play position by an identification number.

15. The system according to claim 14,

wherein the control device is configured to specify the player by specifying the identification number by extracting an image of a face of the player.

16. The system according to any one of claims 12 to 15,

wherein the control device is configured to monitor the recorded history of the wagered chip information, compare the same with statistical data to extract a strange situation, and output an alarm.

17. The system according to any one of claims 12 to 15,

wherein the control device is configured to monitor the recorded history of the wagered chip information, extract a strange situation based on a predetermined condition that is preset, and output an alarm.

18. The system according to any one of claims 12 to 17,

wherein the game is a baccarat game, the betting areas include a player area, a banker area, a tie area, a player pair area, and a banker pair area, and

the control device is configured capable of identifying the position, type, and number of the chips respectively wagered in the player area, the banker area, the tie area, the player

pair area, and the banker pair area.

19. The system according to claim 18, further comprising:

a win/lose result determining apparatus configured to determine a win/lose result of the baccarat game at the gaming table,

wherein the control device is configured to record and monitor an amount of acquired chips and a history of win and lose of each play position based on the identified position, type, and number of the chips and the win/lose result determined by the win/lose result determining apparatus.

20. The system according to claim 18,

wherein the control device is configured to monitor an amount of acquired chips and a history of win and lose that are recorded, specify a player who obtained wins of a predetermined sum or more, and output an alarm.

21. The system according to claim 1, further comprising:

a win/lose result determining apparatus configured to determine a win/lose result of each game at the gaming table; and

a chip tray for a dealer to hold the chips at the gaming table,

wherein the control device is configured to:

identify the position, type, and number of the chips which each player wagers, and identify a total amount of the chips

in the chip tray of the dealer at the gaming table by using an ID embedded in each of the chips; and

in regard to the total amount of the chips in the chip tray before payout, compare a correct total amount of the chips and an actual total amount of the chips in the chip tray, the correct total amount of the chips being obtained by adding or subtracting an increased/decreased amount of the chips calculated from the position, type, and number of the chips wagered by players in the game and the win/lose result of the game obtained from the win/lose result determining apparatus, and determine whether there is a difference between the correct total amount and the actual total amount.