

INTELLIGENT PREDICTION OF BUNDLES OF SPARE PARTS

FIELD

Aspects of the present disclosure provide techniques for intelligent prediction of bundles
5 of parts.

BACKGROUND

Companies that maintain a fleet of vehicles often need spare parts for their vehicles. For example, airlines need spare parts to maintain their airplanes and to meet regulatory and safety requirements. These spare parts can be provided by Original Equipment Manufacturers (OEMs)
10 or third party resellers. An airline can purchase the necessary spare parts using a search tool, for example an Internet based search tool provided by the part seller. The airline will often purchase only the parts it needs for a specific maintenance task, to avoid unnecessary cost and storage of unused parts.

To accomplish this, many airlines employ purchase agents, who maintain a predefined set
15 of parts, for purchase, to use in the desired maintenance task. Many factors can influence which parts the airline will purchase for a maintenance task, including: the aircraft type, the type of maintenance, the condition of the aircraft, the airline's existing inventory, contracts with part suppliers, etc. Often, these parts are available and sold to the airlines individually, even when the airline needs a bundle of several parts to complete the desired maintenance tasks. In some
20 cases, OEMs may be disadvantaged in these individual part sales, based on price or other factors.

SUMMARY

According to an aspect of the present disclosure, there is provided a computer-implemented method for intelligently predicting bundles of replacement parts. The method comprises: determining, using a computer processor, a plurality of maintenance events for a
25 plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts, the determining comprising: determining, using the computer processor, a starting point in time for a first maintenance event, based on the historical data related to the plurality of replacement parts; determining, using the computer processor, an
30 ending point in time for the first maintenance event, based on the historical data related to the

plurality of replacement parts; and identifying, using the computer processor, one or more replacement parts for the first maintenance event, based on at least one of sales of replacement parts, or electronic searches for replacement parts, occurring between the starting point in time and the ending point in time; generating, using the computer processor, a plurality of clusters of replacement parts based on the plurality of maintenance events; and predicting, using the computer processor, a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.

According to another aspect of the present disclosure, there is provided a system. The system comprises: a processor; and a memory storing a program, which, when executed on the processor, performs an operation. The operation comprises: determining a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts, the determining comprising: determining a starting point in time for a first maintenance event, based on the historical data related to the plurality of replacement parts; determining an ending point in time for the first maintenance event, based on the historical data related to the plurality of replacement parts; and identifying one or more replacement parts for the first maintenance event, based on at least one of sales of replacement parts, or electronic searches for replacement parts, occurring between the starting point in time and the ending point in time; generating a plurality of clusters of replacement parts based on the plurality of maintenance events; and predicting a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.

According to yet another aspect of the present disclosure, there is provided a computer program product for intelligently predicting bundles of replacement parts. The computer program product comprises: a non-transitory computer-readable storage medium having computer-readable program code embodied therewith, the computer-readable program code executable by one or more computer processors to perform an operation, the operation comprising: determining a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts; generating a plurality of clusters of replacement parts based on the plurality of maintenance events; generating a two dimensional array relating to the plurality of maintenance events and the plurality of replacement parts; calculating a local weight for a plurality of entries in the two

dimensional array; calculating a global weight for the plurality of entries in the two dimensional array; reducing a dimension of the two dimensional array, based at least in part on the calculated local weights and global weights, wherein generating the plurality of clusters of replacement parts is based on the reduced two dimensional array; and predicting a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.

Embodiments described herein include a computer-implemented method for intelligently predicting bundles of replacement parts. The method includes determining, using a computer processor, a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts. Each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts. The method further includes generating, using the computer processor, a plurality of clusters of replacement parts based on the plurality of maintenance events. The method further includes predicting, using the computer processor, a plurality of bundles of replacement parts, based on the clusters. Each bundle includes a plurality of replacement parts.

CLAIMS

1. A computer-implemented method for intelligently predicting bundles of replacement parts, the method comprising:
 - 5 determining, using a computer processor, a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts, the determining comprising:
 - 10 determining, using the computer processor, a starting point in time for a first maintenance event, based on the historical data related to the plurality of replacement parts;
 - determining, using the computer processor, an ending point in time for the first maintenance event, based on the historical data related to the plurality of replacement parts; and
 - 15 identifying, using the computer processor, one or more replacement parts for the first maintenance event, based on at least one of sales of replacement parts, or electronic searches for replacement parts, occurring between the starting point in time and the ending point in time;
 - generating, using the computer processor, a plurality of clusters of replacement parts
 - 20 based on the plurality of maintenance events; and
 - predicting, using the computer processor, a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.
2. The method of claim 1, wherein determining, using the computer processor, the
25 plurality of maintenance events for the plurality of replacement parts further comprises:
 - generating time series data related to the historical data; and
 - calculating a kernel density estimate related to the time series data, wherein at least one of the starting point in time and the ending point in time is based on the kernel density estimate.
3. The method of claim 1, further comprising:
 - 30 identifying, using the computer processor, a plurality of interchangeable parts among the plurality of replacement parts, wherein the plurality of maintenance events is based on the plurality of interchangeable parts.
4. The method of claim 3, further comprising:
 - 35 determining, using the computer processor, for a first interchangeable part of the plurality of interchangeable parts, an original part identifier and a most recent part identifier, wherein the plurality of maintenance events uses the most recent part identifier in place of the original part identifier.
- 40 5. The method of claim 1, further comprising:

generating, using the computer processor, a two dimensional array relating to the plurality of maintenance events and the plurality of replacement parts, wherein generating, using the computer processor, the plurality of clusters of replacement parts is based on the two dimensional array.

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6. The method of claim 5, wherein the two dimensional array is a binary array.

7. The method of claim 5, further comprising:

calculating a local weight for a plurality of entries in the two dimensional array;

10 calculating a global weight for the plurality of entries in the two dimensional array; and

reducing a dimension of the two dimensional array, based at least in part on the calculated local weights and global weights, wherein generating, using the computer processor, the plurality of clusters of replacement parts is based on the reduced two dimensional array.

15 8. The method of claim 1, further comprising:

determining a price for a first bundle of the plurality of bundles of replacement parts, based at least in part on pre-determined prices for each part in the first bundle, wherein the price for the first bundle is lower than combined pre-determined prices for each part in the first bundle.

20 9. The method of claim 8, wherein the price for the first bundle is determined automatically, using the computer processor, and wherein the price for the first bundle is based on one or more characteristics of the parts in the first bundle.

10. A system, comprising:

25 a processor; and

a memory storing a program, which, when executed on the processor, performs an operation, the operation comprising:

30 determining a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement parts, the determining comprising:

determining a starting point in time for a first maintenance event, based on the historical data related to the plurality of replacement parts;

35 determining an ending point in time for the first maintenance event, based on the historical data related to the plurality of replacement parts; and

identifying one or more replacement parts for the first maintenance event, based on at least one of sales of replacement parts, or electronic searches for replacement parts, occurring between the starting point in time and the ending point in time;

40 generating a plurality of clusters of replacement parts based on the plurality of maintenance events; and

predicting a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.

11. The system of claim 10, wherein determining the plurality of maintenance events for the plurality of replacement parts further comprises:
generating time series data related to the historical data; and
5 calculating a kernel density estimate related to the time series data, wherein at least one of the starting point in time and the ending point in time is based on the kernel density estimate.
12. The system of claim 10, the operation further comprising:
identifying a plurality of interchangeable parts among the plurality of replacement
10 parts, wherein the plurality of maintenance events is based on the plurality of interchangeable parts.
13. The system of claim 10, the operation further comprising:
determining a price for a first bundle of the plurality of bundles of replacement parts,
15 based at least in part on pre-determined prices for each part in the first bundle, wherein the price for the first bundle is lower than combined pre-determined prices for each part in the first bundle.
14. The system of claim 13, wherein the price for the first bundle is determined automatically and wherein the price for the first bundle is based on one or more characteristics of
20 the parts in the first bundle.
15. A computer program product for intelligently predicting bundles of replacement parts, the computer program product comprising:
a non-transitory computer-readable storage medium having computer-readable program
25 code embodied therewith, the computer-readable program code executable by one or more computer processors to perform an operation, the operation comprising:
determining a plurality of maintenance events for a plurality of replacement parts, based on historical data related to the plurality of replacement parts, wherein each maintenance event of the plurality of maintenance events corresponds with one or more of the replacement
30 parts;
generating a plurality of clusters of replacement parts based on the plurality of maintenance events;
generating a two dimensional array relating to the plurality of maintenance events and the plurality of replacement parts;
35 calculating a local weight for a plurality of entries in the two dimensional array;
calculating a global weight for the plurality of entries in the two dimensional array;
reducing a dimension of the two dimensional array, based at least in part on the calculated local weights and global weights, wherein generating the plurality of clusters of
40 replacement parts is based on the reduced two dimensional array; and
predicting a plurality of bundles of replacement parts, based on the clusters, wherein each bundle comprises a plurality of replacement parts.

16. The computer program product of claim 15, the operation further comprising:
determining a price for a first bundle of the plurality of bundles of replacement parts,
based at least in part on pre-determined prices for each part in the first bundle, wherein the price
5 for the first bundle is lower than combined pre-determined prices for each part in the first bundle.
17. The computer program product of claim 16, wherein the price for the first bundle is
determined automatically and wherein the price for the first bundle is based on one or more
characteristics of the parts in the first bundle.