PUMATRONIX

CLASSIFIER

CLASSIFIER

SOFTWARE FOR AUTOMATIC RECOGNITION OF VEHICLE CHARACTERISTICS

Product

Pumatronix Equipamentos Eletrônicos Ltda.

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Change History

Date	Revision	Updated content
07/23/2024	1.0	Review of the layout and general formatting of the document; Content referring to version 1.16.0 of the product
22/09/2025	1.1	Update of Technical Support contact (SAD-901); Brand and Model table correction (SAD-900)

Overview

The continuous increase in population in urban areas poses major challenges in the public management of cities. Intelligent services that use Information and Communication Technologies (ICTs) become increasingly relevant in helping to monitor, control and make efficient and quick decisions to solve problems inherent to the large concentration of people, such as mobility and security in the traffic, energy efficiency, public safety, supply control, among others.

The concept called Smart Cities is a global trend that classifies the strategic use of infrastructure and services based on the application of ICT solutions in urban planning and management, bringing results to the social and economic needs of a city. Therefore, the use of Information Technology allows cities to develop economically while increasing the quality of life of inhabitants by generating efficiency in urban operations.

Examples of these technologies are Intelligent Transport Systems (ITS), in which Pumatronix products are used, such as the Classifier software library, specialized in recognizing vehicle characteristics from images. Responsible for delivering information on the classification of vehicle types in images, location of vehicles in images, detection of images that contain vehicles, validation of vehicle license plate recognition through vehicle type classification and statistics collection, the Classifier software library It is ideal for application in electronic traffic inspection, presenting the expected performance in different types of vehicle flow control and management scenarios.

Handling Risks

The hardkey is the validation key for the Classifier software library and for this reason it must be kept connected while using the product.

Models

The JidoshaLight software library is compatible with PCs (x86/x86_64) with Windows™ or Linux operating systems and ARM A53™ processors with Windows™ or Linux systems and available in the specified formats:

- Windows x64 and x32 - using a *.dll* in the application;
- Linux x64 and x32 - using a *.so* in the application;
- ARM - packages according to the specified model;

Summary

1. Knowing the Product

Classifier is a software library specialized in recognizing vehicle features from images. Currently it can return some characteristics of the vehicles, their location in the image and reliability of the classifications.

The Classifier library was developed to be used in the most diverse applications that require information about vehicles. The Classifier can be used with panoramic or close-up images. To increase its performance, the type of scene that will be used in its operation must be defined via API.

Some most common use cases for the Classifier library:

- Classification of vehicle types in images
- Location of vehicles in images
- Detection of images containing vehicles
- Validation of vehicle license plate recognition through vehicle type classification
- Survey of vehicle types statistics through images

Figure 1 - Classifier application examples: Top: images to be processed by the Classifier; Low: images overlaid with information obtained by the Classifier; Left and center: closed type images; Right: panoramic image

2. Information Generated

The Classifier operates by detecting and classifying objects in images. From this process it is possible to infer the characteristics of each vehicle in the image separately.

In its most basic version, it will detect types of vehicles in the image and their location. The classes that can be distinguished are the following:

- Car
- Motorcycle
- Truck
- Bus

There is still the possibility of configuring the detection of the following classes for daytime panoramic scene configuration:

- Pickup

- SUV
- Van
- Trailer

The Classifier, when configured in its default mode, categorizes all detected vehicles into one of four main classes: Car, Motorcycle, Truck or Bus. In this scenario, vehicles that could belong to more specific categories are allocated to the closest class; for example, Trailers are classified as Trucks, while Pickups, SUVs and Vans are considered Cars, despite slight variations. When activating the extended detection mode (only available for the panoramic and daytime scenes), the system now distinguishes between a total of eight classes, including Pickup, SUV, Van and Trailer, allowing for a more detailed and specific vehicle classification.

After processing the image provided in the input, the Classifier returns the following information for each detected vehicle:

- Vehicle type
- Coordinates of the vehicle in the image, in the form of a bounding box (rectangle)
- Reliability of vehicle type classification, in the form of a probability between 0 and 1

2.1. Feature classification

In addition to the above operation, by activating the `PTX_CLASSIFIER_CONFIG_ENABLE_VEHICLE_CHARACTERISTICS` configuration it is also possible to extract other vehicle characteristics, such as:

- Brand
- Model
- Color

Optional and separately licensed functionality. Contact comercial@pumatronix.com.br for more information.

This option will result in an increase in CLASSIFIER processing time. The increase is proportional to the number of vehicles detected in the image.

2.1.1. Scenario

The vehicle characteristics classification model is under continuous development and currently has some use restrictions, such as:

- Operation is scheduled for daytime
- The recommended usage scenario is those where the view is panoramic.

In addition to these restrictions, in order to maximize the success rate of the solution, it is suggested that the camera be installed in a gantry or semi-gantry with a two-lane view.

2.2. Supported Classes

Classifier supports a total of 9 colors, 17 brands and 67 pre-defined models as below:

Colors
unknown, black, blue, brown, gray, green, red, silver, white, yellow

Brands	Models
unknown	unknown
citroen	c3, c4
fiat	doblo, fiorino, palio, punto, siena, strada, toro, uno, argo, cronos, mobi
ford	ecosport, fiesta, focus, ka, ranger
gm	celta, classic, cobalt, corsa, cruze, montana, onix, prisma, s10, spin, tracker
honda	civic, fit, hr-v, city
hyundai	hb20, creta
iveco	-
jeep	compass, renegade
m.benz	-
mitsubishi	pajero
nissan	frontier, kicks, sentra, versa
renault	clio, duster, fluence, kwid, logan, master, megane, sandero
scania	-
toyota	corolla, etios, hilux, corolla cross, sw4, yaris
volvo	-
vw	amarok, gol, fox/crossfox, jetta, nova saveiro, novo gol, novo voyage, polo, saveiro, spacefox, up, voyage, nivus, t-cross

3. Additional Documentation

Produto	Link	Descrição
Classifier	Integration Manual	Programming and integration manual containing the necessary information for integrating the Classifier library

4. Licensing

The software and attached documentation are protected by copyright. By installing the software, you agree to the terms of the license agreement.

The Classifier software library is designed to work in conjunction with the hardkey that comes with the library. In other words, for the library to function correctly, the hardkey must be connected to the USB of the environment in which the library will be used. There are two hardkey versions, a demo version and

another for general use, with the demo version having an expiration date. When the expiration date expires, the library automatically returns empty plates. If your demo hardkey has expired and you would like to purchase a license or extend the demo period, please contact Pumatronix.

The hardkey is the validation key for the Classifier software library and for this reason it must be kept connected while using the product.

5. Initial Setup

5.1. Minimum Recommended Hardware

5.1.1. Software

- Operational system
  - Linux 32/64 bits with support forGLIBC 2.7 or higher
  - Windows 32/64 bits version 7 or higher
- 7zip: http://www.7-zip.org/

5.1.2. Hardware

- USB port (used by the hardkey)
- CPU x86, x86_64 or ARM A53
- 2GB or more memoryRAM

Although it is possible to use the library in virtual machines, its use is discouraged and not approved. Pumatronix does not provide guarantees of operation and support for the use of its products on virtual machines.

6. Care and Maintenance

Some care is necessary to ensure product performance and extend its useful life.

Product Risks: The use of the product presents risks, which are presented in the Handling Risks section.

6.1. Software update

The current version, 1.16.0, can be installed by extracting the headers (.h) and shared libraries (.so) from the SDK folder into the user's application directory.

If you have any questions, please contact Technical Support via email at support@pumatronix.com or WhatsApp +55 (41) 3016-3173.

7. General Warranty Conditions

Pumatronix guarantees the product against any defect in material or manufacturing process for a period of 1 year from the date of issuance of the invoice, provided that, at the discretion of its authorized technicians, a defect is found under normal conditions of use.

The replacement of defective parts and the performance of services arising from this Warranty will only be carried out at Pumatronix Authorized Technical Assistance or a third party expressly indicated by it, where the product must be delivered for repair.

This Guarantee will only be valid if the product is accompanied by a Maintenance Form duly completed and without erasures and accompanied by an Invoice.

7.1. Situations in which the Product Loses the Warranty

1) Use of software/hardware not compatible with the specifications in the Manual;
2) Connecting the product to the electrical network outside the standards established in the product manual and installations that present excessive voltage variation;
3) Infiltration of liquids from opening/closing the product;
4) Damage caused by natural agents (electrical discharge, flooding, salt spray, excessive exposure to climate variations, among other factors) or excessive exposure to heat (beyond the limits established in the Manual);
5) Use of the product in environments subject to corrosive gases, excessive humidity and/or dust;
6) Show signs of tampering with security seals;
7) Show signs of opening and modification made by the Customer in product locations not authorized by Pumatronix;
8) Damage caused by accidents/falls/vandalism;
9) Display tampered and/or removed serial number;
10) Damage resulting from the transport and packaging of the product by the Customer in conditions incompatible with the same;
11) Misuse and in disagreement with the Instruction Manual.

8. Privacy Policy

In compliance with the General Data Protection Law (LGPD) - Law No. 13,709, of August 14, 2018, this product has programmable functions for capturing and processing images that may violate the LGPD when used, in conjunction with other equipment to capture personal data.

Pumatronix is not responsible for the purposes, use and treatment of the images captured, and control of the information and ways of operating the product are the exclusive decision of the user or purchaser of the product.


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