

METHOD AND DEVICE FOR SCORING DRIVING BEHAVIOR

TECHNICAL FIELD

The present invention relates to the field of vehicle driving behavior analysis technologies, in particular to a method and a device for scoring driving behavior.

BACKGROUND

In recent years, with the increasing number of motor vehicles and the rapid development of the Internet of Vehicles, there are more and more vehicle insurance products combined with the Internet of Vehicles technologies priced based on driver's driving behavior. By scoring the driver's driving behavior, the pricing of the vehicle insurance products may be accurately determined, and the driver's safe driving consumption and the driver's safe driving awareness may be improved, thereby reducing a social traffic accident rate. Data collected by the existing method for scoring the driving behavior is relatively simple, and scoring results are not accurate enough, so that it is difficult to reasonably price the vehicle insurance products.

SUMMARY

In order to solve the above-mentioned technical problems, embodiments of the present invention provide a method and a device for scoring driving behavior, which may improve the accuracy of scoring results, thereby improving the accuracy of vehicle insurance pricing.

The specific technical schemes of the embodiments of the present invention are as follows:

In a first aspect, embodiments of the present invention provide a method for scoring driving behavior, including: obtaining driving behavior data, driving environment data, and business policy data of a target driver; determining target feature data according

to the driving behavior data, the driving environment data, and the business policy data of the target driver; and inputting the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver.

In some embodiments of the present invention, the obtaining driving behavior data, driving environment data, and business policy data of a target driver includes: obtaining the driving behavior data of the target driver by using a mobile software development kit module; obtaining the driving environment data of the target driver by using a vehicle depth camera module; and obtaining the business policy data of the target driver by a preset interface.

In some embodiments of the present invention, the determining target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver includes: extracting, from the driving behavior data of the target driver, a first feature of the target driver, the first feature including at least one of an average driving mileage, an average driving speed, number of rapid accelerations, number of rapid decelerations, number of sudden turns and whether fatigue driving or not; extracting, from the driving environment data of the target driver, a second feature of the target driver, the second feature including at least one of a driving road condition state and number of lane changes; extracting, from the business policy data of the target driver, a third feature and a fourth feature of the target driver, the third feature including personal basic information, and the fourth feature including at least one of policy purchase record information and claim history information; and combining the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

In some embodiments of the present invention, the method in the first aspect further includes: training a machine learning model by using sample data to obtain a driving behavior scoring model.

In some embodiments of the present invention, the training a machine learning model by using sample data to obtain a driving behavior scoring model includes: obtaining the sample data including driving behavior data, driving environment data, and business policy data of a sample driver; determining sample feature data and a

driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and training the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.

In some embodiments of the present invention, the determining sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver includes: determining the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and determining the driving behavior score of the sample driver according to the business policy data of the sample driver.

In some embodiments of the present invention, the determining the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver includes: extracting, from the driving behavior data of the sample driver, a fifth feature of the sample driver; extracting, from the driving environment data of the sample driver, a sixth feature of the sample driver; extracting, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver; and combining the fifth feature, the sixth feature, the seventh feature and the eighth feature to determine the sample feature data.

In some embodiments of the present invention, the determining the driving behavior score of the sample driver according to the business policy data of the sample driver includes: determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

In some embodiments of the present invention, the determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature includes: calculating a claim rate of the sample driver according to the seventh feature and the eighth feature; and determining, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the

lower the driving behavior score of the sample driver.

In some embodiments of the present invention, the machine learning model is a boosting tree model or a random forest model.

In a second aspect, embodiments of the present invention provide a device for scoring driving behavior, including: an obtaining module configured to obtain driving behavior data, driving environment data, and business policy data of a target driver; a determining module configured to determine target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver; and a scoring module configured to input the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver.

In some embodiments of the present invention, the obtaining module is configured to: obtain the driving behavior data of the target driver by using a mobile software development kit module; obtain the driving environment data of the target driver by using a vehicle depth camera module; and obtain the business policy data of the target driver by a preset interface.

In some embodiments of the present invention, the determining module is configured to: extract, from the driving behavior data of the target driver, a first feature of the target driver, the first feature including at least one of an average driving mileage, an average driving speed, number of rapid accelerations, number of rapid decelerations, number of sudden turns and whether fatigue driving or not; extract, from the driving environment data of the target driver, a second feature of the target driver, the second feature including at least one of a driving road condition state and number of lane changes; extract, from the business policy data of the target driver, a third feature and a fourth feature of the target driver, the third feature including personal basic information, and the fourth feature including at least one of policy purchase record information and claim history information; and combine the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

In some embodiments of the present invention, the device in the second aspect further includes: a training module configured to train a machine learning model by

using sample data to obtain a driving behavior scoring model.

In some embodiments of the present invention, the training module is configured to: obtain the sample data including driving behavior data, driving environment data, and business policy data of a sample driver; determine sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and train the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.

In some embodiments of the present invention, the training module is configured to: determine the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and determine the driving behavior score of the sample driver according to the business policy data of the sample driver.

In some embodiments of the present invention, the training module is configured to: extract, from the driving behavior data of the sample driver, a fifth feature of the sample driver; extract, from the driving environment data of the sample driver, a sixth feature of the sample driver; extract, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver; combine the fifth feature, the sixth feature, the seventh feature and the eighth feature to determine the sample feature data; and determine the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

In some embodiments of the present invention, the training module is configured to: calculate a claim rate of the sample driver according to the seventh feature and the eighth feature; and determine, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the lower the driving behavior score of the sample driver.

In some embodiments of the present invention, the machine learning model is a boosting tree model or a random forest model.

In a third aspect, embodiments of the present invention provide a computer device,

including: one or more processors; and a memory configured to store one or more programs. When the one or more programs are executed by the one or more processors, causing the one or more processors to implement the method for scoring the driving behavior mentioned in the first aspect.

In a fourth aspect, embodiments of the present invention provide a computer readable storage medium, which stores a computer program, and when the computer program is executed by a processor, the method for scoring the driving behavior mentioned in the first aspect is implemented.

The embodiments of the present invention provide the method and the device for scoring the driving behavior, by starting from a plurality of dimensions of the driving behavior data, the driving environment data and the business policy data of the target driver, the target feature data of the target driver is extracted, and the driving behavior scoring model is used to predict the driving behavior score of the target driver, thereby improving the accuracy of the scoring results and further improving the accuracy of the vehicle insurance pricing.

BRIEF DESCRIPTION OF DRAWINGS

In order to more clearly illustrate the technical solutions in the embodiments of the present invention, the accompanying drawings used in the description of the embodiments will be briefly described below. It is obvious that the accompanying drawings in the following description are only some embodiments of the present invention. For those of ordinary skill in the art, other accompanying drawings may also be obtained according to these accompanying drawings without any creative works.

FIG. 1 is a schematic flow diagram of a method for scoring driving behavior according to an embodiment of the present invention.

FIG. 2 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention.

FIG. 3 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention.

FIG. 4 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention.

FIG. 5 is a schematic structural diagram of a device for scoring driving behavior according to an embodiment of the present invention.

FIG. 6 is a block diagram of a computer device according to an embodiment of the present invention.

DETAILED DESCRIPTION

In order to make the objects, technical solutions and advantages of the present invention clearer, the technical solutions in the embodiments of the present invention are clearly and completely described in the following with reference to the accompanying drawings in the embodiments of the present invention. It is obvious that the described embodiments are only a part of the embodiments of the present invention, and not all of the embodiments. All other embodiments obtained by those of ordinary skilled in the art based on the embodiments of the present invention without creative works are within the scope of the present invention.

At present, a modeling for scoring driving behavior is mainly to obtain driving behavior data of a user by docking a vehicle sensor or an engine, and to obtain data of whether an observation vehicle has a traffic accident during a driving behavior observation period and risk situation in which the user applies to the insurance company for insurance claims, and uses a classification method to model the driving behavior data and the data described above to predict a risk probability, and then establishes a mapping relationship between a driving behavior score and the risk probability. However, a modeling method for scoring the driving behavior mainly has the following problems: the first is that sources of the collected data are relatively simple and the sources only include information related to the driving behavior, which results in the inaccuracy of the scoring results; the second is that continuity of the user cannot be guaranteed, since a same vehicle may be registered by a plurality of users, which results in that a driving record of a same vehicle does not affiliated with a same user, thus interfering analysis; and the third is that scoring the driving behavior only by the risk probability lacks the measurement of a degree of the risk, which leads to the model not being refined enough.

FIG. 1 is a schematic flow diagram of a method for scoring driving behavior according to an embodiment of the present invention. Referring to FIG. 1, the method includes the following contents.

110: obtaining driving behavior data, driving environment data, and business policy data of a target driver.

Specifically, an executive body for scoring the driving behavior may be a server, the server may be a single server, or a server group composed of a plurality of servers, and within the server group, communication connections may be performed between the plurality of servers.

The server may communicate with a vehicle system through the network, and the vehicle system may obtain the driving behavior data, the driving environment data and the business policy data of the target driver, and then transmit the driving behavior data, the driving environment data and the business policy data to the server.

The driving behavior data may include information such as speed, acceleration, and steering; the driving environment data may include information such as road conditions and lane detection; and the business policy data may include basic information of the target driver, policy purchase information, and claim information.

120: determining target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver.

Specifically, features may be separately extracted from the driving behavior data, the driving environment data, and the business policy data, and combined to obtain target feature data. The target feature data may be a vector.

130: inputting the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver.

Specifically, the driving behavior scoring model may be obtained by training a machine learning model. In this embodiment, the driving behavior scoring model which is offline storage may be called, and the target feature data is input to the driving behavior scoring model, and the driving behavior scoring model may predict the driving behavior score of the target driver and output the driving behavior score of the target driver for other devices that interact with the server to call (for example, the server at the insurance company).

The embodiments of the present invention provide the method for scoring the driving behavior, by starting from a plurality of dimensions of the driving behavior data, the driving environment data and the business policy data of the target driver, the target feature data of the target driver is extracted, and the driving behavior scoring model is used to predict the driving behavior score of the target driver, thereby improving the accuracy of the scoring results and further improving the accuracy of the vehicle insurance pricing.

FIG. 2 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention, and the embodiment shown in FIG. 2 is obtained by extension of the embodiment shown in FIG. 1. In order to avoid repetition, the differences are highlighted. As shown in FIG. 2, the step 110 in FIG. 1 includes the following contents.

111: obtaining the driving behavior data of the target driver through a mobile Software Development Kit (SDK) module.

The driving behavior data may include driving time information, mileage information, speed information, steering information, latitude and longitude information, altitude information, mobile phone call state information, rapid acceleration information, sudden deceleration information, and sharp turn information of the target driver.

The server may communicate with the mobile terminal equipped with the mobile SDK module via the network.

Specifically, data of the GPS, an accelerometer, and a gyro sensor may be collected during driving process of the target driver by using the mobile SDK module in the target driver's mobile terminal to acquire the driving behavior data of the target driver, and the driving behavior data of the target driver is uploaded to the server, and the driving behavior data of the target driver is bound and stored with identity identifier of the target driver by the server.

The SDK module may be located within the mobile terminal, which may be the mobile terminal of the target driver, such as a mobile phone. The mobile phone call state information may reflect whether the target driver is on the phone during driving. Since the driver's call during driving is an act behavior that hinders safe driving, when scoring

the driver's driving behavior, the accuracy of the scoring results may be improved by considering the mobile phone call state information.

In the embodiment of the present invention, since the driving behavior data of the target driver is collected based on the SDK module in the target driver's own mobile terminal, to a certain extent, it can avoid situations in which a driving record of a same vehicle does not affiliated with a same driver because a same vehicle may be registered by a plurality of drivers, so that the driving behavior score can be predicted separately for different drivers.

112: obtaining the driving environment data of the target driver by a vehicle depth camera module.

Data related to driving environment may include target detection information, ranging information, road condition information, and lane detection information.

The server may communicate with the vehicle depth camera module through the network, and the mobile terminal equipped with the mobile SDK module may communicate with the vehicle depth camera module.

Specifically, the vehicle depth camera module may be mounted on the target driver's vehicle. The data related to the driving environment of the target driver may be collected by using the vehicle depth camera module to perform target detection, ranging, road condition detection and lane detection during driving, and the collected data related to the driving environment is uploaded to the server.

113: obtaining the business policy data of the target driver through a preset interface.

The business policy data of the target driver includes basic information of the target driver, policy purchase information, and claim information, and the policy purchase information includes information such as insurance type and insurance coverage.

Specifically, the preset interface may be an Application Programming Interface (API) or other type of interface. The server may interface with a business policy system through the preset interface and obtain business policy data corresponding to identity identifier of the target driver from the business policy system according to the identity identifier of the target driver, and the identity identifier may be a mobile phone number or

a username of the target driver, or other information that uniquely identifies the identity of the driver.

FIG. 3 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention, the embodiment shown in FIG. 3 is obtained by extension of the embodiment shown in FIG. 1. In order to avoid repetition, the differences are highlighted. As shown in FIG. 3, the step 120 in FIG. 1 includes the following contents.

121: extracting, from the driving behavior data of the target driver, a first feature of the target driver.

The first feature includes at least one of an average driving mileage, an average driving speed, number of sudden accelerations, number of sudden decelerations, number of sharp turns, and whether fatigue driving or not.

Specifically, as for each target driver, according to a preset time window and a preset mileage, at least one of the average driving mileage, the average driving speed, the number of sudden accelerations, the number of sudden decelerations, the number of sharp turns, and whether fatigue driving or not per month or daily is extracted from the driving behavior data of the target driver including the driving time information, the mileage information, the speed information, the steering information, the latitude and longitude information, the altitude information, the mobile phone call state information, the rapid acceleration information, the rapid deceleration information, and the sharp turn information, etc.

Alternatively, the first feature may be extracted from the driving behavior data corresponding to each driving trip, i.e., each driving trip corresponds to one scoring.

122: extracting, from the driving environment data of the target driver, a second feature of the target driver.

The second feature includes at least one of a driving road condition state and number of lane changes.

Specifically, as for each target driver, at least one of the driving road condition state and the number of lane changes is extracted from the driving environment data of the target driver including the target detection information, the ranging information, the road condition information, and the lane detection information.

123: extracting, from the business policy data of the target driver, a third feature and a fourth feature of the target driver.

The third feature includes personal basic information, and the fourth feature includes at least one of policy purchase record information and claim history information. The personal basic information may include age, gender, health information, and the like.

124: combining the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

Specifically, the first feature, the second feature, the third feature, and the fourth feature may be combined according to the identity identifier of the target driver to obtain the target feature data. Since the target feature data may more fully characterize the driving behavior of the target driver, the accuracy of the scoring results may be improved.

The first feature, the second feature, the third feature, and the fourth feature may be four vectors which having the same or different dimensions. The target feature data obtained by combining the features may also be a vector, and a dimension of the vector may be a sum of the dimensions of the four vectors before combining the features.

Optionally, before the step 120, the method may further include: performing data pre-processing on the driving behavior data, the driving environment data, and the business policy data of the target driver, which is specifically including data cleaning and data conversion, so as to facilitate feature extraction in subsequent steps.

According to an embodiment of the present invention, the method of FIG. 1 further includes: training a machine learning model by using sample data to obtain a driving behavior scoring model.

FIG. 4 is a schematic flow diagram of a method for scoring driving behavior according to another embodiment of the present invention, the embodiment shown in FIG. 4 is obtained by extension of the embodiment shown in FIG. 1. In order to avoid repetition, the contents described in FIG. 1 are omitted, and the differences are

highlighted. As shown in FIG. 4, the method for scoring the driving behavior includes the following contents.

140: obtaining the sample data including driving behavior data, driving environment data, and business policy data of a sample driver.

The driving behavior data of the sample driver is obtained by a mobile SDK module, and the driving behavior data of the sample driver is uploaded to the server, and the driving behavior data of the sample driver and identity identifier of the sample driver are bound and stored by the server. Since the driving behavior data of the sample driver is collected according to the SDK module in the sample driver's own mobile terminal, to a certain extent, it can avoid situations in which a driving record of a same vehicle does not affiliated with a same driver because a same vehicle may be registered by a plurality of drivers, so as to avoid data interference generated in the subsequent modeling process of the driving behavior scoring model.

The driving environment data of the sample driver is obtained by the vehicle depth camera module, and the driving environment data of the sample driver is uploaded to the server, and data related to driving environment of the sample driver is bound and stored with the identity identifier of the sample driver by the server.

The business policy data of the sample driver is obtained through the preset interface.

The specific implementation process of the step 140, as well as the specific information included in the driving behavior data, the driving environment data and the business policy data of the sample driver may be referred to the descriptions associated with FIG. 1 and FIG. 2 above, and details are not described herein again.

150: determining sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver.

Specifically, the sample feature data is determined according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and the driving behavior score of the sample driver is determined according to the business policy data of the sample driver.

In an embodiment, the determining the sample feature data according to the

driving behavior data, the driving environment data, and the business policy data of the sample driver includes: extracting, from the driving behavior data of the sample driver, a fifth feature of the sample driver; extracting, from the driving environment data of the sample driver, a sixth feature of the sample driver; extracting, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver; and combining the fifth feature, the sixth feature, the seventh feature and the eighth feature to determine the sample feature data. The determining the driving behavior score of the sample driver according to the business policy data of the sample driver includes: determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

Specifically, the fifth feature may include at least one of an average driving mileage, an average driving speed, number of sudden accelerations, number of sudden decelerations, number of sharp turns, and whether fatigue driving or not. The sixth feature may include at least one of a driving road condition state and number of lane changes. The seventh feature can include personal basic information. The eighth feature may include at least one of policy purchase record information and claim history information.

The fifth feature, the sixth feature, the seventh feature, and the eighth feature are combined according to the identity identifier of the sample driver to obtain the sample feature data, and the sample feature data of the sample driver may be stored in a list.

The specific implementation process of the step 150 may be referred to the descriptions associated with FIG. 1 and FIG. 3 above, and details are not described herein again.

In the embodiment of the present invention, since the sample feature data is obtained by extracting the features from the driving behavior data, the driving environment data and the business policy data of the sample driver respectively and then combining the features, the sample feature data thus obtained may more fully characterize the driving behavior of the sample driver, so that a model obtained by the subsequent training can more accurately evaluate the driving behavior of the driver.

In an embodiment, the determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature includes: calculating a

claim rate of the sample driver according to the seventh feature and the eighth feature; and determining, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the lower the driving behavior score of the sample driver.

Specifically, the feature extracted from the business policy data includes claim history information of the sample driver, and the claim rate of the sample driver may be calculated according to the claim history information of the sample driver.

In the mapping relationship table, the higher the claim rate, the lower the driving behavior score. For example, a range of the scores may range from 0 to 100. The driving behavior score which is mapped may be used as tag information for the sample driver.

160: training the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.

The driving behavior scoring model which is trained is stored for scoring the driving behavior of the target driver other than the sample driver. The step 140 to 160 may be executed before the step 130.

According to an embodiment of the present invention, the machine learning model is an eXtreme Gradient Boosting model (XGBoost). As for a given data set $D = \{(x_i, y_i)\}$, a XGBoost model function looks like this:

$$\hat{y}_i = \Phi(x_i) = \sum_{k=1}^K f_k(x_i), f_k \in F$$

Here, K represents number of trees to learn, x_i is the input, and $\hat{y}_i$ represents a prediction result. F is a hypothesis space, and $f(x)$ is the Classification and Regression Tree (CART):

$$F = \{f(x) = w_{q(x)}\} (q: R^m \rightarrow T, w \in R^T)$$

Here, $q(x)$ represents that the sample x has been assigned to a leaf node, and w is a fraction of the leaf node, so $w_{q(x)}$ represents a predicted value of the regression tree to the sample. As can be seen from the above XGBoost model function, the model uses the prediction results of each regression tree in the K regression trees to iteratively calculate to obtain the final prediction result $\hat{y}_i$. Also, the input samples for each regression tree

are related to the training and prediction of the previous regression tree.

Specifically, the feature data of the sample driver is used as x_i in the data set D and the driving behavior score corresponding to the feature data of the sample driver is taken as y_i in the data set D to learn parameters of the K regression trees in the XGBoost model, i.e., the mapping relationship between the input x_i and the output y_i of each regression tree, and x_i may be an n-dimensional vector or an array. I.e., by inputting the known training sample data x_i , the prediction result $\hat{y}_i$ of the above model is compared with the label y_i actually mapped by the training sample data, the parameters of the model are adjusted continuously until an expected accuracy is achieved, and the parameters of the model are determined, so as to establish the driving behavior scoring model, and store the driving behavior scoring model offline for calling when an online driving behavior is scored.

In addition, the machine learning model may also be a boosting tree model other than the XGBoost model, or may be other types of machine learning models, such as a random forest model, which is not limited by the present invention.

The embodiments of the present invention provide the method for scoring the driving behavior, by starting from a plurality of dimensions of the driving behavior data, the driving environment data and the business policy data of the sample driver, the sample feature data is extracted, the driving behavior score of the sample driver is obtained according to the business policy data of the sample driver, and the machine learning model is trained according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model, thus achieving multi-dimensional and refined modeling of the driving behavior of the driver, and further realizing an accurate prediction of the driving behavior score for different drivers by the driving behavior scoring model.

FIG. 5 is a schematic structural diagram of a device 500 for scoring driving behavior according to an embodiment of the present invention. Referring to FIG. 5, the device 500 includes an obtaining module 510, a determining module 520, and a scoring module 530.

The obtaining module 510 is configured to obtain driving behavior data, driving environment data, and business policy data of a target driver; the determining module 520 is configured to determine target feature data according to the driving

behavior data, the driving environment data, and the business policy data of the target driver; and the scoring module 530 is configured to input the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver.

The embodiments of the present invention provide the device for scoring the driving behavior, by starting from a plurality of dimensions of the driving behavior data, the driving environment data and the business policy data of the target driver, the target feature data of the target driver is extracted, and the driving behavior scoring model is used to predict the driving behavior score of the target driver, thereby improving the accuracy of the scoring results and further improving the accuracy of the vehicle insurance pricing.

According to an embodiment of the present invention, the obtaining module 510 is configured to: obtain the driving behavior data of the target driver by using a mobile software development kit module; obtain the driving environment data of the target driver by using a vehicle depth camera module; and obtain the business policy data of the target driver by a preset interface.

According to an embodiment of the present invention, the determining module 520 is configured to: extract, from the driving behavior data of the target driver, a first feature of the target driver, the first feature including at least one of an average driving mileage, an average driving speed, number of rapid accelerations, number of rapid decelerations, number of sudden turns and whether fatigue driving or not; extract, from the driving environment data of the target driver, a second feature of the target driver, the second feature including at least one of a driving road condition state and number of lane changes; extract, from the business policy data of the target driver, a third feature and a fourth feature of the target driver, the third feature including personal basic information, and the fourth feature including at least one of policy purchase record information and claim history information; and combine the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

According to an embodiment of the present invention, the device 500 further includes: a training module 540 configured to train a machine learning model by using sample data to obtain a driving behavior scoring model.

According to an embodiment of the present invention, the training module 540 is configured to: obtain the sample data including driving behavior data, driving environment data, and business policy data of a sample driver; determine sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and train the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.

According to an embodiment of the present invention, the training module 540 is configured to: determine the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and determine the driving behavior score of the sample driver according to the business policy data of the sample driver.

According to an embodiment of the present invention, the training module 540 is configured to: extract, from the driving behavior data of the sample driver, a fifth feature of the sample driver; extract, from the driving environment data of the sample driver, a sixth feature of the sample driver; extract, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver; and combine the fifth feature, the sixth feature, the seventh feature and the eighth feature to determine the sample feature data; and determine the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

According to an embodiment of the present invention, the training module 540 is configured to: calculate a claim rate of the sample driver according to the seventh feature and the eighth feature; and determine, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the lower the driving behavior score of the sample driver.

According to an embodiment of the present invention, the machine learning model is a boosting tree model or a random forest model.

The device for scoring the driving behavior provided by the embodiments of the present invention belongs to a same concept as the method for scoring the driving behavior provided by the embodiments of the present invention, and may execute the method for scoring the driving behavior provided by any embodiments of the present invention, and has corresponding function modules and beneficial effects for executing the method for scoring the driving behavior. For the technical details that are not described in detail in the embodiments, reference may be made to the method for scoring the driving behavior provided by the embodiments of the present invention, and details are not described herein again.

FIG. 6 is a block diagram of a computer device 60 according to an embodiment of the present invention, including: one or more processors 61; and a memory 62 configured to store one or more programs. When the one or more programs are executed by the one or more processors 61, causing the one or more processors 61 to implement the method for scoring the driving behavior as described in the above embodiments.

In addition, the embodiments of the present invention provide a computer readable storage medium on which a computer program is stored. When the computer program is executed by a processor, the method for scoring the driving behavior as described in the above embodiments is implemented.

Those of ordinary skilled in the art appreciate that the embodiment in the embodiments of the present invention may be provided as a method, system, or computer program product. Therefore, in the embodiments of the present invention, a form of embodiments of an entirely hardware embodiment, an entirely software embodiment, or an embodiment combining software and hardware may be employed. Furthermore, in the embodiments of the present invention, a form of the computer program product embodied on one or more computer usable storage medium (including but not limited to disk storage, CD-ROM, optical storage, etc.) which having a computer usable program code may be adopted.

The embodiments of the present invention are described with reference to

flowcharts and/or block diagrams of a method, a device (system), and a computer program product according to the embodiments of the present invention. It should be understood that each flow in the flowcharts and/or each block in the block diagrams, and a combination of the flows in the flowcharts and/or the blocks in the block diagrams may be implemented by computer program instructions. These computer program instructions may be provided to a general purpose computer, a special purpose computer, an embedded processor, or a processor for other programmable data processing devices to produce a machine, causing instructions executed by the computer or the processor for the other programmable data processing devices to generate an apparatus configured to implement the functions specified in one or more flows in the flowcharts and/or one or more blocks in the block diagrams.

The computer program instructions may also be stored in a computer readable memory that can direct the computer or the other programmable data processing devices to operate in a particular manner, such that the instructions stored in the computer readable memory produce an article of manufacture including an instruction apparatus. The instruction apparatus implements the functions specified in one or more flows in the flowcharts and/or one or more blocks in the block diagrams.

These computer program instructions may also be loaded onto the computer or the other programmable data processing devices such that a series of operational steps are performed on the computer or the other programmable data devices to produce a computer-implemented processing, so that the instructions executed in the computer or the other programmable data devices provide steps of the functions specified in one or more flows in the flowcharts and/or one or more blocks in the block diagrams.

While a preferred embodiment in the embodiments of the present invention has been described, those of ordinary skilled in the art can make further changes and modifications to these embodiments once the basic inventive concept is known. Therefore, the appended claims are intended to be interpreted as including the preferred embodiment and all the changes and modifications falling within the scope of the embodiments of the present invention.

It is apparent that those of ordinary skilled in the art can make various modifications and variations to the present invention without departing from the spirit and scope of the present invention. Thus, if these modifications and variations of the present invention fall within the scope of the claims of the present invention and its equivalent technologies, the present invention also intends to include these modifications and variations.

What is claimed is:

1. A method for scoring driving behavior, comprising:
 - obtaining driving behavior data, driving environment data, and business policy data of a target driver;
 - determining target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver; and
 - inputting the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver,wherein the method further comprising:
 - training a machine learning model by using sample data to obtain a driving behavior scoring model,wherein the training a machine learning model by using sample data to obtain a driving behavior scoring model comprises:
 - obtaining the sample data comprising driving behavior data, driving environment data, and business policy data of a sample driver;
 - determining sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and
 - training the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.
2. The method of claim 1, wherein the obtaining driving behavior data, driving environment data, and business policy data of a target driver comprises:
 - obtaining the driving behavior data of the target driver by using a mobile software development kit module;
 - obtaining the driving environment data of the target driver by using a vehicle depth camera module; and
 - obtaining the business policy data of the target driver by a preset interface.
3. The method of claim 1 or 2, wherein the determining target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver comprises:

extracting, from the driving behavior data of the target driver, a first feature of the target driver, the first feature comprising at least one of an average driving mileage, an average driving speed, number of rapid accelerations, number of rapid decelerations, number of sudden turns and whether fatigue driving or not;

extracting, from the driving environment data of the target driver, a second feature of the target driver, the second feature comprising at least one of a driving road condition state and number of lane changes;

extracting, from the business policy data of the target driver, a third feature and a fourth feature of the target driver, the third feature comprising personal basic information, and the fourth feature comprising at least one of policy purchase record information and claim history information; and

combining the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

4. The method of claim 1, wherein the determining sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the business policy data of the sample driver comprises:

determining the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and

determining the driving behavior score of the sample driver according to the business policy data of the sample driver.

5. The method of claim 4, wherein the determining the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver comprises:

extracting, from the driving behavior data of the sample driver, a fifth feature of the sample driver;

extracting, from the driving environment data of the sample driver, a sixth feature of the sample driver;

extracting, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver; and

combining the fifth feature, the sixth feature, the seventh feature and the eighth

feature to determine the sample feature data; and

the determining the driving behavior score of the sample driver according to the business policy data of the sample driver comprises:

determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

6. The method of claim 5, wherein the determining the driving behavior score of the sample driver according to the seventh feature and the eighth feature comprises:

calculating a claim rate of the sample driver according to the seventh feature and the eighth feature; and

determining, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the lower the driving behavior score of the sample driver.

7. The method of any one of claims 1 to 6, wherein the machine learning model is a boosting tree model or a random forest model.

8. A device for scoring driving behavior, comprising:

an obtaining module configured to obtain driving behavior data, driving environment data, and business policy data of a target driver;

a determining module configured to determine target feature data according to the driving behavior data, the driving environment data, and the business policy data of the target driver; and

a scoring module configured to input the target feature data into a driving behavior scoring model to obtain a driving behavior score of the target driver,

wherein the device further comprising:

a training module configured to train a machine learning model by using sample data to obtain a driving behavior scoring model,

wherein the training module is configured to:

obtain the sample data comprising driving behavior data, driving environment data, and business policy data of a sample driver;

determine sample feature data and a driving behavior score of the sample driver according to the driving behavior data, the driving environment data, and the

business policy data of the sample driver; and

train the machine learning model according to the sample feature data and the driving behavior score of the sample driver to obtain the driving behavior scoring model.

9. The device of claim 8, wherein the obtaining module is configured to:

obtain the driving behavior data of the target driver by using a mobile software development kit module;

obtain the driving environment data of the target driver by using a vehicle depth camera module; and

obtain the business policy data of the target driver by a preset interface.

10. The device of claim 8 or 9, wherein the determining module is configured to:

extract, from the driving behavior data of the target driver, a first feature of the target driver, the first feature comprising at least one of an average driving mileage, an average driving speed, number of rapid accelerations, number of rapid decelerations, number of sudden turns and whether fatigue driving or not;

extract, from the driving environment data of the target driver, a second feature of the target driver, the second feature comprising at least one of a driving road condition state and number of lane changes;

extract, from the business policy data of the target driver, a third feature and a fourth feature of the target driver, the third feature comprising personal basic information, and the fourth feature comprising at least one of policy purchase record information and claim history information; and

combine the first feature, the second feature, the third feature and the fourth feature to determine the target feature data.

11. The device of claim 8, wherein the training module is configured to:

determine the sample feature data according to the driving behavior data, the driving environment data, and the business policy data of the sample driver; and

determine the driving behavior score of the sample driver according to the business policy data of the sample driver.

12. The device of claim 11, wherein the training module is configured to:

extract, from the driving behavior data of the sample driver, a fifth feature of the sample driver;

extract, from the driving environment data of the sample driver, a sixth feature of the sample driver;

extract, from the business policy data of the sample driver, a seventh feature and an eighth feature of the sample driver;

combine the fifth feature, the sixth feature, the seventh feature and the eighth feature to determine the sample feature data; and

determine the driving behavior score of the sample driver according to the seventh feature and the eighth feature.

13. The device of claim 12, wherein the training module is configured to:

calculate a claim rate of the sample driver according to the seventh feature and the eighth feature; and

determine, according to a preset mapping relationship table, the driving behavior score of the sample driver which having a mapping relationship with the claim rate, and the higher the claim rate, the lower the driving behavior score of the sample driver.

14. The device of any one of claims 8 to 13, wherein the machine learning model is a boosting tree model or a random forest model.

15. A computer device, comprising:

one or more processors; and

a memory configured to store one or more programs,

wherein when the one or more programs are executed by the one or more processors, causing the one or more processors implement the method for scoring the driving behavior according to any one of claims 1 to 7.

16. A computer readable storage medium on which a computer program is stored, wherein when the computer program is executed by a processor, the method for scoring the driving behavior according to any one of claims 1 to 7 is implemented.