[006] A need therefore exists to provide methods and devices that seek to overcome or at least minimize the above-mentioned problems so as to provide an enhanced content rendering with optimized objectives.

SUMMARY

[006a] In an aspect, the present disclosure refers to a method for rendering organic and paid content, the method comprising:

Receiving, at a device for rendering organic and paid content, a request for content from a user of a social networking system;

in response to the request, determining, by a content provider determination device of the device for rendering organic and paid content, one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

ranking, by a feature score ranking device of the device for rendering organic and paid content, the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

> ranking, by an objective optimization device of the device for rendering organic and paid content, revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider;
>
> optimizing, by the objective optimization device, weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;
>
> computing, by the objective optimization device, final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-ranking, by the objective optimization device, an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

[006b] In another aspect, the present disclosure refers to a device for rendering organic and paid content, the device comprising:

at least one processor; and

a memory including computer program code for execution by the at least one processor, the computer program code instructs the at least one processor to:

receive a request for content from a user of a social networking system;

in response to the request, determine one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

rank the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

rank revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider,

optimize weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;

compute final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-rank an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

[006c] In another aspect, the present disclosure refers to a non-transitory computer readable storage medium having instructions encoded thereon that, when executed by a processor, cause the processor to:

receive a request for content from a user of a social networking system;

in response to the request, determine one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

rank the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

rank revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider,

optimize weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;

compute final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-rank an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

[007] According to an example, there is provided a method for rendering organic and paid content. The method comprises: receiving a request for content from a user of a social networking system; in response to the request, determining one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and ranking the one or more organic content providers and the one or more paid content providers together, the ranking comprising: ranking revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider; optimizing weights of features of the one or more organic content providers and features of the one or more paid content providers based on a single objective optimization or a multi-objective optimization; computing final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and re-ranking an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

[008] According to another example, there is provided a device for rendering organic and paid content. The device comprises: at least one processor; and a memory including computer program code for execution by the at least one processor, the computer program code instructs the at least one processor to: receive a request for content from a user of a social networking system; in response to the request, determine one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and rank the one or more organic content providers and the one or more paid content providers together, the ranking comprising: rank revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is

Claims

1. A method for rendering organic and paid content, the method comprising:

receiving, at a device for rendering organic and paid content, a request for content from a user of a social networking system;

in response to the request, determining, by a content provider determination device of the device for rendering organic and paid content, one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

ranking, by a feature score ranking device of the device for rendering organic and paid content, the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

ranking, by an objective optimization device of the device for rendering organic and paid content, revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider;

optimizing, by the objective optimization device, weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;

computing, by the objective optimization device, final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-ranking, by the objective optimization device, an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

2. The method according to claim 1, wherein during the optimizing of the weights of features, the single objective optimization includes:

$$\max_{w}\left(a * R_{food} + (1-a) * R_{ads}\right)$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n\ for\ n \in 1 \ldots N,$$

wherein

R_{food} is a sum of revenue scores of the one or more organic content providers, wherein the one or more organic content providers are one or more food merchants,

R_{ads} is a sum of revenue scores for the one or more paid content providers, wherein the one or more paid content providers are one or more ads merchants,

a is a weight for the sum of revenue scores of the one or more organic content providers,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

3. The method according to any one of the preceding claims, wherein during the optimizing of the weights of features, the multi-objective optimization includes:

$$\max_{w} R_{food} \; and \; \max_{w} R_{ads}$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n \; for \; n \in 1 \ldots N,$$

wherein

R_{food} is a revenue score for one of the one or more organic content providers, wherein the organic content provider is a food merchant,

R_{ads} is a revenue score for one of the one or more paid content providers, wherein the paid content provider is an ads merchant,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

4. The method according to any one of the preceding claims, wherein the features of the each organic content provider or the each paid content provider comprise one or more predicted conversion rate (pCVR) and/or predicted click-through rate (pCTR) of the each organic content provider or the each paid content provider.

5. The method according to claim 2 or claim 3, wherein the weight of the ith feature of the organic content provider or paid content provider is generated at a personalization data platform.

6. The method according to any one of the preceding claims, further comprising:

Selecting, by the device for rendering organic and paid content, a list of organic content providers and paid content providers for presentation to the user based on the re-ranking.

7. A device for rendering organic and paid content, the device comprising:

at least one processor; and

a memory including computer program code for execution by the at least one processor, the computer program code instructs the at least one processor to:

receive a request for content from a user of a social networking system;

in response to the request, determine one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

rank the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

rank revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider,

optimize weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;

compute final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-rank an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

8. The device according to claim 7, wherein during the optimizing of the weights of features, the device is configured to perform the single objective optimization according to:

$$\max_{w}\left(a * R_{food} + (1-a) * R_{ads}\right)$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n\ for\ n \in 1 \ldots N,$$

wherein

R_{food} is a sum of revenue scores of the one or more organic content providers, wherein the one or more organic content providers are one or more food merchants,

R_{ads} is a sum of revenue scores for the one or more paid content providers, wherein the one or more paid content providers are one or more ads merchants,

a is a weight for the sum of revenue scores of the one or more organic content providers,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

9. The device according to claim 7 or claim 8, wherein during the optimizing of the weights of features, the device is configured to perform the multi-objective optimization according to:

$$\max_{w} R_{food} \; and \; \max_{w} R_{ads}$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n \; for \; n \in 1 \ldots N,$$

wherein

R_{food} is a revenue score for one of the one or more organic content providers, wherein the organic content provider is a food merchant,

R_{ads} is a revenue score for one of the one or more paid content providers, wherein the paid content provider is an ads merchant,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

10. The device according to any one of claims 7 to 9, wherein the features of the each organic content provider or the each paid content provider comprise one or more predicted conversion rate (pCVR) and/or predicted click-through rate (pCTR) of the each organic content provider or the each paid content provider.

11. The device according to claim 8 or claim 9, wherein the weight of the ith feature of the organic content provider or paid content provider is generated at a personalization data platform.

12. The device according to any one of claims 7 to 11, wherein the device is further configured to:

select a list of organic content providers and paid content providers for presentation to the user based on the re-ranking.

13. A non-transitory computer readable storage medium having instructions encoded thereon that, when executed by a processor, cause the processor to:

receive a request for content from a user of a social networking system;

in response to the request, determine one or more organic content providers and one or more paid content providers for the user based on the user's historical data on the social networking system, and

rank the one or more organic content providers and the one or more paid content providers together, the ranking comprising:

rank revenue scores of the one or more organic content providers and revenue scores of the one or more paid content providers, wherein the revenue score of each of the one or more organic content providers is associated with one or more features of the corresponding organic content provider, and wherein the revenue score of each of the one or more paid content providers is associated with one or more features of the corresponding paid content provider,

optimize weights of features of the one or more organic content providers and features of the one or more paid content providers based on a determination whether to proceed with a single objective optimization or a multi-objective optimization;

compute final revenue scores for the one or more organic content providers and the one or more paid content providers based on optimized weights of the features of the one or more organic content providers and the features of the one or more paid content providers; and

re-rank an order of the one or more organic content providers and the one or more paid content providers according to their final revenue scores.

14. The non-transitory computer readable storage medium according to claim 13, further including instructions enclosed thereon that, when during the optimizing of the weights of features, cause the processor to perform the single objective optimization according to:

$$\max_{w}\left(a * R_{food} + (1-a) * R_{ads}\right)$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n\ for\ n \in 1 \ldots N,$$

wherein

R_{food} is a sum of revenue scores of the one or more organic content providers, wherein the one or more organic content providers are one or more food merchants,

R_{ads} is a sum of revenue scores for the one or more paid content providers, wherein the one or more paid content providers are one or more ads merchants,

a is a weight for the sum of revenue scores of the one or more organic content providers,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

15. The non-transitory computer readable storage medium according to claim 13 or 14, further including instructions enclosed thereon that, when during the optimizing of the weights of features, cause the processor to perform the multi-objective optimization according to:

$$\max_{w}\left(a * R_{food} + (1-a) * R_{ads}\right)$$
$$subject\ to\ w_{n1} * x_{n1} + w_{n2} * x_{n2} + \cdots + w_{nI} * x_{nI} = s_n\ for\ n \in 1 \ldots N,$$

wherein

R_{food} is a revenue score for one of the one or more organic content providers, wherein the organic content provider is a food merchant,

R_{ads} is a revenue score for one of the one or more paid content providers, wherein the paid content provider is an ads merchant,

x_{ni} is an ith feature of an organic content provider or a paid content provider ranked at nth position in the ranking of revenue scores,

ω_{ni} is a weight of the ith feature of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores, and

s_n is a final revenue score of the organic content provider or paid content provider ranked at nth position in the ranking of revenue scores.

16. The non-transitory computer readable storage medium according to any one of claims 13 to 15, wherein the features of the each organic content provider or the each paid content provider comprise one or more predicted conversion rate (pCVR) and/or predicted click-through rate (pCTR) of the each organic content provider or the each paid content provider.

17. The non-transitory computer readable storage medium according to claim 14 or claim 15, wherein the weight of the ith feature of the organic content provider or paid content provider is generated at a personalization data platform.

18. The non-transitory computer readable storage medium according to any one of claims 13 to 17, further including instructions enclosed thereon that cause the processor to:

select a list of organic content providers and paid content providers for presentation to the user based on the re-ranking.