

Claims

1. A communications server apparatus for managing the provision of services based on received consumer queries and for forecasting demand for the services, comprising a processor and a memory, the communications server apparatus being configured, under control of the processor, to execute instructions stored in the memory:
- to receive data records comprising data instances of service queries within a past time period, each data instance comprising a plurality of data features;
- 10 to modify a value of a feature of one or more of the data instances to a standardized value to derive modified data records comprising the modified data instances, wherein the feature is a parameter relating to an offer, by the communications server apparatus, to provide a requested service in response to a corresponding consumer query;
- 15 to input values of selected input features of the data instances of the modified data records into a classification model, for the classification model to predict whether or not a service booking will be made for each data instance based on the values of the input features;
- to receive an output comprising a classification prediction, for each data
- 20 instance of the modified data records, from the classification model; and
- to determine an estimate of potential demand for the past time period based on the classification predictions, for improved forecasting of demand for services in a current or future time period.
- 25 2. The communications server apparatus of claim 1, wherein the modification of a value of a feature of the one or more data instances to a standardized value modifies a feature selected from the group consisting of: offer price, wait time and discount, wherein the modification consists of: reducing the offer price, reducing the wait time and increasing the discount, respectively, thereby improving the offer to
- 30 provide the service in response to the query.

3. The communications server apparatus of claim 1 or 2, wherein the communications server apparatus is further configured to execute instructions stored in the memory:
- to determine an estimate of potential demand for the past time period by:
 - defining an upper bound as the total number of data instances minus the number of data instances where the classification prediction indicates a service booking will not be made,
 - defining a lower bound as the number of data instances where the classification prediction indicates a service booking will be made; and
 - calculating an estimate of potential demand based on the upper and lower bounds.
4. The communications server apparatus of claim 1, 2 or 3, wherein the data records comprise data instances of service queries within an immediately preceding time period, and wherein the communications server apparatus is configured, under control of the processor, to execute instructions stored in the memory:
- to perform real-time forecasting of demand for services in a current time period, based on the estimated potential demand for the immediately preceding time period.
5. The communications server apparatus of any preceding claim, wherein the communications server apparatus is configured, under control of the processor, to execute instructions stored in the memory:
- to periodically receive data records comprising data instances of service queries within an immediately preceding time period, and
 - to record an estimate of potential demand for each time period to produce a time series for input into a forecasting algorithm for at least day-ahead forecasting of demand for services.

6. The communications server apparatus of any preceding claim, wherein the received data records comprise data instances of service queries within a past time period for a defined geographical area, for use in estimating potential demand in the defined geographical area, wherein the communications server apparatus is configured, under control of the processor, to execute instructions stored in the memory:

to send a communication to one or more service provider client devices, for managing the location of service provider resources within the geographical area, based on the forecasting of demand for services in a current or future time period in the geographical area.

7. The communications server apparatus of any preceding claim, wherein the classification model is derived by predictive modelling using a machine learning algorithm with supervised learning based on historical data instances of service queries as training data, the historical data instances each having values for the selected input features and a known classification indicating whether or not a service booking was made.

8. The communications server apparatus of any preceding claim, the communications server apparatus being configured to create the classification model, under control of the processor, by executing instructions stored in the memory:

to receive historical data records comprising data instances of service queries recorded by the server communications apparatus over time, wherein each data instance comprises values for a plurality of features and a known classification value indicating whether or not a service booking was made;

to perform feature selection based on the received historical data records to identify relevant features for the classification; and

to create a classification model by predictive modelling using a machine learning algorithm, wherein the predictive modelling comprises supervised learning based on the historical data records as training data.

- 5 9. A communications system comprising a communications server apparatus for managing queries relating to the provision of services and for forecasting demand for the services, a machine-learning classification module for creating a classification model and a potential demand estimation module for estimating demand for the service in a past time period, the communications server apparatus,
- 10 the classification module and the potential demand estimation module configured for communication with each other through communications equipment, wherein:
- the machine-learning classification module comprises a first processor and a first memory, the classification module being configured, under control of the first processor, to execute first instructions stored in the first memory:
- 15 to receive historical data records comprising data instances of service queries recorded by the server communications apparatus over time, wherein each data instance comprises values for a plurality of features and a known classification value indicating whether or not a service booking was made;
- 20 to perform feature selection based on the received historical data records to identify relevant features for the classification; and
- to create a classification model by predictive modelling using a machine learning algorithm, wherein the predictive modelling comprises supervised learning based on the historical data records as training data; and
- 25 wherein:
- the potential demand estimation module comprises a second processor and a second memory, the potential demand estimation module being configured, under control of the second processor, to execute second instructions stored in the second memory:

to receive data records comprising data instances of service queries within a past time period, each data instance comprising a plurality of data features;

5 to modify a value of a feature of one or more of the data instances to a standardized value to derive modified data records comprising the modified data instances, wherein the feature is a parameter relating to an offer, by the communications server apparatus, to provide a requested service in response to a corresponding consumer query;

10 to input values of selected input features of the data instances of the modified data records into a classification model, for the classification model to predict whether or not a service booking will be made for each data instance based on the values of the input features;

to receive an output comprising a classification prediction, for each data instance, from the classification model; and

15 to determine an estimate of potential demand for the past time period based on the classification predictions; and

wherein the communications server apparatus is configured to manage resources associated with the service based on a forecast of expected consumer demand in a current or future time period determined using the estimated potential demand in the past time period.

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10. A method for forecasting demand for the services in a communications server apparatus for managing the provision of the services based on received consumer queries, the method comprising:

25 receiving data records comprising data instances of service queries within a past time period, each data instance comprising a plurality of data features;

modifying a value of a feature of one or more of the data instances to a standardized value to derive modified data records comprising the modified data instances, wherein the feature is a parameter relating to an offer, by the

communications server apparatus, to provide a requested service in response to a corresponding consumer query;

inputting values of selected input features of the modified data instances into a classification model, wherein the classification model predicts whether or not a service booking will be made for each data instance based on the values of the input features;

receiving an output classification prediction, for each data instance, from the classification model; and

determining an estimate of potential demand for the past time period based on the classification predictions, for improved forecasting of demand for services in a current or future time period.

11. The method of claim 10, wherein the modification of a value of a feature of the one or more data instances to a standardized value modifies a feature selected from the group consisting of: offer price, wait time and discount, wherein the modification consists of: reducing the offer price, reducing the wait time and increasing the discount, respectively, thereby improving the offer to provide the service in response to the query.

12. The method of claim 10 or 11, further comprising:

determining an estimate of potential demand for the past time period by:

defining an upper bound as the total number of data instances minus the number of data instances where the classification prediction indicates a service booking will not be made,

defining a lower bound as the number of data instances where the classification prediction indicates a service booking will be made; and

calculating an estimate of potential demand based on the upper and lower bounds.

13. The method of claim 10, 11 or 12, wherein the data records comprise data instances of service queries within an immediately preceding time period, the method further comprising:
- 5 performing real-time forecasting of demand for services in a current time period, based on the estimated potential demand for the immediately preceding time period.
14. The method of any one of claims 10 to 13, further comprising:
- 10 periodically receiving data records comprising data instances of service queries within an immediately preceding time period, and
- recording an estimate of potential demand for each time period to produce a time series for input into a forecasting algorithm for at least day-ahead forecasting of demand for services.
- 15 15. The method of any one of claims 10 to 14, wherein the received data records comprise data instances of service queries within a past time period for a defined geographical area, for use in estimating potential demand in the defined geographical area, the method further comprising:
- 20 sending, by the communications server apparatus, a communication to one or more service provider client devices, for managing the location of service provider resources within the geographical area, based on the forecasting of demand for services in a current or future time period in the geographical area.
16. The method of any one of claims 10 to 15, further comprising:
- 25 creating the classification model by:
- receiving historical data records comprising instances of service queries recorded by the server communications apparatus over time, wherein each data instance comprises values for a plurality of features and a known classification value indicating whether or not a service booking was
- 30 made;

performing feature selection based on the received historical data to identify relevant features for the classification; and

creating a classification model by predictive modelling using a machine learning algorithm, wherein the predictive modelling comprises supervised learning based on the historical data records as training data.

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17. A computer program product comprising instructions for implementing the method of claim 10.

10 18. A non-transitory storage medium storing instructions, which, when executed by a processor, causes the processor to perform the method of claim 10.