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Ganti

(54) **ITERATIVE PROCESSING OF TRANSACTION INFORMATION TO DETECT FRAUD**

(71) Applicant: **VERIZON PATENT AND LICENSING INC.**, BASKING RIDGE, NJ (US)

(72) Inventor: **Visweswararao Ganti**, Acton, MA (US)

(73) Assignee: **VERIZON PATENT AND LICENSING INC.**, BASKING RIDGE, NJ (US)

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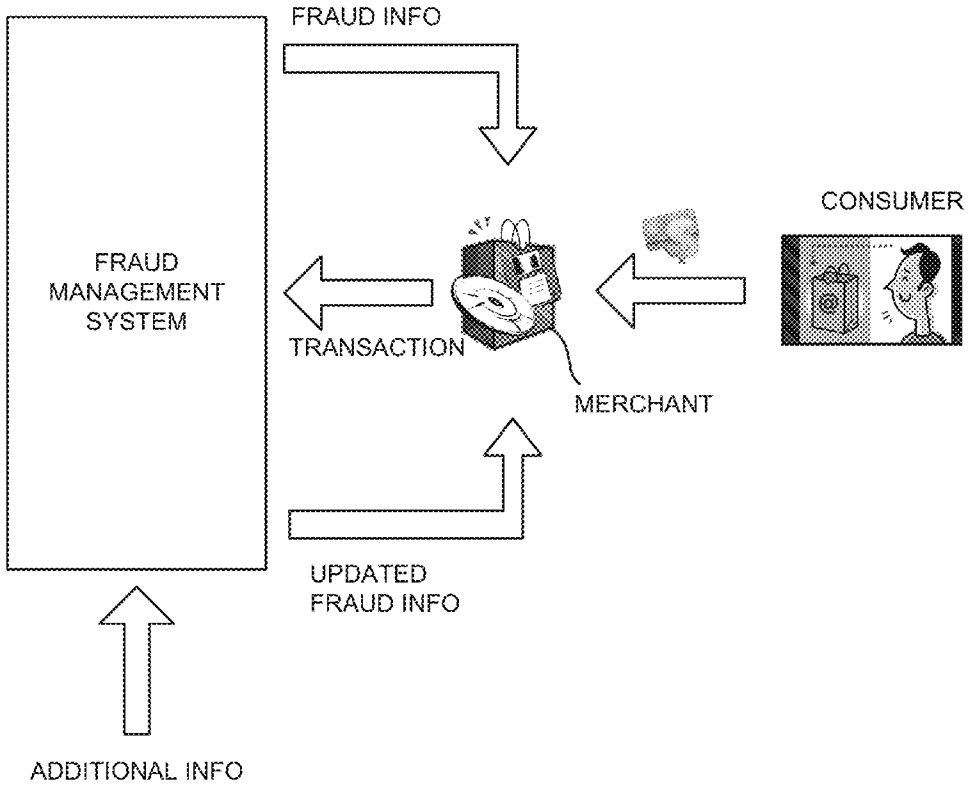
USPC **705/44**

(57) **ABSTRACT**

A fraud management system is configured to store rules for detecting fraud, receive a transaction from a merchant, process the transaction using a first subset of rules to generate a fraud score for the transaction, and output information regarding the fraud score to the merchant to assist the merchant in determining whether to accept, deny, or fulfill the transaction. The fraud management system is further configured to receive, after outputting the information regarding the fraud score to the merchant, additional information relating to the transaction, re-process the transaction using a second subset of rules to generate an update fraud score, and output information regarding the updated fraud score to the merchant to assist the merchant in determining whether to accept, deny, or fulfill the transaction.



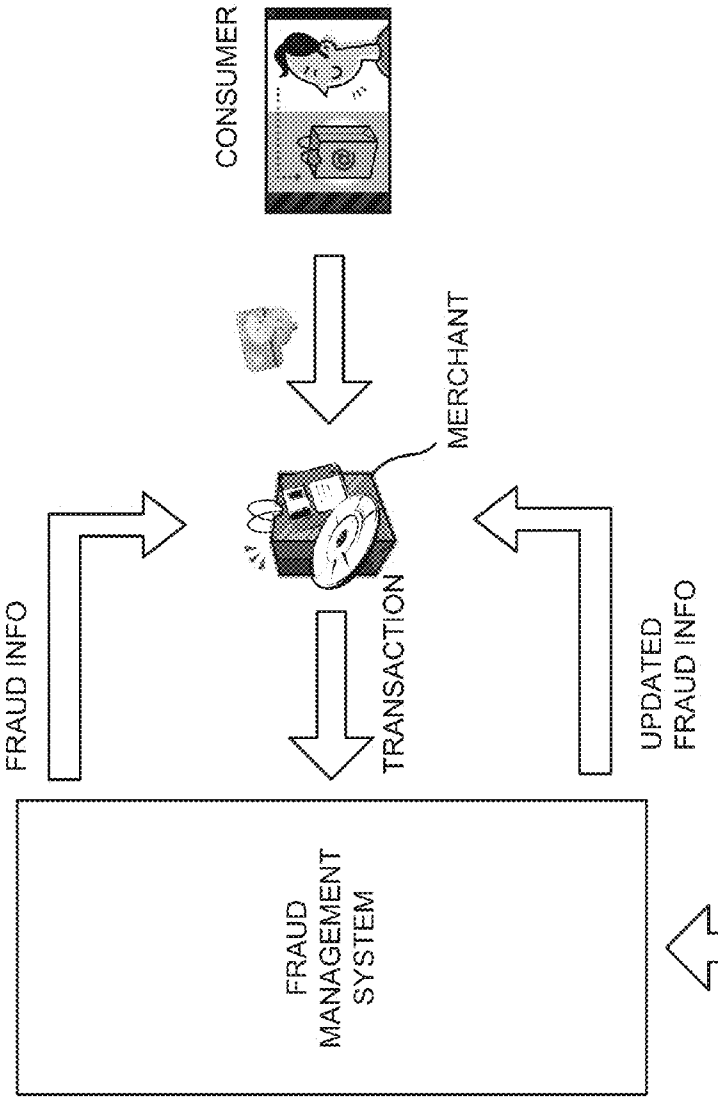
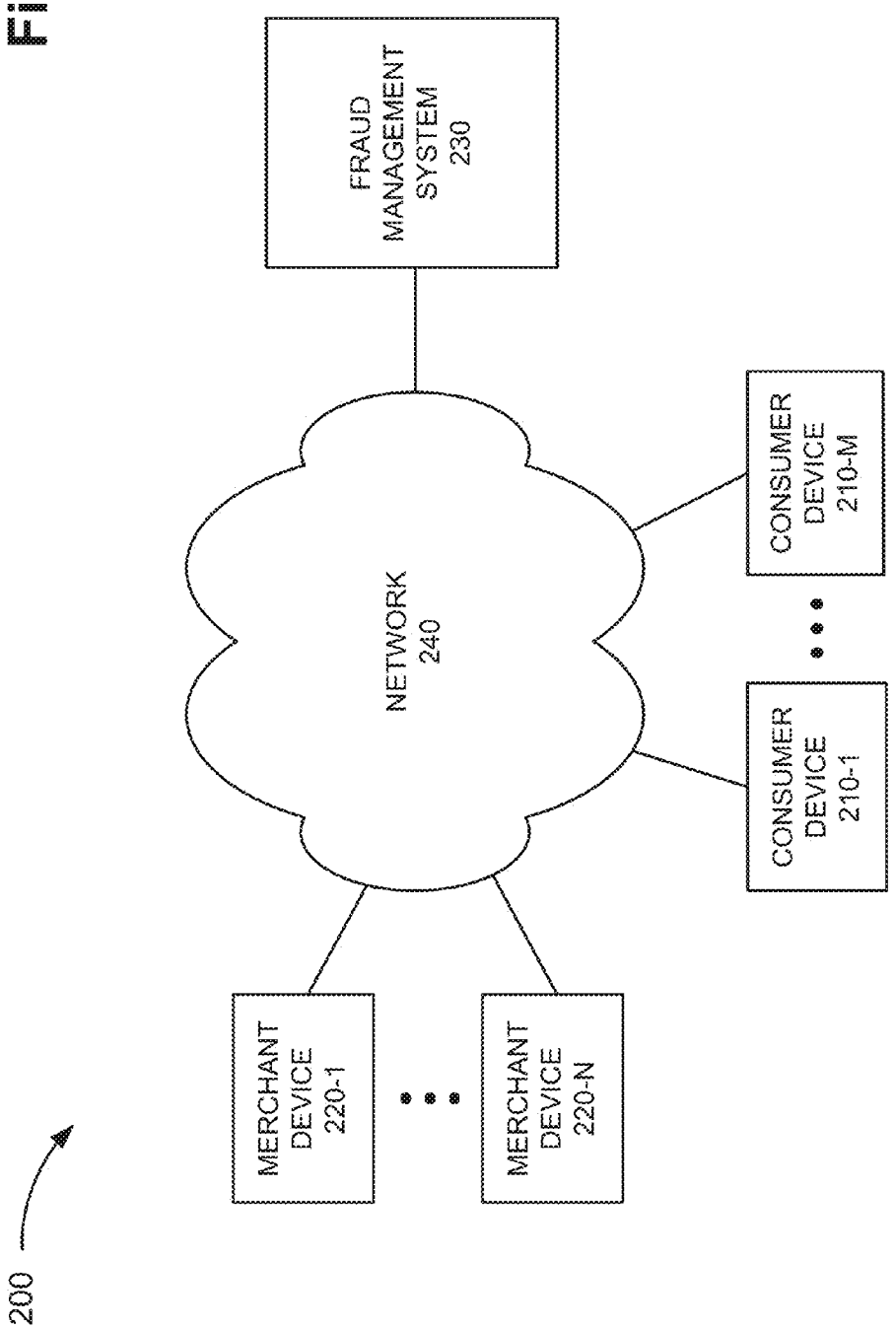

CONSUMER
MERCHANT
FRAUD INFO
TRANSACTION
UPDATED
FRAUD INFO
FRAUD
MANAGEMENT
SYSTEM
ADDITIONAL INFO

Fig. 1

Fig. 2


200
FRAUD MANAGEMENT SYSTEM 230
NETWORK 240
CONSUMER DEVICE 210-M
CONSUMER DEVICE 210-1
MERCHANT DEVICE 220-1
MERCHANT DEVICE 220-N

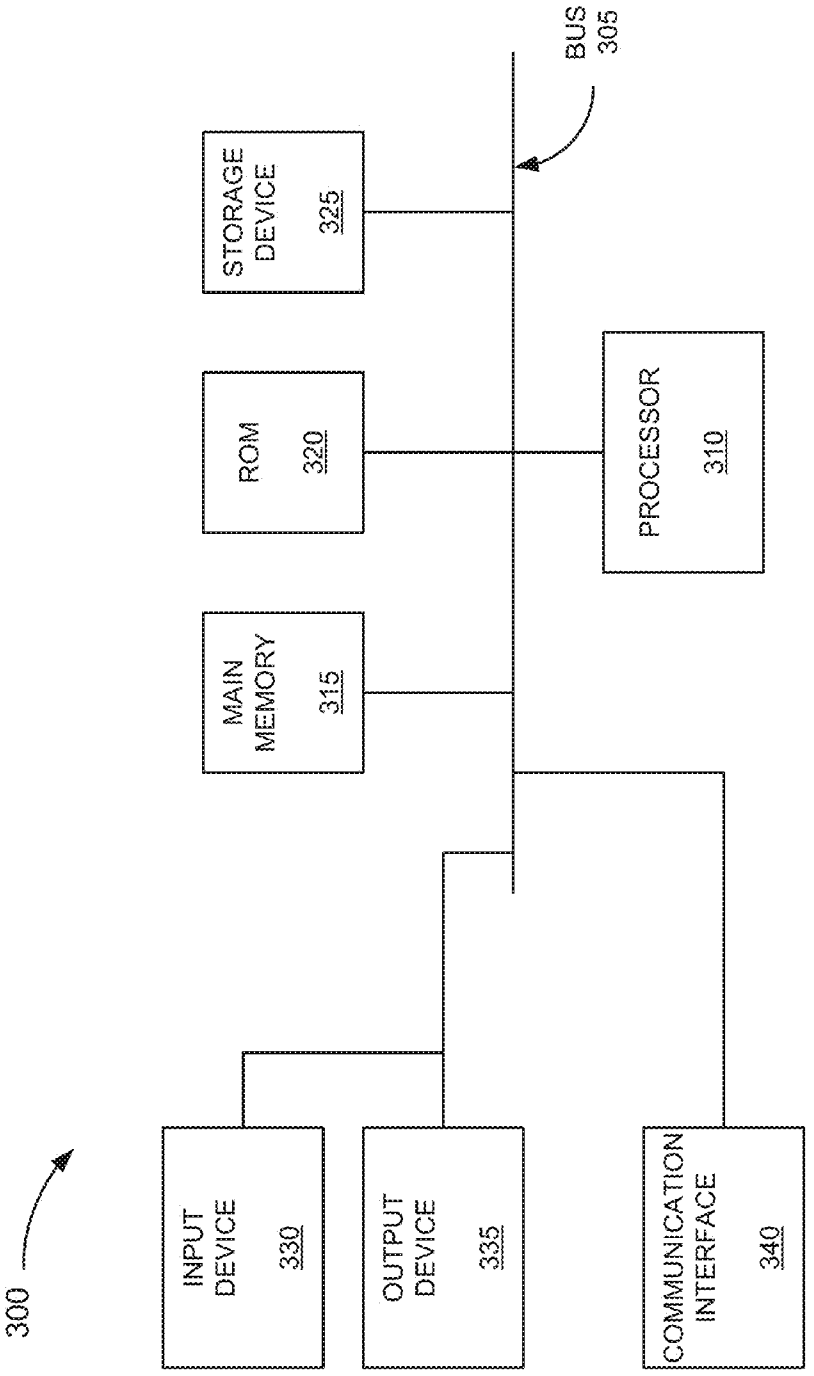

300
INPUT DEVICE 330
OUTPUT DEVICE 335
COMMUNICATION INTERFACE 340
MAIN MEMORY 315
ROM 320
STORAGE DEVICE 325
BUS 305
PROCESSOR 310

Fig. 3

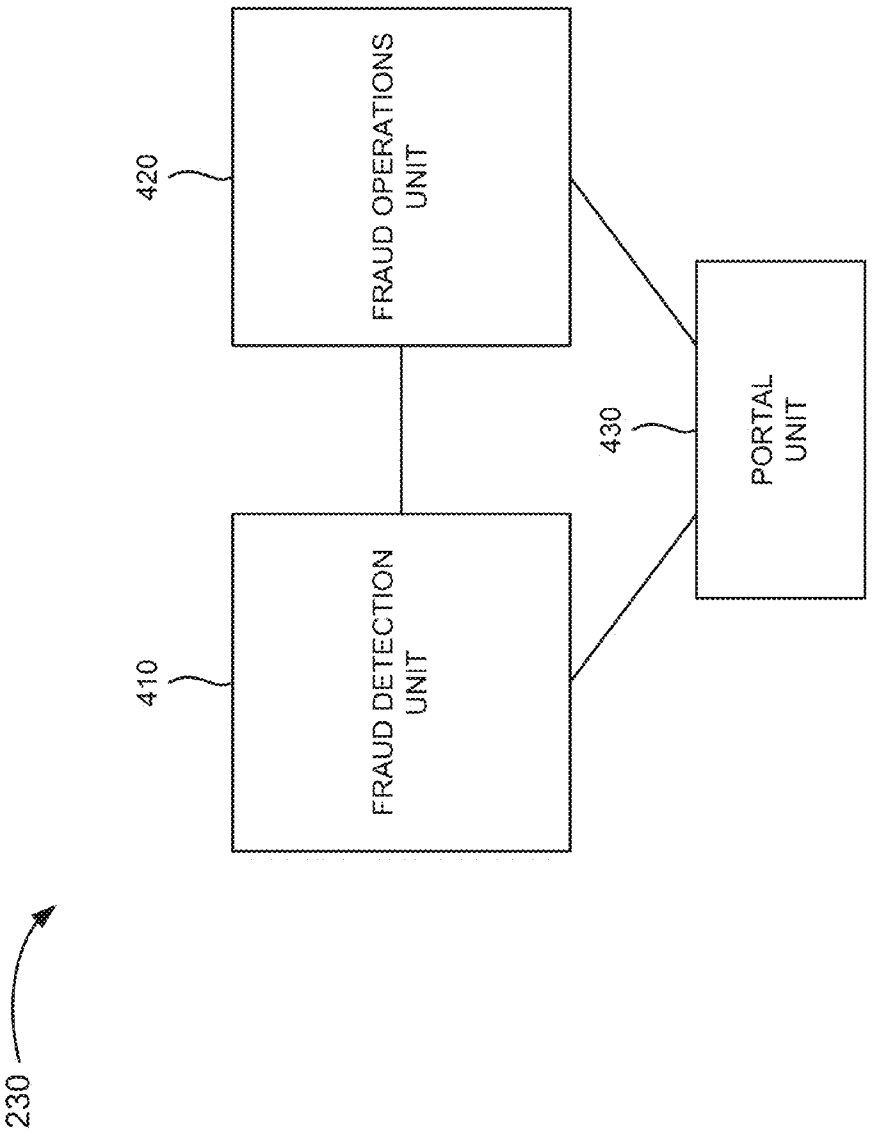

230
410
FRAUD DETECTION UNIT
420
FRAUD OPERATIONS UNIT
430
PORTAL UNIT

Fig. 4

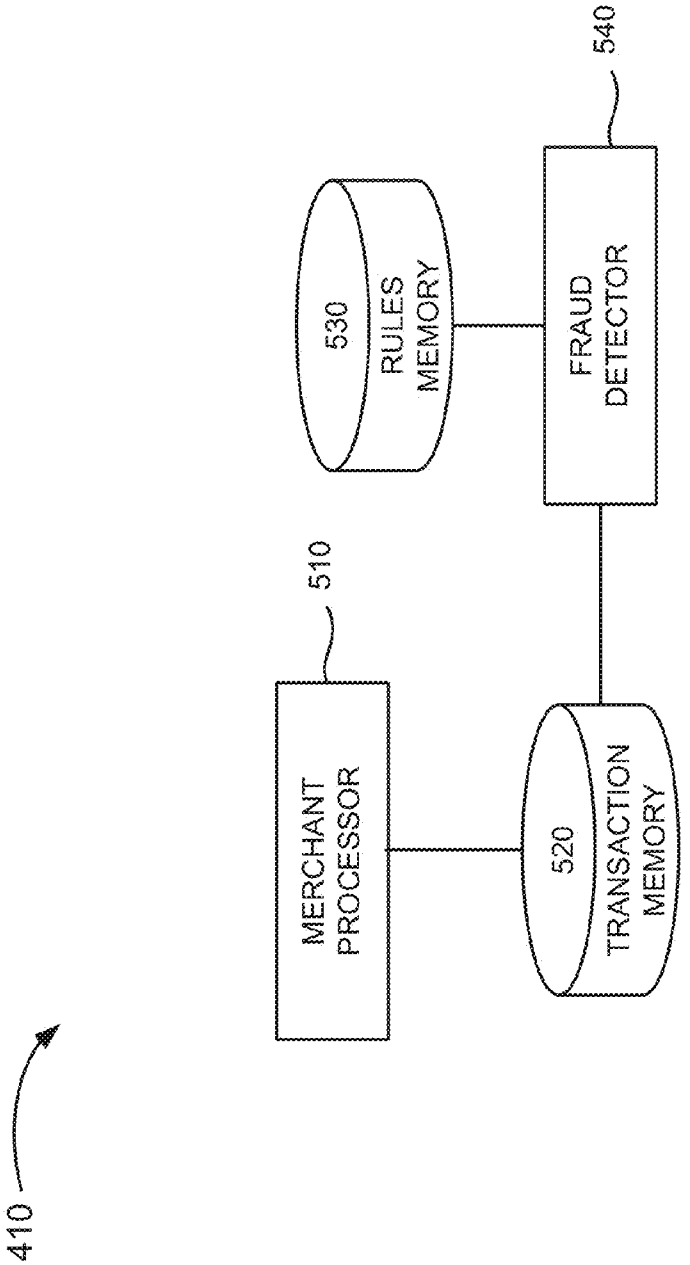

410
MERCHANT PROCESSOR
510
520
TRANSACTION MEMORY
530
RULES MEMORY
FRAUD DETECTOR
540

Fig. 5

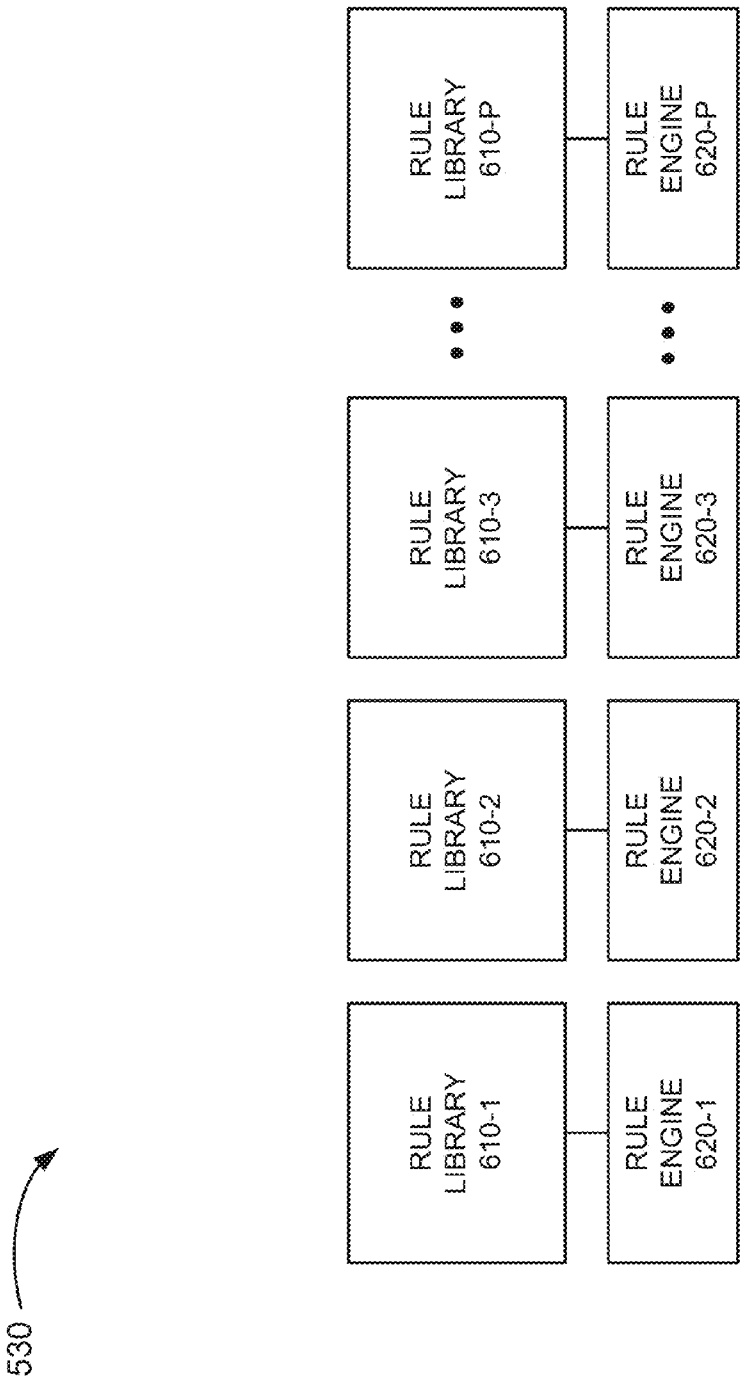

530
RULE LIBRARY 610-1
RULE ENGINE 620-1
RULE LIBRARY 610-2
RULE ENGINE 620-2
RULE LIBRARY 610-3
RULE ENGINE 620-3
RULE LIBRARY 610-P
RULE ENGINE 620-P

Fig. 6

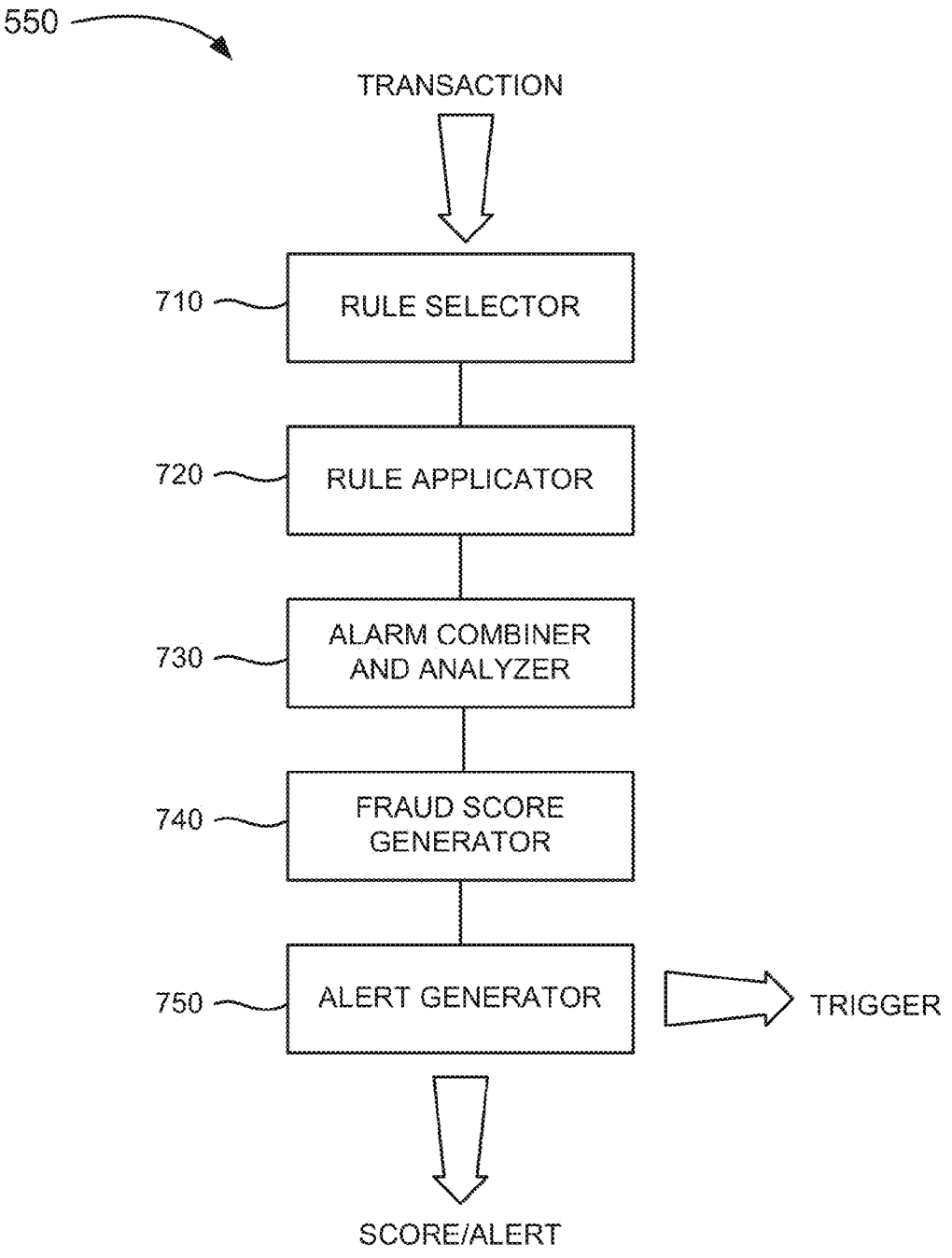

550
TRANSACTION
710
RULE SELECTOR
720
RULE APPLICATOR
730
ALARM COMBINER AND ANALYZER
740
FRAUD SCORE GENERATOR
750
ALERT GENERATOR
TRIGGER
SCORE/ALERT

Fig. 7

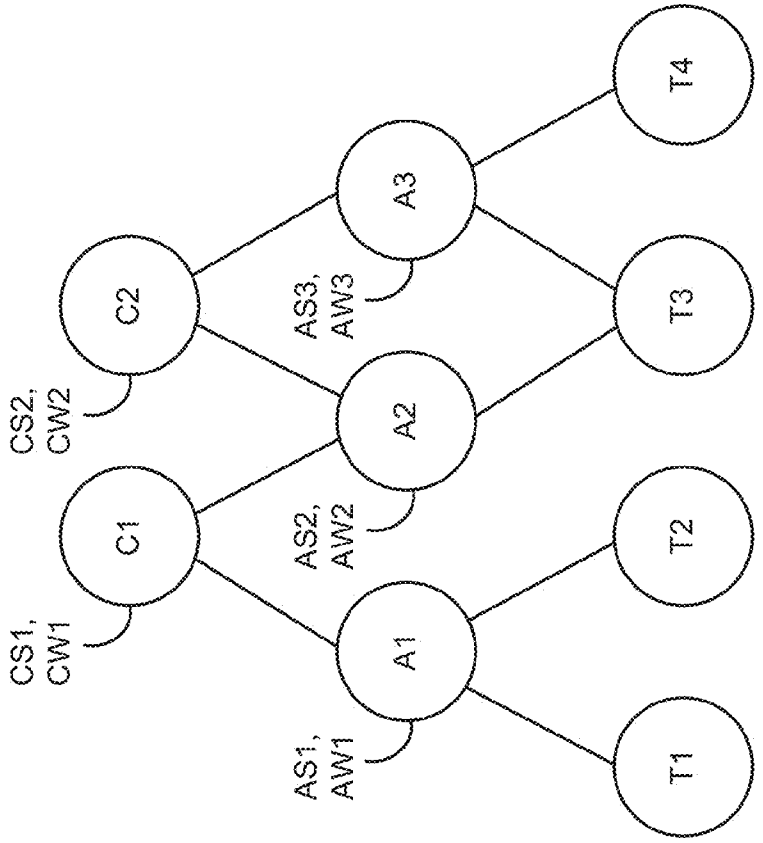


Fig. 8

Fig. 9

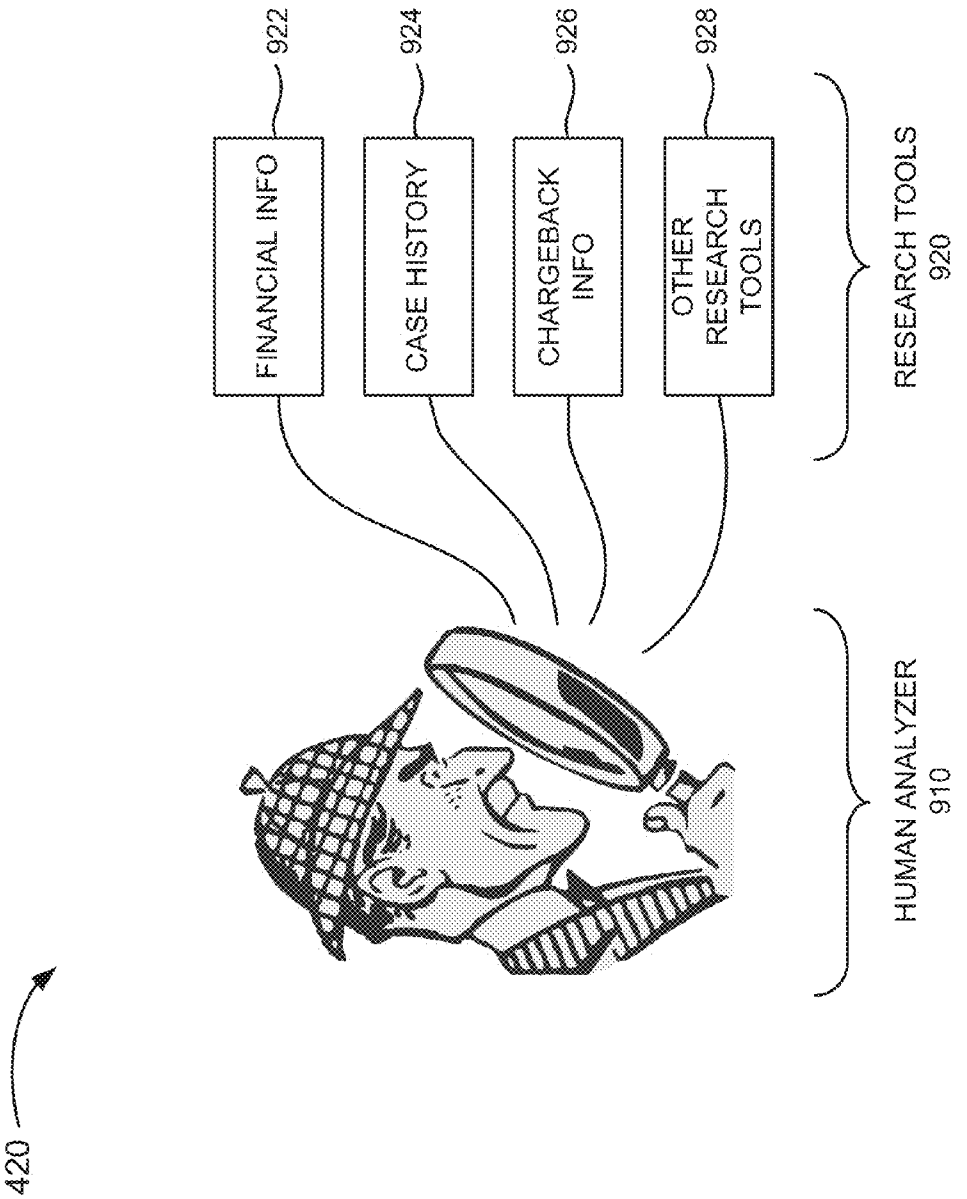
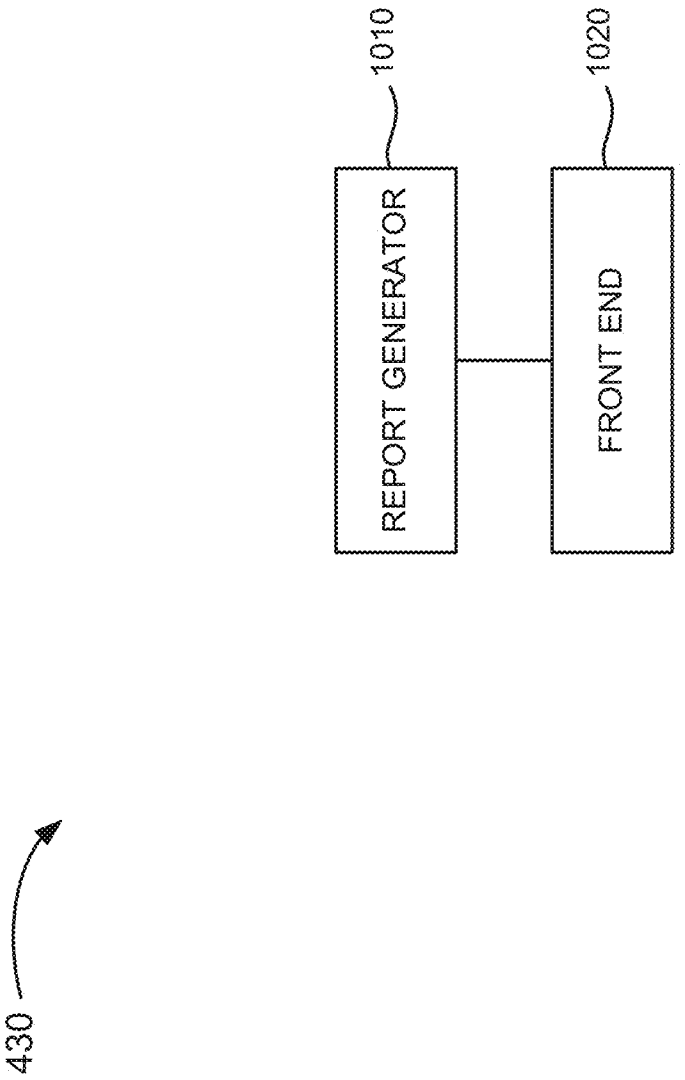

420
922
924
926
928
FINANCIAL INFO
CASE HISTORY
CHARGEBACK INFO
OTHER RESEARCH TOOLS
RESEARCH TOOLS
920
HUMAN ANALYZER
910

Fig. 10



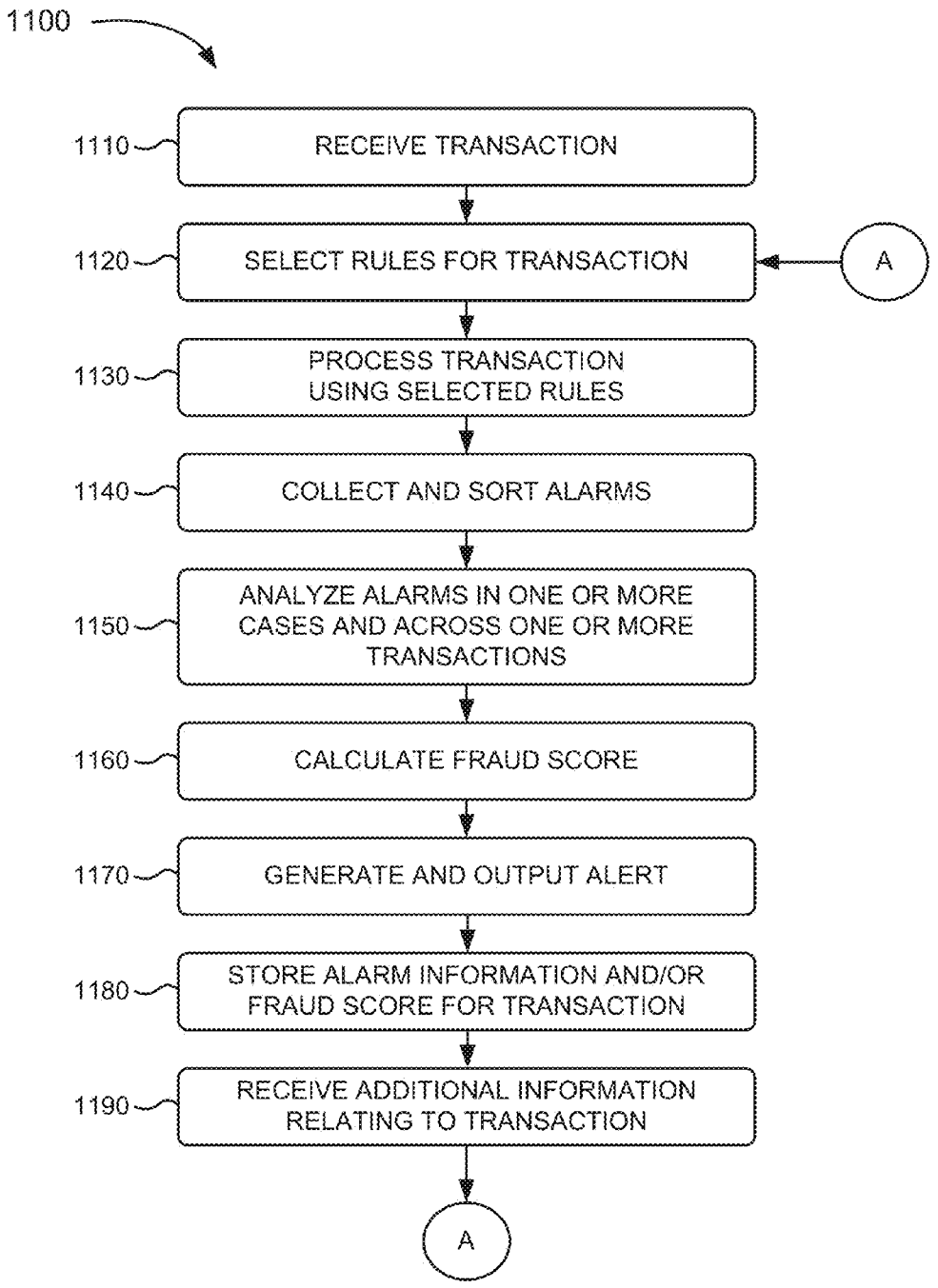

1100
1110
RECEIVE TRANSACTION
1120
SELECT RULES FOR TRANSACTION
A
1130
PROCESS TRANSACTION USING SELECTED RULES
1140
COLLECT AND SORT ALARMS
1150
ANALYZE ALARMS IN ONE OR MORE CASES AND ACROSS ONE OR MORE TRANSACTIONS
1160
CALCULATE FRAUD SCORE
1170
GENERATE AND OUTPUT ALERT
1180
STORE ALARM INFORMATION AND/OR FRAUD SCORE FOR TRANSACTION
1190
RECEIVE ADDITIONAL INFORMATION RELATING TO TRANSACTION
A

Fig. 11

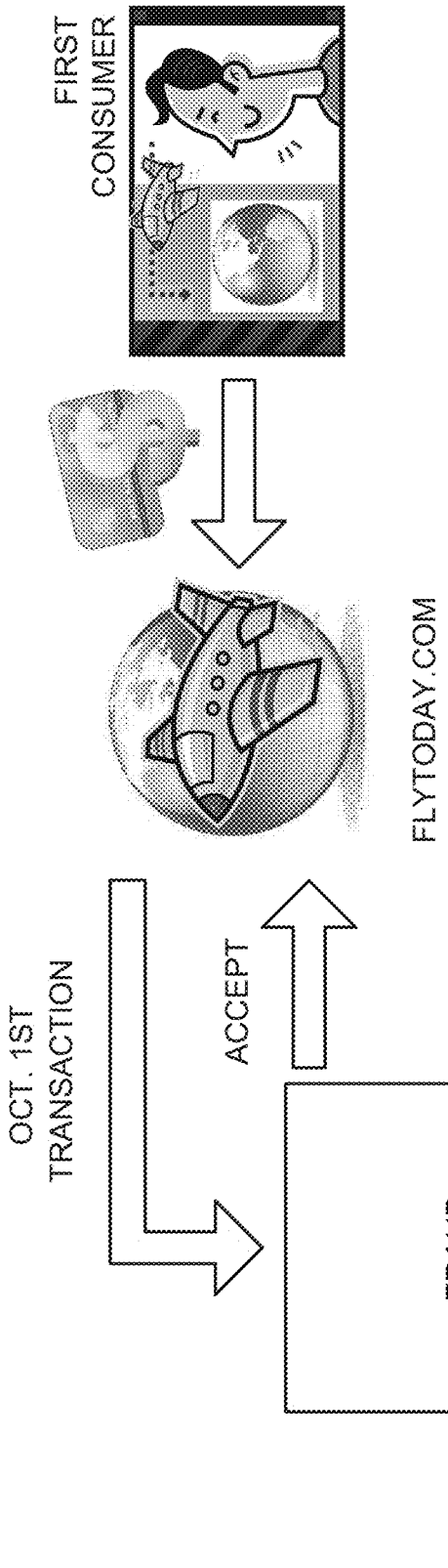

FIRST CONSUMER
FLYTODAY.COM
OCT. 1ST TRANSACTION
ACCEPT
FRAUD MANAGEMENT SYSTEM
230

Fig. 12

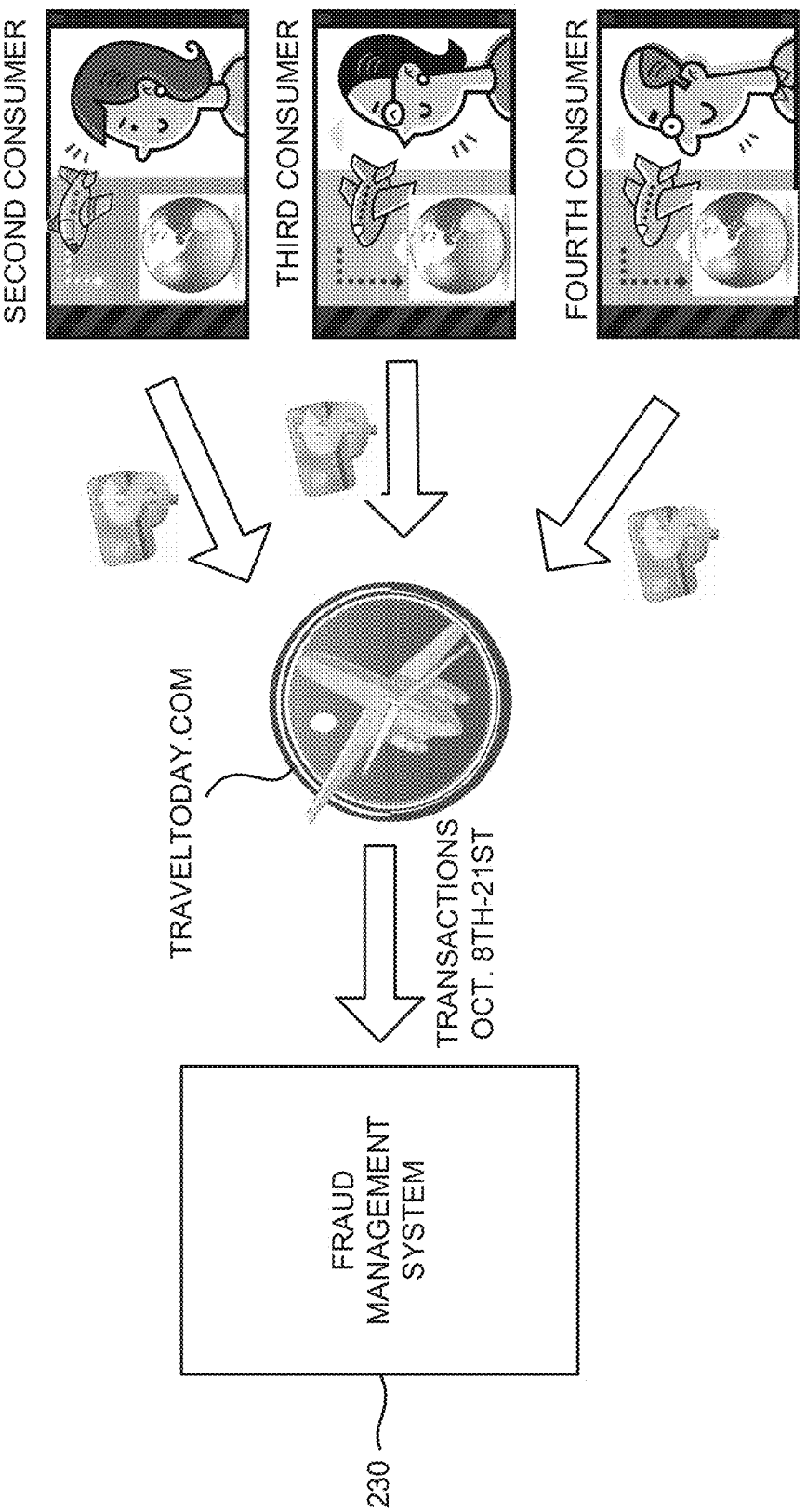

SECOND CONSUMER
THIRD CONSUMER
FOURTH CONSUMER
TRAVELTODAY.COM
TRANSACTIONS
OCT. 8TH-21ST
FRAUD
MANAGEMENT
SYSTEM
230

Fig. 13

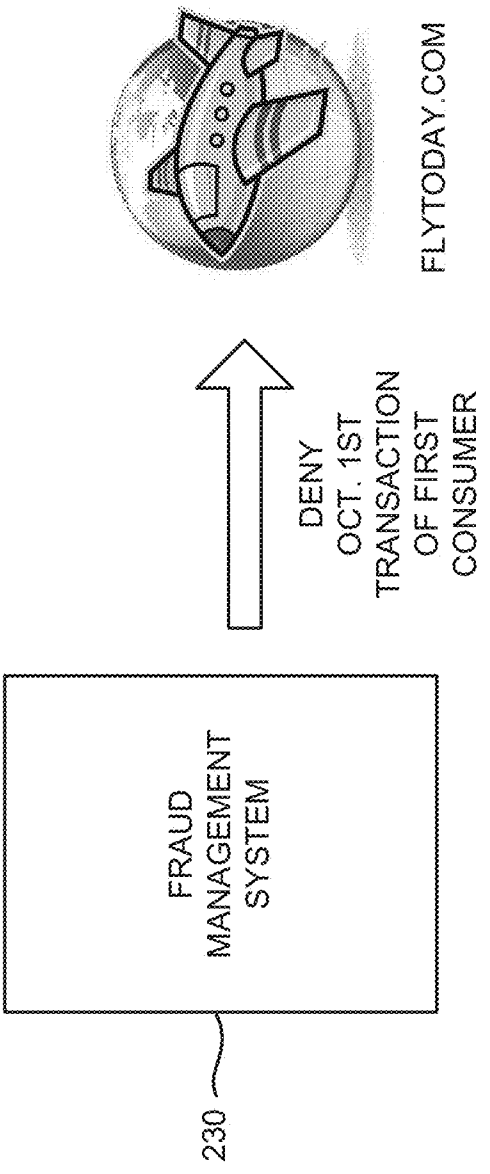

FRAUD MANAGEMENT SYSTEM
230
DENY OCT. 1ST TRANSACTION OF FIRST CONSUMER
FLYTODAY.COM

Fig. 14

ITERATIVE PROCESSING OF TRANSACTION INFORMATION TO DETECT FRAUD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. patent application Ser. No. 12/970,128, filed Dec. 16, 2010, the disclosure of which is hereby incorporated herein in its entirety.

BACKGROUND

[0002] Merchants are much more responsible for the cost of fraud than are financial institutions and consumers. Accordingly, merchants are the most motivated victim group to adopt mitigation strategies. The mitigation strategies vary for online merchants as compared to the "brick and mortar" merchants. For example, online merchants typically employ a mixture of purchased and internally developed software solutions and manage significant fraud operations and claims management departments. "Brick and mortar" merchants adopt different mitigation strategies, where in-person interactions with consumers are possible. The techniques used to commit fraud against merchants are ever-changing. Thus, fraud protection, adopted by merchants, needs to be constantly adapting to the ever-changing fraud techniques.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. **1** is a diagram of an overview of an implementation described herein;

[0004] FIG. **2** is a diagram that illustrates an example environment in which systems and/or methods, described herein, may be implemented;

[0005] FIG. **3** is a diagram of example components of a device that may be used within the environment of FIG. **2**;

[0006] FIG. **4** is a diagram of example functional units of the fraud management system of FIG. **2**;

[0007] FIG. **5** is a diagram of example functional components of the fraud detection unit of FIG. **4**;

[0008] FIG. **6** is a diagram of example libraries that may be present within the rules memory of FIG. **5**;

[0009] FIG. **7** is a diagram of example functional components of the fraud detector of FIG. **5**;

[0010] FIG. **8** is a diagram of example cases into which alarms may be placed by the alarm combiner and analyzer component of FIG. **7**;

[0011] FIG. **9** is a diagram of example functional components of the fraud operations unit of FIG. **4**;

[0012] FIG. **10** is a diagram of example functional components of the portal unit of FIG. **4**;

[0013] FIG. **11** is a flowchart of an example process for analyzing instances of fraud; and

[0014] FIGS. **12-14** are diagrams illustrating an example for identifying a fraudulent transaction.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements.

[0016] An implementation, described herein, may detect a fraudulent transaction, from a merchant, by analyzing information associated with multiple transactions from the merchant and/or one or more other merchants. In one implementation, a particular transaction may be analyzed iteratively. For example, the particular transaction may be analyzed, for fraud, when the particular transaction is received from the merchant, and may be analyzed again, for fraud, one or more later times as additional information, relevant to the particular transaction, is received. The additional information may provide additional context to the fraud analysis and, thereby, improve the determination of whether the particular transaction may be fraudulent.

[0017] FIG. **1** is a diagram of an overview of an implementation described herein. For the example of FIG. **1**, assume that a consumer makes an online purchase of electronic goods via a website of a merchant. To complete the online purchase of the electronic goods, the consumer may provide credit or debit card information to the merchant.

[0018] The merchant may provide information regarding the transaction to a fraud management system. The term "transaction," as used herein, is intended to be broadly interpreted to include an interaction of a consumer with a merchant. The interaction may involve the payment of money, a promise for a future payment of money, the deposit of money into an account, or the removal of money from an account. The term "money," as used herein, is intended to be broadly interpreted to include anything that can be accepted as payment for goods or services, such as currency, coupons, credit cards, debit cards, gift cards, and funds held in a financial account (e.g., a checking account, a money market account, a savings account, a stock account, a mutual fund account, a paypal account, etc.). In one implementation, the transaction may involve a one time exchange of information, between the merchant and the fraud management system, which may occur at the completion of the interaction between the consumer and the merchant (e.g., when the consumer ends an online session with the merchant). In another implementation, the transaction may involve a series of exchanges of information, between the merchant and the fraud management system, which may occur during and/or after completion of the interaction between the consumer and the merchant.

[0019] The fraud management system may process the transaction using selected sets of rules to generate fraud information. The fraud management system may output the fraud information to the merchant to inform the merchant whether the transaction potentially involves fraud. The fraud information may take the form of a fraud score or may take the form of an "accept" alert (meaning that the transaction is not fraudulent) or a "reject" alert (meaning that the transaction is potentially fraudulent). The merchant may then decide whether to permit or deny the transaction, or proceed to fulfill the goods or services secured in the transaction, based on the fraud information. In the description to follow, the phrase "fulfill the transaction," or the like, is intended to refer to fulfilling the goods or services secured in the transaction.

[0020] After the fraud management system initially processes the transaction, the fraud management system may receive additional information that may be relevant to the transaction. The additional information may include information regarding another transaction from this consumer, information regarding a transaction from another consumer, information regarding another transaction from the merchant, information regarding a transaction from another merchant that is affiliated with the merchant, information regarding a transaction from another merchant that is unaffiliated with the

merchant, information regarding a transaction from another merchant that is associated with the same industry as the merchant, information regarding a transaction from another merchant that is associated with a different industry than the merchant, information regarding user behavior of the consumer on the merchant's website, information regarding user behavior of the consumer on another merchant's website, information regarding a human analyst's analysis of the transaction or other transactions from the consumer, and/or other information that might be useful in determining whether the transaction is fraudulent.

[0021] Based on the additional information, the fraud management system may re-process the transaction (one or more times) to generate updated fraud information. The fraud management system may output the updated fraud information to the merchant if the updated fraud information differs from the previously provided fraud information. For example, if the fraud management system previously indicated, to the merchant, that the transaction is not fraudulent and the re-processing of the transaction indicates that the transaction is potentially fraudulent, the fraud management system may notify the merchant that the transaction is potentially fraudulent. As a result, the merchant may be able to take remedial actions to reduce the merchant's loss due to the fraud.

[0022] In some scenarios, the fraud management system may detect potential fraud in near real-time (i.e., while the transaction is occurring). In other scenarios, the fraud management system may detect potential fraud after conclusion of the transaction (perhaps minutes, hours, or days later). In either scenario, the fraud management system may reduce revenue loss contributable to fraud. In addition, the fraud management system may help reduce merchant costs in terms of software, hardware, and personnel dedicated to fraud detection and prevention.

[0023] FIG. **2** is a diagram that illustrates an example environment **200** in which systems and/or methods, described herein, may be implemented. As shown in FIG. **2**, environment **200** may include consumer devices **210-1**, . . . , **210**-M (where M≥1) (collectively referred to as "consumer devices **210**," and individually as "consumer device **210**"), merchant devices **220-1**, . . . , **220**-N (where N≥1) (collectively referred to as "merchant devices **220**," and individually as "merchant device **220**"), fraud management system **230**, and network **240**.

[0024] While FIG. **2** shows a particular number and arrangement of devices, in practice, environment **200** may include additional devices, fewer devices, different devices, or differently arranged devices than are shown in FIG. **2**. Also, although certain connections are shown in FIG. **2**, these connections are simply examples and additional or different connections may exist in practice. Each of the connections may be a wired and/or wireless connection. Further, each consumer device **210** and merchant device **220** may be implemented as multiple, possibly distributed, devices. Alternatively, a consumer device **210** and a merchant device **220** may be implemented within a single device.

[0025] Consumer device **210** may include any device capable of interacting with a merchant device **220** to perform a transaction. For example, consumer device **210** may correspond to a communication device (e.g., a mobile phone, a smartphone, a personal digital assistant (PDA), or a wireline telephone), a computer device (e.g., a laptop computer, a tablet computer, or a personal computer), a gaming device, a set top box, or another type of communication or computation device. As described herein, a user, of a consumer device **210**, may use consumer device **210** to perform a transaction with regard to a merchant device **220**.

[0026] Merchant device **220** may include a device, or a collection of devices, capable of interacting with a consumer device **210** to perform a transaction. For example, merchant device **220** may correspond to a computer device (e.g., a server, a laptop computer, a tablet computer, or a personal computer). Additionally, or alternatively, merchant device **220** may include a communication device (e.g., a mobile phone, a smartphone, a PDA, or a wireline telephone) or another type of communication or computation device. As described herein, merchant device **220** may interact with a consumer device **210** to perform a transaction and may interact with fraud management system **230** to determine whether that transaction is potentially fraudulent.

[0027] Fraud management system **230** may include a device, or a collection of devices, that performs fraud analysis. Fraud management system **230** may receive transaction information from merchant devices **220**, perform fraud analysis with regard to the transaction information, and provide, to merchant devices **220**, information regarding the results of the fraud analysis.

[0028] Network **240** may include any type of network or a combination of networks. For example, network **240** may include a local area network (LAN), a wide area network (WAN) (e.g., the Internet), a metropolitan area network (MAN), an ad hoc network, a telephone network (e.g., a Public Switched Telephone Network (PSTN), a cellular network, or a voice-over-IP (VoIP) network), an optical network (e.g., a FiOS network), or a combination of networks. In one implementation, network **240** may support secure communications between merchants **220** and fraud management system **230**. These secure communications may include encrypted communications, communications via a private network (e.g., a virtual private network (VPN) or a private IP VPN (PIP VPN)), other forms of secure communications, or a combination of secure types of communications.

[0029] FIG. **3** is a diagram of example components of a device **300**. Device **300** may correspond to consumer device **210**, merchant device **220**, or fraud management system **230**. Each of consumer device **210**, merchant device **220**, and fraud management system **230** may include one or more devices **300**.

[0030] As shown in FIG. **3**, device **300** may include a bus **305**, a processor **310**, a main memory **315**, a read only memory (ROM) **320**, a storage device **325**, an input device **330**, an output device **335**, and a communication interface **340**. In another implementation, device **300** may include additional components, fewer components, different components, or differently arranged components.

[0031] Bus **305** may include a path that permits communication among the components of device **300**. Processor **310** may include one or more processors, one or more microprocessors, one or more application specific integrated circuits (ASICs), one or more field programmable gate arrays (FPGAs), or one or more other types of processor that interprets and executes instructions. Main memory **315** may include a random access memory (RAM) or another type of dynamic storage device that stores information or instructions for execution by processor **310**. ROM **320** may include a ROM device or another type of static storage device that stores static information or instructions for use by processor **310**. Storage

device **325** may include a magnetic storage medium, such as a hard disk drive, or a removable memory, such as a flash memory.

[0032] Input device **330** may include a mechanism that permits an operator to input information to device **300**, such as a control button, a keyboard, a keypad, or another type of input device. Output device **335** may include a mechanism that outputs information to the operator, such as a light emitting diode (LED), a display, or another type of output device. Communication interface **340** may include any transceiver-like mechanism that enables device **300** to communicate with other devices or networks (e.g., network **240**). In one implementation, communication interface **340** may include a wireless interface and/or a wired interface.

[0033] Device **300** may perform certain operations, as described in detail below. Device **300** may perform these operations in response to processor **310** executing software instructions contained in a computer-readable medium, such as main memory **315**. A computer-readable medium may be defined as a non-transitory memory device. A memory device may include space within a single physical memory device or spread across multiple physical memory devices.

[0034] The software instructions may be read into main memory **315** from another computer-readable medium, such as storage device **325**, or from another device via communication interface **340**. The software instructions contained in main memory **315** may cause processor **310** to perform processes that will be described later. Alternatively, hardwired circuitry may be used in place of or in combination with software instructions to implement processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

[0035] FIG. **4** is a diagram of example functional units of fraud management system **230**. In one implementation, the functions described in connection with FIG. **4** may be performed by one or more components of device **300** (FIG. **3**) or one or more devices **300**, unless described as being performed by a human.

[0036] As shown in FIG. **4**, fraud management system **230** may include fraud detection unit **410**, fraud operations unit **420**, and portal unit **430**. In another implementation, fraud management system **230** may include fewer functional units, additional functional units, different functional units, or differently arranged functional units. Fraud detection unit **410**, fraud operations unit **420**, and portal unit **430** will be described generally with regard to FIG. **4** and will be described in more detail with regard to FIGS. **5-10**.

[0037] Generally, fraud detection unit **410** may receive information regarding transactions from merchant devices **220** and analyze the transactions to determine whether the transactions are potentially fraudulent. In one implementation, fraud detection unit **410** may classify a transaction as: "safe," "unsafe," or "for review." A "safe" transaction may include a transaction with a fraud score that is less than a first threshold (e.g., less than 5, less than 10, less than 20, etc. within a range of fraud scores of 0 to 100, where a fraud score of 0 may represent a 0% probability that the transaction is fraudulent and a fraud score of 100 may represent a 100% probability that the transaction is fraudulent). An "unsafe" transaction may include a transaction with a fraud score that is greater than a second threshold (e.g., greater than 90, greater than 80, greater than 95, etc. within the range of fraud scores of 0 to 100) (where the second threshold is greater than the first threshold). A "for review" transaction may include a transaction with a fraud score that is greater than a third threshold (e.g., greater than 50, greater than 40, greater than 60, etc. within the range of fraud scores of 0 to 100) and not greater than the second threshold (where the third threshold is greater than the first threshold and less than the second threshold). In one implementation, the first, second, and third thresholds and the range of potential fraud scores may be set by an operator of fraud management system **230**. In another implementation, the first, second, and/or third thresholds and/or the range of potential fraud scores may be set by a merchant. In this case, the thresholds and/or range may vary from merchant-to-merchant. The fraud score may represent a probability that a transaction is fraudulent.

[0038] If fraud detection unit **410** determines that a transaction is a "safe" transaction, fraud detection unit **410** may notify a merchant device **220** that merchant device **220** may safely approve, or alternatively fulfill, the transaction. If fraud detection unit **410** determines that a transaction is an "unsafe" transaction, fraud detection unit **410** may notify a merchant device **220** to take measures to minimize the risk of fraud (e.g., deny the transaction, request additional information from a consumer device **210**, require interaction with a human operator, refuse to fulfill the transaction, etc.). Alternatively, or additionally, fraud detection unit **410** may provide information regarding the unsafe transaction to fraud operations unit **420** for additional processing of the transaction. If fraud detection unit **410** determines that a transaction is a "for review" transaction, fraud detection unit **410** may provide information regarding the transaction to fraud operations unit **420** for additional processing of the transaction.

[0039] Generally, fraud operations unit **420** may receive information regarding certain transactions and may analyze these transactions to determine whether a determination can be made whether the transactions are fraudulent. In one implementation, human analyzers may use various research tools to investigate transactions and determine whether the transactions are fraudulent.

[0040] Generally, portal unit **430** may generate reports and permit merchants to request and gain access to reports relating to transactions associated with the merchants. Portal unit **430** may also function like an access port via which a merchant device **220** may gain access to information from fraud detection unit **410** and/or information from fraud operations unit **420**, and/or otherwise interact with fraud detection unit **410** and/or fraud operations unit **420**.

[0041] FIG. **5** is a diagram of example functional components of fraud detection unit **410**. In one implementation, the functions described in connection with FIG. **5** may be performed by one or more components of device **300** (FIG. **3**) or one or more devices **300**. As shown in FIG. **5**, fraud detection unit **410** may include a merchant processor component **510**, a transaction memory **520**, a rules memory **530**, and a fraud detector component **540**. In another implementation, fraud detection unit **410** may include fewer functional components, additional functional components, different functional components, or differently arranged functional components.

[0042] Merchant processor component **510** may include a device, or a collection of devices, that may interact with merchants to assist the merchants in using fraud management system **230** and that may periodically collect user behavior data concerning activities of consumers in relation to websites of the merchants. For example, merchant processor component **510** may exchange encryption information, such as

public/private keys or VPN information, with a merchant device **220** to permit secure future communications between fraud detection system **230** and merchant device **220**.

[0043] Merchant processor component **510** may receive, from the merchant or merchant device **220**, information that might be useful in detecting a fraudulent transaction. For example, merchant processor component **510** may receive a black list (e.g., a list of consumers or consumer devices **210** that are known to be associated with fraudulent activity) and/or a white list (e.g., a list of consumers or consumer devices **210** that are known to be particularly trustworthy). Additionally, or alternatively, merchant processor component **510** may receive historical records of transactions from the merchant or merchant device **220**. These historical records may include information regarding transactions that were processed by a system other than fraud management system **230**. Additionally, or alternatively, merchant processor component **510** may receive a set of policies from the merchant or merchant device **220**. The policies may indicate thresholds for determining safe transactions, unsafe transactions, and for review transactions, may indicate a range of possible fraud scores (e.g., range of 0 to 100, range of 0 to 1000, etc.), or may indicate other business practices of the merchant. Additionally, or alternatively, merchant processor component **510** may receive a set of rules that are particular to the merchant.

[0044] Merchant processor **510** may also receive user behavior data from a merchant or merchant device **220**. User behavior data may include information regarding a consumer's activity with regard to a merchant's website, such as the pages that the consumer accessed, the searches that the consumer performed, the selections that the consumer made, the purchases that the consumer has made, etc. The user behavior data may correspond to a single session, or multiple sessions, involving the consumer and the merchant. In one implementation, a merchant or merchant device **220** may send user behavior data to merchant processor **510** on-the-fly (i.e., as the activity is happening). Additionally, or alternatively, a merchant or merchant device **220** may send user behavior data to merchant processor **510** at some point after the activity has occurred. In either situation, the user behavior data may be used to determine whether a transaction, associated with this consumer (or another consumer), is fraudulent.

[0045] Transaction memory **520** may include one or more memory devices to store information regarding present and/or past transactions, and/or user behavior data. Present transactions may include transactions currently being processed by fraud detector component **540**, and past transactions may include transactions previously processed by fraud detector component **540**. In one implementation, transaction memory **520** may store data in the form of a database, such as a relational database or an object-oriented database. In another implementation, transaction memory **520** may store data in a non-database manner, such as as tables, linked lists, or another arrangement of data.

[0046] Transaction memory **520** may store various information for any particular transaction. For example, transaction memory **520** might store: information identifying a consumer or a consumer device **210** (e.g., a consumer device ID, an IP address associated with the consumer device, a telephone number associated with the consumer device, a username associated with the consumer, a consumer ID, etc.); information identifying a merchant or a merchant device **220** (e.g., a merchant ID, merchant name, merchant device ID, etc.); information identifying an industry with which the merchant is associated (e.g., retail, medical, travel, financial, etc.); a name, telephone number, and address associated with the consumer; information regarding consumer device **210** (e.g., an IP address associated with the consumer device, a type/version of browser used by the consumer device, cookie information associated with the consumer device, a type/version of an operating system used by the consumer device, etc.); a dollar amount of the transaction; line items of the transaction (e.g., identification of each good/service purchased, each leg of an airplane flight booked, etc.); information regarding a form of payment received from the consumer (e.g., credit card information, debit card information, checking account information, paypal account information, etc.); a day and/or time that the transaction occurred (e.g., 13:15 on Nov. 5, 2010); a geographic location associated with the transaction or the consumer (e.g., a destination location associated with a form of travel, an origination location associated with a form of travel, a location of a hotel for which a room was reserved, a location of a residence of the consumer, etc.), and/or other types of information associated with the transaction, the merchant, the merchant device **220**, the consumer, or the consumer device **210**, and/or a past transaction associated with the merchant, the merchant device **220**, the consumer, or the consumer device **210**.

[0047] Transaction memory **520** may also store other information that might be useful in detecting a fraudulent transaction. For example, transaction memory **520** may store black lists and/or white lists. The black/white lists may be particular to a merchant or an industry or may be applicable across merchants or industries. The black/white lists may be received from merchants or may be generated by fraud management system **230**.

[0048] Transaction memory **520** may also store historical records of transactions from a merchant. These historical records may include transactions that were processed by a system other than fraud management system **230**. The historical records may include information similar to the information identified above and may also include information regarding transactions that the merchant had identified as fraudulent.

[0049] Rules memory **530** may include one or more memory devices to store information regarding rules that may be applicable to transactions. In one implementation, rules memory **530** may store rules in one or more libraries. A "library" may be a block of memory locations (contiguous or non-contiguous memory locations) that stores a set of related rules. In another implementation, rules memory **530** may store rules in another manner (e.g., as database records, tables, linked lists, etc.).

[0050] The rules may include general rules, merchant-specific rules, industry-specific rules, consumer-specific rules, transaction attribute specific rules, single transaction rules, multi-transaction rules, heuristic rules, pattern recognition rules, and/or other types of rules. Some rules may be applicable to all transactions (e.g., general rules may be applicable to all transactions), while other rules may be applicable to a specific set of transactions (e.g., merchant-specific rules may be applicable to transactions associated with a particular merchant). Rules may be used to process a single transaction (meaning that the transaction may be analyzed for fraud without considering information from another transaction) or may be used to process multiple transactions (meaning that the transaction may be analyzed for fraud by considering information from another transaction). Rules may also be appli-

cable to multiple, unaffiliated merchants (e.g., merchants having no business relationships) or multiple, unrelated consumers (e.g., consumers having no familial or other relationship).

[0051] FIG. **6** is a diagram of example libraries that may be present within rules memory **530**. As shown in FIG. **6**, rules memory **530** may include rule libraries **610-1**, **610-2**, **610-3**, . . . **610**-P (P≥1) (collectively referred to as "libraries **610**," and individually as "library **610**") and rule engines **620-1**, **620-2**, **620-3**, . . . **620**-P (collectively referred to as "rule engines **620**," and individually as "rule engine **620**"). While FIG. **6** illustrates that rules memory **530** includes a set of rule libraries **610** and a corresponding set of rule engines **620**, rules memory **530** may include fewer, additional, or different components in another implementation.

[0052] Each rule library **610** may store a set of related rules. For example, a rule library **610** may store general rules that are applicable to all transactions. Additionally, or alternatively, a rule library **610** may store rules applicable to a single transaction (meaning that the transaction may be analyzed for fraud without considering information from another transaction). Additionally, or alternatively, a rule library **610** may store rules applicable to multiple transactions (meaning that the transaction may be analyzed for fraud by considering information from another transaction (whether from the same merchant or a different merchant, whether associated with the same consumer or a different consumer)).

[0053] Additionally, or alternatively, a rule library **610** may store merchant-specific rules. Merchant-specific rules may include rules that are applicable to transactions of a particular merchant, and not applicable to transactions of other merchants. Additionally, or alternatively, a rule library **610** may store industry-specific rules. Industry-specific rules may include rules that are applicable to transactions associated with a particular industry of merchants (e.g., financial, medical, retail, travel, etc.), and not applicable to transactions associated with other industries. Additionally, or alternatively, a rule library **610** may store consumer-specific rules. Consumer-specific rules may include rules that are applicable to transactions of a particular consumer or a particular set of consumers (e.g., all consumers in the consumer's family, all consumers located at a particular geographic location, all consumers located within a particular geographic region, all consumers using a particular type of browser or operating system, etc.), and not applicable to transactions of other consumers or sets of consumers.

[0054] Additionally, or alternatively, a rule library **610** may store location-specific rules. Location-specific rules may include rules that are applicable to transactions associated with a particular geographic area (e.g., an origination location associated with a travel itinerary, a destination location associated with a travel itinerary, a location from which a transaction originated, etc.), and not applicable to transactions associated with other geographic areas. Additionally, or alternatively, a rule library **610** may store rules associated with a particular transaction attribute, such as a dollar amount or range, a name of a traveler, a telephone number, etc.

[0055] The rules in rule libraries **610** may include human-generated rules and/or automatically-generated rules. The automatically-generated rules may include heuristic rules and/or pattern recognition rules. Heuristic rules may include rules that have been generated by using statistical analysis, or the like, that involves analyzing a group of attributes (e.g., a pair of attributes or a tuple of attributes) of transactions, and learning rules associated with combinations of attributes that are indicative of fraudulent transactions. Pattern recognition rules may include rules that have been generated using machine learning, artificial intelligence, neural networks, decision trees, or the like, that analyzes patterns appearing in a set of training data, which includes information regarding transactions that have been identified as fraudulent and information regarding transactions that have been identified as non-fraudulent, and generates rules indicative of patterns associated with fraudulent transactions.

[0056] In other implementations, rule libraries **610** may store other types of rules, other combinations of rules, or differently-generated rules. Because fraud techniques are constantly changing, the rules, in rule libraries **610**, may be regularly updated (either by manual or automated interaction) by modifying existing rules, adding new rules, and/or removing antiquated rules.

[0057] Each rule engine **620** may correspond to a corresponding rule library **610**. A rule engine **620** may receive a transaction from fraud detector component **540**, coordinate the execution of the rules by the corresponding rule library **610**, and return the results (in the form of zero or more alarms) to fraud detector component **540**. In one implementation, rule engine **620** may cause a transaction to be processed by a set of rules within the corresponding rule library **610** in parallel. In other words, the transaction may be concurrently processed by multiple, different rules in a rule library **610** (rather than serially processed).

[0058] Returning to FIG. **5**, fraud detector component **540** may include a device, or a collection of devices, that performs automatic fraud detection on transactions. Fraud detector component **540** may receive a transaction from a particular merchant device **220** and select particular libraries **610** and particular rules within the selected libraries **610** applicable to the transaction. Fraud detector component **540** may then provide the transaction for processing by the selected rules in the selected libraries **610** in parallel. The output of the processing, by the selected libraries **610**, may include zero or more alarms. An "alarm," as used herein, is intended to be broadly interpreted as a triggering of a rule in a library **610**. A rule is triggered when the transaction satisfies the rule. For example, assume that a rule indicates a situation where a consumer reserves a hotel room in the same geographic area in which the consumer lives. A transaction would trigger (or satisfy) the rule if the transaction involved a consumer making a reservation for a hotel room in the town where the consumer lives.

[0059] Fraud detector component **540** may sort and group the alarms and analyze the groups to generate a fraud score. The fraud score may reflect the probability that the transaction is fraudulent. Fraud detector component **540** may send the fraud score, or an alert generated based on the fraud score, to a merchant device **220**. The alert may simply indicate that merchant device **220** should accept, deny, or fulfill the transaction. In one implementation, the processing by fraud detector component **540** from the time that fraud detector component **540** receives the transaction to the time that fraud detector component **540** sends the alert may be within a relatively short time period, such as, for example, within thirty seconds, sixty seconds, or ten seconds. In another implementation, the processing by fraud detector component **550** from the time that fraud detector component **550** receives the transaction to the time that fraud detector component **550**

sends the alert may be within a relatively longer time period, such as, for example, within minutes, hours or days.

[0060] FIG. **7** is a diagram of example functional components of fraud detector component **540**. In one implementation, the functions described in connection with FIG. **7** may be performed by one or more components of device **300** (FIG. **3**) or one or more devices **300**. As shown in FIG. **7**, fraud detector component **540** may include a rule selector component **710**, a rule applicator component **720**, an alarm combiner and analyzer component **730**, a fraud score generator component **740**, and an alert generator component **750**. In another implementation, fraud detector component **540** may include fewer functional components, additional functional components, different functional components, or differently arranged functional components.

[0061] Rule selector component **710** may receive a transaction from a merchant device **220**. In one implementation, the transaction may include various information, such as information identifying a consumer (e.g., name, address, telephone number, etc.); a total dollar amount of the transaction; a name of a traveler (in the case of a travel transaction); line items of the transaction (e.g., information identifying a good or service purchased or rented, origination, destination, and intermediate stops of travel, etc.); information identifying a merchant (e.g., merchant name or merchant identifier); information regarding a form of payment received from the consumer (e.g., credit card information, debit card information, checking account information, paypal account information, etc.); and information identifying a day and/or time that the transaction occurred (e.g., 13:15 on Nov. 5, 2010).

[0062] Additionally, or alternatively, rule selector component **710** may receive other information (called "meta information") from the merchant in connection with the transaction. For example, the meta information may include information identifying a consumer device **210** (e.g., a consumer device ID, an IP address associated with the consumer device, a telephone number associated with the consumer device, etc.); other information regarding consumer device **210** (e.g., an IP address associated with the consumer device, a type/version of browser used by the consumer device, cookie information associated with the consumer device, a type/version of an operating system used by the consumer device, etc.); user behavior data associated with the consumer; and/or other types of information associated with the transaction, the merchant, the merchant device **220**, the consumer, or the consumer device **210**.

[0063] Additionally, or alternatively, rule selector component **710** may receive or obtain other information (called "third party information") regarding the transaction, the merchant, the merchant device **220**, the consumer, or the consumer device **210**. For example, the other information may include a geographic identifier (e.g., zip code or area code) that may correspond to the IP address associated with consumer device **210**. The other information may also, or alternatively, include information identifying an industry with which the merchant is associated (e.g., retail, medical, travel, financial, etc.). Rule selector component **710** may obtain the third party information from a memory or may use research tools, such an IP address-to-geographic location identifier look up tool or a merchant name-to-industry look up tool.

[0064] Additionally, or alternatively, rule selector component **710** may receive or obtain historical information regarding the merchant, the merchant device **220**, the consumer, the consumer device **210**, or information included in the transaction. In one implementation, rule selector component **710** may obtain the historical information from transaction memory **520** (FIG. **5**).

[0065] The transaction information, the meta information, the third party information, and/or the historical information may be individually referred to as a "transaction attribute" or an "attribute of the transaction," and collectively referred to as "transaction attributes" or "attributes of the transaction."

[0066] Rule selector component **710** may generate a profile for the transaction based on the transaction attributes. Based on the transaction profile and perhaps relevant information in a white or black list (i.e., information, relevant to the transaction, that is present in a white or black list), rule selector component **710** may select a set of libraries **610** within rules memory **530** and/or may select a set of rules within one or more of the selected libraries **610**. For example, rule selector component **710** may select libraries **610**, corresponding to general rules, single transaction rules, multi-transaction rules, merchant-specific rules, industry-specific rules, etc., for the transaction.

[0067] Rule applicator component **720** may cause the transaction to be processed using rules of the selected libraries **610**. For example, rule applicator component **720** may provide information regarding the transaction to rule engines **620** corresponding to the selected libraries **610**. Each rule engine **620** may process the transaction in parallel and may process the transaction using all or a subset of the rules in the corresponding library **610**. The transaction may be concurrently processed by different sets of rules (of the selected libraries **610** and/or within each of the selected libraries **610**). The output, of each of the selected libraries **610**, may include zero or more alarms. As explained above, an alarm may be generated when a particular rule is triggered (or satisfied).

[0068] Alarm combiner and analyzer component **730** may aggregate and correlate the alarms. For example, alarm combiner and analyzer component **730** may analyze attributes of the transaction(s) with which the alarms are associated (e.g., attributes relating to a form of payment, an IP address, a travel destination, etc.). Alarm combiner and analyzer component **730** may sort the alarms, along with alarms of other transactions (past or present), into groups (called "cases") based on values of one or more of the attributes of the transactions associated with the alarms (e.g., credit card numbers, IP addresses, geographic locations, consumer names, etc.). The transactions, included in a case, may involve one merchant or multiple, unaffiliated merchants and/or one consumer or multiple, unrelated consumers.

[0069] Alarm combiner and analyzer component **730** may separate alarms (for all transactions, transactions sharing a common transaction attribute, or a set of transactions within a particular window of time) into one or more cases based on transaction attributes. For example, alarm combiner and analyzer component **730** may place alarms associated with a particular credit card number into a first case, alarms associated with another particular credit card number into a second case, alarms associated with a particular IP address into a third case, alarms associated with a consumer or consumer device **210** into a fourth case, alarms associated with a particular merchant into a fifth case, alarms associated with a particular geographic location into a sixth case, etc. A particular alarm may be included in multiple cases.

[0070] FIG. **8** is a diagram of example cases into which alarms may be placed by alarm combiner and analyzer component **730**. As shown in FIG. **8**, assume that fraud detector

component **540** receives four transactions T**1**-T**4**. By processing each of transactions T**1**-T**4** using rules in select libraries **610**, zero or more alarms may be generated. As shown in FIG. **8**, assume that three alarms A**1**-A**3** are generated. An alarm may be an aggregation of one or more transactions (e.g., alarm A**1** is the aggregation of transactions T**1** and T**2**; alarm A**2** is the aggregation of transaction T**3**; and alarm A**3** is the aggregation of transactions T**3** and T**4**) that share a common attribute. The alarms may be correlated into cases. As shown in FIG. **8**, assume that two cases C**1** and C**2** are formed. A case is a correlation of one or more alarms (e.g., case C**1** is the correlation of alarms A**1** and A**2**; and case C**2** is the correlation of alarms A**2** and A**3**) that share a common attribute.

[0071] An individual alarm may not be sufficient evidence to determine that a transaction is fraudulent. When the alarm is correlated with other alarms in a case, then a clearer picture of whether the transaction is fraudulent may be obtained. Further, when multiple cases involving different attributes of the same transaction are analyzed, then a decision may be made whether a transaction is potentially fraudulent.

[0072] Returning to FIG. **7**, fraud score generator component **740** may generate a fraud score. Fraud score generator component **740** may generate a fraud score from information associated with one or more cases (each of which may include one or more transactions and one or more alarms). In one implementation, fraud score generator component **740** may generate an alarm score for each generated alarm. For example, each of the transaction attributes and/or each of the rules may have a respective associated weight value. Thus, when a particular transaction attribute causes a rule to trigger, the generated alarm may have a particular score based on the weight value of the particular transaction attribute and/or the weight value of the rule. When a rule involves multiple transactions, the generated alarm may have a particular score that is based on a combination of the weight values of the particular transaction attributes.

[0073] In one implementation, fraud score generator component **740** may generate a case score for a case by combining the alarm scores in some manner. For example, fraud score generator component **740** may generate a case score (CS) by using a log-based Naïve Bayesian algorithm, such as:

$$CS = \frac{\sum_i \frac{AS_i \times AW_i}{AM_i}}{\sum_i AW_i} \times 1000,$$

where CS may refer to the score for a case, AS_i may refer to an alarm score for a given value within an alarm i, AW_i may refer to a relative weight given to alarm i, and AM_i may refer to a maximum score value for alarm i. The following equation may be used to calculate AS_i when the score for the alarm involves a list (e.g., more than one alarm in the case):

$$AS_i = 1-(1-s_1)\times(1-s_2)\times(1-s_n).$$

Alternatively, fraud score generator component **740** may generate a case score using an equation, such as:

$$CS = \sum_{k=1}^{m} AS_k,$$

-continued

or

$$CS = \sum_{k=1}^{m} AS_k \times AW_k$$

(as shown in FIG. **8**, alarm A**1** has an alarm score AS**1** and a weight value AW**1**, alarm A**2** has an alarm score AS**2** and a weight value AW**2**, and alarm A**3** has an alarm score AS**3** and a weight value AW**3**).

[0074] Fraud score generator component **740** may generate a fraud score for a transaction by combining the case scores in some manner. For example, fraud score generator component **740** may generate the fraud score (FS) using an equation, such as:

$$FS = \sum_{k=1}^{n} CS_k.$$

[0075] In another implementation, each case may have an associated weight value (as shown in FIG. **8**, case C**1** has a case score CS**1** and a weight value CW**1**, and case C**2** has a case score CS**2** and a weight value CW**2**). In this situation, fraud score generator component **740** may generate the fraud score using an equation, such as:

$$FS = \sum_{k=1}^{n} CS_k \times CW_k,$$

where CW may refer to a weight value for a case.

[0076] Alert generator component **750** may generate an alert and/or a trigger based, for example, on the fraud score. In one implementation, alert generator component **750** may classify the transaction, based on the fraud score, into: safe, unsafe, or for review. As described above, fraud detection unit **410** may store policies for a particular merchant that indicate, among other things, the thresholds that are to be used to classify a transaction as safe, unsafe, or for review. When the transaction is classified as safe or unsafe, alert generator component **750** may generate and send the fraud score and/or an alert (e.g., safe/unsafe or accept/deny) to the merchant so that the merchant can make an intelligent decision as to whether to accept, deny, or fulfill the transaction. When the transaction is classified as for review, alert generator component **750** may generate and send a trigger to fraud operations unit **420** so that fraud operations unit **420** may perform further analysis regarding a transaction or a set of transactions associated with a case.

[0077] As described briefly above and in more detail below, fraud detector component **540** may analyze a particular transaction at multiple, different times. For example, fraud detector component **540** may initially process the transaction to generate a fraud score and/or an alert, as described above. As additional information is obtained relating to one or more of the transaction attributes, fraud detector component **540** may subsequently process the transaction one or more additional times to update the fraud score and/or the alert.

[0078] FIG. **9** is a diagram of example functional components of fraud operations unit **420**. In one implementation, the

functions described in connection with FIG. **9** may be performed by one or more components of device **300** (FIG. **3**) or one or more devices **300**, unless described as being performed by a human. As shown in FIG. **9**, fraud operations unit **420** may include a human analyzer **910** and a set of research tools **920**. In another implementation, fraud operations unit **420** may include fewer, additional, or different functional components.

[0079] Human analyzer **910** may include a person, or a set of people, trained to research and detect fraudulent transactions. Human analyzer **910** may analyze for review transactions (e.g., transactions included in consolidated cases) and perform research to determine whether the transactions are fraudulent. Additionally, or alternatively, human analyzer **910** may perform trending analysis, perform feedback analysis, modify existing rules, and/or create new rules. Human analyzer **910** may record the results of transaction analysis and may present the results to fraud detection unit **410** and/or one or more merchant devices **220**. Human analyzer **910** may cause modified rules and/or new rules to be stored in appropriate libraries **610**.

[0080] Research tools **920** may include financial information **922**, case history **924**, chargeback information **926**, and other research tools **928**. Financial information **922** may include financial data and tools. Case history **924** may include a repository of previously analyzed cases. In one implementation, case history **924** may store a repository of cases for some period of time, such as six months, a year, two years, five years, etc. Chargeback information **926** may include information regarding requests for reimbursements (commonly referred to as "chargebacks") from a financial institution when the financial institution identifies a fraudulent transaction. When the financial institution identifies a fraudulent transaction, the financial institution may contact the merchant that was involved in the transaction and indicate, to the merchant, that the merchant's account is going to be debited for the amount of the transaction and perhaps have to pay a penalty fee. Other research tools **928** may include reverse telephone number look up tools, address look up tools, white pages tools, Internet research tools, etc. which may facilitate the determination of whether a transaction is fraudulent.

[0081] FIG. **10** is a diagram of example functional components of portal unit **430**. In one implementation, the functions described in connection with FIG. **10** may be performed by one or more components of device **300** (FIG. **3**) or one or more devices **300**. As shown in FIG. **10**, portal unit **430** may include a report generator component **1010** and a front end component **1020**. In another implementation, portal unit **430** may include fewer functional components, additional functional components, different functional components, or differently arranged functional components.

[0082] Report generator component **1010** may generate reports for merchants. For example, a merchant may request (e.g., via front end component **1020**) a particular report relating to transactions that the merchant sent to fraud management system **230**. The report may provide information regarding the analysis of various transactions and may be tailored, by the merchant, to include information that the merchant desires. Report generator component **1010** may be configured to generate reports periodically, only when prompted, or at any other interval specified by a merchant. Report generator component **1010** may automatically send reports to merchants or may make the reports available to the merchants via front end component **1020**.

[0083] In one implementation, report generator component **1010** may segregate information prior to generating a report. As explained above, a case may include information regarding transactions of multiple, unaffiliated merchants. For business reasons, when generating a report for a particular merchant, report generator component **1010** may remove information regarding transactions from other merchants ("other transactions"), including, for example, the influence that the other transactions had in generating fraud scores and in triggering particular rules. Report generator component **1010** may adjust scores (alarm, case, and/or fraud scores) to remove the effects from the other transactions.

[0084] Front end component **1020** may present a user interface accessible to merchants. Via front end component **1020**, merchants may request reports, access previously-generated reports, interact with a human analyzer, or interact with fraud detection unit **410** and/or fraud operations unit **420** in another manner. In one implementation, front end component **1020** may automatically send generated reports to merchants (e.g., via email, facsimile, etc.) or may store generated reports in a memory to await retrieval by the merchants.

[0085] FIG. **11** is a flowchart of an example process **1100** for analyzing instances of fraud. In one implementation, process **1100** may be performed by one or more components/devices of fraud management system **230**. In another implementation, one or more blocks of process **1100** may be performed by one or more other components/devices, or a group of components/devices including or excluding fraud management system **230**.

[0086] Process **1100** may include receiving a transaction (block **1110**). For example, fraud detector component **540** may receive a transaction from a merchant device **220**. Merchant device **220** may use secure communications, such as encryption or a VPN, to send the transaction to fraud management system **230**. In one implementation, merchant device **220** may send the transaction to fraud management system **230** in near real time (e.g., when a consumer submits money to the merchant for the transaction) and perhaps prior to the money being accepted by the merchant. In another implementation, merchant device **220** may send the transaction to fraud management system **230** after the money, for the transaction, has been accepted by the merchant (e.g., after the money has been accepted but prior to a product or service, associated with the transaction, being fulfilled, or possibly after the money has been accepted and after the product or service, associated with the transaction, has been fulfilled). In practice, fraud management system **230** may simultaneously receive information regarding multiple transactions from one or more merchant devices **220**.

[0087] Rules may be selected for the transaction (block **1120**). For example, fraud detector component **540** may generate a profile for the transaction based on transaction attributes (e.g., information in the transaction itself, meta information associated with the transaction, third party information associated with the transaction, and/or historical information associated with one or more attributes of the transaction). Fraud detector component **540** may use the profile and relevant information in a black or white list (if any information, relevant to the transaction, exists in a black or white list) to select a set of libraries **610** and/or a set of rules within one or more libraries **610** in the selected set of libraries **610**. For example, fraud detector component **540** may select libraries **610** having single transaction rules, multi-transaction rules, merchant-specific rules, industry-specific rules,

consumer-specific rules, or the like, based on information in the profile and/or information (if any) in a black or white list. As described above, some rules may be selected for every transaction.

[0088] The transaction may be processed using the selected rules (block **1130**). For example, fraud detector component **540** may provide the transaction to rule engines **620** corresponding to the selected set of libraries **610** for processing. In one implementation, fraud detector component **540** may provide the transaction for processing by multiple rule engines **620** in parallel. The transaction may also be processed using two or more of the rules, in the selected set of rules of a library **610**, in parallel. By processing the transaction using select rules, the accuracy of the results may be improved over processing the transaction using all of the rules (including rules that are irrelevant to the transaction). When a rule triggers (is satisfied), an alarm may be generated. The output of processing the transaction using the selected rules may include zero or more alarms.

[0089] The alarms may be collected and sorted (block **1140**). For example, fraud detector component **540** may aggregate the alarms and may analyze attributes of the transactions with which the alarms are associated (e.g., attributes relating to a particular form of payment, a particular geographic area, a particular consumer, etc.). Fraud detector component **540** may correlate the alarms, along with alarms of other transactions (past or present associated with the same or different (unaffiliated) merchants), into cases based on values of the attributes of the transactions associated with alarms. For example, fraud detector component **540** may include one or more alarms associated with a particular credit card number in a first case, one or more alarms associated with a particular travel destination in a second case, one or more alarms associated with a particular country in a third case, etc. As described above, a particular alarm may be included in multiple cases.

[0090] The alarms, in one or more cases, may be analyzed across one or more transactions (block **1150**). For example, fraud detector component **540** may analyze the alarms in a case (where the alarms may be associated with multiple transactions possibly from multiple, unaffiliated merchants and/or possibly from multiple, different industries) to determine whether the alarms justify a determination that the transaction is potentially fraudulent. By analyzing alarms in multiple cases, fraud detector component **540** may get a good picture of whether fraudulent activity is occurring.

[0091] A fraud score may be generated (block **1160**). For example, fraud detector component **540** may generate a case score for each of the cases using a technique, such as a technique described previously. Fraud detector component **540** may combine the case scores, associated with the transaction, to generate a fraud score for the transaction. In one implementation, as described above, the case scores, associated with the different cases, may be weighted differently. For example, the fraud score of case **1** may have an associated weight of CW**1**, the fraud score of case **2** may have an associated weight of CW**2**, the fraud score of case **3** may have an associated weight of CW**3**, etc. Thus, in this implementation, the different case scores may not contribute equally to the fraud score. The fraud score may reflect a probability that the transaction is fraudulent.

[0092] In one implementation, the fraud score may include a value in the range of 0 to 100, where "0" may reflect a 0% probability that the transaction is fraudulent and "100" may reflect a 100% probability that the transaction is fraudulent. It may be possible for the case score of a particularly important case (with a high weight value) to drive the fraud score to 100 (even without any contribution from any other cases).

[0093] An alert may be generated (block **1170**). For example, fraud detector component **540** may generate an alert based on the fraud score and policies associated with the merchant. For example, the merchant may specify policies that indicate what fraud scores constitute a safe transaction, what fraud scores constitute an unsafe transaction, and what fraud scores constitute a for review transaction. Fraud detector component **540** may generate an alert that indicates, to the merchant, that the transaction should be permitted or that the transaction should be denied.

[0094] Fraud detector component **540** may send the alert and/or the fraud score to the merchant so that the merchant can process the transaction accordingly. In one implementation, fraud detector component **540** may send the alert and/or fraud score while the merchant is still processing the transaction (e.g., before the merchant has approved the transaction). In another implementation, fraud detector component **540** may send the alert and/or fraud score after the merchant has completed processing the transaction (e.g., after the merchant has approved the transaction). In the latter implementation, when the transaction is determined to be potentially fraudulent, the merchant may take measures to minimize its loss (e.g., by canceling the airline tickets, by canceling shipping of the ordered product, by canceling performance of the ordered service, by canceling the payment of a medical claim, etc.).

[0095] Alarm information and/or the fraud score, for the transaction, may be stored (block **1180**). For example, fraud detector component **540** may store the alarms that were generated for the transaction and/or the alarm scores associated with those alarms. Additionally, or alternatively, fraud detector component **540** may store the fraud score that was calculated for the transaction.

[0096] Additional information, relating to the transaction, may be received (block **1190**). For example, at some later point in time after calculating the fraud score for the transaction, fraud detector component **540** may receive additional information that is relevant to the transaction (e.g., information relating to an attribute of the transaction). The additional information may include, for example, information regarding another transaction from this consumer, information regarding a transaction from another consumer, information regarding another transaction from the merchant, information regarding a transaction from another merchant that is affiliated with the merchant, information regarding a transaction from another merchant that is unaffiliated with the merchant, information regarding a transaction from another merchant that is associated with the same industry as the merchant, information regarding a transaction from another merchant that is associated with a different industry than the merchant, user behavior data associated with the consumer with regard to the merchant's website, user behavior data associated with the consumer with regard to another merchant's website, information regarding a human analyst's analysis of the transaction or other transactions from the consumer, and/or other information that might be useful in determining whether the transaction is fraudulent.

[0097] Rules may be selected again for the transaction (block **1120**). For example, fraud detector component **540** may generate a profile for the transaction based on transaction

attributes (e.g., information in the transaction itself, meta information associated with the transaction, third party information associated with the transaction, and/or historical information associated with one or more attributes of the transaction). In this case, the transaction attributes may include the additional information that was received and that relates to the previously-processed transaction.

[0098] As explained above, fraud detector component **540** may use the profile and relevant information in a black or white list (if any information, relevant to the transaction, exists in a black or white list) to select a set of libraries **610** and/or a set of rules within one or more libraries **610** in the selected set of libraries **610**.

[0099] The transaction may be processed using the selected rules (block **1130**). For example, fraud detector component **540** may provide the transaction to rule engines **620** corresponding to the selected set of libraries **610** for processing, as described above. The output of processing the transaction using the selected rules may include zero or more alarms.

[0100] The alarms may be collected and sorted (block **1140**). For example, fraud detector component **540** may aggregate the alarms and may analyze attributes of the transactions with which the alarms are associated (e.g., attributes relating to a particular form of payment, a particular geographic area, a particular consumer, etc.). Fraud detector component **540** may correlate the alarms, along with alarms of other transactions (past or present associated with the same or different (unaffiliated) merchants), into cases based on values of the attributes of the transactions associated with alarms.

[0101] The alarms, in one or more cases, may be analyzed across one or more transactions (block **1150**). For example, fraud detector component **540** may analyze the alarms in a case to determine whether the alarms justify a determination that the transaction is potentially fraudulent. By analyzing alarms in multiple cases, fraud detector component **540** may get a good picture of whether fraudulent activity is occurring.

[0102] A fraud score may be generated (block **1160**). For example, fraud detector component **540** may generate a case score for each of the cases using a technique, such as a technique described previously. Fraud detector component **540** may combine the case scores, associated with the transaction, to generate a fraud score for the transaction.

[0103] An alert may be generated (block **1170**). For example, as explained above, fraud detector component **540** may generate an alert based on the fraud score and policies associated with the merchant. In this case, fraud detector component **540** may determine whether the fraud score and/or the alert differs from the fraud score and/or alert that was previously generated. If the fraud score and/or the alert differs, fraud detector component **540** may send the alert and/or the fraud score to the merchant so that the merchant can process the transaction accordingly. For example, if the alert and/or fraud score indicates that the transaction, which was previously identified as not fraudulent, is now determined to be potentially fraudulent, the merchant may take measures to minimize its loss (e.g., by canceling the airline tickets, by canceling shipping of the ordered product, by canceling performance of the ordered service, by canceling the payment of a medical claim, etc.).

[0104] Blocks **1120-1190**, of process **1100**, may be repeated one or more times. Each iteration of blocks **1120-1190** may be based on additionally received information and, thus, improve the calculation of the fraud score.

[0105] FIGS. **12-14** are diagrams illustrating an example for identifying a fraudulent transaction. As shown in FIG. **12**, assume that a first consumer uses a particular credit card on a merchant's website (shown as FlyToday.com in FIG. **12**) to purchase a trip. For example, assume that, on October 1st, the first consumer purchases a trip that leaves Phoenix on November 1st for Mexico City and returns to Phoenix on November 10th.

[0106] The transaction, associated with this trip, may be processed by fraud management system **230**. For example, fraud management system **230** may receive the transaction associated with the first consumer, select rules for the transaction, such as travel industry rules, FlyToday.com-specific rules, credit card rules, IP address rules, Mexico City rules, single transaction rules, multi-transaction rules, etc., and process the transaction, in parallel, using the selected rules. Assume that a set of the selected rules trigger and generate corresponding alarms. For example, a rule may generate an alarm because the travel is destined for the hot destination of Mexico City (a hot destination may refer to a destination known to be associated with fraudulent activity).

[0107] Fraud management system **230** may process the alarms, correlate the alarms into cases, and determine, for example, that the transaction is likely not fraudulent based on the information known to fraud management system **230** at the time of processing the October 1st transaction associated with the first consumer. Fraud management system **230** may notify the FlyToday.com merchant that the transaction is not fraudulent. In other words, based on the totality of information available to fraud management system **230** at the time of processing the transaction associated with the first consumer, fraud management system **230** may determine that the transaction is not fraudulent and may notify the FlyToday.com merchant to accept the transaction, as shown in FIG. **12**.

[0108] As shown in FIG. **13**, assume that second, third, and fourth consumers use credit cards to purchase trips on another merchant's website (shown as TravelToday.com in FIG. **13**). For example, assume that, on October 8th, the second consumer purchases a trip, for the same traveler as the trip purchased by the first consumer, that leaves Las Vegas on November 8th for Rio de Janeiro and returns to Las Vegas on November 15th; that, on October 16th, the third consumer, using the same IP address as the first consumer, purchases a trip that leaves San Francisco on November 12th for Rio de Janeiro and returns to San Francisco on November 15th; and that, on October 21st, the fourth consumer, also using the same IP address as the first consumer, purchases a trip that leaves Miami on November 11th for Rio de Janeiro and returns to Miami on November 15th.

[0109] Fraud management system **230** may receive the transactions associated with the second, third, and fourth consumers, select rules for the transactions, such as travel industry rules, TravelToday.com-specific rules, credit card rules, IP address rules, Rio de Janeiro rules, Miami rules, single transaction rules, multi-transaction rules, etc., and process the transactions, in parallel, using the selected rules. Assume that, for each of the transactions, a set of the selected rules trigger and generate corresponding alarms. For example, one rule may generate an alarm because the travel is destined for the hot destination of Rio de Janeiro; another rule may generate an alarm because the travel originated in the hot location of Miami; another rule may generate an alarm because there is overlapping travel (e.g., the travel itineraries overlap—one leaves on November 1st and returns on Novem-

ber 10th, and the other leaves on November 8th and returns on November 15th); and another rule may generate an alarm because the travel from the first, third, and fourth consumers originate from the same IP address.

[0110] Fraud management system **230** may process the alarms, correlate the alarms into cases, and determine, for example, that one or more of the transactions, from the second, third, and fourth consumers, is potentially fraudulent based on the information known to fraud management system **230** at the time of processing the transactions associated with the second, third, and fourth consumers. In other words, based on the totality of information available to fraud management system **230** at the time of processing the transactions associated with the second, third, an fourth consumers, fraud management system **230** may determine that one or more of the transactions is potentially fraudulent and may notify the TravelToday.com merchant to deny, or not fulfill, the transaction (s).

[0111] Based on the transactions from the second, third, and fourth consumers, among other things, fraud management system **230** may determine that the transaction from the first consumer should be re-processed. For example, fraud management system **230** may determine that the transactions, from the second, third, and fourth consumers, share at least one attribute with the transaction from the first consumer. As a result, fraud management system **230** may re-process the transaction from the first consumer.

[0112] Assume that when fraud management system **230** re-processes the transaction, fraud management system **230** determines that the transaction is potentially fraudulent. For example, fraud management system **230** may determine that the overlapping travel (e.g., the first and second consumers purchase trips for the same traveler, where one of the trips leaves Phoenix on November 1st for Mexico City and returns to Phoenix on November 10th, and the other one of the trips leaves Las Vegas on November 8th for Rio de Janeiro and returns to Las Vegas on November 15th); the multiple purchases of travel to the hot destination of Rio de Janeiro (e.g., the second, third, and fourth consumers purchase travel to Rio de Janeiro); the multiple purchases of travel from the same IP address (e.g., the first, third, and fourth consumers purchase travel from the same IP address); etc. contribute to a determination that the transaction, associated with the first consumer, is potentially fraudulent. In other words, based on the totality of information available to fraud management system **230** at the time of re-processing the transaction associated with the first consumer, fraud management system **230** may determine that the transaction is potentially fraudulent and may notify the FlyToday.com merchant to deny, or not fulfill, the transaction, as shown in FIG. **14**. As a result, the FlyToday.com merchant may take measures to minimize its loss, such as canceling the tickets purchased by the first consumer (provided that the travel had not already occurred).

[0113] An implementation, described herein, may determine potentially fraudulent transactions by re-processing transactions when additional information, relating to one or more attributes associated with the transactions, becomes available. As described above, the transactions and the additional information may be associated with a single merchant, multiple, unaffiliated merchants associated with a particular industry, or multiple, unaffiliated merchants associated with multiple, different industries. By processing the transactions in such a manner, better fraud detection results may be obtained over prior, existing fraud detection systems.

[0114] The foregoing description provides illustration and description, but is not intended to be exhaustive or to limit the invention to the precise form disclosed. Modifications and variations are possible in light of the above disclosure or may be acquired from practice of the invention.

[0115] For example, while a series of blocks has been described with regard to FIG. **11**, the order of the blocks may be modified in other implementations. Further, non-dependent blocks may be performed in parallel.

[0116] It will be apparent that different aspects of the description provided above may be implemented in many different forms of software, firmware, and hardware in the implementations illustrated in the figures. The actual software code or specialized control hardware used to implement these aspects is not limiting of the invention. Thus, the operation and behavior of these aspects were described without reference to the specific software code—it being understood that software and control hardware can be designed to implement these aspects based on the description herein.

[0117] Even though particular combinations of features are recited in the claims and/or disclosed in the specification, these combinations are not intended to limit the disclosure of the invention. In fact, many of these features may be combined in ways not specifically recited in the claims and/or disclosed in the specification. Although each dependent claim listed below may directly depend on only one other claim, the disclosure of the invention includes each dependent claim in combination with every other claim in the claim set.

[0118] No element, act, or instruction used in the present application should be construed as critical or essential to the invention unless explicitly described as such. Also, as used herein, the article "a" is intended to include one or more items. Where only one item is intended, the term "one" or similar language is used. Further, the phrase "based on" is intended to mean "based, at least in part, on" unless explicitly stated otherwise.

What is claimed is:

1. A method, comprising:

receiving, by one or more computer devices, first transaction data for a first transaction associated with a first consumer;

identifying, by the one or more computer devices, a plurality of first transaction attributes associated with the first transaction data;

determining, by the one or more computer devices and based on the first transaction data, a first fraud probability for the first transaction;

determining, by the one or more computer devices, that the first fraud probability corresponds to a first fraud classification, defined by a first set of policies associated with a first set of merchants, that differs from a corresponding second fraud classification defined by a second set of policies associated with a second set of merchants;

outputting, by the one or more computer devices, the first fraud classification to a first merchant associated with the first transaction when the first set of merchants includes the first merchant;

receiving, by the one or more computer devices and after outputting the first fraud classification, second transaction data for a second transaction associated with a second consumer that differs from the first consumer;

identifying, by one or more computer devices, a plurality of second transaction attributes associated with the second transaction data;

determining, by the one or more computer devices, that at least one transaction attribute is common to the first transaction attributes and the second transaction attributes;

determining, by the one or more computer devices, a second fraud probability for the first transaction based on the second transaction data; and

outputting, by the one or more computer devices, an updated fraud classification to the first merchant based on the second fraud probability as defined by the first set of policies.

2. The method of claim **1**, wherein a second merchant that differs from the first merchant is associated with the second transaction.

3. The method of claim **2**, wherein the second set of merchants includes the second merchant and the first set of merchants is associated with a first industry that differs from a second industry associated with the second set of merchants.

4. The method of claim **1**, wherein outputting the first fraud classification includes:

generating a first alert, associated with the first transaction, based on the first fraud classification, wherein the first alert corresponds to a first recommendation that the merchant accept, deny, or fulfill the first transaction, and

outputting the first alert to the first merchant.

5. The method of claim **4**, wherein outputting the updated fraud classification includes:

generating a second alert, associated with the first transaction, based on the updated fraud classification, wherein the second alert corresponds to a second recommendation that the first merchant accept, deny, or fulfill the first transaction,

determining whether the second recommendation differs from the first recommendation, and

outputting the second alert to the first merchant only when the second recommendation differs from the first recommendation.

6. The method of claim **5**, wherein the updated fraud classification and the second fraud classification are the same.

7. The method of claim **5**, wherein the updated fraud classification differs from the second fraud classification.

8. A system, comprising:

a communication interface;

one or more memory devices to store instructions for detecting fraud; and

one or more processors to execute the instructions to:

receive, via the communication interface, first transaction data for a first transaction associated with a first consumer,

identify a plurality of first transaction attributes associated with the first transaction data,

determine, based on the first transaction data, a first fraud probability for the first transaction,

determine that the first fraud probability corresponds to a first fraud classification, defined by a first set of policies associated with a first set of merchants, that differs from a corresponding second fraud classification defined by a second set of policies associated with a second set of merchants,

output, via the communication interface, the first fraud classification to a first merchant associated with the first transaction when the first set of merchants includes the first merchant,

receive, via the communication interface and after outputting the first fraud classification, second transaction data for a second transaction associated with a second consumer that differs from the first consumer,

identify a plurality of second transaction attributes associated with the second transaction data,

determine that at least one transaction attribute is common to the first transaction attributes and the second transaction attributes,

determine a second fraud probability for the first transaction based on the second transaction data, and

output, via the communication interface, an updated fraud classification to the first merchant based on the second fraud probability as defined by the first set of policies.

9. The system of claim **8**, wherein a second merchant that differs from the first merchant is associated with the second transaction.

10. The system of claim **9**, wherein the second set of merchants includes the second merchant and the first set of merchants is associated with a first industry that differs from a second industry associated with the second set of merchants.

11. The method of claim **8**, wherein the one or more processors execute the instructions to output the first fraud classification by:

generating a first alert, associated with the first transaction, based on the first fraud classification, wherein the first alert corresponds to a first recommendation that the merchant accept, deny, or fulfill the first transaction, and

outputting the first alert to the first merchant.

12. The method of claim **11**, wherein the one or more processors execute the instructions to output the updated fraud classification by:

generating a second alert, associated with the first transaction, based on the updated fraud classification, wherein the second alert corresponds to a second recommendation that the first merchant accept, deny, or fulfill the first transaction,

determining whether the second recommendation differs from the first recommendation, and

outputting the second alert to the first merchant only when the second recommendation differs from the first recommendation.

13. The method of claim **12**, wherein the updated fraud classification and the second fraud classification are the same.

14. The method of claim **12**, wherein the updated fraud classification differs from the second fraud classification.

15. A non-transitory computer-readable medium that stores instructions executable by one or more computer devices to perform a method, comprising:

receiving, via a communication interface, first transaction data for a first transaction associated with a first consumer;

identifying, by the one or more computer devices, a plurality of first transaction attributes associated with the first transaction data;

determining, by the one or more computer devices and based on the first transaction data, a first fraud probability for the first transaction;

determining, by the one or more computer devices, that the first fraud probability corresponds to a first fraud classification, defined by a first set of policies associated with a first set of merchants, that differs from a corresponding

second fraud classification defined by a second set of policies associated with a second set of merchants;

outputting, via the communication interface, the first fraud classification to a first merchant associated with the first transaction when the first set of merchants includes the first merchant;

receiving, via the communication interface and after outputting the first fraud classification, second transaction data for a second transaction associated with a second consumer that differs from the first consumer;

identifying, by one or more computer devices, a plurality of second transaction attributes associated with the second transaction data;

determining, by the one or more computer devices, that at least one transaction attribute is common to the first transaction attributes and the second transaction attributes;

determining, by the one or more computer devices, a second fraud probability for the first transaction based on the second transaction data; and

outputting, via the communication interface, an updated fraud classification to the first merchant based on the second fraud probability as defined by the first set of policies.

16. The non-transitory computer-readable medium of claim **15**, wherein a second merchant that differs from the first merchant is associated with the second transaction.

17. The non-transitory computer-readable medium of claim **16**, wherein the second set of merchants includes the second merchant and the first set of merchants is associated with a first industry that differs from a second industry associated with the second set of merchants.

18. The non-transitory computer-readable medium of claim **15**, wherein outputting the first fraud classification includes:

generating a first alert, associated with the first transaction, based on the first fraud classification, wherein the first alert corresponds to a first recommendation that the merchant accept, deny, or fulfill the first transaction, and

outputting the first alert to the first merchant.

19. The method of claim **18**, wherein outputting the updated fraud classification includes:

generating a second alert, associated with the first transaction, based on the updated fraud classification, wherein the second alert corresponds to a second recommendation that the first merchant accept, deny, or fulfill the first transaction,

determining whether the second recommendation differs from the first recommendation, and

outputting the second alert to the first merchant only when the second recommendation differs from the first recommendation.

20. The method of claim **19**, wherein the updated fraud classification and the second fraud classification are the same.

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