

Technical Disclosure Commons

Defensive Publications Series

October 2020

SYSTEM, METHOD, AND COMPUTER PROGRAM PRODUCT FOR PREDICTING PROFILE ACTIVITY OF A USER PROFILE BASED ON USER PROFILES ASSOCIATED WITH A GEOGRAPHIC REGION

YURAN ZHOU
VISA

YIWEI ZHANG
VISA

NISHTHA GANDHI
VISA

LAWSON LAU
VISA

DEBESH KUMAR
VISA

Follow this and additional works at: https://www.tdcommons.org/dpubs_series

Recommended Citation

ZHOU, YURAN; ZHANG, YIWEI; GANDHI, NISHTHA; LAU, LAWSON; and KUMAR, DEBESH, "SYSTEM, METHOD, AND COMPUTER PROGRAM PRODUCT FOR PREDICTING PROFILE ACTIVITY OF A USER PROFILE BASED ON USER PROFILES ASSOCIATED WITH A GEOGRAPHIC REGION", Technical Disclosure Commons, (October 29, 2020)

https://www.tdcommons.org/dpubs_series/3730



This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/).

This Article is brought to you for free and open access by Technical Disclosure Commons. It has been accepted for inclusion in Defensive Publications Series by an authorized administrator of Technical Disclosure Commons.

**TITLE “SYSTEM, METHOD, AND COMPUTER
PROGRAM PRODUCT FOR PREDICTING PROFILE
ACTIVITY OF A USER PROFILE BASED ON USER
PROFILES ASSOCIATED WITH A GEOGRAPHIC
REGION”**

VISA

YURAN ZHOU

YIWEI ZHANG

NISHTHA GANDHI

LAWSON LAU

DEBESH KUMAR

TECHNICAL FIELD

[0001] This disclosure relates generally to predicting profile activity of a user profile and, in some non-limiting embodiments or aspects, to systems, methods, and computer program products for predicting profile activity of a user profile based on user profiles associated with a geographic region.

BACKGROUND

[0002] Certain techniques for predicting profile activity may rely on analysing data associated with a plurality of user profiles. For example, a user profile may include data associated with one or more payment transactions that occur within a time period and/or the like. Such techniques may attempt to predict future activity based on the one or more trends identified based on the data in such user profiles.

[0003] However, certain such techniques may suffer due to the systems that implement these techniques identifying trends in data or portions thereof that are not relevant, inaccurate, and/or the like (e.g., the system may identify a trend that will not continue in the future, the system may identify a trend that has been discontinued, the system may identify a trend that will occur in a subset of user profiles but will not occur in a different subset of user profiles, the system may identify a trend based on data and/or portions thereof that are not accurate predictors of future behavior, and/or the like). As such, the accuracy of predictions of future activities may be limited (e.g., reduced, unacceptable, insufficient, and/or the like). Additionally, by virtue of the inclusion of the one or more user profiles in the plurality of user profiles for which the trends are not relevant, the system may expend computational resources analysing the one or more user profiles unnecessarily. Moreover, analysing data across the entire time period may fail to account for changes in certain portions of the data over successive time periods (and/or successive sub-periods within the time period), e.g., due to a change in behavior of a user associated with a user profile.

[0004] The information disclosed in this background of the disclosure section is only for enhancement of understanding of the general background of the invention and should not be taken as an acknowledgement or any form of suggestion that this information forms the prior art already known to a person skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears.

[0006] The same numbers are used throughout the figures to reference like features and components. Some embodiments of device or system and/or methods in accordance with embodiments of the present subject matter are now described, by way of example only, and with reference to the accompanying figures, in which:

[0007] FIG.1 is a diagram of a non-limiting aspect or embodiment of an example environment for predicting profile activity of a user profile based on user profiles associated with a geographic region;

[0008] FIG. 2 is a diagram of a non-limiting aspect or embodiment of components of one or more devices and/or one or more systems of FIG.1;

[0009] FIG. 3 is a flowchart of a non-limiting aspect or embodiment of a process for predicting profile activity of a user profile based on user profiles associated with a geographic region; and

[0010] FIG.4 illustrates a block diagram of an exemplary computer system for implementing embodiments consistent with the present disclosure.

[0011] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the disclosure described herein.

DESCRIPTION OF THE DISCLOSURE

[0012] For purposes of the description hereinafter, the terms “end,” “upper,” “lower,” “right,” “left,” “vertical,” “horizontal,” “top,” “bottom,” “lateral,” “longitudinal,” and derivatives thereof shall relate to the disclosure as it is oriented in the drawing figures. However, it is to be understood that the disclosure may assume various alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments or aspects of the disclosure. Hence, specific dimensions and other physical characteristics related to the embodiments or aspects of the embodiments disclosed herein are not to be considered as limiting unless otherwise indicated.

[0013] No aspect, component, element, structure, act, step, function, instruction, and/or the like used herein should be construed as critical or essential unless explicitly described as such. In addition, as used herein, the articles “a” and “an” are intended to include one or more items and may be used interchangeably with “one or more” and “at least one.” Furthermore, as used herein, the term “set” is intended to include one or more items (e.g., related items, unrelated items, a combination of related and unrelated items, etc.) and may be used interchangeably with “one or more” or “at least one.” Where only one item is intended, the term “one” or similar language is used. Also, as used herein, the terms “has,” “have,” “having,” or the like are intended to be open-ended terms. Further, the phrase “based on” is intended to mean “based at least partially on” unless explicitly stated otherwise.

[0014] As used herein, the terms “communication” and “communicate” may refer to the reception, receipt, transmission, transfer, provision, and/or the like of information (e.g., data, signals, messages, instructions, commands, and/or the like). For one unit (e.g., a device, a system, a component of a device or system, combinations thereof, and/or the like) to be in communication with another unit means that the one unit is able to directly or indirectly receive information from and/or send (e.g., transmit) information to the other unit. This may refer to a direct or indirect connection that is wired and/or wireless in nature. Additionally, two units may be in communication with each other even though the information transmitted may be modified, processed, relayed, and/or routed between the first and second unit. For example, a first unit may be in communication with a second unit even though the first unit passively receives information and does not actively transmit information to the

second unit. As another example, a first unit may be in communication with a second unit if at least one intermediary unit (e.g., a third unit located between the first unit and the second unit) processes information received from the first unit and transmits the processed information to the second unit. In some non-limiting embodiments or aspects, a message may refer to a network packet (e.g., a data packet and/or the like) that includes data.

[0015] As used herein, the terms “issuer,” “issuer institution,” “issuer bank,” or “payment device issuer,” may refer to one or more entities that provide accounts to individuals (e.g., users, customers, and/or the like) for conducting payment transactions, such as credit payment transactions and/or debit payment transactions. For example, an issuer institution may provide an account identifier, such as a primary account number (PAN), to a customer that uniquely identifies one or more accounts associated with that customer. In some non-limiting embodiments or aspects, an issuer may be associated with a bank identification number (BIN) that uniquely identifies the issuer institution. As used herein “issuer system” may refer to one or more computer systems operated by or on behalf of an issuer, such as a server executing one or more software applications. For example, an issuer system may include one or more authorization servers for authorizing a transaction.

[0016] As used herein, the term “account identifier” may refer to one or more types of identifiers associated with an account (e.g., a PAN associated with an account, a card number associated with an account, a payment card number associated with an account, a token associated with an account, and/or the like). In some non-limiting embodiments or aspects, an issuer may provide an account identifier (e.g., a PAN, a token, and/or the like) to a user (e.g., an account holder) that uniquely identifies one or more accounts associated with that user. The account identifier may be embodied on a payment device (e.g., a physical instrument used for conducting payment transactions, such as a payment card, a credit card, a debit card, a gift card, and/or the like) and/or may be electronic information communicated to the user that the user may use for electronic payment transactions. In some non-limiting embodiments or aspects, the account identifier may be an original account identifier, where the original account identifier was provided to a user at the creation of the account associated with the account identifier. In some non-limiting embodiments or aspects, the account identifier may be a supplemental account identifier, which may include an account identifier that is provided to a user after the original account identifier was provided to the user. For example, if the original account identifier is forgotten, stolen, and/or the like, a supplemental account identifier may be provided to the user. In some non-limiting embodiments or aspects, an account identifier may be

directly or indirectly associated with an issuer institution such that an account identifier may be a token that maps to a PAN or other type of account identifier. Account identifiers may be alphanumeric, any combination of characters and/or symbols, and/or the like.

[0017] As used herein, the term “token” may refer to an account identifier that is used as a substitute or replacement for another account identifier, such as a PAN. Tokens may be associated with a PAN or other original account identifier in one or more data structures (e.g., one or more databases and/or the like) such that they may be used to conduct a payment transaction without directly using the original account identifier. In some non-limiting embodiments or aspects, an original account identifier, such as a PAN, may be associated with a plurality of tokens for different individuals or purposes. In some non-limiting embodiments or aspects, tokens may be associated with a PAN or other account identifiers in one or more data structures such that they can be used to conduct a transaction without directly using the PAN or the other account identifiers. In some examples, an account identifier, such as a PAN, may be associated with a plurality of tokens for different uses or different purposes.

[0018] As used herein, the term “merchant” may refer to one or more entities (e.g., operators of retail businesses) that provide goods and/or services, and/or access to goods and/or services, to a user (e.g., a customer, a consumer, and/or the like) based on a transaction, such as a payment transaction. As used herein “merchant system” may refer to one or more computer systems operated by or on behalf of a merchant, such as a server executing one or more software applications. As used herein, the term “product” may refer to one or more goods and/or services offered by a merchant.

[0019] As used herein, a “point-of-sale (POS) device” may refer to one or more devices, which may be used by a merchant to conduct a transaction (e.g., a payment transaction) and/or process a transaction. For example, a POS device may include one or more client devices. Additionally or alternatively, a POS device may include peripheral devices, card readers, scanning devices (e.g., code scanners), Bluetooth® communication receivers, near-field communication (NFC) receivers, radio frequency identification (RFID) receivers, and/or other contactless transceivers or receivers, contact-based receivers, payment terminals, and/or the like.

[0020] As used herein, a “point-of-sale (POS) system” may refer to one or more client devices and/or peripheral devices used by a merchant to conduct a transaction. For example, a POS system may include one or more POS devices and/or other like devices that may be used to conduct a payment

transaction. In some non-limiting embodiments or aspects, a POS system (e.g., a merchant POS system) may include one or more server computers programmed or configured to process online payment transactions through webpages, mobile applications, and/or the like.

[0021] As used herein, the term “transaction service provider” may refer to an entity that receives transaction authorization requests from merchants or other entities and provides guarantees of payment, in some cases through an agreement between the transaction service provider and an issuer institution. For example, a transaction service provider may include a payment network such as Visa®, MasterCard®, American Express®, or any other entity that processes transactions. As used herein “transaction service provider system” may refer to one or more computer systems operated by or on behalf of a transaction service provider, such as a transaction service provider system executing one or more software applications. A transaction service provider system may include one or more processors and, in some non-limiting embodiments or aspects, may be operated by or on behalf of a transaction service provider.

[0022] As used herein, the term “acquirer” may refer to an entity licensed by the transaction service provider and approved by the transaction service provider to originate transactions (e.g., payment transactions) involving a payment device associated with the transaction service provider. As used herein, the term “acquirer system” may also refer to one or more computer systems, computer devices, and/or the like operated by or on behalf of an acquirer. The transactions the acquirer may originate may include payment transactions (e.g., purchases, original credit transactions (OCTs), account funding transactions (AFTs), and/or the like). In some non-limiting embodiments or aspects, the acquirer may be authorized by the transaction service provider to assign merchant or service providers to originate transactions involving a payment device associated with the transaction service provider. The acquirer may contract with payment facilitators to enable the payment facilitators to sponsor merchants. The acquirer may monitor compliance of the payment facilitators in accordance with regulations of the transaction service provider. The acquirer may conduct due diligence of the payment facilitators and ensure proper due diligence occurs before signing a sponsored merchant. The acquirer may be liable for all transaction service provider programs that the acquirer operates or sponsors. The acquirer may be responsible for the acts of the acquirer’s payment facilitators, merchants that are sponsored by the acquirer’s payment facilitators, and/or the like. In some non-limiting embodiments or aspects, an acquirer may be a financial institution, such as a bank.

[0023] As used herein, the term “payment gateway” may refer to an entity and/or a payment processing system operated by or on behalf of such an entity (e.g., a merchant service provider, a payment service provider, a payment facilitator, a payment facilitator that contracts with an acquirer, a payment aggregator, and/or the like), which provides payment services (e.g., transaction service provider payment services, payment processing services, and/or the like) to one or more merchants. The payment services may be associated with the use of portable financial devices managed by a transaction service provider. As used herein, the term “payment gateway system” may refer to one or more computer systems, computer devices, servers, groups of servers, and/or the like operated by or on behalf of a payment gateway.

[0024] As used herein, the terms “electronic wallet,” “electronic wallet mobile application,” and “digital wallet” may refer to one or more electronic devices including one or more software applications configured to facilitate and/or conduct transactions (e.g., payment transactions, electronic payment transactions, and/or the like). For example, an electronic wallet may include a user device (e.g., a mobile device) executing an application program, server-side software, and/or databases for maintaining and providing data to be used during a payment transaction to the user device. As used herein, the term “electronic wallet provider” may include an entity that provides and/or maintains an electronic wallet and/or an electronic wallet mobile application for a user (e.g., a customer). Examples of an electronic wallet provider include, but are not limited to, Google Wallet™, Android Pay®, Apple Pay®, and Samsung Pay®. In some non-limiting examples, a financial institution (e.g., an issuer institution) may be an electronic wallet provider. As used herein, the term “electronic wallet provider system” may refer to one or more computer systems, computer devices, servers, groups of servers, and/or the like operated by or on behalf of an electronic wallet provider.

[0025] As used herein, the term “payment device” may refer to a payment card (e.g., a credit or debit card), a gift card, a smartcard, smart media, a payroll card, a healthcare card, a wristband, a machine-readable medium containing account information, a keychain device or fob, an RFID transponder, a retailer discount or loyalty card, and/or the like. The payment device may include a volatile or a non-volatile memory to store information (e.g., an account identifier, a name of the account holder, and/or the like).

[0026] As used herein, the terms “client” and “client device” may refer to one or more computing devices, such as processors, storage devices, and/or similar computer components, that access a

service made available by a server. In some non-limiting embodiments or aspects, a “client device” may refer to one or more devices that facilitate payment transactions, such as POS devices and/or POS systems used by a merchant. In some non-limiting embodiments or aspects, a client device may include an electronic device configured to communicate with one or more networks and/or facilitate payment transactions such as, but not limited to, one or more desktop computers, one or more portable computers (e.g., tablet computers), one or more mobile devices (e.g., cellular phones, smartphones, PDAs, wearable devices, such as watches, glasses, lenses, and/or clothing, and/or the like), and/or other like devices. Moreover, a “client” may also refer to an entity, such as a merchant, that owns, utilizes, and/or operates a client device for facilitating payment transactions with a transaction service provider.

[0027] As used herein, the term “server” may refer to one or more computing devices, such as processors, storage devices, and/or similar computer components that communicate with client devices and/or other computing devices over a network, such as the Internet or private networks and, in some examples, facilitate communication among other servers and/or client devices.

[0028] As used herein, the term “system” may refer to one or more computing devices or combinations of computing devices such as, but not limited to, processors, servers, client devices, software applications, and/or other like components. In addition, reference to “a server” or “a processor,” as used herein, may refer to a previously-recited server and/or processor that is recited as performing a previous step or function, a different server and/or processor, and/or a combination of servers and/or processors. For example, as used in the specification and the claims, a first server and/or a first processor that is recited as performing a first step or function may refer to the same or different server and/or a processor recited as performing a second step or function.

[0029] Provided are improved systems, methods, and computer program products for predicting profile activity of a user profile based on user profiles associated with a geographic region. For example, a method may include receiving, with at least one processor, a plurality of user profiles. In some non-limiting embodiments or aspects, each respective user profile of the plurality of user profiles may be associated with a respective user. In some non-limiting embodiments or aspects, each respective user profile of the plurality of user profiles may include: transaction data associated with at least one payment transaction associated with the respective user, and address data associated with an address of the respective user. In some non-limiting embodiments or aspects, the method may

include extracting, with at least one processor, a first set of user profiles from the plurality of user profiles based on the address of the respective user for each respective user profile. In some non-limiting embodiments or aspects, the method may include extracting, with at least one processor, a first subset of user profiles from the first set of user profiles, wherein the transaction data of each user profile of the first subset of user profiles comprises at least one payment transaction associated with a first merchant system prior to a first time period, wherein a remaining subset of user profiles comprises each user profile of the first set of user profiles other than the first subset of user profiles. In some non-limiting embodiments or aspects, the method may include extracting, with at least one processor, a second subset of user profiles and a third subset of user profiles from the remaining subset of user profiles, wherein the transaction data of each user profile of the second subset of user profiles comprises at least one payment transaction associated with the first merchant system during the first time period, and wherein the third subset of user profiles comprises each user profile of the remaining subset of user profiles other than the second subset of user profiles. In some non-limiting embodiments or aspects, the method may include determining, with at least one processor, a plurality of feature values for each respective user profile of the second subset of user profiles and the third subset of user profiles, the plurality of feature values comprising at least one spending behavior feature based on the transaction data of the respective user profile and at least one time-related spending behavior feature based on a change in at least one of the at least one spending behavior feature between a second time period and a third time period, the second time period and the third time period both being within the first time period, the second time period preceding the third time period. In some non-limiting embodiments or aspects, the method may include training, with at least one processor, a predictive model based on the plurality of feature values of the second subset of user profiles and the third subset of user profiles.

[0030] By virtue of implementation of the systems, methods, and computer program products described herein, such systems may implement the methods described herein to identify trends that are relevant (e.g., the system may identify a trend that will continue in the future, the system may identify a trend that will occur in one or more subsets of user profiles, and/or the like). Specifically, the system may predict future activity for one or more user profiles of the plurality of user profiles based on trends that are relevant to the one or more user profiles. This, in turn, may increase the accuracy of the future activities predicted by the system. Additionally, by virtue of the inclusion of the one or more user profiles in the plurality of user profiles for which the trends are relevant, the system may reduce computational resource consumption when analysing the one or more user

profiles. Moreover, by virtue of the inclusion of one or more time-related spending behavior feature(s), the system may account for changes in certain portions of the data over successive time periods (and/or successive sub-periods within the time period), thereby improving accuracy of predictions of future behavior.

[0031] Referring now to FIG.1, FIG.1 is a diagram of an example environment 100 in which devices, systems, methods, and/or products described herein may be implemented. As shown in FIG. 1, environment 100 includes transaction processing network 101, user device 102, merchant system 104, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112. Transaction processing network 101, user device 102, merchant system 104, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112 may interconnect (e.g., establish a connection to communicate, and/or the like) via wired connections, wireless connections, or a combination of wired and wireless connections.

[0032] User device 102 may include one or more devices configured to be in communication with merchant system 104, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112 via communication network 114. For example, user device 102 may include a payment device, a smartphone, a tablet, a laptop computer, a desktop computer, and/or the like. In some non-limiting embodiments or aspects, user device 102 may be configured to transmit and/or receive data to and/or from merchant system 104 via an imaging system and/or a short-range wireless communication connection (e.g., an NFC communication connection, an RFID communication connection, a Bluetooth® communication connection, and/or the like). In some non-limiting embodiments or aspects, user device 102 may be associated with a user (e.g., an individual operating a device).

[0033] Merchant system 104 may include one or more devices configured to be in communication with user device 102, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112 via communication network 114. For example, merchant system 104 may include one or more servers, one or more groups of servers, one or more client devices, one or more groups of client devices, and/or the like. In some non-limiting embodiments or aspects, merchant system 104 may include a point-of-sale (POS) device. In some non-limiting embodiments or aspects, merchant system 104 may be configured to transmit and/or receive data to and/or from user device 102 via an imaging system and/or a short-range wireless communication connection. In

some non-limiting embodiments or aspects, merchant system 104 may be associated with a merchant as described herein.

[0034] Payment gateway system 106 may include one or more devices configured to be in communication with user device 102, merchant system 104, acquirer system 108, transaction service provider system 110, and/or issuer system 112 via communication network 114. For example, payment gateway system 106 may include one or more servers, one or more groups of servers, and/or the like. In some non-limiting embodiments or aspects, payment gateway system 106 may be associated with a payment gateway as described herein.

[0035] Acquirer system 108 may include one or more devices configured to be in communication with user device 102, merchant system 104, payment gateway system 106, transaction service provider system 110, and/or issuer system 112 via communication network 114. For example, acquirer system 108 may include one or more servers, one or more groups of servers, and/or the like. In some non-limiting embodiments or aspects, acquirer system 108 may be associated with an acquirer as described herein.

[0036] Transaction service provider system 110 may include one or more devices configured to be in communication with user device 102, merchant system 104, payment gateway system 106, acquirer system 108, and/or issuer system 112 via communication network 114. For example, transaction service provider system 110 may include one or more servers (e.g., a transaction processing server), one or more groups of servers, and/or the like. In some non-limiting embodiments or aspects, transaction service provider system 110 may be associated with a transaction service provider as described herein.

[0037] Issuer system 112 may include one or more devices configured to be in communication with user device 102, merchant system 104, payment gateway system 106, acquirer system 108, and/or transaction service provider system 110 via communication network 114. For example, issuer system 112 may include one or more servers, one or more groups of servers, and/or the like. In some non-limiting embodiments or aspects, issuer system 112 may be associated with an issuer institution that issued a payment account and/or instrument (e.g., a credit account, a debit account, a credit card, a debit card, and/or the like) to a user (e.g., a user associated with user device 102 and/or the like).

[0038] In some non-limiting embodiments or aspects, transaction processing network 101 may include one or more systems in a communication path for processing a transaction. For example, transaction processing network 101 may include merchant system 104, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112 in a communication path (e.g., a communication path, a communication channel, a communication network, and/or the like). As an example, transaction processing network 101 may process (e.g., initiate, conduct, authorize, and/or the like) an electronic payment transaction via the communication path between merchant system 104, payment gateway system 106, acquirer system 108, transaction service provider system 110, and/or issuer system 112.

[0039] Communication network 114 may include one or more wired and/or wireless networks. For example, communication network 114 may include a cellular network (e.g., a long-term evolution (LTE) network, a third generation (3G) network, a fourth generation (4G) network, a code division multiple access (CDMA) network, etc.), a public land mobile network (PLMN), a local area network (LAN), a wide area network (WAN), a metropolitan area network (MAN), a telephone network (e.g., the public switched telephone network (PSTN)), a private network, an ad hoc network, an intranet, the Internet, a fiber optic-based network, a cloud computing network, and/or the like, and/or a combination of some or all of these or other types of networks.

[0040] The number and arrangement of systems and/or devices shown in FIG.1 are provided as an example. There may be additional systems and/or devices, fewer systems and/or devices, different systems and/or devices, or differently arranged systems and/or devices than those shown in FIG.1. Furthermore, two or more systems and/or devices shown in FIG.1 may be implemented within a single system or a single device, or a single system or a single device shown in FIG.1 may be implemented as multiple, distributed systems or devices. Additionally or alternatively, a set of systems or a set of devices (e.g., one or more systems, one or more devices) of environment 100 may perform one or more functions described as being performed by another set of systems or another set of devices of environment 100.

[0041] Referring now to FIG.2, illustrated is a diagram of example components of device 200. Device 200 may correspond to one or more devices of transaction processing network 101, one or more devices of user device 102 (e.g., one or more devices of a system of user device 102), one or more devices of merchant system 104, one or more devices of the payment gateway system 106, one

or more devices of acquirer system 108, one or more devices of transaction service provider system 110, one or more devices of the issuer system 112, and/or one or more devices of the communication network 114. In some non-limiting embodiments or aspects, one or more devices of user device 102, one or more devices of merchant system 104, one or more devices of payment gateway system 106, one or more devices of acquirer system 108, one or more devices of transaction service provider system 110, one or more devices of issuer system 112, and/or one or more devices of the communication network 114 may include at least one device 200 and/or at least one component of device 200. As shown in FIG.2, device 200 may include bus 202, processor 204, memory 206, storage component 208, input component 210, output component 212, and communication interface 214.

[0042] Bus 202 may include a component that permits communication among the components of device 200. In some non-limiting embodiments or aspects, processor 204 may be implemented in hardware, software, or a combination of hardware and software. For example, processor 204 may include a processor (e.g., a central processing unit (CPU), a graphics processing unit (GPU), an accelerated processing unit (APU), etc.), a microprocessor, a digital signal processor (DSP), and/or any processing component (e.g., a field-programmable gate array (FPGA), an application-specific integrated circuit (ASIC), etc.) that can be programmed to perform a function. Memory 206 may include random access memory (RAM), read-only memory (ROM), and/or another type of dynamic or static storage device (e.g., flash memory, magnetic memory, optical memory, etc.) that stores information and/or instructions for use by processor 204.

[0043] Storage component 208 may store information and/or software related to the operation and use of device 200. For example, storage component 208 may include a hard disk (e.g., a magnetic disk, an optical disk, a magneto-optic disk, a solid state disk, etc.), a compact disc (CD), a digital versatile disc (DVD), a floppy disk, a cartridge, a magnetic tape, and/or another type of computer-readable medium, along with a corresponding drive.

[0044] Input component 210 may include a component that permits device 200 to receive information, such as via user input (e.g., a touchscreen display, a keyboard, a keypad, a mouse, a button, a switch, a microphone, a camera, etc.). Additionally, or alternatively, input component 210 may include a sensor for sensing information (e.g., a global positioning system (GPS) component, an accelerometer, a gyroscope, an actuator, etc.). Output component 212 may include a component that

provides output information from device 200 (e.g., a display, a speaker, one or more light-emitting diodes (LEDs), etc.).

[0045] Communication interface 214 may include a transceiver-like component (e.g., a transceiver, a separate receiver and transmitter, etc.) that enables device 200 to communicate with other devices, such as via a wired connection, a wireless connection, or a combination of wired and wireless connections. Communication interface 214 may permit device 200 to receive information from another device and/or provide information to another device. For example, communication interface 214 may include an Ethernet interface, an optical interface, a coaxial interface, an infrared interface, a radio frequency (RF) interface, a universal serial bus (USB) interface, a Wi-Fi® interface, a cellular network interface, and/or the like.

[0046] Device 200 may perform one or more processes described herein. Device 200 may perform these processes based on processor 204 executing software instructions stored by a computer-readable medium, such as memory 206 and/or storage component 208. A computer-readable medium (e.g., a non-transitory computer-readable medium) is defined herein as a non-transitory memory device. A non-transitory memory device includes memory space located inside of a single physical storage device or memory space spread across multiple physical storage devices.

[0047] Software instructions may be read into memory 206 and/or storage component 208 from another computer-readable medium or from another device via communication interface 214. When executed, software instructions stored in memory 206 and/or storage component 208 may cause processor 204 to perform one or more processes described herein. Additionally, or alternatively, hardwired circuitry may be used in place of or in combination with software instructions to perform one or more processes described herein. Thus, embodiments or aspects described herein are not limited to any specific combination of hardware circuitry and software.

[0048] Memory 206 and/or storage component 208 may include data storage or one or more data structures (e.g., a database, and/or the like). Device 200 may be capable of receiving information from, storing information in, communicating information to, or searching information stored in the data storage or one or more data structures in memory 206 and/or storage component 208. For example, the information may include transaction data, input data, output data, transaction data, account data, or any combination thereof.

[0049] The number and arrangement of components shown in FIG.2 are provided as an example. In some non-limiting embodiments or aspects, device 200 may include additional components, fewer components, different components, or differently arranged components than those shown in FIG.2. Additionally, or alternatively, a set of components (e.g., one or more components) of device 200 may perform one or more functions described as being performed by another set of components of device 200.

[0050] Referring now to FIG.3, illustrated is a flowchart of a non-limiting aspect or embodiment of a process 300 for predicting profile activity of a user profile based on user profiles associated with a geographic region. In some non-limiting embodiments or aspects, one or more of the functions described with respect to process 300 may be performed (e.g., completely, partially, etc.) by transaction service provider system 110. In some non-limiting embodiments or aspects, one or more of the steps of process 300 may be performed (e.g., completely, partially, and/or the like) by another device or a group of devices separate from and/or including transaction service provider system 110, such as user device 102, merchant system 104, payment gateway system 106, acquirer system 108, and/or issuer system 112.

[0051] As shown in FIG.3, at step 302, process 300 may include receiving a plurality of user profiles. For example, transaction service provider system 110 may receive a plurality of user profiles. For example, transaction service provider system 110 may receive at least some of the plurality of user profiles from merchant system 104, issuer system 112, and/or the like. Additionally, or alternatively, transaction service provider system 110 may receive at least some of the plurality of user profiles from a data storage device, which may be local or remote to transaction service provider system 110.

[0052] In some non-limiting embodiments or aspects, transaction service provider system 110 may receive the plurality of user profiles based on transmitting a request for one or more of the user profiles of the plurality of user profiles. Additionally or alternatively, transaction service provider system 110 may periodically receive the one or more user profiles (e.g., merchant system 104, issuer system 112, a data storage device, and/or the like may periodically transmit the user profiles to transaction service provider system 110).

[0053] In some non-limiting embodiments or aspects, each respective user profile of the plurality of user profiles may be associated with a respective user. In some non-limiting embodiments or aspects, a user profile may include transaction data associated with at least one payment transaction associated with (e.g., involving) the respective user, address data associated with an address of the respective user, demographic data associated with at least one demographic category associated with the respective user, merchant category group (MCG) data associated with a MCG of at least one respective merchant system associated with each of the at least one payment transaction associated with the respective user, MCG share-of-wallet data associated with an aggregated transaction value associated with each MCG of the MCG data, transaction time data associated with a time at which each payment transaction of the at least one payment transaction was initiated, total transaction volume data associated with an aggregated transaction value of the at least one payment transaction associated with the respective user, and/or the like. In some non-limiting embodiments or aspects, the MCG data may include data associated with at least one of a home improvement MCG, a grocery MCG, a wholesale MCG, and/or the like.

[0054] As shown in FIG.3, at step 304, process 300 may include extracting a first set of user profiles from the plurality of user profiles based on an address of the respective user of each respective user profile. For example, transaction service provider system 110 may extract a first set of user profiles from the plurality of user profiles based on an address of the respective user of each respective user profile.

[0055] In some non-limiting embodiments or aspects, transaction service provider system 110 may receive merchant location data associated with at least one merchant location of merchant (e.g., a merchant associated with merchant system 104 and/or the like). For example, transaction service provider system 110 may receive merchant location data associated with at least one merchant location of merchant system 104 (e.g., at least one store associated with merchant system 104, at least one storefront associated with merchant system 104, at least one kiosk associated with merchant system 104, at least one booth associated with merchant system 104, at least one pop-up location associated with merchant system 104, at least one pick-up and/or drop-off location associated with merchant system 104, at least one outlet associated with merchant system 104, at least one retail location associated with merchant system 104, at least one wholesale location associated with merchant system 104, and/or the like). Additionally or alternatively, transaction service provider system 110 may extract a first set of user profiles from the plurality of user profiles based on the address of the

respective user for each respective user profile and the at least one merchant location associated with merchant system 104. In some non-limiting embodiments or aspects, the at least one merchant location associated with merchant system 104 may include a plurality of merchant locations. In some non-limiting embodiments or aspects, transaction service provider system 110 may extract the first set of user profiles from the plurality of user profiles based on the address of the respective user for each respective user profile, the at least one merchant location associated with merchant system 104, and a range (e.g., a distance measured in miles, a distance measured in an amount of time needed when commuting from the address of the respective user to the at least one merchant location, and/or the like). For example, transaction service provider system 110 may extract the first set of user profiles from the plurality of user profiles based on the address of the respective user for each respective user profile, the at least one merchant location associated with merchant system 104, and the range, where the address of the respective user for each respective user profile that transaction service provider system 110 extracts satisfies the range. In some non-limiting embodiments or aspects, satisfying a range may refer to a value being greater than the range, more than the range, higher than the range, greater than or equal to the range, less than the range, fewer than the range, lower than the range, less than or equal to the range, equal to the range, and/or the like. In some non-limiting embodiments or aspects, transaction service provider system 110 may extract the first set of user profiles from the plurality of user profiles based on the address of the respective user for each respective user profile being within the range of at least one merchant location of the plurality of merchant locations associated with merchant system 104.

[0056] As shown in FIG.3, at step 306, process 300 may include extracting a first subset of user profiles from the first set of user profiles wherein a remaining subset of user profiles comprises each user profile of the first set of user profiles other than the first subset of user profiles. For example, transaction service provider system 110 may extract a first subset of user profiles from the first set of user profiles wherein a remaining subset of user profiles comprises each user profile of the first set of user profiles other than the first subset of user profiles. In some non-limiting embodiments or aspects, the transaction data of each user profile of the first subset of user profiles may include at least one payment transaction associated with (e.g., involving and/or the like) a merchant system of a merchant. For example, the transaction data of each user profile of the first subset of user profiles may include at least one payment transaction associated with (e.g., involving) a merchant system of a merchant prior to (e.g., that was initiated prior to) a first time period.

[0057] As shown in FIG.3, at step 308, process 300 may include extracting a second subset of user profiles and a third subset of user profiles from the remaining subset of user profiles. For example, transaction service provider system 110 may extract a second subset of user profiles and a third subset of user profiles from the remaining subset of user profiles. In such an example, the transaction data of each user profile of the second subset of user profiles may include at least one payment transaction associated with (e.g., involving) merchant system 104 during the first time period. In some non-limiting embodiments or aspects, the third subset of user profiles may include each user profile of the remaining subset of user profiles other than the second subset of user profiles.

[0058] As shown in FIG. 3, at step 310, process 300 may include determining a plurality of feature values for each respective user profile of the second subset of user profiles and the third subset of user profiles. For example, transaction service provider system 110 may determine a plurality of feature values for each respective user profile of the second subset of user profiles and the third subset of user profiles. In such an example, the plurality of feature values may include at least one spending behavior feature value and/or at least one time-related spending behavior feature value. In some non-limiting embodiments or aspects, the at least one spending behavior feature value may be based on the transaction data of the respective user profile. In some non-limiting embodiments or aspects, the at least one time-related spending behavior feature value may be based on a change in at least one of the at least one spending behavior feature value between a second time period and a third time period. For example, the at least one time-related spending behavior feature value may be based on a change in at least one of the at least one spending behavior feature value between a second time period and a third time period, where the second time period and the third time period are both included within the first time period. In some non-limiting embodiments or aspects, the second time period may precede the third time period. In some non-limiting embodiments or aspects, the plurality of feature values for each respective user profile of the second subset of user profiles and the third subset of user profiles may include at least one demographic feature. For example, the plurality of feature values for each respective user profile of the second subset of user profiles and the third subset of user profiles may include at least one demographic feature based on the demographic data of the respective user profile.

[0059] As shown in FIG.3, at step 312, process 300 may include training a predictive model based on the plurality of feature values of the second subset of user profiles and the third subset of user profiles. For example, transaction service provider system 110 may train a predictive model based on the plurality of feature values of the second subset of user profiles and the third subset of user profiles.

In such an example, transaction service provider system 110 may provide the plurality of feature values of the second subset of user profiles and/or the third subset of user profiles as input to the predictive model when training the predictive model. In some non-limiting embodiments or aspects, the predictive model may be a supervised clustering model, a decision tree model, a gradient boosting model, a gradient tree boosting model, any combination thereof, and/or the like.

[0060] In some non-limiting embodiments or aspects, transaction service provider system 110 may generate a prediction for one or more user profiles. For example, transaction service provider system 110 may generate a prediction for one or more user profiles of the third subset of user profiles. In some non-limiting embodiments or aspects, transaction service provider system 110 may generate the prediction for the one or more user profiles of the third subset of user profiles based on the plurality of feature values for the third subset of user profiles. In some non-limiting embodiments or aspects, transaction service provider system 110 may generate the prediction for the one or more user profiles of the third subset of user profiles based on transaction service provider system 110 providing the feature values for the one or more user profiles of the third subset of user profiles as input to the predictive model. For example, transaction service provider system 110 may generate a prediction for the third subset of user profiles based on transaction service provider system 110 providing the feature values for the third subset of user profiles as input to the predictive model. In some non-limiting embodiments or aspects, transaction service provider system 110 may generate an output associated with a prediction for each respective user profile of the third subset of user profiles based on transaction service provider system 110 providing the feature values of the third subset of user profiles as input to the predictive model. In some non-limiting embodiments or aspects, a prediction may be associated with a probability that a user profile is a potential target user profile. For example, a prediction for each respective user profile of the third subset of user profiles may be associated with a probability that the respective user profile is a potential target user profile.

[0061] In some non-limiting embodiments or aspects, a regional score for a region may be determined. For example, transaction service provider system 110 may determine a regional score for a region. In some non-limiting embodiments or aspects, transaction service provider system 110 may determine the regional score for the region based on one or more predictions for one or more user profiles. For example, transaction service provider system 110 may determine the regional score for the region based on one or more predictions for one or more user profiles of the third subset of user profiles. For example, transaction service provider system 110 may determine the regional score for

the region based on one or more predictions for one or more user profiles of the third subset of user profiles, where the address of the respective user of the respective user profiles of the third subset of user profiles is within the region.

[0062] Although the above methods, systems, and computer program products have been described in detail for the purpose of illustration based on what is currently considered to be the most practical and preferred embodiments or aspects, it is to be understood that such detail is solely for that purpose and that the present disclosure is not limited to the described embodiments or aspects but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. For example, it is to be understood that the present disclosure contemplates that, to the extent possible, one or more features of any embodiment or aspect can be combined with one or more features of any other embodiment or aspect.

[0063] FIG.4 illustrates a block diagram of an exemplary computer system for implementing embodiments consistent with the present disclosure.

[0064] In an embodiment, the computer system 400 may be transaction processing system 101, for predicting profile activity of a user profile based on user profiles associated with a geographic region. The computer system 400 may include a central processing unit (“CPU” or “processor”) 402. The processor 402 may comprise at least one data processor for executing program components for executing user or system-generated business processes. The processor 402 may include specialized processing units such as integrated system (bus) controllers, memory management control units, floating point units, graphics processing units, digital signal processing units, etc.

[0065] The processor 402 may be disposed in communication with one or more input/output (I/O) devices (412 and 413) via I/O interface 401. The I/O interface 401 may employ communication protocols/methods such as, without limitation, audio, analog, digital, stereo, IEEE-1394, serial bus, Universal Serial Bus (USB), infrared, PS/2, BNC, coaxial, component, composite, Digital Visual Interface (DVI), high-definition multimedia interface (HDMI), Radio Frequency (RF) antennas, S-Video, Video Graphics Array (VGA), IEEE 802.n /b/g/n/x, Bluetooth, cellular (e.g., Code-Division Multiple Access (CDMA), High-Speed Packet Access (HSPA+), Global System For Mobile Communications (GSM), Long-Term Evolution (LTE) or the like), etc.

[0066] Using the I/O interface 401, the computer system 400 may communicate with one or more I/O devices (412 and 413). In some implementations, the processor 402 may be disposed in communication with a communication network 409 via a network interface 403. The network interface 403 may employ connection protocols including, without limitation, direct connect, Ethernet (e.g., twisted pair 10/100/1000 Base T), Transmission Control Protocol/Internet Protocol (TCP/IP), token ring, IEEE 802.11a/b/g/n/x, etc. Using the network interface 403 and the communication network 409, the computer system 400 may be connected to device 200. The communication network 409 can be implemented as one of the several types of networks, such as intranet or any such wireless network interfaces. The communication network 409 may either be a dedicated network or a shared network, which represents an association of several types of networks that use a variety of protocols, for example, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), Wireless Application Protocol (WAP), etc., to communicate with each other. Further, the communication network 409 may include a variety of network devices, including routers, bridges, servers, computing devices, storage devices, etc.

[0067] In some embodiments, the processor 402 may be disposed in communication with a memory 405 e.g., RAM, and ROM, etc. as shown in Fig 4, via a storage interface 404. The storage interface 404 may connect to memory 405 including, without limitation, memory drives, removable disc drives, etc., employing connection protocols such as Serial Advanced Technology Attachment (SATA), Integrated Drive Electronics (IDE), IEEE-1394, Universal Serial Bus (USB), fiber channel, Small Computer Systems Interface (SCSI), etc. The memory drives may further include a drum, magnetic disc drive, magneto-optical drive, optical drive, Redundant Array of Independent Discs (RAID), solid-state memory devices, solid-state drives, etc.

[0068] The memory 405 may store a collection of program or database components, including, without limitation, user/application, an operating system 407, a web browser 408, a user interface 406, and the like. In some embodiments, computer system 400 may store user/application data, such as the data, variables, records, etc. as described in this invention. Such databases may be implemented as fault-tolerant, relational, scalable, secure databases such as Oracle or Sybase.

[0069] The operating system 407 may facilitate resource management and operation of the computer system 400. Examples of operating systems include, without limitation, Apple Macintosh™ OS X™, UNIX™, Unix-like system distributions (e.g., Berkeley Software Distribution (BSD)),

FreeBSD™, Net BSD™, Open BSD™, etc.), Linux distributions (e.g., Red Hat™, Ubuntu™, K-Ubuntu™, etc.).

[0070] International Business Machines (IBM™) OS/2™, Microsoft Windows™ (XP™, Vista/7/8, etc.), Apple iOS™, Google Android™, Blackberry™ Operating System (OS), or the like. A user interface may facilitate display, execution, interaction, manipulation, or operation of program components through textual or graphical facilities. For example, user interfaces may provide computer interaction interface elements on a display system operatively connected to the computer system 400, such as cursors, icons, check boxes, menus, windows, widgets, etc. Graphical User Interfaces (GUIs) may be employed, including, without limitation, Apple™ Macintosh™ operating systems' Aqua™, IBM™ OS/2™, Microsoft™ Windows™ (e.g., Aero, Metro, etc.), Unix X-Windows™, web interface libraries (e.g., ActiveX, Java, JavaScript, AJAX, HTML, Adobe Flash, etc.), or the like.

[0071] The illustrated steps are set out to explain the exemplary embodiments shown, and it should be anticipated that ongoing technological development will change the manner in which particular functions are performed. These examples are presented herein for purposes of illustration, and not limitation. Further, the boundaries of the functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternative boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope and spirit of the disclosed embodiments. Also, the words "comprising," "having," "containing," and "including," and other similar forms are intended to be equivalent in meaning and be open ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item or items or meant to be limited to only the listed item or items.

[0072] Furthermore, one or more computer-readable storage media may be utilized in implementing embodiments consistent with the present disclosure. A computer readable storage medium refers to any type of physical memory on which information or data readable by a processor may be stored. Thus, a computer readable storage medium may store instructions for execution by one or more processors, including instructions for causing the processor(s) to perform steps or stages consistent with the embodiments described herein. The term "computer readable medium" should be

understood to include tangible items and exclude carrier waves and transient signals, i.e., are non-transitory.

[0073] Examples include random access memory (RAM), read-only memory (ROM), volatile memory, non-volatile memory, hard drives, CD ROMs, DVDs, flash drives, disks, and any other known physical storage media.

[0074] The terms "an embodiment", "embodiment", "embodiments", "the embodiment", "the embodiments", "one or more embodiments", "some embodiments", and "one embodiment" mean "one or more (but not all) embodiments of the invention(s)" unless expressly specified otherwise.

[0075] The terms "including", "comprising", "having" and variations thereof mean "including but not limited to", unless expressly specified otherwise.

[0076] The enumerated listing of items does not imply that any or all the items are mutually exclusive, unless expressly specified otherwise. The terms "a", "an" and "the" mean "one or more", unless expressly specified otherwise.

[0077] A description of an embodiment with several components in communication with each other does not imply that all such components are required. On the contrary, a variety of optional components are described to illustrate the wide variety of possible embodiments of the invention.

[0078] When a single device or article is described herein, it may be readily apparent that more than one device/article (whether they cooperate) may be used in place of a single device/article. Similarly, where more than one device or article is described herein (whether or not they cooperate), it may be readily apparent that a single device/article may be used in place of the more than one device or article or a different number of devices/articles may be used instead of the shown number of devices or programs. The functionality and/or the features of a device may be alternatively embodied by one or more other devices which are not explicitly described as having such functionality/features. Thus, other embodiments of the invention need not include the device itself.

[0079] The illustrated operations of **Fig.3** show certain events occurring in a certain order. In alternative embodiments, certain operations may be performed in a different order, modified, or removed. Moreover, steps may be added to the above described logic and still conform to the described embodiments. Further, operations described herein may occur sequentially or certain

operations may be processed in parallel. Yet further, operations may be performed by a single processing unit or by distributed processing units.

[0080] Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter.

**SYSTEM, METHOD, AND COMPUTER PROGRAM PRODUCT FOR
PREDICTING PROFILE ACTIVITY OF A USER PROFILE BASED ON USER PROFILES
ASSOCIATED WITH A GEOGRAPHIC REGION**

ABSTRACT

Systems, computer-implemented methods, and computer program products for predicting profile activity of a user profile based on user profiles associated with a geographic region may include receiving a plurality of user profiles; extracting a first set of user profiles based on an address of a respective user for each respective user profile; and extracting a first subset, a second subset, and a third subset of user profiles. Transaction data of each user profile of the second subset of user profiles may include at least one payment transaction associated with a first merchant system. The third subset of user profiles may include each user profile of a remaining subset of user profiles other than the second subset of user profiles. Methods may also include determining a plurality of feature values for each respective user profile of the second subset and the third subset of user profiles.

1/4

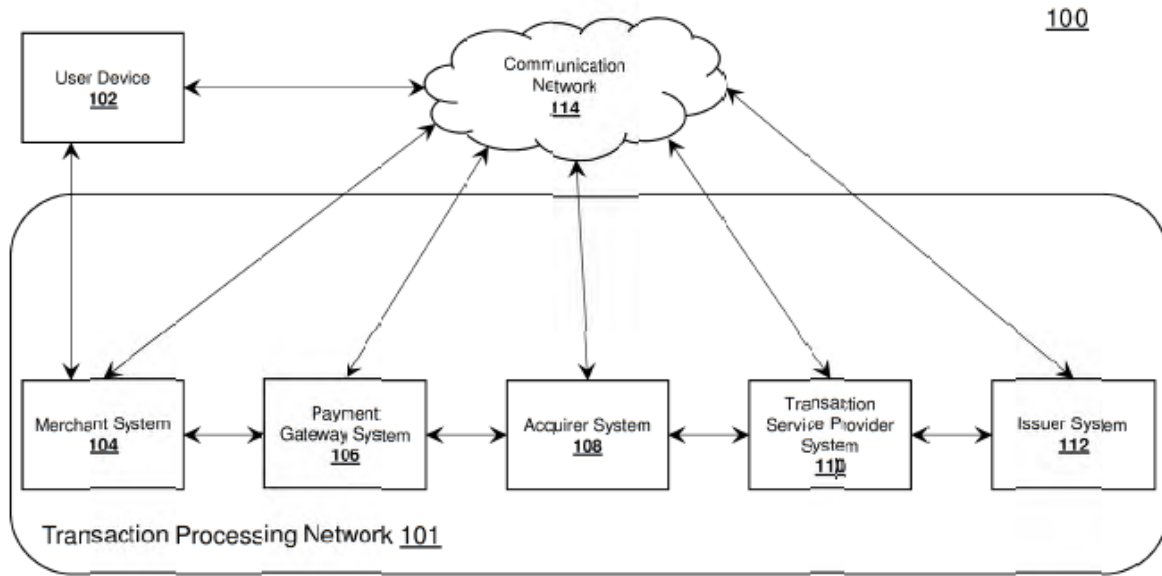


FIG 1

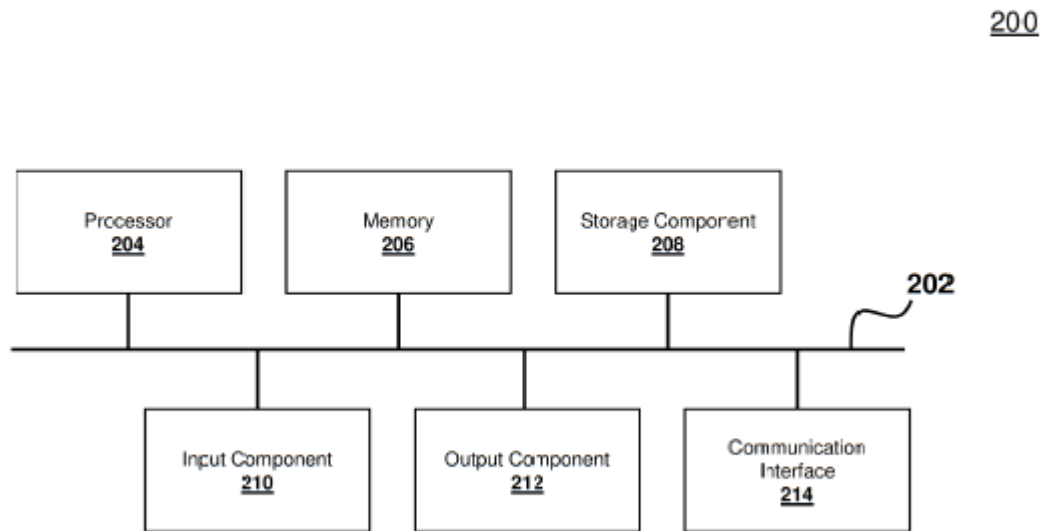


FIG.2

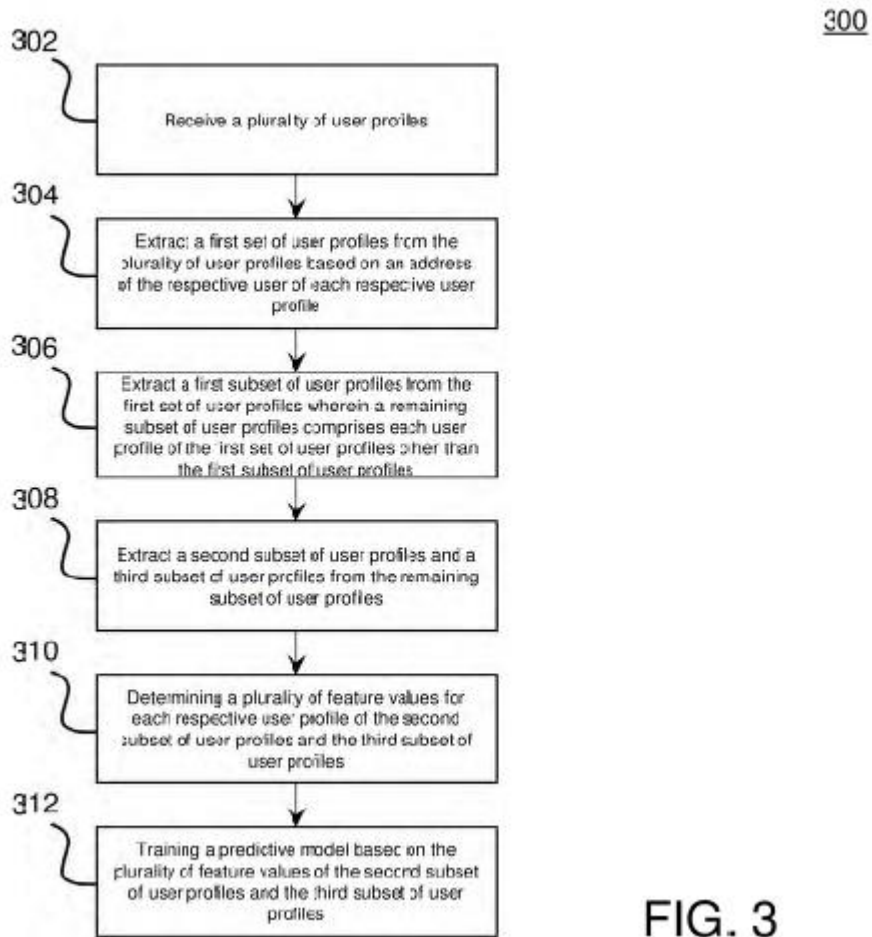


FIG. 3

FIG.3

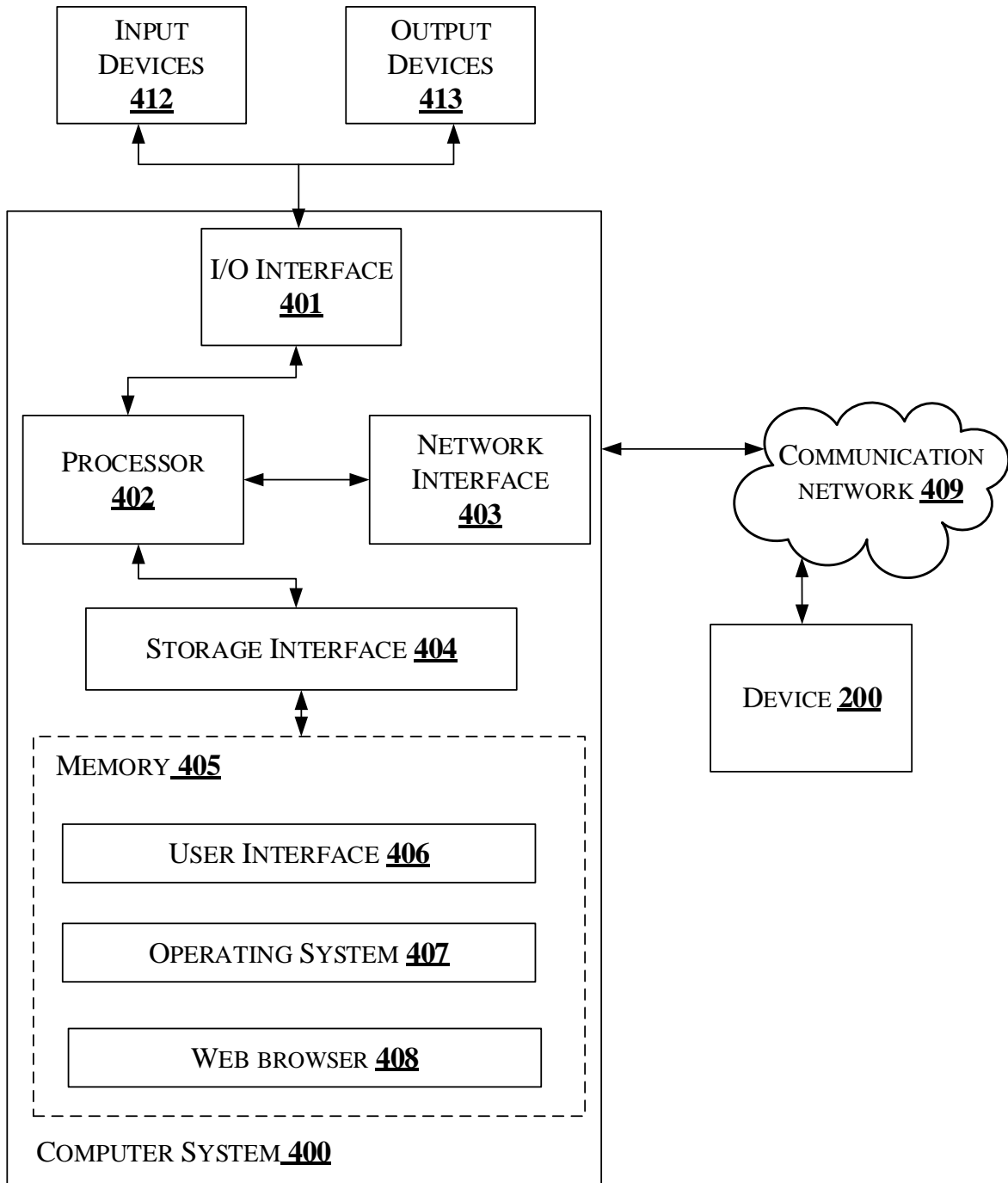


FIG.4