Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

PROJECT DESIGN PHASE -2

Technology Architecture

1.The Functions of Intelligent Damage Assessment System

Intelligent damage determination system can be used to determine the appearance damage of vehicles in small cases. The system completes the whole process of survey and damage determination through four functions. They are:

(1) Accident investigation: Photographs of target vehicles and multiple trio vehicles were taken and
uploaded, intelligent recognition, information input, intelligent recognition and event finalization are
completed in accident investigation.
(2) Intelligent image damage assessment: image damage assessment is achieved by intelligent
component recognition and intelligent damage recognition.
(3) Damage result output: Damage results including maintenance scheme recommendation and
maintenance price recommendation are automatically given according to damage recognition results.
(4) Vehicle insurance anti-fraud: In the process of fixing the damage, the anti-fraud screening of
vehicle insurance is completed by means of image fraud recognition and logical detection.
Intelligent damage assessment system can assist the damage locator in the front-end damage
detection process. The operator only needs to take several photos to upload according to the
requirements, and the system can automatically identify the damage degree of the damaged parts and
components. The system in the back-end nuclear damage link can provide auxiliary nuclear damage
and anti-fraud services. It can identify the cases of fixed-loss errors through the logical recognition of

vehicle parts, image fraud recognition, fixed-loss logic recognition, etc. At the same time, it can also
meet the demands of anti-fraud and leakage prevention.
At present, the intelligent damage assessment system can realize the appearance damage of
passenger cars, including CAR, SUV, MPV and VAN. The applicable damage range covers all types
of damage of vehicle exterior parts; the applicable environment range covers rain and snow
environment, dark environment (vehicle can be seen by human eyes), strong light environment and
other scenarios.

2.The Realization Path of Intelligent Damage Assessment System

Intelligent damage determination system has four functional modules: accident investigation, image damage, result output and anti-fraud of automobile insurance. The implementation path is described in detail below.

2.1. Accident Investigation

Accident investigation module includes the photography of certificates and vehicle photos, the intelligent recognition of certificate photos and the intelligent stereotyping work based on the basic
information data of vehicle accessories.

2.1.1. Take Photos.

The photographs taken in the accident investigation of intelligent damage determination system include driving license (front and side pages), driving license (front and side pages), person-car photograph, vehicle corner photograph and vehicle damage photograph. In order to apply the photograph of vehicle damage to the image damage based on artificial intelligence image recognition algorithm, some shooting requirements are put forward:

1) Using smartphones to shoot pictures with no less than 2 million pixels.

(2) For the photography of vehicle damage, it is necessary to shoot the vehicle damage head-on so that the damage location is as far as possible in the center of the picture. The shooting distance is about 1 meter, and it is suitable to shoot clearly.

(3) Multiple damage or cross-component vehicle appearance damage, if the damage distance is relatively close, then a photo can be taken, if the damage distance is relatively far, can not take a photo, then need to be taken separately. In addition, the intellectualization of photography is also reflected in the following aspects: When taking photographs, it automatically identifies whether it is a document photo, a person-car photo, etc. If the photograph does not meet the requirements is not approved, it needs to be re-taken. At the same time, it is not mandatory to satisfy what angle of shooting can be taken, which is easy to operate and makes it easier for the damage fixer or other users to use.

2.1.2. Intelligent ID Recognition.

For the photos of the uploaded driving license (front and side pages), driving license (front and side pages) and other documents, the intelligent damage determination system embedded OCR recognition technology. The VIN code, license plate number, engine number, driver's name and other information of the uploaded driving license and driver's license can be intelligently recognized and filled in. At present, the embedded OCR technology can recognize Chinese characters, English upper and lower case letters, numbers and other information, and the recognition accuracy is 98.5%. Aiming at the problem of manual input for most fixed-loss products at mobile terminals, the embedding of OCR technology can not only save the time for the invalidation personnel to input the certificates without basic information, such as the three vehicles, but also effectively avoid the problems of input errors, which greatly improves the work efficiency.

2.1.3. Intelligent Stereotyping and Fixing. The advantages of intelligent loss determination system are

also reflected in its abundant basic information data. Through VIN code, the basic information
database of vehicles and accessories can be automatically linked to realize the output of specific
vehicle information such as brand, vehicle system, vehicle type, and OE code of parts corresponding
to vehicle type, so as to realize one-to-one correspondence between vehicles and accessories.

2.2. Intelligent Image Damage Assessment

The core of intelligent damage fixing products is to determine which kind of damage happened to the exterior parts of the vehicle by image. The system has been experimented many times in the development of intelligent image damage algorithm. Finally, it divides the problem into three parts: the recognition of appearance parts by image, the recognition of damage parts by image, and the determination of damage parts by relative position relationship.

2.2.1. Vehicle Appearance Component Recognition Algorithms.

According to the statistics of vulnerable parts in vehicle accidents, thirty-one vehicle exterior parts have been identified in this product. Each part is divided into front and back parts, regardless of left and right parts. Aiming at the recognition of 31 vehicle appearance parts (regardless of left or right), the recognition algorithm for panoramic or local vehicles is realized, in the complex environment of rain and snow, too strong light or dark, by using the self-built data set of vehicle appearance parts and the depth learning target detection algorithm. The list of parts is shown in Table 1. The component recognition algorithm AP50 is 88.7%. Table 1. Partial List of Vehicle

In order to avoid overlapping of location areas after vehicle appearance parts detection, it is difficult to determine the location relationship of subsequent damage. The method of case segmentation is adopted, that is, the appearance of the image is recognized by the method of pixel-level object segmentation. As an extension of Faster R-CNN [6], Mask R-CNN [7] can achieve object segmentation. The effect of the recognition algorithm for vehicle appearance parts is shown in Figure 1.

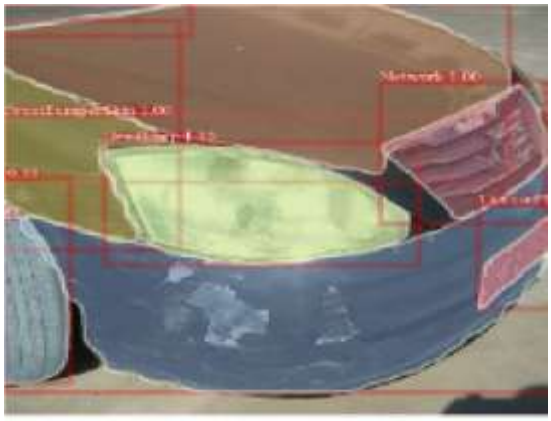

Figure 1. Effect Diagram of Vehicle Appearance Component Recognition Algorithm

2.2.2. Damage Recognition Algorithms for Vehicle Appearance Components. This product is aimed at six types of vehicle appearance damage, and also applies the deep learning target detection method. Through the self-built damage data set, it can recognize high-light pictures, low contrast pictures and multi-category mixed iamage. The list of damage types is shown in Table 2. The damage recognition algorithm AP50 is 87.6%. Table 2. Damage Type List of Vehicle Appearance Components.

Damage data sets are labeled with rectangular frames. The effect of vehicle appearance damage
recognition algorithm is shown in Figure 2.

Figure 2. Effect Diagram of Vehicle Appearance Damage Recognition Algorithm