System for license plates recognition based on viola-jones algorithm

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Abstract - Described system for license plates recognition. Analyzed algorithms of classification and recognition. The system architecture is described and compared to the similar systems.

Keywords : machine learning, pattern recognition, client-server system.

Introduction

Images recognition became extremely popular today. Pattern recognition is closely related to the discipline of machine learning.

Typical statements of pattern recognition tasks:

1. The task of identification, which is to erase a particular specific object among its similar.
2. Classifying object to one or another class. This may be, for example, the task of recognizing letters or deciding whether there is a defect in some technical detail.
3. Cluster analysis, which consists in the distribution of a given set of objects into classes. This task is often called a classification without a teacher, because, unlike task 2, classes are not given.

Object of study

The object of research is the license plates recognition system. Such systems are usually used by various private firms to control cars that have the right to be on the site of a protected object. In general, the structure of such a system is as follows:

• high-quality camera
• server that in real time receives data stream from the camera and processes it.
• A client with whom security guards work. When the server recognizes a license plate, the information about the owner of the car is transmitted to the client.

Analysis of existing solutions

One of the existing analogue of the plates recognition system is the system "Oberig". It is a hardware and software complex designed for reading and recognizing state automobile license plates.

Scope of use:

• stationary and mobile traffic police stations
• international checkpoints and objects under the supervision of customs authorities (IUC, STZ, etc.)
• parking facilities, entry / exit facilities

Main features:

• read state road vehicle license plates up to 255 km / h
• recognition of more than 300 types of license plates (all types of Ukrainian numbers, CIS countries and the Baltic States, 20 European countries, 5 countries of Latin America and the USA)
• Managing and storing recognized numerical logs in the database (supported by DBASE - DBASE, MS ACCESS, MS SQL Server, MySQL, PostgreSQL, ORACLE)

Therefore, the user should be authorized, before being able to work with the system. To authorize, user must enter his username and password. After that, the user will be able to observe

the video stream from the camera. If the system can recognize a car number in the image from the camera - user will see information about the owner of the car.

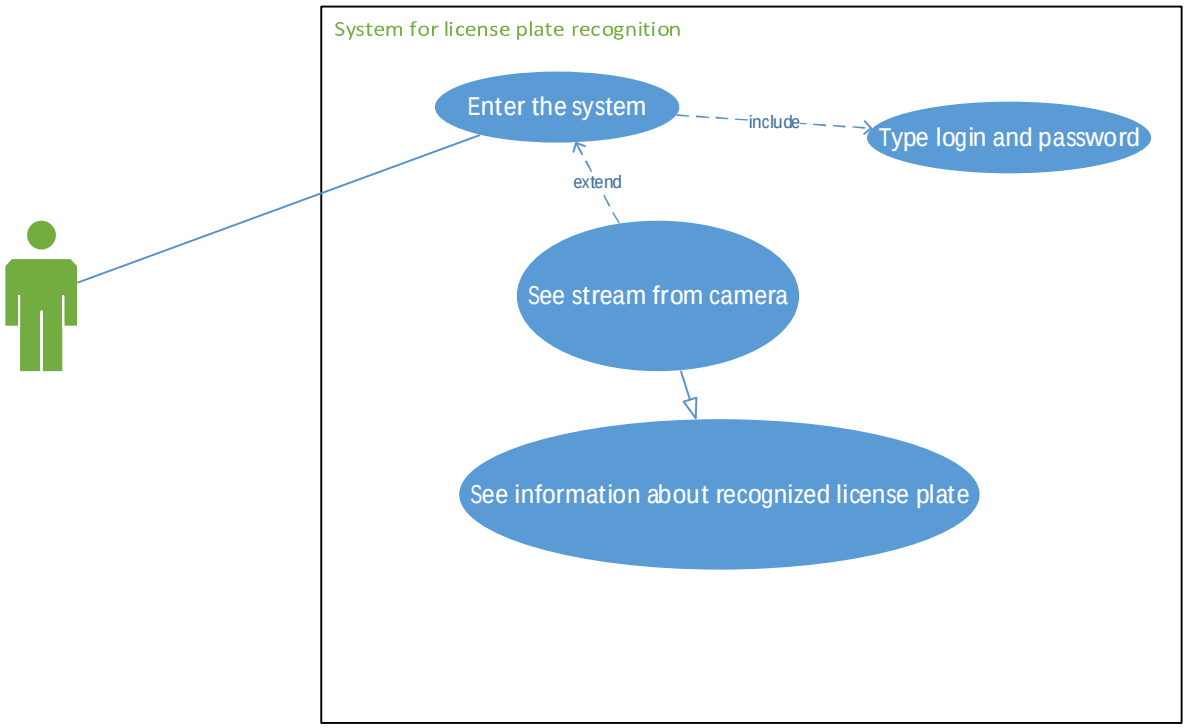

Fig. 1 Use case diagram of system

The system is based on the classic client-server architecture with a thick client. The client in this case is an application on the terminal. To obtain access to use the system, the trustee must be authorized. The server will operate under the HTTP protocol.

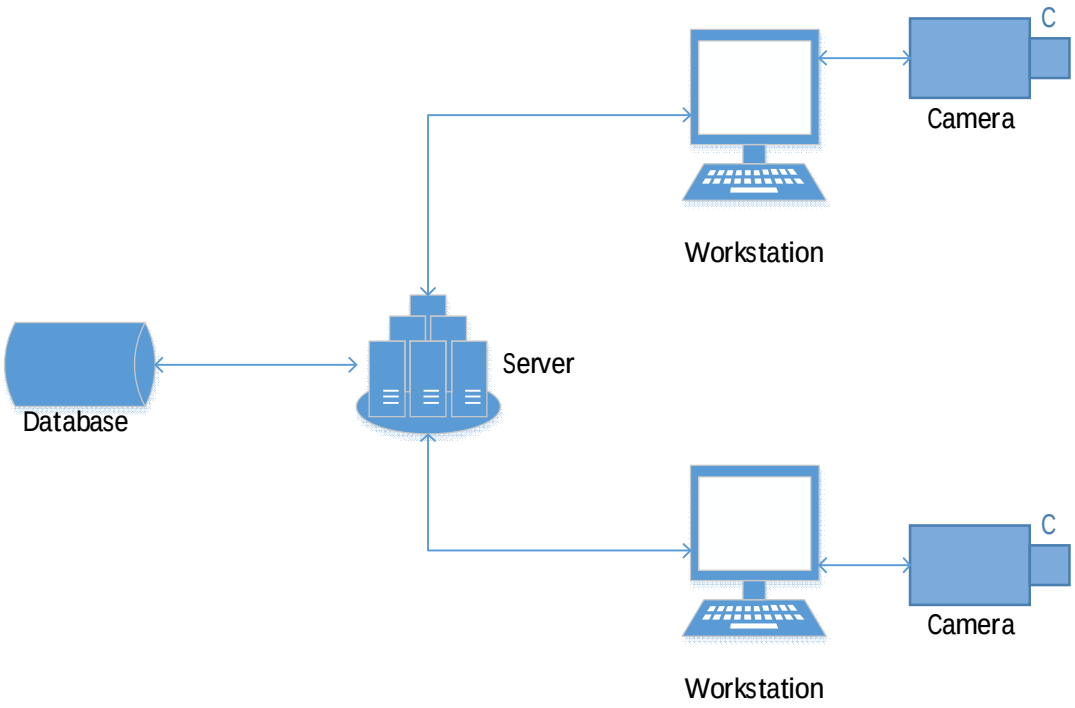

Fig. 2 Structure diagram of the system

Basic workflow of the web server:

• Verification of user authorization
• Find information on the car owner in the car number
• Saving information about the recognized number in the database

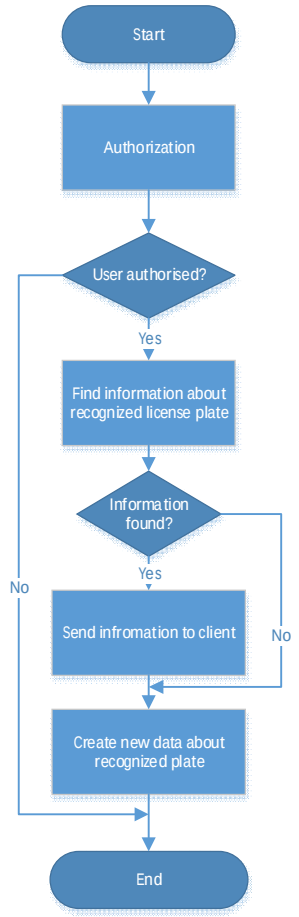

Fig. 3 Block-scheme of server workflow

Analysis of algorithms used for recognition

The Viola-Jones method is an algorithm that allows you to detect objects in real-time images. It was proposed by Paul Viola and Michael Jones in 2001.

The basis of the Viola-Jones method is the Haar's primitives [1], representing the partition of a given rectangular area. The Haar's primitives can be seen in Fig. 4.

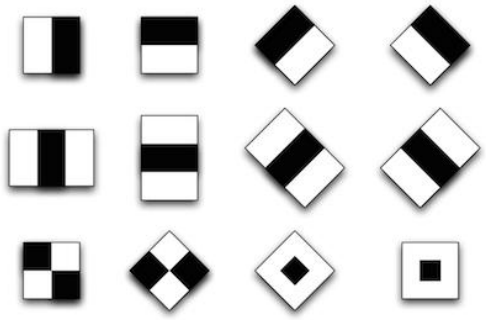

Fig. 4 Haar's primitives

In the original version of the Viola-Jones algorithm, only the horizontal and vertical primitives were used. Later 45-degree slopes and asymmetrical figures were offered. Also,

instead of calculating the usual difference, it was suggested that each primitive will be assigned a certain weight, and the value of the sign is calculated as a weighted sum of pixels of different types of regions.

From the values of a pair of pixels, it is difficult to make some meaningful information for classification, while from the two Haar's primitives is built, for example, the first cascade of the system for pattern recognition, which has a well-meaning interpretation.

The complexity of calculating a sign and obtaining a pixel value is O (1) [1].
The algorithm is a meta-algorithm, in the process of learning builds a composition of the basic learning algorithms to improve their efficiency. AdaBoost is an adaptive boosting algorithm in the sense that each subsequent classifier is built on objects that are poorly classified by previous classifiers [2].

AdaBoost causes a weak classifier in a loop. After each call, the weight distribution is updated, which corresponds to the importance of each of the study sample objects for classification. For each iteration, the weight of each incorrectly classified object increases, thus the new classifier "focuses its attention" on objects.

The method of support vectors [3] is a set of related teaching methods with a teacher, which are used for classification and regression. Having a set of training examples, each of which is noted as belonging to one of two categories, the algorithm of training the method of reference vectors builds a model that predicts whether a new example falls into one category or another. In machine learning, the method of support vectors is a data analysis method for classification and regression analysis using models with controlled learning with associated learning algorithms, which are called support vector machines. For a given set of training samples, each of which is marked as belonging to one or other of two categories, the training algorithm of the SVM builds a model that relates new samples to one or another category.

Conclusion

Analogues of the system are analyzed, their weaknesses and strengths are revealed. The Viola-Jones method and the method of support vectors are analyzed. Use case diagram and the structural scheme of the system were developed. Analyzed technologies used for realization.

References

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