

METHOD AND APPARATUS FOR MINING USER INTENTION BASED ON USER TRANSACTION DATA

TECHNICAL FIELD

[0001] One or more embodiments of this specification relate to the computer field,
5 and in particular, to a method and an apparatus for mining a user intention based on
user transaction data.

BACKGROUND

[0002] Transactions of hundreds of billions of quotas are conducted in an electronic
payment system every day, and the transactions link complex transaction relationship
10 networks between people, merchants, institutions, and the like. Each transaction
involves fund flow of a user, and key information in the transaction may be referred to
as user transaction data, for example, a user involved in the transaction, a fund product
involved in the transaction, or amount information of the transaction. Through analysis
of the user transaction data, an intention behind a series of transactions conducted by
15 the user can be mined. Through the mined user intention, corresponding applications
such as fund path optimization, fund product optimization, and fund risk and safety
guarantee can be performed, and these have a high business value.

[0003] In the prior art, a user intention is mined based on user transaction data, and
requirements in terms of efficiency and accuracy cannot be satisfied.

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SUMMARY

[0004] A method and an apparatus for mining a user intention based on user
transaction data are described in one or more embodiments of this specification, so that
requirements for efficiency and accuracy can be satisfied.

[0005] According to a first aspect, a method for mining a user intention based on user transaction data is provided, and the method includes: obtaining a pre-constructed time-sequence transaction graph, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction; obtaining a user intention sub-graph corresponding to a specific user intention, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type; matching the user intention sub-graph with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and determining, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph relates.

[0006] In a possible implementation, the determining a user intention of a target user to whom the first transaction sub-graph relates includes: determining a user corresponding to a node of an initial fund source in the first transaction sub-graph as a user with the specific user intention.

[0007] In a possible implementation, the matching the user intention sub-graph with the time-sequence transaction graph includes: splitting the time-sequence transaction graph into multiple fund chain sub-graphs, where a start node and an end node of the fund chain sub-graph each have a specified fund container type; and matching the user intention sub-graph with each fund chain sub-graph in a distributed manner, to obtain a first transaction sub-graph included in each fund chain sub-graph.

[0008] In a possible implementation, the obtaining a user intention sub-graph corresponding to a specific user intention includes: displaying nodes respectively corresponding to multiple fund container types; receiving a node selection instruction and a connection establishment instruction of the user; and selecting a node corresponding to a target fund container type according to the node selection instruction, and adding a connection edge between two nodes according to the connection establishment instruction, to obtain the user intention sub-graph.

[0009] In a possible implementation, the obtaining a user intention sub-graph corresponding to a specific user intention includes: receiving a user intention sub-graph described by using domain specific language, where the domain specific language is used to indicate a fund container type of each node included in the user intention sub-graph and a connection edge between two nodes.

[0010] In a possible implementation, each node in the time-sequence transaction graph has corresponding node attribute information, each connection edge has corresponding edge attribute information, and node attribute information and/or edge attribute information of the user intention sub-graph satisfy a preset constraint condition; and the matching the user intention sub-graph with the time-sequence transaction graph includes: separately matching the user intention sub-graph with a graph structure, node attribute information, and/or edge attribute information of the time-sequence transaction graph to obtain the first transaction sub-graph, where node attribute information and/or edge attribute information of the first transaction sub-graph satisfy the constraint condition.

[0011] Further, the node attribute information includes a user identifier corresponding to the node, and the constraint includes a restriction on whether user identifiers of nodes are consistent.

[0012] Further, the edge attribute information includes time information of a transaction corresponding to the connection edge, and the constraint condition includes a restriction on a time sequence of connection edges.

[0013] Further, the edge attribute information includes amount information of a transaction corresponding to the connection edge, and the constraint condition includes a restriction on amounts of connection edges.

[0014] Further, the edge attribute information includes a direction of the connection edge, and the constraint condition includes a restriction on the direction of the connection edge.

[0015] In a possible implementation, each node in the time-sequence transaction graph has corresponding node attribute information, and each connection edge has corresponding edge attribute information; and after the obtaining a first transaction sub-

graph included in the time-sequence transaction graph, the method further includes: obtaining node attribute information of a target node in the first transaction sub-graph or edge attribute information of a target connection edge for display.

[0016] According to a second aspect, an apparatus for mining a user intention based on user transaction data is provided, and the apparatus includes: a first obtaining unit, configured to obtain a pre-constructed time-sequence transaction graph, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction; a second obtaining unit, configured to obtain a user intention sub-graph corresponding to a specific user intention, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type; a matching unit, configured to match the user intention sub-graph obtained by the second obtaining unit with the time-sequence transaction graph obtained by the first obtaining unit, to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and a determining unit, configured to determine, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph obtained by the matching unit relates.

[0017] According to a third aspect, a computer-readable storage medium storing a computer program is provided. When the computer program is executed on a computer, the computer is enabled to perform the method in the first aspect.

[0018] According to a fourth aspect, a computing device including a memory and a processor is provided. The memory stores executable code, and when the processor executes the executable code, the method in the first aspect is implemented.

[0019] According to the method and the apparatus provided in the embodiments of this specification, a pre-constructed time-sequence transaction graph is obtained first, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each

connection edge corresponds to one transaction; then, a user intention sub-graph corresponding to a specific user intention is obtained, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type; then, the user intention sub-graph is matched with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and finally, a user intention of a target user to whom the first transaction sub-graph relates is determined based on the specific user intention. As can be learned from above, in the embodiments of this specification, user transaction data of each user is modeled and abstracted, to construct a time-sequence transaction graph, and a specific user intention is described in a sub-graph mode. In a local sub-graph matching manner, a message propagation mode in a conventional graph iteration process is avoided, so that a user intention is mined infinitely, a user intention of high complexity can be mined, and requirements for efficiency and accuracy can be satisfied.

BRIEF DESCRIPTION OF DRAWINGS

[0020] To describe technical solutions of embodiments of the present invention more clearly, the following briefly describes the accompanying drawings required for describing the embodiments. Clearly, the accompanying drawings in the following descriptions show merely some embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0021] FIG. 1 is a schematic diagram of an implementation scenario according to an embodiment of this specification;

[0022] FIG. 2 is a schematic diagram of a transaction scenario according to an embodiment of this specification;

[0023] FIG. 3 is a schematic diagram of a transaction scenario according to another embodiment of this specification;

[0024] FIG. 4 is a schematic diagram of a transaction scenario according to another

embodiment of this specification;

[0025] FIG. 5 is a flowchart of a method for mining a user intention based on user transaction data according to an embodiment;

[0026] FIG. 6 is a schematic diagram of a composition structure of a time-sequence transaction graph according to an embodiment;

[0027] FIG. 7 shows a user intention sub-graph corresponding to an intention of idle turnover of funds according to an embodiment;

[0028] FIG. 8 shows a user intention sub-graph corresponding to a fund bypass intention according to an embodiment;

[0029] FIG. 9 is a schematic diagram of a matched first transaction sub-graph according to an embodiment; and

[0030] FIG. 10 is a schematic block diagram of an apparatus for mining a user intention based on user transaction data according to an embodiment.

DESCRIPTION OF EMBODIMENTS

[0031] Solutions provided in this specification are described below with reference to accompanying drawings.

[0032] FIG. 1 is a schematic diagram of an implementation scenario according to an embodiment of this specification. This implementation scenario relates to mining of a user intention based on user transaction data. As shown in FIG. 1, after a user opens an account 1 in an electronic payment system, the account 1 is associated with various fund products, for example, a fund product 1, a fund product 2, ..., and a fund product 10. Each fund product may also be associated with multiple sub-products, for example, a fund product 4 is associated with a sub-product 1, a sub-product 2, ..., and a sub-product 5. The various fund products described above may include products within the electronic payment system, such as a consumer credit product, a loan service product, an electronic wallet product, a monetary fund product, and a bank product. Generally, the consumer credit product grants consumption limits of different amounts to users, and during consumption, the user can use the limit in advance and enjoy shopping

experience of consumption before payment; for the loan service product, users can apply for different loan limits based on different credit ratings of the users; the electronic wallet product means that amounts that have been transferred from a bank card or in another manner to an account in the electronic payment system can support recharging, transferring, consumption, and the like; the monetary fund product can be directly used for consumption payment such as shopping, transferring, and payment and repayment in addition to a money management function; and the bank product corresponds to a commercial bank based on a cloud computing architecture in a core system, and the product may include sub-products such as regular deposit, current deposit, and money management. The various fund products described above may further include products external to the electronic payment system, for example, bank cards of various banks bound to the account 1 by the user.

[0033] When the user conducts a transaction using a payment service of the electronic payment system, funds corresponding to the transaction correspondingly flow in fund products. The fund products are carriers for inflow or outflow of the funds, and may be equivalent to containers for storing the funds, and may also be referred to as fund containers. The fund container has a fund container type corresponding to the fund product. User transaction data generated in each transaction generally includes the following information: a fund container for outflow of funds, a fund container for inflow of funds, an account corresponding to the fund container, a transaction purpose, and the like.

[0034] FIG. 2 is a schematic diagram of a transaction scenario according to an embodiment of this specification. As shown in FIG. 2, in this transaction scenario, funds are withdrawn from a fund product 1 of an account 1, and the funds are transferred to a fund product 2 of the account 1 for the purpose of repayment. For example, the fund product 1 is a monetary fund product that corresponds to a fund container of this type, and the fund product 2 is a consumer credit product that corresponds to a fund container of this type. This transaction scenario belongs to flow of funds between different fund containers of the same account.

[0035] FIG. 3 is a schematic diagram of a transaction scenario according to another

embodiment of this specification. As shown in FIG. 3, in this transaction scenario, funds are withdrawn from a fund product 3 of an account 1, and the funds are transferred to a fund product 4 of an account 2 for the purpose of consumption. For example, the fund product 3 is a consumption credit product that corresponds to a fund container of this type, and the fund product 4 is an electronic wallet product that corresponds to a fund container of this type. This transaction scenario belongs to flow of funds between different fund containers of different accounts.

[0036] FIG. 4 is a schematic diagram of a transaction scenario according to another embodiment of this specification. As shown in FIG. 4, in this transaction scenario, a natural person may open multiple accounts in an electronic payment system, each account is associated with a corresponding fund container, and a cross-account transaction may be flow of funds between different fund containers of two different accounts of a natural person. For example, a natural person opens an account 1 and an account 2. The account 1 is associated with a fund product 1, a fund product 2, a fund product 3, a fund product 4, and a fund product 5, and the account 2 is also associated with the fund product 1, the fund product 2, the fund product 3, the fund product 4, and the fund product 5. One cross-account transaction may be flow of funds between a fund container corresponding to the fund product 3 of the account 1 and a fund container corresponding to the fund product 4 of the account 2, and a transaction purpose may be consumption.

[0037] In the embodiments of this specification, based on the various scenarios above, a time-sequence transaction graph can be constructed by using user transaction data of all transactions in the electronic payment system, and the time-sequence transaction graph is mined and analyzed to identify a user intention.

[0038] Time-sequence transaction graph: Funds flow between fund containers as the transaction is conducted, and transactions are conducted in a time sequence. Core information such as a fund container for outflow of funds, a fund container for inflow of funds, transaction time, and an amount in the transaction is abstracted, so that a time-sequence transaction graph can be constructed. The time-sequence transaction graph includes a node and a connection edge. Each node corresponds to a single fund

container of a single user, and each connection edge corresponds to one transaction. Funds flow with time of the edge; in other words, the funds flow with time of the transaction.

5 [0039] Data mining means a non-trivial process of revealing implicit, previously unknown, and potentially valuable information from a large amount of data.

[0040] A user intention means a certain purpose or intention that the user wishes to achieve.

10 [0041] FIG. 5 is a flowchart of a method for mining a user intention based on user transaction data according to an embodiment. The method may be based on the scenario shown in any one of FIG. 1 to FIG. 4. As shown in FIG. 5, in this embodiment, the method for mining a user intention based on user transaction data includes the following steps: Step 51: Obtain a pre-constructed time-sequence transaction graph, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction. Step 52: Obtain a user intention sub-graph corresponding to a specific user intention, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type. Step 53: Match the user intention sub-graph with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure. Step 54: Determine, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph relates. Specific implementations of the previous steps are described below.

25 [0042] First, in step 51, a pre-constructed time-sequence transaction graph is obtained, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction. It can be understood that if each user in an electronic payment system can open multiple accounts, a single node
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can specifically correspond to a single fund container of a single account of a single user.

[0043] FIG. 6 is a schematic diagram of a composition structure of a time-sequence transaction graph according to an embodiment. As shown in FIG. 6, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction. Each circle in the graph represents one node, and a line segment between two circles represents one connection edge. A number in the circle represents a user identifier or an account identifier, and same numbers in different circles represent the same user or account corresponding to different nodes. A letter in the circle represents a fund container type. For example, letter A represents a loan service product, letter B represents a bank card, and letter C represents an electronic wallet product. Magnitude of a number indicated by the connection edge is used to distinguish a sequence of transaction time. For example, a transaction indicated by number 1 is conducted before a transaction indicated by number 2. Text indicated by the connection edge is used to indicate a transaction purpose, for example, lending, recharging, shopping, or repayment. There are 24 funds containers for a total of 6 accounts in the time-sequence transaction graph. It can be understood that the time-sequence transaction graph is merely an example, and some information is omitted in the graph for brevity.

[0044] In this embodiment of this specification, the time-sequence transaction graph may be dynamically updated. In other words, the time-sequence transaction graph can be dynamically updated when a new transaction is conducted. Funds of the user flow in the time-sequence transaction graph, and a user intention behind these transactions can be mined through analysis of flowing nodes, dwelling duration, or a final fund destination.

[0045] Each node in the time-sequence transaction graph has corresponding node attribute information, and each connection edge has corresponding edge attribute information.

[0046] For example, the node attribute information includes a user identifier corresponding to the node or an account identifier corresponding to the node, and the

edge attribute information includes time information of a transaction corresponding to the connection edge, amount information of the transaction corresponding to the connection edge, a direction of the connection edge, a transaction purpose, and the like.

[0047] Then, in step 52, a user intention sub-graph corresponding to a specific user intention is obtained, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type. It can be understood that the target graph structure includes a preset quantity of nodes and a preset quantity of connection edges, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction.

[0048] In this embodiment of this specification, the specific user intention is described in a sub-graph mode, and sub-graphs may be sliced through a visual interface operation; or the specific user intention may be described by code, and a subsequent matching principle and bottom-layer execution logic do not need to be cared about. In this way, a mining threshold is significantly lowered.

[0049] In an example, the obtaining a user intention sub-graph corresponding to a specific user intention includes:

displaying nodes respectively corresponding to multiple fund container types;

receiving a node selection instruction and a connection establishment instruction of the user; and

selecting a node corresponding to a target fund container type according to the node selection instruction, and adding a connection edge between two nodes according to the connection establishment instruction, to obtain the user intention sub-graph.

[0050] In another example, the obtaining a user intention sub-graph corresponding to a specific user intention includes:

[0051] receiving a user intention sub-graph described by using domain specific language (domain specific language, DSL), where the domain specific language is used to indicate a fund container type of each node included in the user intention sub-graph and a connection edge between two nodes.

[0052] In this embodiment of this specification, a corresponding user intention sub-graph can be established for the specific user intention.

[0053] FIG. 7 shows a user intention sub-graph corresponding to an intention of idle turnover of funds according to an embodiment. As shown in FIG. 7, the user intention sub-graph includes four nodes and three connection edges. Fund container types corresponding to the nodes are separately denoted by letters A, B, C, and C. For example, letter A represents a loan service product, letter B represents a bank card, letter C represents an electronic wallet product, fund container A and fund container C correspond to fund products inside an electronic payment system, and fund container B corresponds to a fund product external to the electronic payment system. Text indicated by the connection edge is used to indicate a transaction purpose, for example, lending, recharging, or shopping. The user intention sub-graph corresponds to a series of transaction behaviors of the user. The user lends money to fund container B through fund container A, then the money flows back to fund container C through fund container B, and finally fund container C is used for shopping. It can be understood that the two fund containers C in the graph belong to different accounts. The two different accounts may belong to the same user, or may belong to different users. An ultimate purpose of a transaction conducted by the user is shopping, some transaction behaviors are unnecessary, and funds do not need to flow through some fund containers. Therefore, the user intention sub-graph corresponds to a user intention of idle turnover of funds. The user's transaction behavior can be simplified by guiding and optimizing the user's transaction behavior.

[0054] FIG. 8 shows a user intention sub-graph corresponding to a fund bypass intention according to an embodiment. As shown in FIG. 8, the user intention sub-graph includes three nodes and two connection edges. Fund container types corresponding to the nodes are separately denoted by letters B, D, and B. For example, letter B represents a bank card, letter D represents a monetary fund product, fund container D corresponds to a fund product inside an electronic payment system, and fund container B corresponds to a fund product external to the electronic payment system. The user intention sub-graph corresponds to a series of transaction activities of the user. The user

subscribes to funds in fund container D by using funds in fund container B, and then redeems the funds to fund container B. It can be understood that two fund containers B in the graph merely indicate the same fund container type, and are essentially two different fund containers. The user intention in such a mode may only use the fund container inside the electronic payment system to transfer funds, and this may affect benefits of the electronic payment system. Transaction behaviors of a user with a fund bypass intention can be limited to some extent, to eliminate or reduce adverse impact on a platform.

[0055] In an example, each node in the time-sequence transaction graph has corresponding node attribute information, each connection edge has corresponding edge attribute information, and node attribute information and/or edge attribute information of the user intention sub-graph need to satisfy a preset constraint condition in addition to having the specified target graph structure.

[0056] Further, the node attribute information includes a user identifier corresponding to the node, and the constraint includes a restriction on whether user identifiers of nodes are consistent.

[0057] For example, the user intention sub-graph includes node A and node B, and the constraint condition includes: user identifiers of node A and node B are the same.

[0058] Further, the edge attribute information includes time information of a transaction corresponding to the connection edge, and the constraint condition includes a restriction on a time sequence of connection edges.

[0059] For example, the user intention sub-graph includes connection edge E1, connection edge E2, and connection edge E3, and the constraint condition includes: time of E1 is earlier than time of E2, and time of E2 is earlier than time of E3.

[0060] Further, the edge attribute information includes amount information of a transaction corresponding to the connection edge, and the constraint condition includes a restriction on amounts of connection edges.

[0061] For example, the user intention sub-graph includes connection edge E1, connection edge E2, and connection edge E3, and the constraint condition includes: an amount of E1 is greater than or equal to an amount of E2, and the amount of E2 is

greater than or equal to an amount of E3.

[0062] Further, the edge attribute information includes a direction of the connection edge, and the constraint condition includes a restriction on the direction of the connection edge.

5 **[0063]** For example, the user intention sub-graph includes node A, node B, node C, and node D, and connection edge E1, connection edge E2, and connection edge E3, and the constraint condition includes: a direction of E1 is from node A to node B, a direction of E2 is from node B to node C, and a direction of E3 is from node C to node D. It can be understood that the direction of the connection edge represents a flowing direction
10 of funds.

[0064] Then, in step 53, the user intention sub-graph is matched with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure. It can be understood that the first transaction sub-graph is a sub-graph of the
15 time-sequence transaction graph.

[0065] In this embodiment of this specification, the matching the user intention sub-graph with the time-sequence transaction graph may be: establishing a correspondence between nodes and connection edges of two graphs based on a mode identification method of a graph theory, and this is a combinatorial optimization problem, and can be
20 solved by using a discrete optimization method or a continuous optimization method.

[0066] In an embodiment, the matching the user intention sub-graph with the time-sequence transaction graph includes:

splitting the time-sequence transaction graph into multiple fund chain sub-graphs, where a start node and an end node of the fund chain sub-graph each have a
25 specified fund container type; and

matching the user intention sub-graph with each fund chain sub-graph in a distributed manner, to obtain a first transaction sub-graph included in each fund chain sub-graph.

[0067] In this example, the time-sequence transaction graph is split into fund chain
30 sub-graphs, and then the user intention sub-graph is matched with each fund chain sub-

graph in a distributed manner, so that a problem of inclined resources or prominent hotspots during direct matching of a large-scale time-sequence transaction graph can be resolved.

[0068] In this embodiment of this specification, in the foregoing distributed execution process, fund chain sub-graphs of specific data can be evenly allocated to multiple stations. For example, there are 100 fund chain sub-graphs and 5 stations in total, and 20 fund chain sub-graphs can be allocated to each station. After the fund chain sub-graphs are matched with the user intention sub-graph, a user with a specific user intention in the fund chain sub-graph can be found, and after matching for all stations, a total quantity of people with a specific user intention can be collected to mine the user intention. When there are multiple preset user intentions, the preset user intentions are matched in sequence, so that intention people corresponding to all configured preset user intentions can be mined.

[0069] It can be understood that splitting the time-sequence transaction graph into multiple fund chain sub-graphs is essentially splitting a large graph into multiple smaller graphs. The splitting can be specifically performed according to a preset rule. The rule is set flexibly, and different rules may be set in different scenarios. For example, the rule can be to classify several nodes for which transaction time differences are within a predetermined range into one fund chain sub-graph, or can be to classify several nodes for which transaction amount differences are within a predetermined range into one fund chain sub-graph.

[0070] Optionally, a start node and an end node of the fund chain sub-graph may have a specified fund container type, which is a fund container type capable of representing an initial source of funds, for example, a bank card, a consumer credit product, or a loan service product.

[0071] In an example, each node in the time-sequence transaction graph has corresponding node attribute information, each connection edge has corresponding edge attribute information, and node attribute information and/or edge attribute information of the user intention sub-graph satisfy a preset constraint condition.

[0072] The matching the user intention sub-graph with the time-sequence

transaction graph includes:

separately matching the user intention sub-graph with a graph structure, node attribute information, and/or edge attribute information of the time-sequence transaction graph to obtain the first transaction sub-graph, where node attribute
5 information and/or edge attribute information of the first transaction sub-graph satisfy the constraint condition.

[0073] FIG. 9 is a schematic diagram of a matched first transaction sub-graph according to an embodiment. As shown in FIG. 9, the time-sequence transaction graph shown in FIG. 6 is matched with the user intention sub-graph corresponding to the
10 intention of idle turnover of funds shown in FIG. 7 to obtain a first intention sub-graph within a rectangular box. It can be understood that the first intention sub-graph is a sub-graph of the time-sequence transaction graph, and the first intention sub-graph and the user intention sub-graph each have a target graph structure, and node attribute information and/or edge attribute information satisfy a preset constraint condition.

[0074] Finally, in step 54, a user intention of a target user to whom the first transaction sub-graph relates is determined based on the specific user intention. It can be understood that the nodes included in the first transaction sub-graph may correspond
15 to the same user, or may correspond to different users. When the first transaction sub-graph relates to multiple users, user intentions of the users may be separately determined for each user, or may be determined only for some users.
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[0075] In an example, the determining a user intention of a target user to whom the first transaction sub-graph relates includes:

determining a user corresponding to a node of an initial fund source in the first transaction sub-graph as a user with the specific user intention.

[0076] In an example, each node in the time-sequence transaction graph has corresponding node attribute information, and each connection edge has corresponding
25 edge attribute information.

[0077] After the obtaining a first transaction sub-graph included in the time-sequence transaction graph, the method further includes:

30 obtaining node attribute information of a target node in the first transaction

sub-graph or edge attribute information of a target connection edge for display.

[0078] For example, node attribute information such as a user identifier of node A in the first transaction sub-graph or a fund container type of node A can be obtained, and a transaction purpose corresponding to connection edge E2 in the first transaction sub-graph and edge attribute information such as a transaction amount corresponding to connection edge E1 can be obtained.

[0079] According to the method provided in this embodiment of this specification, a pre-constructed time-sequence transaction graph is obtained first, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction; then, a user intention sub-graph corresponding to a specific user intention is obtained, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type; then, the user intention sub-graph is matched with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and finally, a user intention of a target user to whom the first transaction sub-graph relates is determined based on the specific user intention. As can be learned from above, in the embodiments of this specification, user transaction data of each user is modeled and abstracted, to construct a time-sequence transaction graph, and a specific user intention is described in a sub-graph mode. In a local sub-graph matching manner, a message propagation mode in a conventional graph iteration process is avoided, so that a user intention is mined infinitely, a user intention of high complexity can be mined, and requirements for efficiency and accuracy can be satisfied.

[0080] According to an embodiment in another aspect, an apparatus for mining a user intention based on user transaction data is further provided. The apparatus is configured to perform the method provided in the embodiments of this specification. FIG. 10 is a schematic block diagram of an apparatus for mining a user intention based on user transaction data according to an embodiment. As shown in FIG. 10, the

apparatus 1000 includes:

a first obtaining unit 1001, configured to obtain a pre-constructed time-sequence transaction graph, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction;

a second obtaining unit 1002, configured to obtain a user intention sub-graph corresponding to a specific user intention, where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type;

a matching unit 1003, configured to match the user intention sub-graph obtained by the second obtaining unit 1002 with the time-sequence transaction graph obtained by the first obtaining unit 1001, to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and

a determining unit 1004, configured to determine, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph obtained by the matching unit 1003 relates.

[0081] Optionally, in an embodiment, the determining unit 1004 is specifically configured to determine a user corresponding to a node of an initial fund source in the first transaction sub-graph as a user with the specific user intention.

[0082] Optionally, in an embodiment, the matching unit 1003 includes:

a splitting sub-unit, configured to split the time-sequence transaction graph into multiple fund chain sub-graphs, where a start node and an end node of the fund chain sub-graph each have a specified fund container type; and

an execution sub-unit, configured to match, in a distributed manner, the user intention sub-graph with each fund chain sub-graph obtained by the splitting sub-unit, to obtain a first transaction sub-graph included in each fund chain sub-graph.

[0083] Optionally, in an embodiment, the second obtaining unit 1002 includes:

a displaying sub-unit, configured to display nodes respectively

corresponding to multiple fund container types;

a receiving sub-unit, configured to receive a node selection instruction and a connection establishment instruction of the user; and

5 a construction sub-unit, configured to: select a node corresponding to a target fund container type according to the node selection instruction received by the receiving sub-unit, and add a connection edge between two nodes according to the connection establishment instruction received by the receiving sub-unit, to obtain the user intention sub-graph.

[0084] Optionally, in an embodiment, the second obtaining unit 1002 is specifically
10 configured to receive a user intention sub-graph described by using domain specific language, where the domain specific language is used to indicate a fund container type of each node included in the user intention sub-graph and a connection edge between two nodes.

[0085] Optionally, in an embodiment, each node in the time-sequence transaction
15 graph has corresponding node attribute information, each connection edge has corresponding edge attribute information, and node attribute information and/or edge attribute information of the user intention sub-graph satisfy a preset constraint condition.

[0086] The matching unit 1003 is specifically configured to separately match the
20 user intention sub-graph with a graph structure, node attribute information, and/or edge attribute information of the time-sequence transaction graph to obtain the first transaction sub-graph, where node attribute information and/or edge attribute information of the first transaction sub-graph satisfy the constraint condition.

[0087] Further, the node attribute information includes a user identifier
25 corresponding to the node, and the constraint includes a restriction on whether user identifiers of nodes are consistent.

[0088] Further, the edge attribute information includes time information of a transaction corresponding to the connection edge, and the constraint condition includes a restriction on a time sequence of connection edges.

[0089] Further, the edge attribute information includes amount information of a
30 transaction corresponding to the connection edge, and the constraint condition includes

a restriction on amounts of connection edges.

[0090] Further, the edge attribute information includes a direction of the connection edge, and the constraint condition includes a restriction on the direction of the connection edge.

5 **[0091]** Optionally, in an embodiment, each node in the time-sequence transaction graph has corresponding node attribute information, and each connection edge has corresponding edge attribute information.

[0092] The apparatus further includes:

a third obtaining unit, configured to: after the matching unit 1003 obtains
10 the first transaction sub-graph included in the time-sequence transaction graph, obtain node attribute information of a target node in the first transaction sub-graph or edge attribute information of a target connection edge for display.

[0093] According to the apparatus provided in this embodiment of this specification, a first obtaining unit 1001 first obtains a pre-constructed time-sequence transaction
15 graph, where the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph includes a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction; then, a second obtaining unit 1002 obtains a user intention sub-graph corresponding to a specific user intention,
20 where the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type; then, a matching unit 1003 matches the user intention sub-graph with the time-sequence transaction graph to obtain a first transaction sub-graph included in the time-sequence transaction graph, where the first transaction sub-graph has the target graph structure; and finally, a
25 determining unit 1004 determines, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph relates. As can be learned from above, in this embodiment of this specification, user transaction data of each user is modeled and abstracted, to construct a time-sequence transaction graph, and a specific user intention is described in a sub-graph mode. In a local sub-graph matching manner,
30 a message propagation mode in a conventional graph iteration process is avoided, so

that a user intention is mined infinitely, a user intention of high complexity can be mined, and requirements for efficiency and accuracy can be satisfied.

5 [0094] According to an embodiment in another aspect, a computer-readable storage medium is further provided. The computer-readable storage medium stores a computer program, and when the computer program is executed by a computer, the computer is enabled to perform the method described with reference to FIG. 5.

10 [0095] According to an embodiment in still another aspect, a computing device including a memory and a processor is further provided. The memory stores executable code, and when the processor executes the executable code, the method described with reference to FIG. 5 is implemented.

[0096] A person skilled in the art should be aware that in the foregoing one or more examples, functions described in the present invention may be implemented by hardware, software, firmware, or any combination thereof. When implemented by using software, these functions may be stored in a computer-readable medium or transmitted as one or more instructions or code on the computer-readable medium.

15 [0097] The objectives, technical solutions, and beneficial effects of the present invention are further described in detail in the foregoing specific implementations. It should be understood that the foregoing descriptions are merely specific implementations of the present invention, but are not intended to limit the protection scope of the present invention. Any modification, equivalent replacement, improvement, or the like made on a basis of the technical solutions of the present invention shall fall within the protection scope of the present invention.

CLAIMS

What is claimed is:

1. A method for mining a user intention based on user transaction data, wherein the method comprises:

5 obtaining a pre-constructed time-sequence transaction graph, wherein the time-sequence transaction graph is constructed based on user transaction data of each user, the time-sequence transaction graph comprises a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction;

10 obtaining a user intention sub-graph corresponding to a specific user intention, wherein the user intention sub-graph has a specified target graph structure, and each node in the target graph structure has a specified fund container type;

 matching the user intention sub-graph with the time-sequence transaction graph to obtain a first transaction sub-graph comprised in the time-sequence transaction graph,
15 wherein the first transaction sub-graph has the target graph structure; and

 determining, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph relates.

2. The method according to claim 1, wherein the determining a user intention of a target user to whom the first transaction sub-graph relates comprises:

20 determining a user corresponding to a node of an initial fund source in the first transaction sub-graph as a user with the specific user intention.

3. The method according to claim 1, wherein the matching the user intention sub-graph with the time-sequence transaction graph comprises:

 splitting the time-sequence transaction graph into multiple fund chain sub-graphs,
25 wherein a start node and an end node of the fund chain sub-graph each have a specified fund container type; and

 matching the user intention sub-graph with each fund chain sub-graph in a distributed manner, to obtain a first transaction sub-graph comprised in each fund chain sub-graph.

4. The method according to claim 1, wherein the obtaining a user intention sub-graph corresponding to a specific user intention comprises:

displaying nodes respectively corresponding to multiple fund container types;

receiving a node selection instruction and a connection establishment instruction

5 of the user; and

selecting a node corresponding to a target fund container type according to the node selection instruction, and adding a connection edge between two nodes according to the connection establishment instruction, to obtain the user intention sub-graph.

5. The method according to claim 1, wherein the obtaining a user intention sub-graph corresponding to a specific user intention comprises:

receiving a user intention sub-graph described by using domain specific language, wherein the domain specific language is used to indicate a fund container type of each node comprised in the user intention sub-graph and a connection edge between two nodes.

6. The method according to claim 1, wherein each node in the time-sequence transaction graph has corresponding node attribute information, each connection edge has corresponding edge attribute information, and node attribute information and/or edge attribute information of the user intention sub-graph satisfy a preset constraint condition; and

the matching the user intention sub-graph with the time-sequence transaction graph comprises:

separately matching the user intention sub-graph with a graph structure, node attribute information, and/or edge attribute information of the time-sequence transaction graph to obtain the first transaction sub-graph, wherein node attribute information and/or edge attribute information of the first transaction sub-graph satisfy the constraint condition.

7. The method according to claim 6, wherein the node attribute information comprises a user identifier corresponding to the node, and the constraint comprises a restriction on whether user identifiers of nodes are consistent.

8. The method according to claim 6, wherein the edge attribute information

comprises time information of a transaction corresponding to the connection edge, and the constraint condition comprises a restriction on a time sequence of connection edges.

9. The method according to claim 6, wherein the edge attribute information comprises amount information of a transaction corresponding to the connection edge,
5 and the constraint condition comprises a restriction on amounts of connection edges.

10. The method according to claim 6, wherein the edge attribute information comprises a direction of the connection edge, and the constraint condition comprises a restriction on the direction of the connection edge.

11. The method according to claim 1, wherein each node in the time-sequence
10 transaction graph has corresponding node attribute information, and each connection edge has corresponding edge attribute information; and

after the obtaining a first transaction sub-graph comprised in the time-sequence transaction graph, the method further comprises:

obtaining node attribute information of a target node in the first transaction sub-
15 graph or edge attribute information of a target connection edge for display.

12. An apparatus for mining a user intention based on user transaction data, wherein the apparatus comprises:

a first obtaining unit, configured to obtain a pre-constructed time-sequence transaction graph, wherein the time-sequence transaction graph is constructed based on
20 user transaction data of each user, the time-sequence transaction graph comprises a node and a connection edge, a single node corresponds to a single fund container of a single user, and each connection edge corresponds to one transaction;

a second obtaining unit, configured to obtain a user intention sub-graph corresponding to a specific user intention, wherein the user intention sub-graph has a
25 specified target graph structure, and each node in the target graph structure has a specified fund container type;

a matching unit, configured to match the user intention sub-graph obtained by the second obtaining unit with the time-sequence transaction graph obtained by the first obtaining unit, to obtain a first transaction sub-graph comprised in the time-sequence
30 transaction graph, wherein the first transaction sub-graph has the target graph structure;

and

a determining unit, configured to determine, based on the specific user intention, a user intention of a target user to whom the first transaction sub-graph obtained by the matching unit relates.

5 13. A computer-readable storage medium storing a computer program, wherein when the computer program is executed on a computer, the computer is enabled to perform the method according to any one of claims 1 to 11.

10 14. A computing device, comprising a memory and a processor, wherein the memory stores executable code, and when the processor executes the executable code, the method according to any one of claims 1 to 11 is implemented.