

CLAIMS

1. A method of searching a group based on a social network, comprising:
 - receiving a group search request transmitted by a query terminal, wherein the group search request contains a specified query user identification (ID), a specified group scale, and a group coritivity, wherein the group coritivity defines a minimum number of group members adjacent to other members;
 - retrieving a pre-generated social network graph in response to the group search request, wherein the social network graph is generated according to social relation data in a social network site, and the social network graph comprises a plurality of user nodes and an edge set configured to connect the user nodes;
 - constructing a breadth first search (BFS) tree using the user node corresponding to the query user ID as a root node, wherein the BFS tree traverses all the user nodes in the social network graph starting from the query user ID, successively;
 - determining a shortest social distance from each user node to the root node according to the constructed BFS tree;
 - calculating a difference between the group scale and the shortest social distance, wherein the user node corresponding to the difference being not greater than 1 is defined as a pruning node;
 - removing the pruning node and an edge set associated with the pruning node in the social network graph, and generating a pruned social network graph;
 - searching whether there exists a user node corresponding to the node coritivity being less than the group coritivity in the user nodes of the pruned social network graph or not, wherein the node coritivity is the number of nodes adjacent to the user node;
 - removing the searched user node from the pruned social network and updating the pruned social network graph when the user node exists;
 - performing search expansion using the user node corresponding to the query user ID as a starting node according to the social network graph, and determining a user node having a maximum number of adjacent nodes in the social network graph as a

group member in each search expansion layer until the number of determined group members equals to the group scale;

wherein the user node included in a first level of the expansion layer is an adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer;

forming a group to be searched by the determined group members and the query user; and

determining whether a group coritivity of the group to be searched is no less than the specified group coritivity or not, and feeding back the group to be searched as a query result to the query terminal for displaying when the group coritivity of the group to be searched is no less than the specified group coritivity.

2. The method of claim 1, wherein performing the search expansion using the user node corresponding to the query user ID as the starting node according to the social network graph, and determining the user node having the maximum number of adjacent nodes in the social network graph as the group member in each search expansion layer until the number of determined group members equals to the group scale; wherein the user node included in a first level of the expansion layer is an adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer, comprises:

locating the user node at which the query user ID is located in the social network graph, and performing a layer expansion using the located user node as the starting node to generate a first expansion layer of an expansion subgraph, wherein the user node included in the first expansion layer is the user node adjacent to the query user;

determining a group member from the first expansion layer of the expansion subgraph, wherein the user node corresponding to the group member is the user node having the maximum number of adjacent nodes in the social network graph; and

performing an expansion of the next level of expansion layer of the expansion

subgraph using the user node corresponding to the group member in the first expansion layer as the starting node, and determining a new group member in a corresponding expansion layer until the number of the determined group members equals to the group scale.

3. The method of claim 1, wherein there is a plurality of determined groups to be searched; the method further comprises:

determining edge sets between the group members in the groups to be searched according to the social network graph, and constructing a group network graph of each group to be searched using the group members as the user nodes according to the determined edge sets;

calculating an intimacy degree of each group network graph; and

feeding back the group to be searched corresponding to the group network graph with a maximum intimacy degree as the query result to the query terminal for displaying.

4. The method of claim 3, wherein a formula of calculating the intimacy degree of the group network graph is:

$$Co(G) = \sum_{(u,v) \in E} \omega(u,v)$$

wherein $Co(G)$ is the intimacy degree of the group, $G = (V, E)$ is the group network graph, V is a set of vertices in the group network graph, E is an edge set in the group network graph,

$$\text{nodes } u, v \in V, \text{ and } (u, v) \in E, \quad \omega(u, v) = \frac{|N(u) \cap N(v)| + 1}{|N(u) \cup N(v)|},$$

wherein $N(u)$ is an adjacent node set of node u , $|N(u) \cap N(v)|$ is the number of common nodes of node u and node v .

5. A server comprising a processor, and a memory storing computer executable instructions, which, when executed by the processor cause the processor to perform steps comprising:

receiving a group search request transmitted by a query terminal, wherein the group search request contains a specified query user identification (ID), a specified group scale, and a group coritivity, wherein the group coritivity defines a minimum number of group members adjacent to other members;

retrieving a pre-generated social network graph in response to the group search request, wherein the social network graph is generated according to social relation data in a social network site, and the social network graph comprises a plurality of user nodes and an edge set configured to connect the user nodes;

constructing a breadth first search (BFS) tree using the user node corresponding to the query user ID as a root node, wherein the BFS tree traverses all the user nodes in the social network graph starting from the query user ID, successively;

determining a shortest social distance from each user node to the root node according to the constructed BFS tree;

calculating a difference between the group scale and the shortest social distance, wherein the user node corresponding to the difference being not greater than 1 is defined as a pruning node;

removing the pruning node and an edge set associated with the pruning node in the social network graph, and generating a pruned social network graph;

searching whether there exists a user node corresponding to the node coritivity being less than the group coritivity in the user nodes of the pruned social network graph or not, wherein the node coritivity is the number of nodes adjacent to the user node;

removing the searched user node from the pruned social network and updating the pruned social network graph when the user node exists;

performing search expansion using the user node corresponding to the query user ID as a starting node according to the social network graph, and determining a user node having a maximum number of adjacent nodes in the social network graph as a group member in each search expansion layer until the number of determined group members equals to the group scale;

wherein the user node included in a first level of the expansion layer is an

adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer;

forming a group to be searched by the determined group members and the query user; and

determining whether a group coritivity of the group to be searched is no less than the specified group coritivity or not, and feeding back the group to be searched as a query result to the query terminal for displaying when the group coritivity of the group to be searched is no less than the specified group coritivity.

6. The server of claim 5, wherein after executing step of retrieving a pre-generated social network graph in response to the group search request, wherein the social network graph is generated according to social relation data in a social network site, and the social network graph comprises a plurality of user nodes and an edge set configured to connect the user nodes, the processor further executes steps comprising:

constructing a BFS tree using the user node corresponding to the query user ID as a root node, wherein the BFS tree traverses all the user nodes in the social network graph starting from the query user ID, successively;

determining a shortest social distance from each user node to the root node according to the constructed BFS tree; and

calculating a difference between the group scale and the shortest social distance, wherein the user node corresponding to the difference being not greater than 1 is defined as a pruning node, removing the pruning node and an edge set associated with the pruning node in the social network graph, and generating a pruned social network graph.

7. The server of claim 6, wherein after executing step of calculating the difference between the group scale and the shortest social distance, the user node corresponding to the difference being not greater than 1 is defined as a pruning node, the pruning node and the edge set associated with the pruning node are removed in the social

network graph, and generating the pruned social network graph, the processor further executes steps comprising:

- searching whether there exists a user node corresponding to the node coritvity being less than the group coritvity in the user nodes of the pruned social network graph or not, wherein the node coritvity is the number of nodes adjacent to of the user node, and

- removing the searched user node from the pruned social network and updating the pruned social network graph when the user node exists.

8. The server of claim 5, wherein the processor executes performing the search expansion using the user node corresponding to the query user ID as the starting node according to the social network graph, and determining the user node having the maximum number of adjacent nodes in the social network graph as the group member in each search expansion layer until the number of determined group members equals to the group scale;

- wherein the user node included in a first level of the expansion layer is an adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer, which comprises:

- locating the user node at which the query user ID is located in the social network graph, and performing a layer expansion using the located user node as the starting node to generate a first expansion layer of an expansion subgraph, wherein the user node included in the first expansion layer is the user node adjacent to the query user;

- determining a group member from the first expansion layer of the expansion subgraph, wherein the user node corresponding to the group member is the user node having the maximum number of adjacent nodes in the social network graph; and

- performing an expansion of the next level of expansion layer of the expansion subgraph using the user node corresponding to the group member in the first expansion layer as the starting node, and determining a new group member in a corresponding expansion layer until the number of the determined group members

equals to the group scale.

9. The server of claim 5, wherein there is a plurality of determined groups to be searched; the processor further executes following steps:

determining edge sets between the group members in the groups to be searched according to the social network graph, and constructing a group network graph of each group to be searched using the group members as the user nodes according to the determined edge sets;

calculating an intimacy degree of each group network graph; and

feeding back the group to be searched corresponding to the group network graph with a maximum intimacy degree as the query result to the query terminal for displaying.

10. The server of claim 9, wherein a formula of calculating the intimacy degree of the group network graph is:

$$Co(G) = \sum_{(u,v) \in E} \omega(u,v)$$

wherein $Co(G)$ is the intimacy degree of the group, $G = (V, E)$ is the group network graph, V is a set of vertices in the group network graph, E is an edge set in the group network graph,

$$\text{nodes } u, v \in V, \text{ and } (u, v) \in E, \quad \omega(u, v) = \frac{|N(u) \cap N(v)| + 1}{|N(u) \cup N(v)|},$$

wherein $N(u)$ is an adjacent node set of node u , $|N(u) \cap N(v)|$ is the number of common nodes of node u and node v .

11. At least one non-transitory computer-readable medium storing computer executable instructions, which, when executed by at least one processor cause the at least one processor to perform steps comprising:

receiving a group search request transmitted by a query terminal, wherein the group search request contains a specified query user identification (ID), a specified group scale, and a group coritivity, wherein the group coritivity defines a minimum

number of group members adjacent to other members;

retrieving a pre-generated social network graph in response to the group search request, wherein the social network graph is generated according to social relation data in a social network site, and the social network graph comprises a plurality of user nodes and an edge set configured to connect the user nodes;

constructing a breadth first search (BFS) tree using the user node corresponding to the query user ID as a root node, wherein the BFS tree traverses all the user nodes in the social network graph starting from the query user ID, successively;

determining a shortest social distance from each user node to the root node according to the constructed BFS tree;

calculating a difference between the group scale and the shortest social distance, wherein the user node corresponding to the difference being not greater than 1 is defined as a pruning node;

removing the pruning node and an edge set associated with the pruning node in the social network graph, and generating a pruned social network graph;

searching whether there exists a user node corresponding to the node coritivity being less than the group coritivity in the user nodes of the pruned social network graph or not, wherein the node coritivity is the number of nodes adjacent to the user node;

removing the searched user node from the pruned social network and updating the pruned social network graph when the user node exists;

performing search expansion using the user node corresponding to the query user ID as a starting node according to the social network graph, and determining a user node having a maximum number of adjacent nodes in the social network graph as a group member in each search expansion layer until the number of determined group members equals to the group scale;

wherein the user node included in a first level of the expansion layer is an adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer;

forming a group to be searched by the determined group members and the query user; and

determining whether a group coritivity of the group to be searched is no less than the specified group coritivity or not, and feeding back the group to be searched as a query result to the query terminal for displaying when the group coritivity of the group to be searched is no less than the specified group coritivity.

12. The non-transitory computer-readable medium of claim 11, wherein after executing step of retrieving a pre-generated social network graph in response to the group search request, wherein the social network graph is generated according to social relation data in a social network site, and the social network graph comprises a plurality of user nodes and an edge set configured to connect the user nodes, the processor further executes steps comprising:

constructing a BFS tree using the user node corresponding to the query user ID as a root node, wherein the BFS tree traverses all the user nodes in the social network graph starting from the query user ID, successively;

determining a shortest social distance from each user node to the root node according to the constructed BFS tree; and

calculating a difference between the group scale and the shortest social distance, wherein the user node corresponding to the difference being not greater than 1 is defined as a pruning node, removing the pruning node and an edge set associated with the pruning node in the social network graph, and generating a pruned social network graph.

13. The non-transitory computer-readable medium of claim 12, wherein after executing step of calculating the difference between the group scale and the shortest social distance, the user node corresponding to the difference being not greater than 1 is defined as a pruning node, the pruning node and the edge set associated with the pruning node are removed in the social network graph, and generating the pruned social network graph, the processor further executes steps comprising:

searching whether there exists a user node corresponding to the node coritivity being less than the group coritivity in the user nodes of the pruned social network graph or not, wherein the node coritivity is the number of nodes adjacent to of the user node, and

removing the searched user node from the pruned social network and updating the pruned social network graph when the user node exists.

14. The non-transitory computer-readable medium of claim 11, the processor executes performing the search expansion using the user node corresponding to the query user ID as the starting node according to the social network graph, and determining the user node having the maximum number of adjacent nodes in the social network graph as the group member in each search expansion layer until the number of determined group members equals to the group scale;

wherein the user node included in a first level of the expansion layer is an adjacent node of the query user, and the user node included in a next level of expansion layer is the user node adjacent to the group member determined by an upper level of the expansion layer, which comprises:

locating the user node at which the query user ID is located in the social network graph, and performing a layer expansion using the located user node as the starting node to generate a first expansion layer of an expansion subgraph, wherein the user node included in the first expansion layer is the user node adjacent to the query user;

determining a group member from the first expansion layer of the expansion subgraph, wherein the user node corresponding to the group member is the user node having the maximum number of adjacent nodes in the social network graph; and

performing an expansion of the next level of expansion layer of the expansion subgraph using the user node corresponding to the group member in the first expansion layer as the starting node, and determining a new group member in a corresponding expansion layer until the number of the determined group members equals to the group scale.

15. The one non-transitory computer-readable medium of claim 11, wherein there is a plurality of determined groups to be searched; the processor further executes following steps:

determining edge sets between the group members in the groups to be searched according to the social network graph, and constructing a group network graph of each group to be searched using the group members as the user nodes according to the determined edge sets;

calculating an intimacy degree of each group network graph; and

feeding back the group to be searched corresponding to the group network graph with a maximum intimacy degree as the query result to the query terminal for displaying.

16. The non-transitory computer-readable medium of claim 15, wherein a formula of calculating the intimacy degree of the group network graph is:

$$Co(G) = \sum_{(u,v) \in E} \omega(u,v)$$

wherein $Co(G)$ is the intimacy degree of the group, $G = (V, E)$ is the group network graph, V is a set of vertices in the group network graph, E is an edge set in the group network graph,

$$\text{nodes } u, v \in V, \text{ and } (u, v) \in E, \quad \omega(u, v) = \frac{|N(u) \cap N(v)| + 1}{|N(u) \cup N(v)|},$$

wherein $N(u)$ is a set of nodes adjacent to node u , $|N(u) \cap N(v)|$ is the number of common nodes of node u and node v .