

A SYSTEM SUITABLE FOR DETECTING AN IDENTIFICATION CARD, AND AN APPARATUS AND A PROCESSING METHOD IN ASSOCIATION THERETO

Field Of Invention

5 **[0001]** The present specification generally relates to a system suitable for detecting an identification card. The present specification further relates to one or both of an apparatus and a processing method associable to the system.

Background

10 **[0002]** In the electronic know your client/customer (eKYC) context, it is essential to capture data/information concerning a client/customer.

[0003] This can conventionally be done by manner of, for example, using a device to detect an Identification (ID) card belonging to or associated with a client/customer.

15 The ID card can include personal information/data (e.g., name, ID number, nationality and/or date of birth) associated with its owner (i.e., client/customer to whom the ID card belongs to or is associated with).

[0004] One conventional solution/technique is to use an electronic device to scan the
20 ID belonging to or associated with a client/customer. Other convention techniques include using an electronic device to capture an image of an ID card belonging to or associated with a client/customer.

[0005] However, the present specification contemplates that data/information need
25 not necessarily be captured in a reliable and/or efficient manner.

[0006] Specifically, the present specification contemplates that conventional solutions/techniques do not facilitate the detection of an ID card in a user-friendly, efficient and/or reliable manner.

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[0007] The present specification contemplates that there is a need to improve the manner in which an ID card can be detected.

Summary of the Invention

[0008] To improve the manner in which an Identification (ID) card can be detected, the present specification contemplates a two-stage based detection strategy.

5 **[0009]** By manner of the contemplated two-stage based strategy, the present specification contemplates that an ID card can be detected in a more reliable/accurate manner without, for example, needing to substantially rely/over reliance on optimal positioning of an ID card relative to a detection device. Moreover, attempts required for capturing client/customer data/information can possibly be
10 substantially reduced (or, for example, only a single attempt might be required). Therefore, the present specification further contemplates that the detection of an ID card in a user-friendly manner and/or an efficient manner can be facilitated.

[0010] In accordance with an embodiment of the specification, there is provided an
15 apparatus.

[0011] The processor can include a capturing device that can capture data associated with an Identification (ID) Card which is associated with a customer, captured data being processable by a deep learning algorithm so as to obtain
20 general predictive information concerning the ID card. The processor can further include a processor that processes the general predictive information for targeted determination of information concerning the ID card.

[0012] In accordance with another embodiment of the specification, there is provided
25 a processing method.

[0013] The processing method can include a first stage Identification (ID) Card detection step wherein general predictive information concerning the ID card is obtained based on a Convolutional Neural Network (CNN).
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[0014] The processing method can further include a second stage ID card detection step wherein targeted information concerning the ID card is determined based on the obtained general predictive information.

Brief Description of the Drawings

[0015] Embodiments of the specification are described hereinafter with reference to the following drawings, in which:

5 [0016] Fig. 1 shows an example of a system which can include at least one apparatus and/or at least one database, according to an embodiment of the specification;

[0017] Fig. 2 shows an example of the apparatus of Fig. 1 in further detail, according to an embodiment of the specification;

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[0018] Fig. 3 shows an example scenario in association with the system of Fig. 1, according to an embodiment of the specification;

15 [0019] Fig. 4 shows that an example of a computer device which can correspond to, or be associated with, the apparatus of Fig. 1 and/or the database of Fig. 1, according to an embodiment of the specification;

[0020] Fig. 5 shows an example of a processing method in association with the system of Fig. 1, according to an embodiment of the specification; and

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[0021] Fig. 6 shows a diagram illustrating an example of modules of an apparatus which can, for example, correspond to the apparatus of Fig. 2, according to an embodiment of the specification.

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Detailed Description

[0022] The present specification contemplates that, concerning the earlier discussed conventional solutions/techniques, reliable detection, using a detection device, of an Identification (ID) card of a client/customer is dependent on positioning of the ID card relative to the detection device.

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[0023] For example, if the ID card is positioned relative to the detection device such that the captured image of the ID card is skewed (e.g., in a situation where a picture

of the ID card had been taken at an extreme angle) and/or if the ID card is positioned too far away from the detection device, it is possible that data/information associated with the client/customer may not be captured accurately. This may result in erroneous data/information being captured and/or multiple attempts being required for capturing client/customer data/information.

[0024] Therefore, the present specification contemplates that conventional solutions/techniques require an ID card to be optimally positioned relative to a detection device and, thus, do not facilitate the detection of an ID card in a user-friendly, efficient and/or reliable manner.

[0025] To improve the manner in which an ID card can be detected, the present specification generally contemplates a two-stage based detection as will be discussed in further detail with reference to Fig. 1 to Fig. 6.

[0026] Embodiments will be described, by way of example only, with reference to the drawings. Like reference numerals and characters in the drawings refer to like elements or equivalents.

[0027] Some portions of the description which follows are explicitly or implicitly presented in terms of algorithms and functional or symbolic representations of operations on data within a computer memory. These algorithmic descriptions and functional or symbolic representations are the means used by those skilled in the data processing arts to convey most effectively the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities, such as electrical, magnetic or optical signals capable of being stored, transferred, combined, compared, and otherwise manipulated.

[0028] Unless specifically stated otherwise, and as apparent from the following, it will be appreciated that throughout the present specification, discussions utilizing terms such as “receiving”, “scanning”, “calculating”, “determining”, “replacing”, “generating”,

“initializing”, “outputting”, or the like, refer to the action and processes of a computer system, or similar electronic device, that manipulates and transforms data represented as physical quantities within the computer system into other data similarly represented as physical quantities within the computer system or other information storage, transmission or display devices.

[0029] The present specification also discloses one or more apparatuses for performing the operation(s) of one or more methods. Such apparatus(es) may be specially constructed for the required purposes, or may comprise a computer or other device selectively activated or reconfigured by a computer program stored in the computer. The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various machines may be used with programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform the required method steps may be appropriate. The structure of a computer suitable for executing the various methods / processes described herein will appear from the description below.

[0030] In addition, the present specification also implicitly discloses a computer program, in that it would be apparent to the person skilled in the art that the individual steps of the method described herein may be put into effect by computer code. The computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the specification contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the spirit or scope of the specification.

[0031] Furthermore, one or more of the steps of the computer program may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a computer. The computer readable

medium may also include a hard-wired medium such as exemplified in the Internet system, or wireless medium such as exemplified in the GSM mobile telephone system. The computer program when loaded and executed on such a computer effectively results in an apparatus that implements the steps of the preferred method.

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[0032] The foregoing will be discussed in further detail with reference to Fig. 1 to Fig. 6 hereinafter.

10 **[0033]** Referring to Fig. 1, an example of a system 100 is shown, according to an embodiment of the specification. The system 100 can be suitable for use for detecting at least one identification (ID) card which can belong to/ be associated with at least one client/customer. An ID card can carry, or be associated with, information/data associated with a client/customer. Detection of the ID card(s) can, for example, be based on a two-stage based detection/strategy as will be discussed
15 later in further detail, according to an embodiment of the specification.

[0034] The system 100 can include one or more apparatuses 102, one or more databases 104 and a communication network 106.

20 **[0035]** The apparatus(es) 102 can be coupled to the database(s) 104. Specifically, the apparatus(es) 102 can, for example, be coupled to the database(s) 104 via the communication network 106.

25 **[0036]** In one embodiment, the apparatus(es) 102 can be coupled to the communication network 106 and the database(s) 104 can be coupled to the communication network 106. Coupling can be by manner of one or both of wired coupling and wireless coupling. The apparatus(es) 102 can, in general, be configured to communicate with the database(s) 104 via the communication network 106.

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[0037] The apparatus(es) 102 can, for example, correspond to one or more computers (e.g., laptops, desktop computers and/or electronic mobile devices having computing capabilities such as Smartphones and electronic tablets).

[0038] In general, the apparatus(es) 102 can be configured to capture information/data associated with a client/customer. Based on the captured information/data (i.e., associated with a client/customer), the apparatus(es) 102 can be configured to generate and communicate one or more input signals.

[0039] For example, the apparatus(es) 102 can be configured to capture at least one image associated with an ID card carrying information/data associated with a client/customer. The present specification contemplates that the captured image(s) could contain spurious information/data (e.g., unnecessary background image in addition to the image of the ID card). In this regard, the present specification contemplates that the input signal(s) could contain spurious data/information (i.e., unrelated to data/information associated with the client/customer). The present specification contemplates the reduction/elimination of such spurious data/information.

[0040] In accordance with an embodiment of the specification, the input signal(s) can be communicated from the apparatus(es) 102 to the database(s) 104 for processing to generate one or more detection signal(s). The detection signal(s) can, for example, correspond to predictive based information concerning the ID card. The detection signal(s) can be communicated from the database(s) 104 to the apparatus(es) 102 for processing. The apparatus(es) 102 can be configured to perform one or more processing tasks in respect of the detection signal(s) to generate one or more output signal(s). The output signal(s) can, for example, correspond to an image of the ID card where spurious information/data had been substantially reduced/eliminated (e.g., unnecessary background image has been substantially reduced/eliminated).

[0041] The present specification contemplates the possibility that the aforementioned output signal(s) may not be of desirable (or non-ideal) quality. For example, spurious data/information may not have been reduced/eliminated in an adequate manner and/or data/information concerning the client/customer of an ID card may

not have been reproduced in an intelligible/accurate manner (e.g., in an example situation of an occurrence of skew).

[0042] In accordance with an embodiment of the specification, the apparatus(es) 102 can be configured to determine whether the output signal(s) is/are of acceptable quality. If the output signal(s) is/are determined to be of unacceptable/inadequate/non-ideal quality, the apparatus(es) 102 can be further configured to process the detection signal(s) by manner of adjustment/refinement so as to generate one or more adjusted detection signal(s). The apparatus(es) 102 can yet be further configured to communicate the adjusted detection signal(s) to the database(s) 104 for processing to generate one or more refined detection signals. The refined detection signal(s) can be communicated from the database(s) 104 to the apparatus(es) 102 for further processing in a manner so as to produce refined output signal(s).

[0043] The refined output signal(s) can be considered to be a higher quality (e.g., more accurate, more intelligible and/or higher reduction of spurious information/data) as compared to the aforementioned output signal(s). Specifically, the refined output signal(s) can, for example, be considered to be a higher quality version (e.g., a more accurate version/a more intelligible version) of the output signal(s).

[0044] The apparatus(es) 102 will be discussed in further detail with reference to Fig. 2, according to an embodiment of the specification.

[0045] The database(s) 104 can, for example, carry a deep learning type algorithm/network or can, for example correspond to a deep learning type algorithm/network. In one example, the database(s) 104 can correspond to one or more host devices (e.g., one or more computers, or a network of computers) which carry a Convolutional Neural Network (CNN). In another example, the database(s) 104 can correspond to a CNN.

[0046] Generally, the database(s) 104 can be configured to receive one or both of the input signal(s) and the preprocessed input signal(s) for further processing to

generate one or both of the detection signal(s) and the refined detection signal(s) based, for example, on the CNN. The database(s) 104 can be further configured to communicate the detection signal(s) and/or the refined detection signal(s) to the apparatus(es) 102 for further processing.

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[0047] The communication network 106 can, for example, correspond to an Internet communication network. Communication (i.e., between the apparatus(es) 102 and the database(s) 104) via the communication network 106 can be by manner of one or both of wired communication and wireless communication.

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[0048] Earlier mentioned, the present specification contemplates a two-stage based detection.

[0049] The first stage detection can relate to obtaining/deriving the aforementioned detection signal(s). For example, in relation to the first stage detection, predicative based processing can be performed to generally predict information such as position (e.g., based on the aforementioned corner point(s) associated with the ID card portion 302) associated with an ID card.

[0050] The second stage detection can relate generally to processing the detection signal(s) to obtain/generate the aforementioned output signal(s). The second stage detection can, optionally, further relate to generating/obtaining the aforementioned refined output signal(s) based on the aforementioned refined detection signal(s). For example, in relation to the second stage detection, predicative based processing can be performed to a targeted (i.e., pinpoint) determination of information such as position (e.g., based on the aforementioned corner point(s) associated with the processed ID card portion 306 and/or the refined ID card portion 308) associated with the ID card.

[0051] The apparatus(es) 102 can now be discussed in further detail with reference to Fig. 2, according to an embodiment of the specification, hereinafter.

[0052] Referring to Fig. 2, an apparatus 102 is shown in further detail in the context of an embodiment 200, according to an embodiment of the specification.

[0053] In the embodiment 200, the apparatus(es) 102 can include one or more capturing devices 202 and one or more processors 204. The capturing device(s) 202 can be coupled to the processor(s) 204. Coupling can be by manner of one or both of wired coupling and wireless coupling.

[0054] The capturing device(s) 202 can be configured to capture information/data associated with a client/customer. In one example, a capturing device 202 can correspond to an image capturing device (e.g., a camera) which can be configured to capture at least one image associated with an ID card as will be later discussed in further detail in the context of an example scenario with reference to Fig. 3.

[0055] Based on the captured information/data (i.e., associated with a client/customer), the capturing device(s) 202 can be configured to generate and communicate one or more input signals. The input signal(s) can be communicated from the capturing device(s) 202 to one or both of the processor(s) 204 and the database(s) 104. As discussed earlier, the input signal(s) could include spurious data/information (e.g., background image).

[0056] The processor(s) 204 can be configured to receive the input signal(s). Moreover, the processor(s) 204 can be configured to one or both of communicate the input signal(s) and process the input signal(s) (i.e., communicate the input signal(s) and/or process the input signal(s)).

[0057] For example, the processor(s) 204 can be configured to communicate the input signal(s) to the database(s) 104 for processing. The database(s) 104 can be configured to process the input signal(s) by manner of predictive based processing (e.g., based on the CNN) to generate one or more detection signals. The detection signal(s) can be communicated to the processor(s) 204 for further processing.

[0058] The processor(s) 204 can be configured to perform one or more processing tasks in respect of the detection signal(s).

[0059] In one embodiment, the processor(s) 204 can be configured to perform transformation-based processing (e.g., perspective transformation-based processing). For example, the detection signal(s) can be processed by manner of perspective transformation-based processing to generate one or more output signals associated with the ID card. The output signal(s) can, for example, correspond to an image of the ID card with the possibility of the aforementioned spurious data/information being substantially reduced/eliminated. The processor(s) 204 can be further configured to perform determination-based processing to determine whether the output signal(s) is/are of acceptable quality. For example, determination of acceptable quality can be based on whether spurious data/information can be/had been reduced/eliminated in an adequate manner and/or data/information concerning the client/customer of an ID card can be/had been reproduced in an intelligible/accurate manner.

[0060] In one embodiment, the processor(s) 204 can be further configured to perform adjustment/refinement-based processing if the output signal(s) is/are determined to be of unacceptable/inadequate/non-ideal quality.

[0061] Specifically, if the output signal(s) is/are determined to be of unacceptable/inadequate/non-ideal quality, the processor(s) 204 can be further configured to process the received detection signal(s) by manner of predetermined adjustment/refinement. Specifically, the received detection signal(s) can be processed by manner of adjustment/refinement-based processing to generate adjusted detection signal(s).

[0062] Adjustment/refinement-based processing can, for example, relate to the application of a predetermined adjustment/refinement parameter. This will be discussed later in further detail with reference to an example scenario with reference to Fig. 3, according to an embodiment of the specification.

[0063] The adjusted detection signal(s) can be communicated from the apparatus(es) 102 (e.g., from the processor(s) 204) to the database(s) 104 for further processing. Based on the adjusted detection signal(s), the database(s) 104 can be configured to generate one or more refined detection signal(s). The refined detection signal(s) can be communicated from the database(s) 104 to the apparatus(es) 102 for processing (e.g., by the processor(s) 204) in a manner so as to generate one or more refined output signal(s) associated with the ID card. For example, the refined detection signal(s) can be received and processed by the processor(s) by manner of perspective transformation-based processing to generate refined output signal(s) associated with the ID card.

[0064] As mentioned earlier, the refined output signal(s) can be considered to be a higher quality (e.g., more accurate/ more intelligible) as compared to the aforementioned output signal(s). Specifically, the refined output signal(s) can, for example, be considered to be a higher quality version (e.g., a more accurate version/a more intelligible version) of the output signal(s).

[0065] The foregoing will be discussed based on an example scenario 300 with reference to Fig. 3 hereinafter.

[0066] Referring to Fig. 3, an example scenario 300 is shown, according to an embodiment of the specification.

[0067] As mentioned earlier, the apparatus(es) 102 can be configured to, for example, capture at least one image associated with an ID card, according to an embodiment of the specification.

[0068] In the example scenario 300, a captured image 300a, a processed image 300b and a refined image 300c are discussed.

[0069] The captured image 300a can be associated with an ID card portion 302 and can include a background image portion 304. Specifically, the captured image 300a can correspond to an image which is a combination of the ID card portion 302 and

the background image portion 304. The ID card portion 302 can be based on an “x” by “y” resolution (e.g., a 400 by 300 resolution; a 400 X 300 resolution where “x” = 300 and “y” = 400) and can be associated with one or more corner points. The background image portion 304 can be considered to be spurious data/information.

5 For example, in the captured image 300a, the proportion of the ID card portion 302 can be higher compared to background image portion 304 (e.g., a ratio of 80 parts ID card portion 302 to 20 parts background image portion 304). In one example, about 70 % of the captured image 300a can be the ID card portion 302 whereas about 30% of the captured image 300a can be the background image portion 304.

10 **[0070]** Additionally, the ID card portion 302 associated with the captured image 300a can, for example, be visually perceived to be skewed (e.g., in an example situation where the ID card was poorly positioned and image is taken/captured when the ID card was positioned at an extreme angle), according to an embodiment of the specification.

15 **[0071]** Moreover, the aforementioned input signal(s) can be associated with the captured image 300a.

20 **[0072]** After the input signal(s) (i.e., associated with the captured image 300a) is/are communicated from the apparatus(es) 102 and received by the database(s) 104, the database(s) 104 can process the captured image 300a by manner of predicative processing (e.g., based on the aforementioned CNN) so as to predict information concerning the corner point(s), of the ID card portion 302, as denoted by p1, p2, p3 and p4. The aforementioned detection signal(s) can correspond to predicted information concerning the corner points (i.e., p1, p2, p3 and p4).

25 **[0073]** The detection signal(s) can be received by the apparatus(es) 102 for processing (e.g., perspective transformation-based processing) to generate the aforementioned output signal(s) which can correspond to a processed image 300b.

[0074] The processed image 300b can be associated with a processed ID card portion 306. Additionally, the aforementioned background image portion 304 can be

substantially reduced/eliminated as compared to that per captured image 300a. For example, in the processed image 300b, the proportion of the processed ID card portion 306 can be much higher compared to background image portion 304 (e.g., a ratio of 100 parts processed ID card portion 306 to 1-part background image portion 304). In one example, 90% or more of the processed image 300b can be the processed ID card portion 306 whereas 10% or less of the processed image 300b can be the background image portion 304. Furthermore, in one embodiment, the processed ID card portion 306 can be considered to be visually perceivable to be less skewed as compared to the ID card portion 302. Specifically, extent of skew associated with the processed ID card portion 306 can be lesser as compared to the ID card portion 302. In one embodiment, skewing can be substantially eliminated (e.g., the processed ID card portion 306 can be substantially visually perceivable to be not skewed).

[0075] For example, the captured image 300a and the processed image 300b can each be associated with an identification (i.e., ID card portion 302/processed ID card portion 306) to spurious data ratio (i.e., background image portion 304). The identification to spurious data ratio associated with the processed image 300b can be considered to be better/improved as compared to the captured image 300a. Specifically, the processed ID card portion 306 to background image portion 304 ratio per the processed image 300b can be higher as compared to the ID card portion 302 to background image portion 304 ratio per the captured image 300a. More specifically, the proportion of the processed ID card portion 306 (i.e., relative to the background image portion 304) per the processed image 300b can be considered to be much higher as compared to the proportion of the ID card portion 302 (i.e., relative to the background image portion 304) per the captured image 300a.

[0076] In this regard, the processed image 300b can, for example, correspond to a set of output signal(s) in which data/information associated with a client/customer (i.e., in association with the processed ID card portion 306) can be more accurately reproduced/reproduced in a more intelligible manner (i.e., as compared client or customer data/information in association with the ID card portion 302).

[0077] The processed ID card portion 306 can be associated with one or more corner points. For example, the processed ID card portion 306 can be associated with four corner points as denoted by p1', p2', p3' and p4'. Information concerning the corner point(s) of the processed ID card portion 306 can be derived/obtained/determined based on, for example, perspective transformation-based processing in respect of the corner point(s) of the ID card portion 302.

[0078] For example, p1, p2, p3 and p4 can be processed by manner of perspective transformation-based processing to produce p1', p2', p3' and p4' respectively.

[0079] In the 400 by 300 resolution based context per the example scenario 300, p1' can be predefined as (0, 0), p2' can be predefined as (400, 0), p3' can be predefined as (400, 300) and p4' can be predefined as (0, 300), according to an embodiment of the specification.

[0080] Appreciably, the processed image 300b can, for example, be considered to be an improved version of the captured image 300a in that data/information associated with a client/customer can be reproduced/obtained/determined in a more accurate/intelligible manner. In this regard, it is contemplated that an ID card can be detected in a more reliable/accurate manner without, for example, needing to substantially rely/over reliance on optimal positioning of an ID card relative to a detection device. Moreover, attempts required for capturing client/customer data/information can possibly be substantially reduced (or, for example, only a single attempt might be required). Therefore, the present specification can, for example, further facilitate the detection of an ID card in a user-friendly manner and/or an efficient manner.

[0081] The present specification contemplates the possibility that still further improvement could be required/desired in respect of the processed image 300b. For example, the processed image 300b can be considered to be still of inadequate/unacceptable/non-ideal quality.

[0082] Hence, a refined image 300c, which can be considered to be of a higher quality (e.g., more accurate/ more intelligible) compared to the processed image 300b, can be generated, according to an embodiment of the specification. The refined image 300c can, for example, correspond to the aforementioned refined output signal(s).

[0083] Specifically, the present specification contemplates that, in one embodiment, a refined image 300c can be produced based on the aforementioned adjusted detection signal(s). The refined image 300c can be associated with or can correspond substantially to a refined ID card portion 308.

[0084] For example, one or more refinement/adjustment parameters can be applied to the received detection signal(s) to generate the adjusted detection signal(s). An adjustment/refinement can, for example, in relation to the width and/or height associated with the ID card portion 302 in association with the captured image 300a.

[0085] Specifically, the ID card portion 302 can be associated with a width (as denoted by “w”) and a height (as denoted by “h”). For example, in regard to the detection signal(s) (i.e., which as discussed earlier, can correspond to predicted information concerning the corner points “p1,” “p2,” “p3” and “p4” associated with the ID card portion 302) a predetermined adjustment/refinement factor of a multiplication of 0.1 and w (i.e., $0.1 \times w$ or $0.1 * w$) can be applied in respect of “x” and a predetermined adjustment/refinement factor of a multiplication of 0.1 and h (i.e., $0.1 \times h$ or $0.1 * h$) can be applied to “y” as follows:

- $p1(x, y) = p1(x - 0.1 * w, y - 0.1 * h)$
- $p2(x, y) = p2(x + 0.1 * w, y - 0.1 * h)$
- $p3(x, y) = p3(x + 0.1 * w, y + 0.1 * h)$
- $p4(x, y) = p4(x - 0.1 * w, y + 0.1 * h)$

[0086] In this regard, it is appreciable that the adjusted detection signal(s) can include $p1(x, y)$, $p2(x, y)$, $p3(x, y)$ and/or $p4(x, y)$, according to an embodiment of the specification.

[0087] In the 400 by 300 resolution based context per the example scenario 300, $p1(x, y)$ can be predefined as (0, 0) (e.g., $x=0$; $y=0$), $p2(x, y)$ can be predefined as (400, 0) (e.g., $x=400$; $y=0$), $p3(x, y)$ can be predefined as (400, 300) (e.g., $x=400$; $y=300$) and $p4(x, y)$ can be predefined as (400, 0) (e.g., $x=400$; $y=0$), according to an embodiment of the specification.

[0088] The adjusted detection signal(s) (e.g., $p1(x, y)$, $p2(x, y)$, $p3(x, y)$ and/or $p4(x, y)$) can be communicated to the database(s) 104 for processing (e.g., based on the CNN) to generate refined predictive based information (e.g., the corner point(s)) concerning the ID card. Refined predictive based information concerning, for example, the corner point(s) of the ID card can, for example, be signified by $p1''$, $p2''$, $p3''$ and $p4''$. For example, $p1(x, y)$, $p2(x, y)$, $p3(x, y)$ and/or $p4(x, y)$ can be processed based on the CNN to generate $p1''$, $p2''$, $p3''$ and/or $p4''$ respectively. In this regard, it is appreciable that the refined detection signal(s) can include $p1''$, $p2''$, $p3''$ and/or $p4''$.

[0089] For example, $p1''$, $p2''$, $p3''$ and/or $p4''$ can be processed by manner of perspective transformation-based processing (e.g., by the apparatus(es) 102) to produce $pp1$, $pp2$, $pp3$ and/or $pp4$ respectively.

[0090] The refined ID card portion 308 can be associated with/can include one or more corner point(s) which can be denoted by $pp1$, $pp2$, $pp3$ and/or $pp4$. In the 400 by 300 resolution based context per the example scenario 300, $pp1$ can be predefined as (0, 0), $pp2$ can be predefined as (400, 0), $pp3$ can be predefined as (400, 300) and $pp4$ can be predefined as (400, 0), according to an embodiment of the specification.

[0091] In one embodiment, the refined image 300c should ideally be without a background image portion 304. In this regard, the refined image 300c can, for example, substantially correspond to the refined ID card portion 308 (i.e., without a background image portion 304/ the background image portion 304, if any, is considered to be negligible). Hence, in the refined image 300c, the aforementioned background image portion 304 (per the captured image 300a and/or the processed

image 300b) can be considered to have been at least substantially eliminated (or negligible). For example, more than 98% (e.g., ideally 100%) of the refined image 100c can be the refined ID card portion 308 whereas 2% or less (e.g., ideally 0%) of the refined image 300c can be the background image portion 304. Therefore, as
5 compared to the processed image 300b, in the refined image 300c, the proportion of the refined ID card portion 308 can be considered to be even much higher compared to the background image portion 304 (e.g., a ratio of 100 parts refined ID card portion 308 to 0.1-part or 0-part background image portion 304).

10 **[0092]** Furthermore, in one embodiment, the refined ID card portion 308 can, for example, be considered to be visually perceivable to be less skewed as compared to the processed ID card portion 306. Specifically, extent of skew associated with the refined ID card portion 308 can be lesser as compared to the processed ID card portion 306. In one embodiment, skewing can be substantially eliminated (i.e., the
15 refined card portion 308 is not visually perceivable to be skewed).

[0093] As mentioned earlier, the refined output signal(s) (i.e., corresponding to the refined image 300c) can be considered to be a higher quality (e.g., more accurate/
20 more intelligible) as compared to the aforementioned output signal(s) (i.e., corresponding to the processed image 300b). Specifically, the refined image 300c can, for example, be considered to be a higher quality version (e.g., a more accurate version/a more intelligible version) of the processed image 300b.

[0094] In this regard, it is contemplated that one technical effect is that an ID card
25 can be detected in a more reliable/accurate manner without, for example, needing to substantially rely/over reliance on optimal positioning of an ID card relative to a detection device. For example, an ID card can be detected in a reliable/accurate manner even in an example situation where the ID card was poorly positioned (e.g., at an extreme angle) relative to, for example, the apparatus 102. Moreover,
30 attempts required for capturing client/customer data/information can possibly be substantially reduced (or, for example, only a single attempt might be required). Therefore, another technical effect can be that the detection of an ID card in a user-friendly manner and/or an efficient manner can be facilitated.

[0095] To put the foregoing in perspective, the present specification contemplates, in accordance with an embodiment, an apparatus 102 which can include a capturing device 202 and a processor 204. The capturing device 202 can, for example, be coupled to the processor 204.

[0096] The capturing device 202 can be configured to capture data associated with an Identification Card (ID) which can be associated with a customer or a client. The captured data (e.g., corresponding to the aforementioned input signal(s) which can correspond to the captured image 300a) can be processed by a deep learning algorithm so as to obtain general predictive information (e.g., corresponding to the aforementioned detection signal(s)) concerning the ID card. The deep learning algorithm can, for example, be carried by/hosted by a database 104.

[0097] The processor 204 can be configured to process the general predictive information (e.g., corresponding to the aforementioned detection signal(s)) for targeted determination of information (e.g., to determine/generate one or both of: the aforementioned output signal(s) which can correspond to the processed image 300b and the aforementioned refined output signal(s) which can correspond to the refined image 300c; at least one of the output signal(s) and the refined output signal(s)) concerning the ID card.

[0098] In one embodiment, the deep learning algorithm can correspond to a Convolutional Neural Network (CNN) that can be configured to obtain/derive/determine general predictive information in relation to at least one corner point (e.g., p1, p2, p3 and/or p4) associated with the ID card.

[0099] In one embodiment, the processor 204 can be further configured to process the general predictive information (e.g., corresponding to the aforementioned detection signal(s)) to generate adjusted refined predictive information (e.g., corresponding to the aforementioned adjusted detection signal(s)) which can be processed by the deep learning algorithm (e.g., CNN) to derive refined predictive information (e.g., corresponding to the aforementioned refined detection signal(s)).

For example, targeted determination of information concerning the ID card can be based on the refined predictive information (e.g., deriving/obtaining/determining the aforementioned refined output signal(s) based on the aforementioned refined detection signal(s)).

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[0100] In one embodiment, the general predictive information can be in relation to a plurality of corner points (e.g., p1, p2, p3 and/or p4) associated with the ID card. The processor 204 can be configured to process the general predictive information by manner of perspective transformation-based processing for targeted determination of information concerning the ID card (e.g., corresponding to the aforementioned output signal(s) which can correspond to the processed image 300b).

[0101] In one embodiment, perspective transformation-based processing can be performed in connection with the general predictive information (e.g., p1, p2, p3 and/or p4) to generate a plurality of defined corner points (e.g., p1', p2', p3' and/or p4').

[0102] In one embodiment, the processor 204 can be further configured to process the general predictive information (e.g., p1 to p4) by manner of adjustment-based processing to derive a plurality of adjusted corner points (e.g., corresponding to the aforementioned adjusted detection signal(s) which can, for example, include p1(x, y), p2(x, y), p3(x, y) and/or p4(x, y)). For example, adjustment-based processing can relate to an application of an adjustment factor to the general predictive information (e.g., p1 to p4).

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[0103] Moreover, in one embodiment, the ID card can be associated with a width (w) and a height (h). Additionally, the ID card can be associated with a resolution defined based on "x" by "y" (e.g., 400 x 300 resolution). The adjustment factor can, for example, be 0.1. The adjusted corner points can be defined as follows:

- 30
- $p1(x, y) = p1(x-0.1*w, y-0.1*h)$
 - $p2(x, y) = p2(x+0.1*w, y-0.1*h)$
 - $p3(x, y) = p3(x+0.1*w, y+0.1*h)$
 - $p4(x, y) = p4(x-0.1*w, y+0.1*h)$

[0104] In one embodiment, the processor 204 can be configured to communicate the adjusted corner points (e.g., $p1(x, y)$, $p2(x, y)$, $p3(x, y)$ and/or $p4(x, y)$) for further processing by, for example, the CNN to obtain refined predictive information (e.g., $p1''$, $p2''$, $p3''$ and/or $p4''$). The processor 204 can be further configured to process the refined predictive information by manner of perspective transformation-based processing to derive a plurality of refined corner points (e.g., $pp1$, $pp2$, $pp3$ and/or $pp4$).

[0105] Appreciably, targeted determination of information concerning the ID card can be based on one or both of the defined corner points (e.g., $p1'$, $p2'$, $p3'$ and/or $p4'$) and the refined corner points ($pp1$, $pp2$, $pp3$ and/or $pp4$).

[0106] The present specification contemplates that in one example, an apparatus 102 and/or a database 104 can correspond to/be associated with a computing device. This will be discussed in the context of an example computing device with reference to Fig. 4 hereinafter.

[0107] Fig. 4 shows, according to an embodiment of the specification, an example computing device 400, hereinafter interchangeably referred to as a computer system 400. The following description of the computing device 400 is provided by way of example only and is not intended to be limiting.

[0108] As shown in Fig 4, the example computing device 400 includes a processor 404 for executing software routines. Although a single processor is shown for the sake of clarity, the computing device 400 may also include a multi-processor system. The processor 404 is connected to a communication infrastructure 406 for communication with other components of the computing device 400. The communication infrastructure 406 may include, for example, a communications bus, cross-bar, or network.

[0109] The computing device 400 further includes a main memory 408, such as a random access memory (RAM), and a secondary memory 410. The secondary

memory 410 may include, for example, a hard disk drive 412 and/or a removable storage drive 414, which may include a floppy disk drive, a magnetic tape drive, an optical disk drive, or the like. The removable storage drive 414 reads from and/or writes to a removable storage unit 418 in a well-known manner. The removable storage unit 418 may include a floppy disk, magnetic tape, optical disk, or the like, which is read by and written to by removable storage drive 414. As will be appreciated by persons skilled in the relevant art(s), the removable storage unit 418 includes a computer readable storage medium having stored therein computer executable program code instructions and/or data.

[0110] In an alternative implementation, the secondary memory 410 may additionally or alternatively include other similar means for allowing computer programs or other instructions to be loaded into the computing device 400. Such means can include, for example, a removable storage unit 422 and an interface 420. Examples of a removable storage unit 422 and interface 420 include a program cartridge and cartridge interface (such as that found in video game console devices), a removable memory chip (such as an EPROM or PROM) and associated socket, and other removable storage units 422 and interfaces 420 which allow software and data to be transferred from the removable storage unit 422 to the computer system 400.

[0111] The computing device 400 also includes at least one communication interface 424. The communication interface 424 allows software and data to be transferred between computing device 400 and external devices via a communication path 426. In various embodiments of the specification, the communication interface 424 permits data to be transferred between the computing device 400 and a data communication network, such as a public data or private data communication network. The communication interface 424 may be used to exchange data between different computing devices 400 which such computing devices 400 form part an interconnected computer network. Examples of a communication interface 424 can include a modem, a network interface (such as an Ethernet card), a communication port, an antenna with associated circuitry and the like. The communication interface 424 may be wired or may be wireless. Software and data transferred via the communication interface 424 are in the form of signals which can be electronic,

electromagnetic, optical or other signals capable of being received by communication interface 424. These signals are provided to the communication interface via the communication path 426.

5 **[0112]** As shown in Fig 4, the computing device 400 further includes a display interface 402 which performs operations for rendering images to an associated display 430 and an audio interface 432 for performing operations for playing audio content via associated speaker(s) 434.

10 **[0113]** As used herein, the term "computer program product" may refer, in part, to removable storage unit 418, removable storage unit 422, a hard disk installed in hard disk drive 412, or a carrier wave carrying software over communication path 426 (wireless link or cable) to communication interface 424.

15 **[0114]** Computer readable storage media refers to any non-transitory tangible storage medium that provides recorded instructions and/or data to the computing device 400 for execution and/or processing. Examples of such storage media include floppy disks, magnetic tape, CD-ROM, DVD, Blu-ray™ Disc, a hard disk drive, a ROM or integrated circuit, USB memory, a magneto-optical disk, or a
20 computer readable card such as a PCMCIA card and the like, whether or not such devices are internal or external of the computing device 400. Examples of transitory or non-tangible computer readable transmission media that may also participate in the provision of software, application programs, instructions and/or data to the computing device 400 include radio or infra-red transmission channels as well as a
25 network connection to another computer or networked device, and the Internet or Intranets including e-mail transmissions and information recorded on Websites and the like.

30 **[0115]** The computer programs (also called computer program code(s)/algorithm(s)) are stored in main memory 408 and/or secondary memory 410. Computer programs can also be received via the communication interface 424. Such computer programs, when executed, enable the computing device 400 to perform one or more features of embodiments discussed herein. In various embodiments, the computer programs,

when executed, enable the processor 404 to perform features of the above-described embodiments. Accordingly, such computer programs represent controllers of the computer system 400.

5 **[0116]** Software may be stored in a computer program product and loaded into the computing device 400 using the removable storage drive 414, the hard disk drive 412, or the interface 420. Alternatively, the computer program product may be downloaded to the computer system 400 over the communications path 426. The software, when executed by the processor 404, causes the computing device 400 to
10 perform functions of embodiments described herein.

[0117] It is to be understood that the embodiment of Fig. 4 is presented merely by way of example. Therefore, in some embodiments one or more features of the computing device 400 may be omitted. Also, in some embodiments, one or more
15 features of the computing device 400 may be combined together. Additionally, in some embodiments, one or more features of the computing device 400 may be split into one or more component parts.

[0118] It will be appreciated that the elements illustrated in Fig. 4 function to provide
20 means for performing the various functions and operations of the servers as described in the above embodiments.

[0119] In an implementation, a server may be generally described as a physical device comprising at least one processor and at least one memory including
25 computer program code. The at least one memory and the computer program code are configured to, with the at least one processor, cause the physical device to perform the requisite operations.

[0120] Referring to Fig. 5, an example of a processing method 500 in association
30 with the system 100 is shown, according to an embodiment of the specification.

[0121] The processing method 500 can include any one of an input (or “inputting”) step 502, a processing (or “generating”) step 504 and an output (or “outputting”) step

506, or any combination thereof. The processing method 500 can further include a refining step 508, according to an embodiment of the specification. The processing 500 can yet further include a training step 510, according to an embodiment of the specification.

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[0122] The processing method 500 can, for example, be associated with a two-stage detection of an ID card, according to an embodiment of the specification.

10 **[0123]** With regard to the input step 502, the aforementioned input signal(s) can be generated. Specifically, one or more input signals associated with an ID card can be generated.

15 **[0124]** With regard to the processing step 504, the input signal(s) can be processed to determine/obtain predictive based information concerning the ID card. Predictive based information concerning the ID card can, for example, correspond to the aforementioned detection signal(s). Moreover, processing of the input signal(s) can be via a deep learning algorithm, according to an embodiment of the specification. For example, processing of the input signal(s) can be based on the CNN.

20 **[0125]** With regard to the output step 506, the aforementioned output signal(s) can be generated. Specifically, one or more output signal(s) can be generated based on the detection signal(s).

25 **[0126]** With regard to the refining step 508, the aforementioned refined output signal(s) can be generated. As discussed earlier, one or more refined output signal(s) can be generated based on one or more refined detection signal(s).

30 **[0127]** With regard to the training step 510, the deep learning algorithm can be trained. Training of the deep learning algorithm can be based on one or both of the output signal(s) and the refined output signal(s).

[0128] Earlier mentioned, the processing method 500 can, in one embodiment, be associated with a two-stage detection of an ID card. The two-stage detection of an

ID card can, for example, be associated with a first stage identification (ID) card detection step and a second stage ID card detection step, according to an embodiment of the specification.

5 **[0129]** The first stage detection (of an ID card) can be associated with the input step 502 and the processing step 504.

10 **[0130]** The second stage detection (of an ID card) can be associated with one or both of the output step 506 and the refining step 508 (i.e., the output step 506 and/or the refining step 508).

15 **[0131]** Appreciably, in one embodiment, the training step 510 can be based on the first stage detection and/or the second stage detection. For example, the CNN can be trained based on the first stage detection and the second stage detection.

20 **[0132]** Generally, the present specification contemplates, in one embodiment, a processing method 500 which can include a first stage identification (ID) card detection step and a second stage ID card detection step.

25 **[0133]** With regard to the first stage ID card detection step, general predictive information (e.g., p1, p2, p3 and/or p4) concerning the ID card can be obtained based on, for example, a Convolutional Neural Network (CNN).

30 **[0134]** With regard to the second stage ID card detection step, targeted information concerning the ID card can be determined (e.g., by manner of perspective transformation-based processing) based on the obtained general predictive information (e.g., p1, p2, p3 and/or p4).

35 **[0135]** The present specification contemplates that in one embodiment, the CNN can be trained based on one or both of the first stage ID card detection step and the second stage ID card detection step (i.e., the first stage ID card detection step and/or the second stage ID card detection step).

[0136] Referring to Fig. 6, an example of modules of an apparatus 600 is shown according to an embodiment of the specification. The apparatus 600 can be an example of an embodiment of the aforementioned apparatus 102.

5 **[0137]** As shown, the apparatus 600 can include a first module 602 and a second module 604. The first module 602 can be associated with the aforementioned first stage detection (of an ID card). The second module 604 can be associated with the aforementioned second stage detection (of an ID card).

10 **[0138]** Specifically, the apparatus 600 can include a first module 602 that obtains/captures data/information associated with a client/customer and generates one or more input signals (e.g., corresponding to the captured image 300a) based on the captured/obtained data/information. As mentioned earlier, one or more detection signals can be generated based on the input signal(s).

15 **[0139]** The apparatus 600 can further include a second module 602 that processes the detection signal(s) to generate one or more output signal(s) (e.g., corresponding to the processed image 300b). The second module 602 can, in one embodiment, generate one or more refined output signals (e.g., corresponding to the refined
20 image 300c). In one embodiment, the detection signal(s) can be further processed to obtain one or more refined detection signals. One or more refined output signal(s) can be generated based on the refined detection signal(s).

25 **[0140]** Fig. 6 can, for example, be interpreted as illustrating an internal functional module and/or a structure of a detection apparatus that can detect an ID card based on a two-stage detection strategy, according to an embodiment of the specification.

30 **[0141]** It should be further appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments.

[0142] In one example, the task of determination-based processing can be omitted. Specifically, the processor(s) can, by default (i.e., without needing to determine

whether the output signal(s) is/are of acceptable/adequate quality), be configured to perform adjustment/refinement-based processing on the detection signal(s) to generate one or more refined detection signals.

- 5 **[0143]** In another example, in accordance with an embodiment of the specification, the database(s) 104 can be configured to generate one or more refined output signal(s) based on a combination of the detection signal(s) and the refined detection signal(s).
- 10 **[0144]** In the foregoing manner, various embodiments of the specification are described for addressing at least one of the foregoing disadvantages. Such embodiments are intended to be encompassed by the following claims, and are not to be limited to specific forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this specification that numerous changes
- 15 and/or modification can be made, which are also intended to be encompassed by the following claims.

Claim(s)

1. An apparatus comprising:

5 a capturing device that captures data associated with an Identification (ID) Card which is associated with a customer, captured data being processable by a deep learning algorithm so as to obtain general predictive information concerning the ID card; and

a processor that processes the general predictive information for targeted determination of information concerning the ID card.

- 10 2. The apparatus as in claim 1,

wherein the deep learning algorithm corresponds to a Convolutional Neural Network (CNN) that derives general predictive information in relation to at least one corner point associated with the ID card.

- 15 3. The apparatus as in claim 1,

20 wherein the processor further processes the general predictive information to generate adjusted predictive information which is processable by the deep learning algorithm to derive refined predictive information, and

wherein targeted determination of information concerning the ID card is based on the refined predictive information.

- 25 4. The apparatus as in claim 1,

wherein the general predictive information is in relation to a plurality of corner points associated with the ID card, and

30 wherein the processor processes the general predictive information by manner of perspective transformation-based processing for targeted determination of information concerning the ID card.

5. The apparatus as in claim 4,
wherein the ID card is associated with four corner points and general predictive information, which can include p1, p2, p3 and p4, relates to the four corner points associated with the ID card, and
wherein perspective transformation-based processing is performed in connection with p1, p2, p3 and p4 to generate four defined corner points as denoted by p1', p2', p3' and p4'.

6. The apparatus as in claim 5,
wherein the processor further processes the general predictive information, p1 to p4, by manner of adjustment-based processing to derive four adjusted corner points as denoted by p1(x, y), p2(x, y), p3(x, y) and p4(x, y), and
wherein adjustment-based processing relates to an application of an adjustment factor to p1 to p4.

7. The apparatus as in claim 6,
wherein the ID card is associable with a width (w) and a height (h) and the ID card is associable with a resolution defined based on "x" by "y", and
wherein the adjustment factor is 0.1, and the adjusted corner points:
p1(x, y) is defined as p1(x-0.1*w, y-0.1*h),
p2(x, y) is defined as p2(x+0.1*w, y-0.1*h),
p3(x, y) is defined as p3(x+0.1*w, y+0.1*h), and
p4(x, y) is defined as p4(x-0.1*w, y+0.1*h).

8. The apparatus as in claim 7,
wherein the processor communicates the adjusted corner points p1(x, y) to p4(x, y) for processing by the deep learning algorithm to derive refined predictive information, and

wherein the processor further processes the refined predictive information by manner of perspective transformation-based processing to derive four refined corner points as denoted by pp1, pp2, pp3 and pp4.

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9. The apparatus as in claim 8,
wherein targeted determination of information concerning the ID card is based on at least one of the defined corner points and the refined corner points.

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10. A processing method comprising:
a first stage Identification (ID) card detection step wherein general predictive information concerning the ID card is obtained based on a Convolutional Neural Network (CNN); and
a second stage ID card detection step wherein targeted information concerning the ID card is determined based on the obtained general predictive information.

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11. The processing method as in claim 11,
wherein the CNN is capable of being trained based on at least one of the first stage ID card detection step and the second stage ID card detection step.

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