

## SYSTEMS AND METHODS FOR GENERATING RECOMMENDATIONS USING A CORPUS OF DATA

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of the filing date of U.S. Provisional Application No. 62/266,419 filed on December 11, 2015, which is hereby incorporated by reference in its entirety.

### BACKGROUND

[0002] This disclosure relates generally to information networks and, more particularly, to computer systems and computer-based methods for generating recommendations and detecting fraudulent behavior based a corpus of data with linked elements.

[0003] At least some known recommender systems use historical data to determine preferences of a user, which are then applied to new data to discern potential information in the new data that is of interest to the user. For example, by monitoring financial transaction data from financial transactions of a payment card cardholder, a pattern of cardholder preferences is able to be generated. For example, if an account holder makes frequent purchases at outdoor oriented department stores and fewer purchases at book stores, an inference may be made about the preferences of recreational activities favored by the cardholder. These known recommender systems would tend to provide other outdoor oriented stores to the cardholder when queried in, for example, a new geographic location.

[0004] However, providing meaningful recommendations of merchants for a user without a personal profile of preferences for that user is difficult and in some cases, not possible.

### SUMMARY

[0005] In a first aspect, the present disclosure provides a computer-based method for recommending a merchant, the method implemented using a recommender computer device coupled to a memory device, the method comprising: receiving, by a first

receiving component of the recommender computer device, financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants; generating, by a first generating component of the recommender system, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants; receiving, by a second receiving component of the recommender computer device, a query for a recommendation of a merchant from an account holder or other user; and generating, by a second generating component of the recommender computer device, using the merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender computer device, the recommender module configured to infer user preferences of the account holder from attributes of the plurality of merchants that were visited by the account holder.

[0005a] In a second aspect, the present disclosure provides a recommender system for recommending a merchant comprises one or more processors communicatively coupled to one or more memory devices, said recommender system are configured to: receive, by a first receiving component of the recommender system, financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants; generate, by a first generating component of the recommender system, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants; receive, by a second receiving component of the recommender system, a query for a recommendation of a merchant from an account holder; and generate, by a second generating component of the recommender system, using the merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender system, the recommender module configured to infer user preferences from attributes of the plurality of merchants that were visited by the account holder.

[0005b] In a third aspect, the present disclosure provides One or more non-transitory computer-readable storage media having computer-executable instructions embodied thereon, wherein when executed by at least one processor of a recommender system, the computer-executable instructions cause the recommender system to: receive, by a first receiving component of the recommender system, financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants; generate, by a first generating component of the recommender system, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants; receive, by a second receiving component of the recommender system, a query for a recommendation of a merchant from an account holder; and generate, by a second generating component of the recommender system, using a merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender system, the recommender module configured to infer user preferences from attributes of the plurality of merchants that were visited by the account holder.

[0005c] In one embodiment, a method of recommending a merchant includes receiving financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants and generating a merchant

## CLAIMS

1. A computer-based method for recommending a merchant, the method implemented using a recommender computer device coupled to a memory device, the method comprising:

receiving financial transaction data, by a first receiving component of the recommender computer device, documenting financial transactions between a plurality of account holders and a plurality of merchants;

generating, by a first generating component of the recommender computer device, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants;

receiving, by a second receiving component of the recommender computer device, a query for a recommendation of a merchant from an account holder or other user; and

generating, by a second generating component of the recommender computer device, using the merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender computer device, the recommender module configured to infer user preferences of the account holder from attributes of the plurality of merchants that were visited by the account holder.

2. The computer-based method of Claim 1, wherein generating, by the first generating component of the recommender computer device, the merchant correspondence matrix comprises generating the merchant correspondence matrix by correlating the interactions between each of the plurality of account holders and respective merchants of the plurality of merchants.

3. The computer-based method of Claim 2, wherein, by the second generating component of the recommender computer device, generating the ranked list of

merchants comprises generating the ranked list of merchants based on an express list of user preferences of the account holder.

4. The computer-based method of Claim 3, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants based on the express list of user preferences of the account holder comprises generating the ranked list of merchants based on user preferences of the account holder associated with a registered primary account number (PAN) of an account holder's account.

5. The computer-based method of Claim 3, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants based on an express list of user preferences of the account holder comprises generating the ranked list of merchants based on user preferences of the account holder received from an account holder prior to receiving the query for the recommendation.

6. The computer-based method of Claim 3, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants based on an express list of user preferences of the account holder comprises generating the ranked list of merchants based on user preferences of the account holder received from an account holder or other user contemporaneously with the query for the recommendation.

7. The computer-based method of Claim 1, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants comprises applying a selectable number of iterations of a user preference vector to the merchant correspondence matrix.

8. The computer-based method of Claim 7, wherein applying the selectable number of iterations of the user preference vector to the merchant correspondence matrix comprises applying a first amount of activation in the plurality of merchants in the merchant correspondence matrix at the locations previously visited, the first amount of activation increasing the rank of merchants based on the number of previous visits.

9. The computer-based method of Claim 7, wherein applying a selectable number of iterations of a user preference vector to the merchant correspondence

matrix comprises distributing the first amount of activation through the plurality of merchants in the merchant correspondence matrix.

10. The computer-based method of Claim 1, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants comprises:

generating a first temporary ranked list of merchants based on the merchant correspondence matrix using no expressed user preferences of the account holder;

generating a second temporary ranked list of merchants based on the merchant correspondence matrix using expressed user preferences of the account holder;

assigning a merchant's final ranking based on a number of positions the merchant has changed between the second temporary ranked list and the first temporary ranked list.

11. The computer-based method of Claim 1, wherein generating, by the second generating component of the recommender computer device, the ranked list of merchants comprises:

creating a first ranked list of merchants for a first metropolitan area;

using a portion of the top ranked merchants to seed a second merchant correspondence matrix; and

creating a second ranked list of merchants for a second metropolitan area using them seeded second merchant correspondence matrix.

12. A recommender system for recommending a merchant comprises one or more processors communicatively coupled to one or more memory devices, said recommender system is configured to:

receive, by a first receiving component of the recommender system, financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants;

generate, by a first generating component of the recommender system, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants;

receive, by a second receiving component of the recommender system, a query for a recommendation of a merchant from an account holder; and

generate, by a second generating component of the recommender system, using the merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender system, the recommender module configured to infer user preferences from attributes of the plurality of merchants that were visited by the account holder.

13. The system of Claim 12, wherein said first generating component of the recommender system is configured to generate the merchant correspondence matrix by correlating the interactions between each of the plurality of account holders and respective merchants of the plurality of merchants.

14. The system of Claim 12, wherein said second generating component of the recommender system is configured to generate the ranked list of merchants based on an express list of user preferences.

15. The system of Claim 12, wherein said second generating component of the recommender system is configured to generate the ranked list of merchants based on user preferences associated with a registered primary account number (PAN) of an account holder's account.

16. One or more non-transitory computer-readable storage media having computer-executable instructions embodied thereon, wherein when executed by at least one processor of a recommender system, the computer-executable instructions cause the recommender system to:

receive, by a first receiving component of the recommender system, financial transaction data documenting financial transactions between a plurality of account holders and a plurality of merchants;

generate, by a first generating component of the recommender system, a merchant correspondence matrix that includes the plurality of merchants and a plurality of indicators of interactions associated with pairs of the plurality of merchants, the plurality of indicators of interactions tallying financial transactions conducted by the plurality of account holders at both of the merchants in at least one of the pairs of the plurality of merchants;

receive, by a second receiving component of the recommender system, a query for a recommendation of a merchant from an account holder; and

generate, by a second generating component of the recommender system, using the merchant correspondence matrix, a ranked list of merchants based on a recommender algorithm programmed in a recommender module communicatively coupled to the recommender system, the recommender module configured to infer user preferences from attributes of the plurality of merchants that were visited by the account holder.

17. The computer-readable storage media of Claim 16, wherein generating, by the second generating component of the recommender system, the ranked list of merchants comprises applying a selectable number of iterations of a user preference vector to the merchant correspondence matrix.

18. The computer-readable storage media of Claim 17, wherein applying the selectable number of iterations of the user preference vector to the merchant correspondence matrix comprises applying a first amount of activation in the plurality of merchants in the merchant correspondence matrix at the locations previously visited, the first amount of activation increasing the rank of merchants based on the number of previous visits.

19. The computer-readable storage media of Claim 17, wherein applying a selectable number of iterations of a user preference vector to the merchant correspondence matrix comprises distributing the first amount of activation through the plurality of merchants in the merchant correspondence matrix.

20. The computer-readable storage media of Claim 16, wherein generating, by the second generating component of the recommender system, the ranked list of merchants comprises:

generating a first temporary ranked list of merchants based on the merchant correspondence matrix using no expressed user preferences;

generating a second temporary ranked list of merchants based on the merchant correspondence matrix using expressed user preferences;

assigning a merchant's final ranking based on a number of positions the merchant has changed between the second temporary ranked list and the first temporary ranked list.