Forensic ANPR 3.0.1

User Guide

Copyright © 2024, Eyedea Recognition s.r.o.

All rights reserved

Eyedea Recognition s.r.o. is not responsible for any damages or losses caused by incorrect or inaccurate results or unauthorized use of the software Forensic ANPR.

Gemalto, the Gemalto logo, are trademarks and service marks of Gemalto and are registered in certain countries. Safenet, Sentinel, Sentinel Local License Manager and Sentinel Hardware Key are registered trademarks of Safenet, Inc.

Microsoft Windows, Windows XP, Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows 10 Windows 11 and Windows logo are registered trademarks of Microsoft Corporation.

Intel is a trademark of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

NVIDIA, the NVIDIA logo, GeForce®, GeForce® GTX, CUDA®, the CUDA logo are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and/or other countries.

Contact:

Address:
Eyedea Recognition, s.r.o.
Vyšehradská 320/49
128 00, Prague 2
Czech Republic

web: http://www.eyedea.ai

email: info@eyedea.ai

Table of Contents

1 Introduction 1-4
2 Hardware requirements 2-5
2.1 Minimal requirements 2-5
2.2 Recommended requirements 2-5
3 Version history 3-6
4 Installation and uninstallation 4-8
4.1 Installation of the application 4-8
4.2 Network license setting 4-12
5 Program control 5-14
5.1 Starting the program 5-14
5.2 Project 5-14
5.2.1 Creating a new project 5-15
5.2.2 Opening an existing project 5-15
5.2.3 'Analyze Video / Images without creating a project' option 5-15
5.3 Step 1 – Interval selection 5-16
5.4 Step 2 – Tracked license plate selection 5-17
5.5 Step 3 – Selection of analyzed images 5-21
5.6 Step 4 – Results 5-22
5.6.1 Summary results 5-23
5.6.2 Detailed results 5-24
6 Vehicle register explorer 6-26
6.1 Database connection 6-26
6.2 Creating a new database 6-27
6.2.1 Import data – Common rules 6-28
6.2.2 Import data – Single file 6-28
6.2.3 Import data – Multiple files 6-29
6.3 Displaying vehicle register 6-30
6.3.1 Filter fields 6-31
6.3.2 Result table 6-32
6.3.3 Score 6-33
7 Settings 7-35
7.1 Language 7-35
7.2 Application parameters 7-35
7.3 Saving settings 7-36

1 Introduction

The software Forensic ANPR is a desktop application which is used to recognize difficult-to-read license plates from video or set of photos. The program in the form of a wizard processes videos and images in various formats, resolution and quality.

This software enables to play the source video or set of photos and select an interval for further analysis. Within this interval, the license plates are automatically detected, from which the user for each frame selects the requested one to be analyzed. The output of the program is an ordered set of hypotheses of the analyzed license plate text.

The application includes an explorer of SQL database into which it is possible to import data for example from the vehicle register. These records can be filtered by the license plate text, country, color, make and model of the vehicle and automatically compare them with the hypotheses of the analyzed license plate text, optionally also recognized make, model and color of the vehicle.

It is expected that the process to obtain the result usually needs to be documented, so the program allows the user to create a project with information about the status of the application that is being automatically saved and can be reloaded in the future.

The analytical core of the system is based on advanced recognition algorithms, which are created using the statistical methods of automatic learning on large training sets. It is necessary to assess the quality of the detection and recognition features on the basis of the statistical evaluation of the larger number of samples.

2 Hardware requirements

2.1 Minimal requirements

- Processor: Intel® Core™ i5, 2 cores (4 logical processors)
- RAM: 4 GB
- Hard disk: 256 GB (optional SSD)
- Operating system: Microsoft Windows 10 or 11, 64b

2.2 Recommended requirements

- Processor: Intel® Core™ i7, 4 cores (8 logical processors)
- RAM: 16 GB
- Hard disk: 512 GB, SSD
- GPU (optional): NVIDIA® GeForce® GTX 1050 Ti, 4GB GDDR5
- Operating system: Microsoft Windows 10 or 11, 64b

3 Version history

Forensic ANPR 3.0.1

Released: 2024/01/05

- Fixed GPU device (graphical processing unit) detection
- Used more precise LPM detector module
- Shown splash screen during application startup

Forensic ANPR 3.0.0

Released: 2023/12/22

- New LPM detector detecting license plates as well as car boxes (vehicles)
- Updated OCR engine (reading license plates)
- Added support for MMR (model and make recognition)
- All SDK engines now support GPU (graphical processing unit) computation
- Extended support for video and image formats
- Simplified tracked license plate selection
- Added Country field to the Vehicle register explorer
- Enabled full-text selection of filter criteria in the Vehicle register explorer
- Enabled import of all data into the Register database using a single file
- Updated HASP to the latest version (9.12)

Forensic ANPR 2.1.0

Released: 2023/04/25

- New product branding as “Forensic ANPR”
- Updated PostgreSQL to the latest version (15.2)
- Updated HASP to the latest version (8.5)

LowResANPR 2.0.1

Released: 2022/11/11

- Updated HASP to the latest version (8.4)

LowResANPR 2.0.0

Released: 2020/03/04

- Possibility to compare the results with the vehicle register
- Displaying results by character
- Possibility of license plate manual detection

LowResANPR 1.0.1

Released: 2019/04/29

- Fixed license check at application start

LowResANPR 1.0

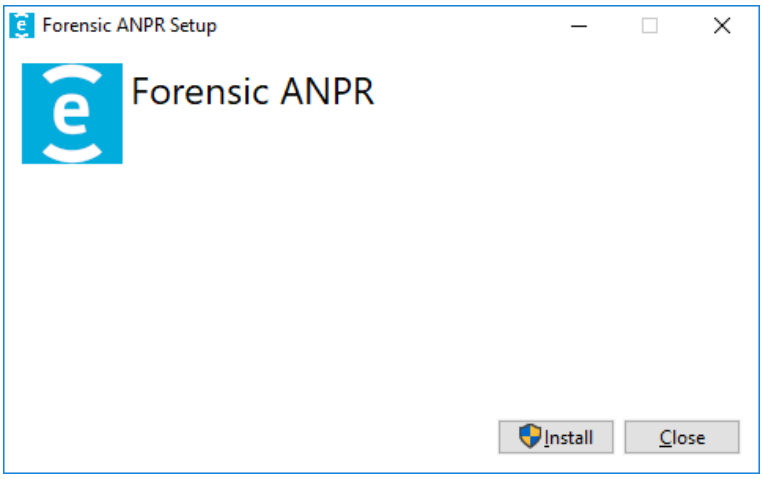
Released: 2019/04/12

- First release of the application

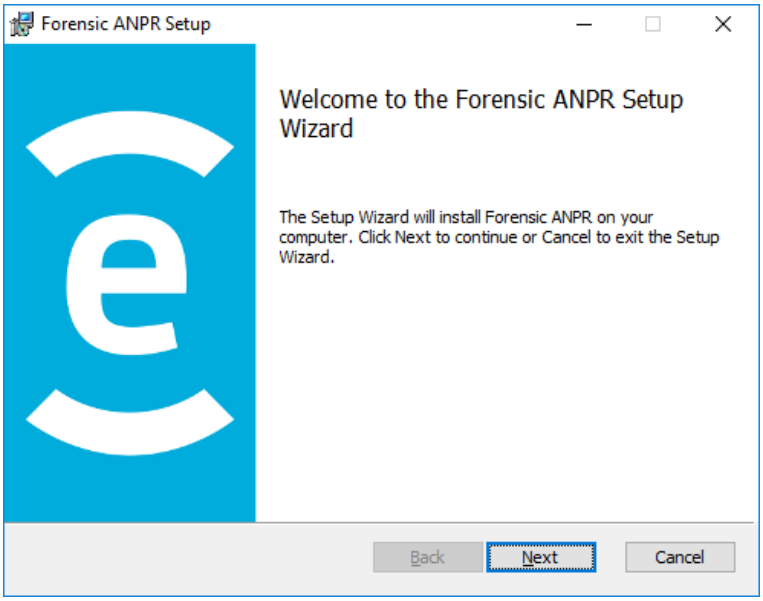
4 Installation and uninstallation

4.1 Installation of the application

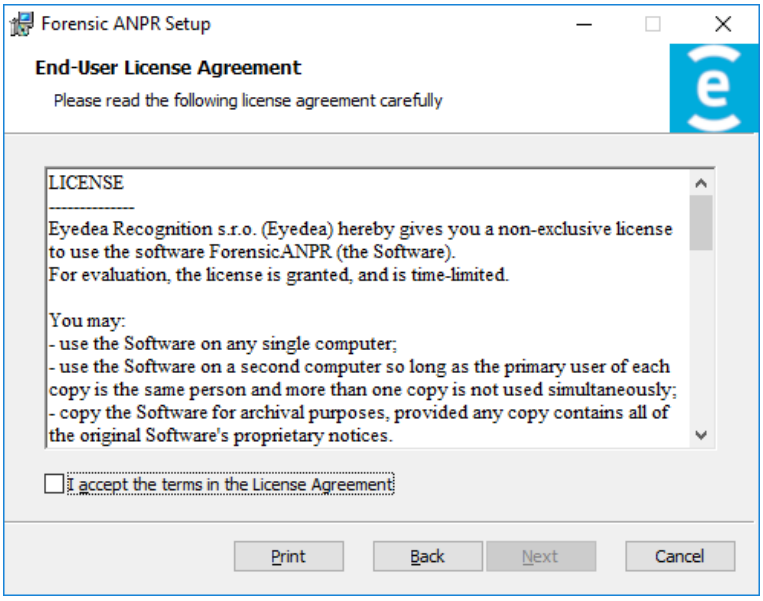
Installation of the application starts using file ForensicANPRSetup64.exe in the installation package. The following window is displayed after the start, it informs about initiation of an installation process.



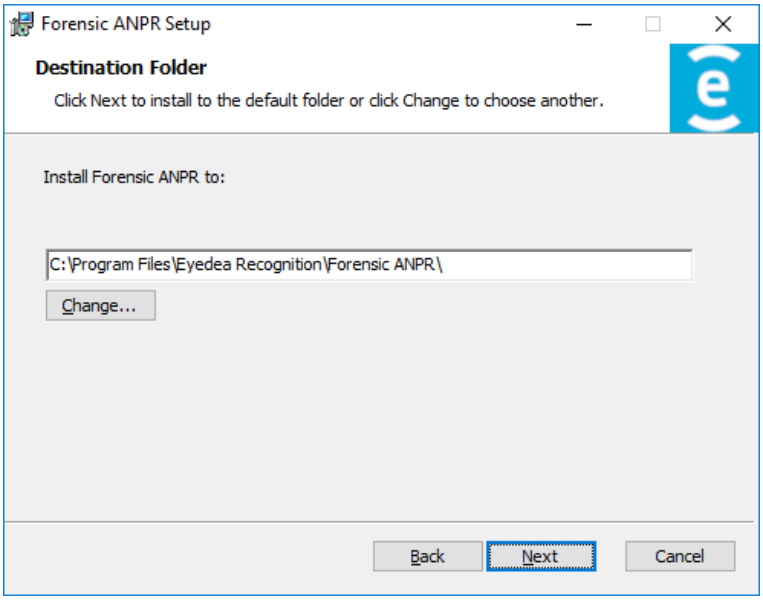
After pressing the Install button, the installation of important libraries for running Forensic ANPR takes place, then the following window appears.



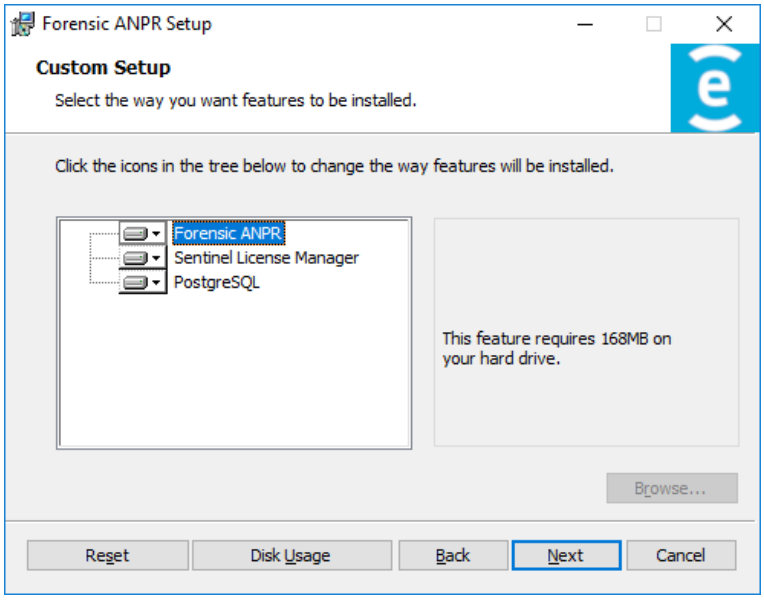
Clicking the Next button, the License Agreement is displayed.



After reading the License Agreement and confirmation using the choice I accept the terms in the license agreement it is possible to continue to the next step using the Next button.



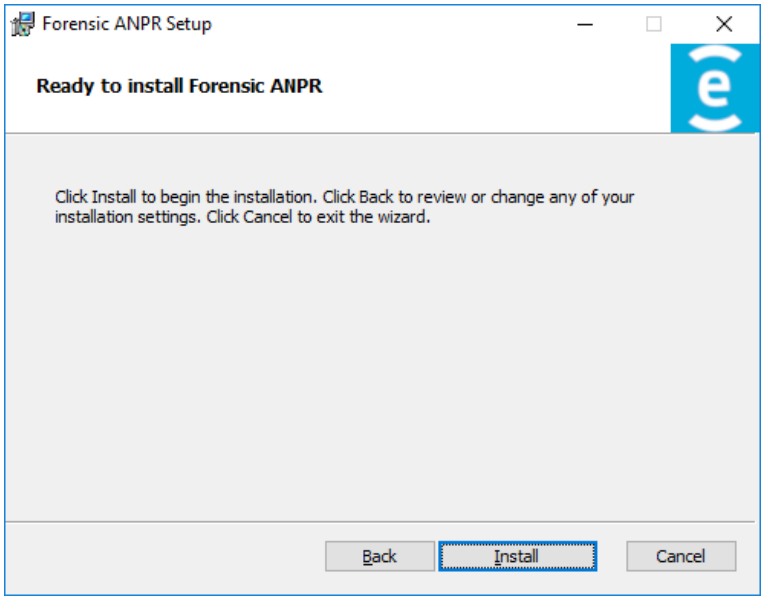
In this window, it is possible to change the folder alternatively, where the program is installed. Press the Next button.



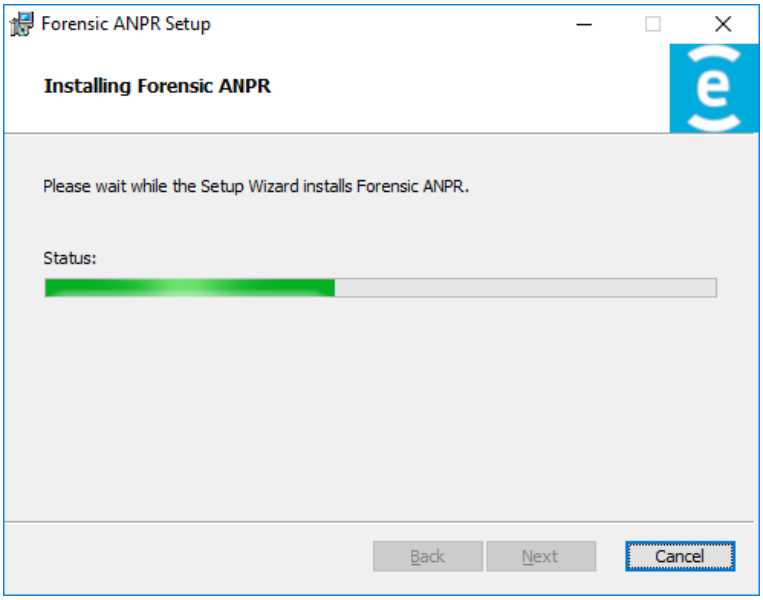
On the Custom Setup page, you can choose which components will be installed. The default installation contains all of them – Forensic ANPR is this application, Sentinel License Manager is used to verify the license and is required to run Forensic ANPR and PostgreSQL is a database system which is necessary to run the integrated vehicle register explorer with the local database (however, it is not necessary for the basic application run).

If you do not wish to install any of these components, click on the arrow next to the disk symbol and select the last option Entire feature will be unavailable marked with a cross from the drop-down menu.

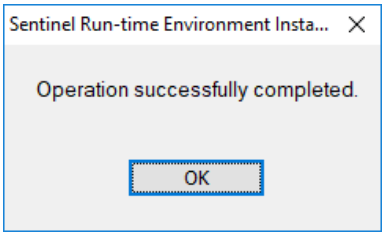
Press the Next button to continue to the last page before the installation.



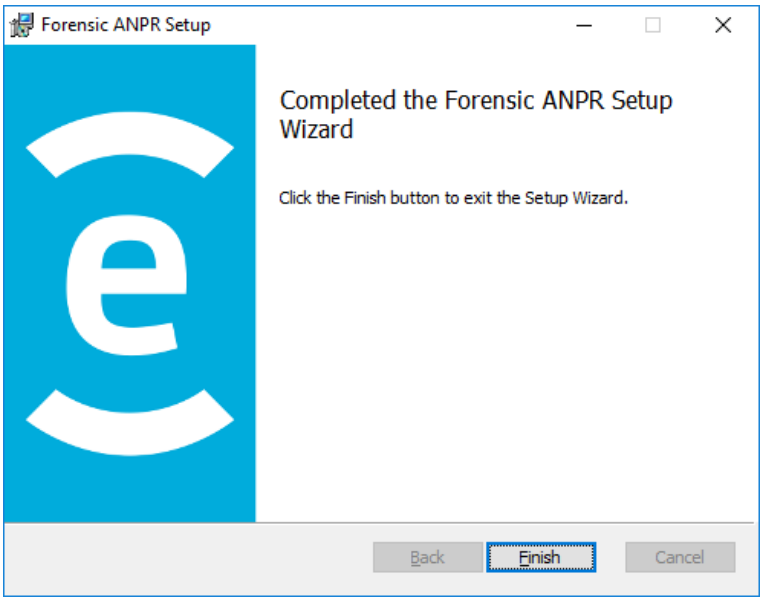
Now it is possible to start the installation itself using the Install button. This installation copies all necessary files and drivers selected on the previous page.



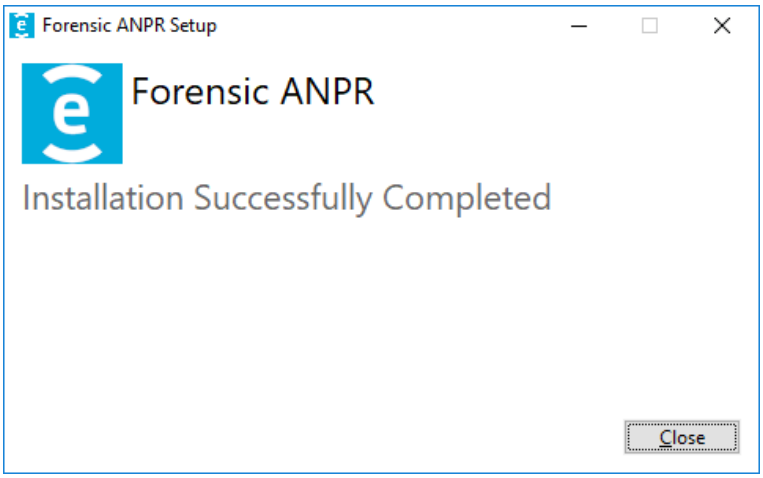
The installation of the hardware key driver takes place automatically, but it can require confirming a report on finishing the installation.



When the installation is complete, the following window appears. Press the Finish button to exit the installer.

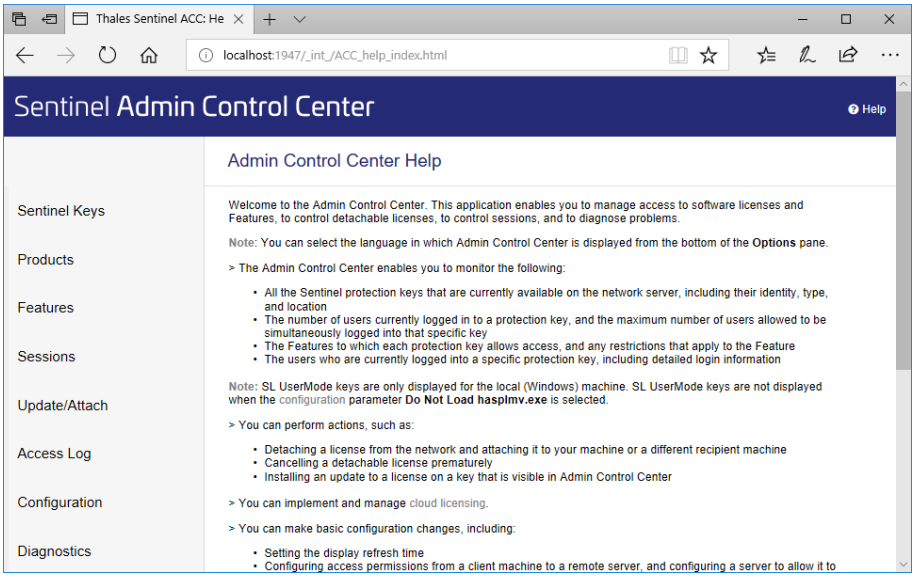


Now the application is installed and ready for use.



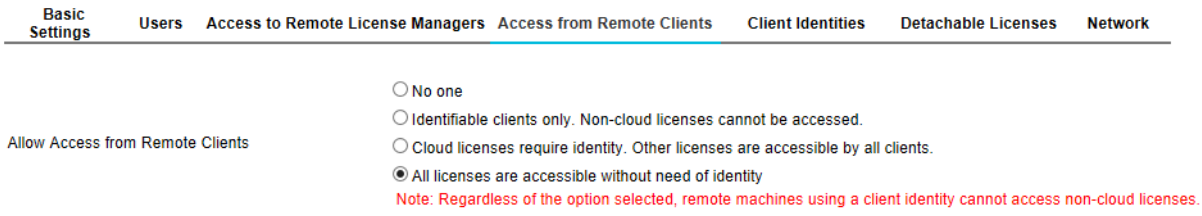
4.2 Network license setting

After the successful Sentinel License Server installation, open the address http://localhost:1947 in a web browser and check whether the license server is running. If the Sentinel Admin Control Center web application is displayed, the license server is running. License server can be configured to allow to connect clients to use available licenses (configured as a server) or it can connect to another license server (configured as a client).



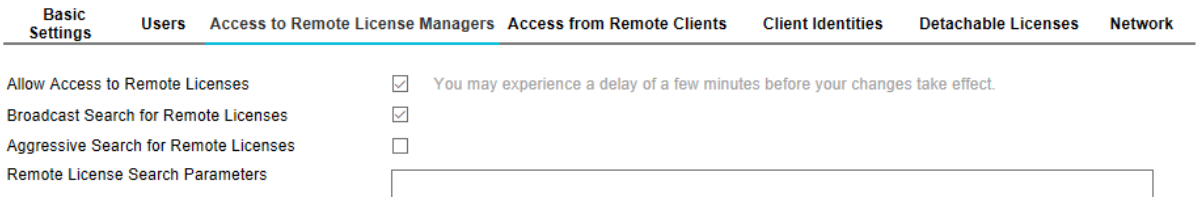
Server configuration

To set the license server as a license provider, please open the address in your web browser http://localhost:1947/_int_/config_from.html and choose the appropriate option from Allow Access from Remote Clients to allow other clients to connect to the network license key plugged in the server.



Client configuration

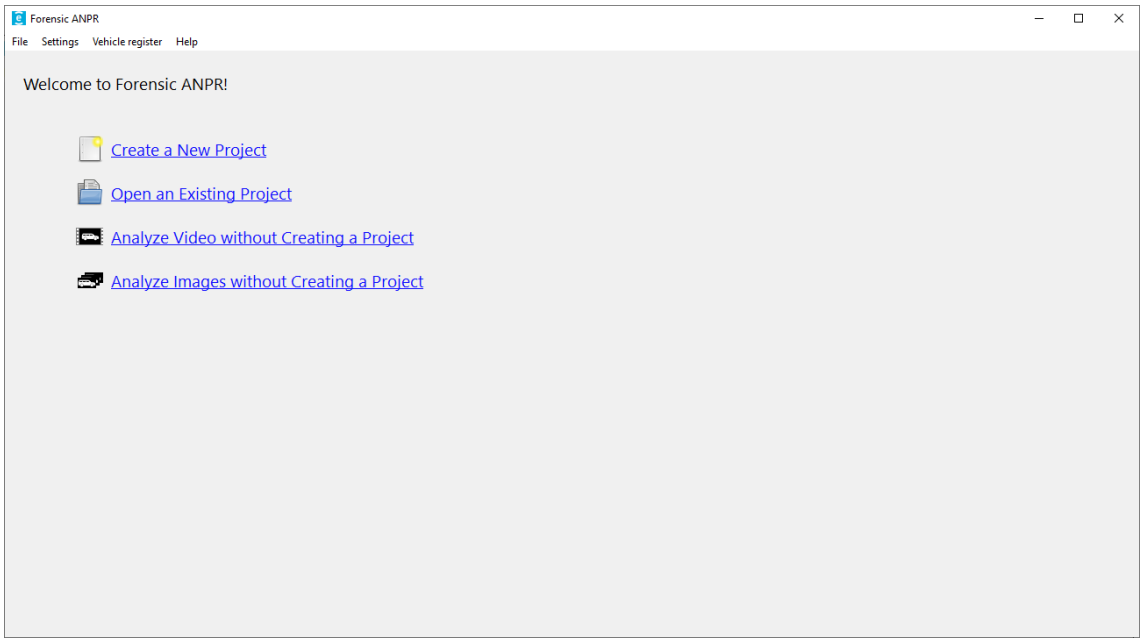
To set the license server as a client, open the address http://localhost:1947/_int_/config_to.html in a web browser and choose the Allow Access to Remote Licenses option. If the license provider is in another network than the computer, put the server's IP address into the field Remote License Search Parameters.



5 Program control

5.1 Starting the program

When you start the program (or close the project), a welcome screen is displayed.



If your operating system is in Czech, the application will be switched to Czech at its first run, otherwise it will be in English (you can switch between English and Czech using the Settings → Language → English / Czech, or Nastavení → Jazyk → Angličtina / Čeština menu in Czech).

Like other settings, the application stores the selected language to reuse this setting when restarted. The setting options are described in more detail in chapter 7 Settings.

5.2 Project

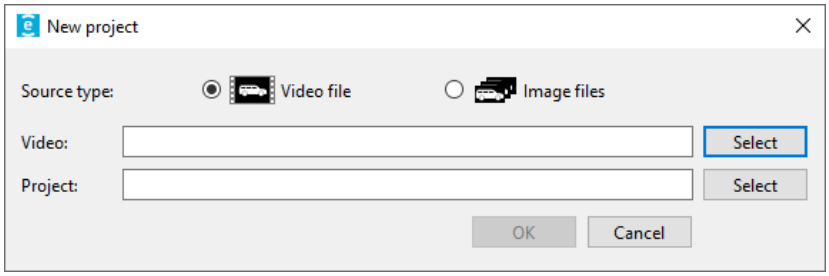
It is expected that the process to obtain the result usually needs to be documented, so the program allows the user to create a project for each analyzed license plate. The project file contains information about the current status of the application, is automatically saved (always in the transition to the next page and before closing the project) and allows the user to return to the analysis in the future.

The project is stored in XML format and includes the name and path to the source video or set of photos, possibly with additional information, data on the detected license plates as well as user selection and the resulting hypotheses. Although the XML file is saved in a plain text ("human readable"), we do not recommend editing project files outside the Forensic ANPR application.

Project file, on the contrary, does not physically contain the video or photos, so that the source data must remain in its original location to successfully reopen the project.

5.2.1 Creating a new project

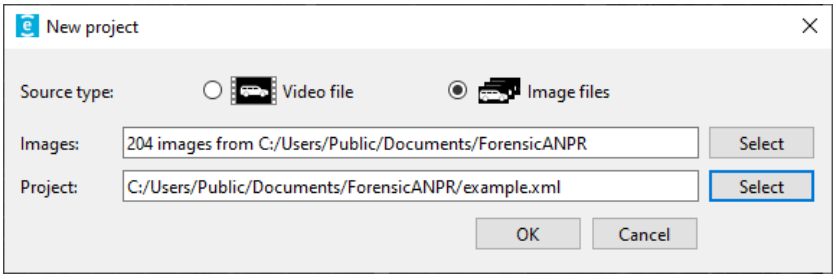
To display the dialog window for creating a new project, click the Create a New Project option on the welcome screen or select File → New project from the menu.



The source can be either a single video file, or one or more images. Depending on which option is selected in the Source type menu, the appropriate line with the Video: or Images: label will be displayed below it, and the appropriate source will be selected after clicking in the text box or the Select button.

Supported are most of the common video formats with codecs of the ffmpeg standard (which is most of the known codecs[1]), including AVI, MPG, MP4 and MOV. Most of the common image formats are supported, too, including JPG, JPEG, PNG and BMP.

Clicking on the Project: text box or the corresponding Select button opens a dialog window for saving the project file.



When you press the OK button, the project file is created, and the first step of the wizard is displayed – Step 1 – Interval selection.

5.2.2 Opening an existing project

You can open an existing project by clicking the Open an Existing Project option on the welcome screen or selecting File → Open project from the menu.

5.2.3 'Analyze Video / Images without creating a project' option

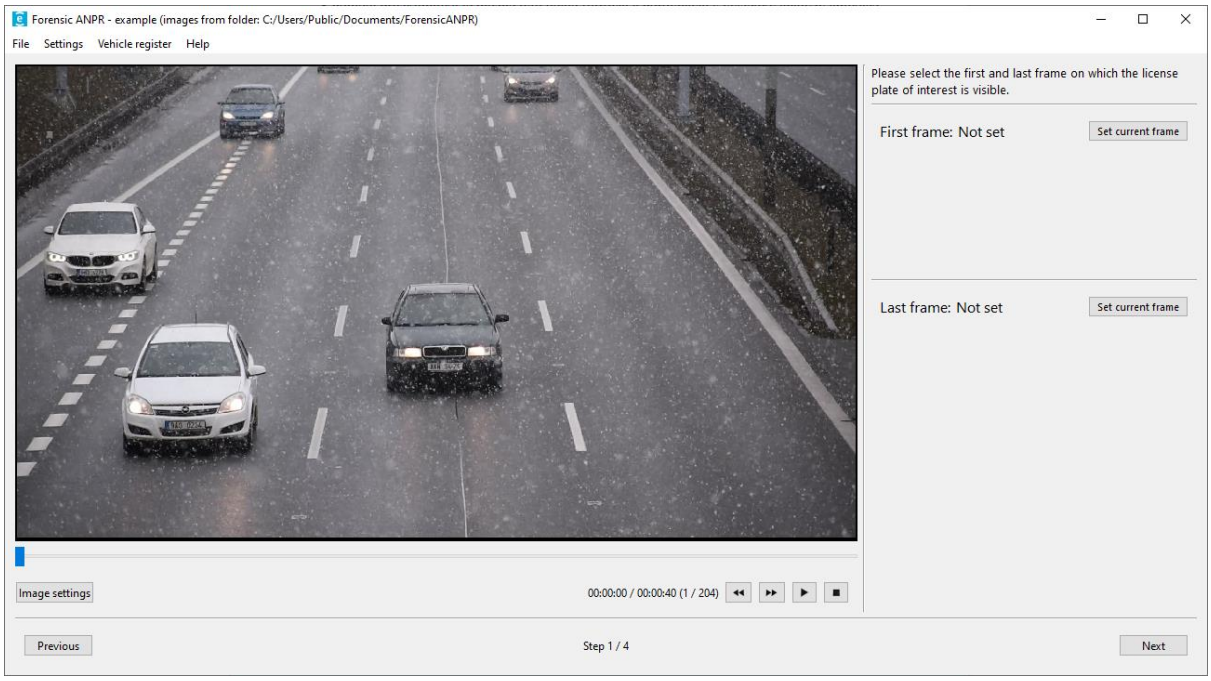
If you do not want to save the project at all or want to start analyzing a video or photos before saving the project, you can use either of the Analyze Video / Images without creating a Project options on the welcome screen. In these cases, the application does not automatically save anything during your work, but you can save the project at any time using the File →

[1] In the case that it is necessary to process the video, which codec the program does not support, it is necessary to re-encode the video before processing.

Save project as menu item. Since then, it has become a regular project which is automatically saved on an ongoing basis.

5.3 Step 1 – Interval selection

The first step is to select an interval of the input video or photos to work with in the next steps.



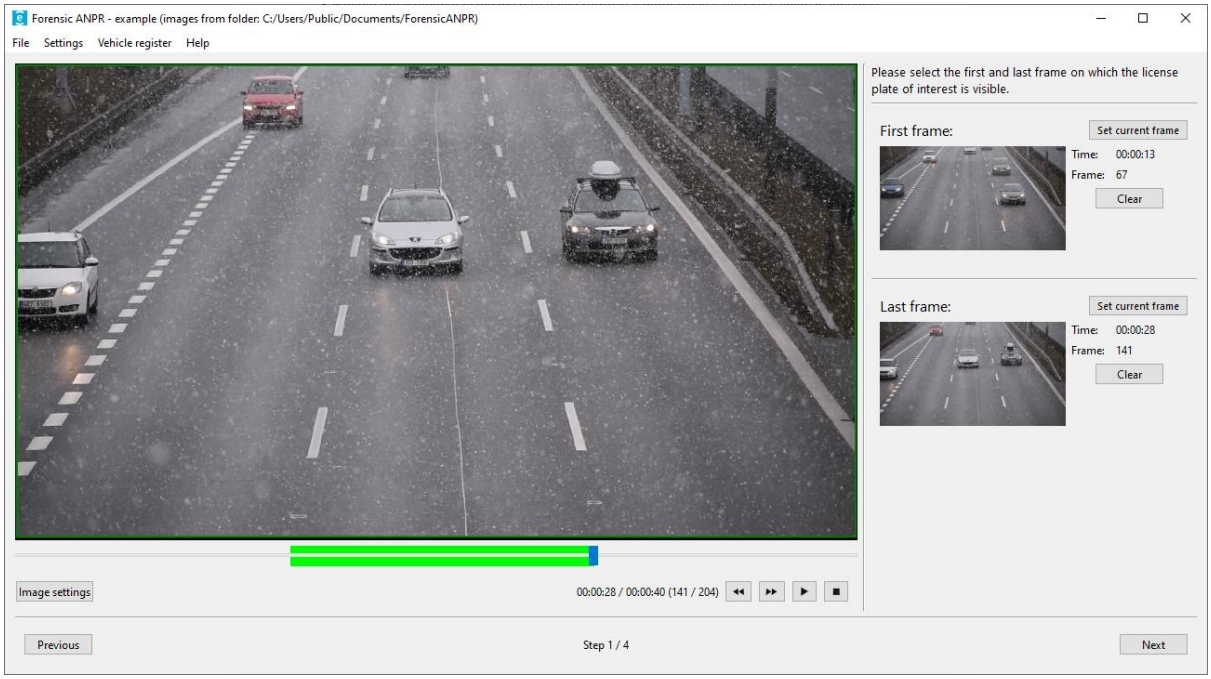
In the left part of the window, there is a video player that allows you to slide one frame back and forth, start / pause and stop playback. Image settings button opens a dialog window where you can adjust the brightness and contrast (after confirming with the OK button, the settings apply to the entire video or all photos, the Reset button returns to the default state). There is a slider above the player control buttons to quickly navigate through the video. You can zoom in or out by rotating the mouse wheel while holding down the Ctrl key.

If the source is a sequence of photos, it is possible to set the playback speed in the Settings menu, see chapter 7.2 Application parameters. The same playback speed will be used in the next step.

In the right part of the window there are panels for selecting and displaying the first and last frame of the analyzed interval. Set the desired image in the player and select it by pressing the Set current frame button. The selected image can be exchanged for another by pressing the Set current frame button again, it can also be deleted with the Delete button.

For better orientation, the slider is highlighted in green at the selected interval, and selected images in the player are framed in dark green. If you have selected only the first or last image, a yellow color is used to mark the interval towards the end or beginning of the video, respectively.

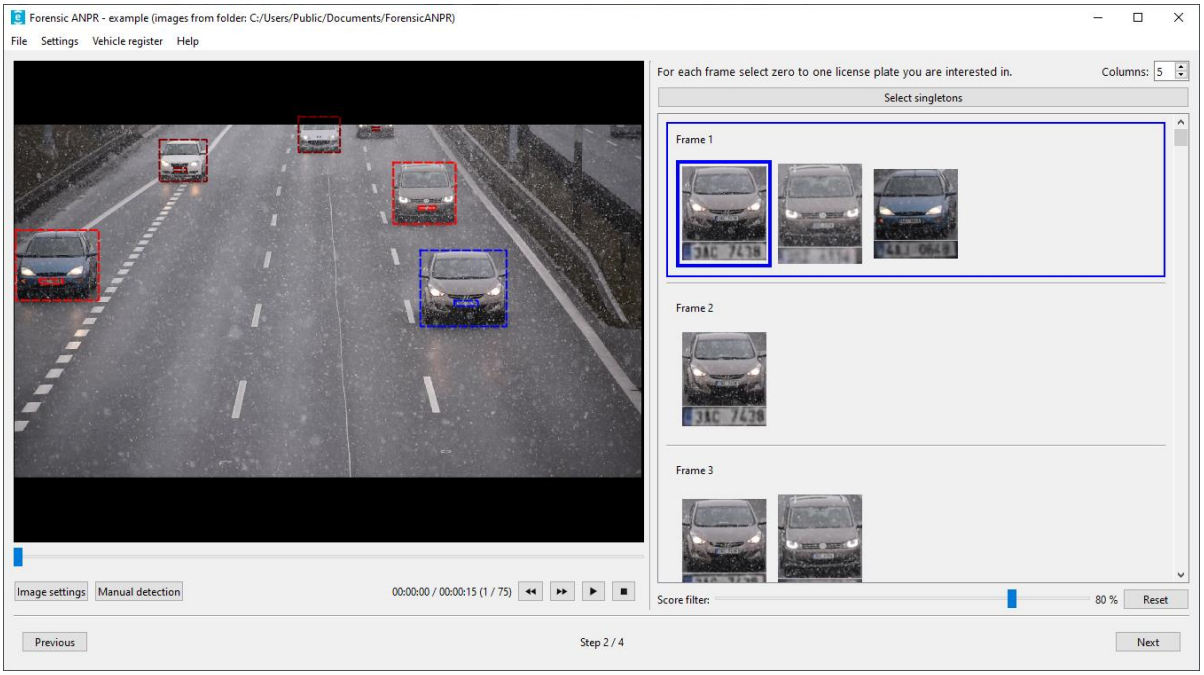
The length of the selected interval is not limited by the application, but we recommend that the number of selected pictures does not exceed a few dozen.



Once you have made your selection, you can move on by pressing the Next button at the bottom of the wizard. The application then reads the selected images into memory and detects the license plates. Conversely, by pressing the Previous button and confirming the dialog box, if you really want to close the project, you will return to the welcome screen.

5.4 Step 2 – Tracked license plate selection

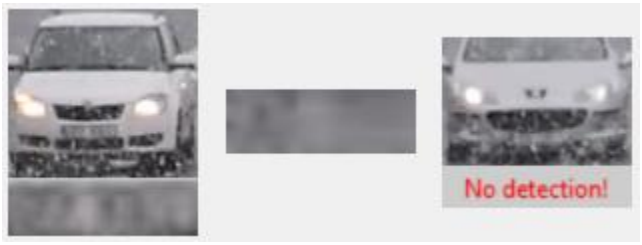
In the second step, it is necessary to select from all detected license plates (in the previously selected interval) only those belonging to the tracked vehicle. This allows for a maximum of one license plate per frame.



In the left part of the window, there is a video player in which the interval selected in the previous step is recorded. The detected license plates and carboxes (vehicles; only if supported by the detector) are marked with a red frame, one of which is highlighted in blue.

On the right, thumbnail previews of the detections (with score high enough, see later) are displayed for each frame. The panel representing the current frame is framed in blue, and the detection highlighted in the video player is also blue framed. If the detector evaluates that the license plate and the carbox belong to the same vehicle, the application works with them as a single object. The detection can be:

1. license plate together with carbox,
2. license plate alone,
3. or carbox alone (then, a red sign "No detection!" is displayed instead of a preview of the license plate in the right part of the window).



Below the list of detections, there is a slider that allows you to set the filter value for the minimum score of the displayed detections (generally, this is the detector's confidence that it is really the given type of object). For filtering purposes, only the license plate detection score is taken into account; carbox detections alone are shown only with a zero minimum score filter. Changing the filter value only filters the displayed license plate thumbnails but does not affect their selection. Press the Reset button to reset the filter to its default value.

Among the images you can navigate using the video player in the same manner as in Step 1, by clicking the appropriate panel on the right, as well as using the up and down keys. To go to the first frame, press the Home key; to go to the last frame, press the End key.

If you click on a detection thumbnail in the right part of the window, that license plate and carbox will be highlighted in the list as well as in the player in blue; you make the selection by double-clicking, the selected detection is framed in green. **Only one license plate can be selected on each frame, which must also contain a license plate.** If you want to cancel the selection, right-click on any detection thumbnail in the list to change its status from "selected" to "highlighted" (in blue).

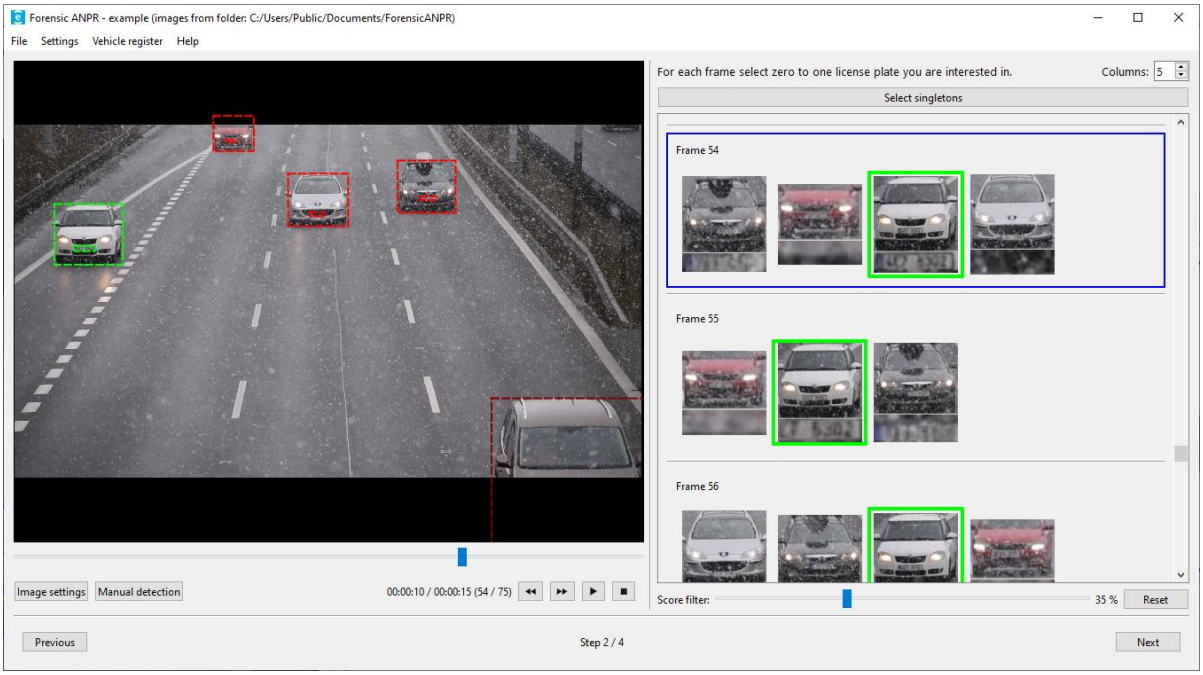
It is also possible to select detections using the keyboard. Press the space bar to mark a highlighted detection as selected, press space bar again to cancel the selection (so it will be highlighted in blue again). Press the left and right keys to change the highlighted detection within a single frame.

The final selection method is a direct selection by clicking on the detected license plate or carbox in the video player (this way you can select even a detection that is not shown in the list on the right due to its low score). Right-click in the player to deselect the detection. Double-click in the player to move to the next frame (double-clicking the detection in the player will select it and then move to the next frame).

The following table summarizes all the control options on this page.

User action	Application reaction
Change frame in the player	Highlighted frame in the list
Click on a frame in the list	Highlighted frame, updated player
Click on a detection in the list	Changed highlighted detection
Double-click on a detection in the list	Selected detection
Right-click on a detection in the list	Canceled detection selection (highlighted)
Click on a detection in the player	Selected detection
Right-click in the player	Canceled detection selection (highlighted)
Double-click in the player	Moved to the next frame
Home key	Moved to the first frame
End key	Moved to the last frame
Up key	Moved to the previous frame
Down key	Moved to the next frame
Left key	Changed highlighted detection
Right key	Changed highlighted detection
Space bar	Selected highlighted detection
	Canceled detection selection (highlighted)

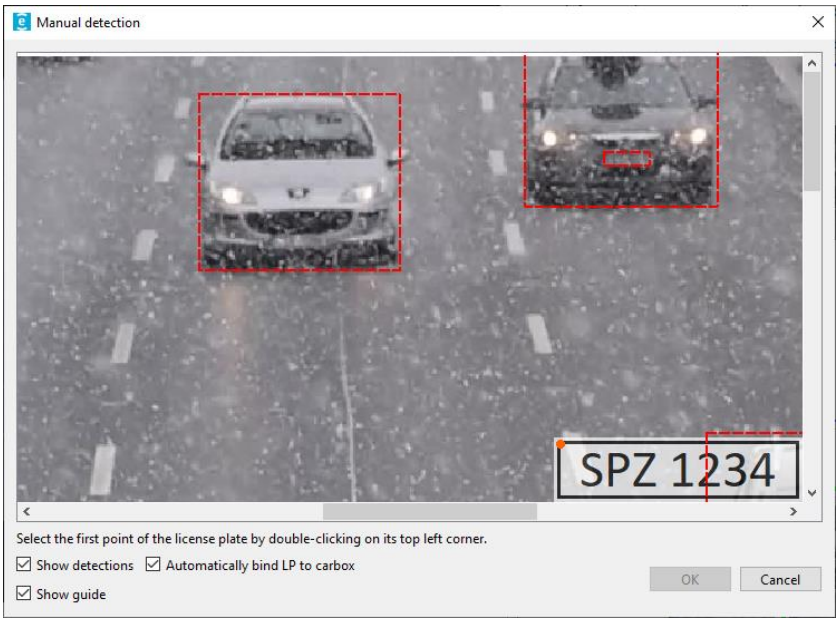
Detections that are not displayed in the list on the right because of a low score are framed in dark red instead of ordinary light red in the player. Similarly, a dark green color is used to frame a selected detection with a lower score than the current filter setting.



It often happens that there is only one vehicle on the record. To avoid the need to manually mark detections on each frame in such unambiguous cases, pressing the Select singletons button above the list of detections will mark the only detections (at the selected filter setting) on the frame.

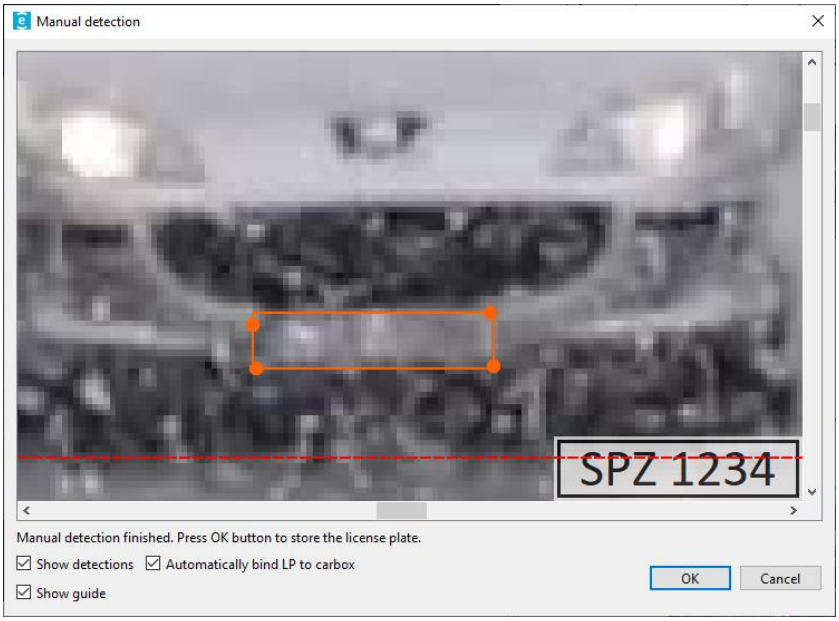
If you hover the mouse cursor over the detection preview, you will see a context box with all the information detected so far. In this step these are the type of detection (license plate or carbox including the score), in the next steps the make, model and color of the vehicle (if MMR is enabled) and finally the most likely hypothesis of the license plate text prediction will be added for the selected detections.

If the detector does not detect the desired license plate, you can mark it manually using the dialog window that appears when you press the Manual detection button. This way you can also add a license plate to a lone carbox.



As in the player, you can zoom in or out by rotating the mouse wheel while holding down the Ctrl key. Instructions appear below the image. If Show guide option is checked, a sample license plate is displayed in the lower right corner, with an orange circle flashing to indicate the point to mark: upper left corner, upper right corner, lower right corner and lower left corner (in this order). Marking is done by double-clicking; if you want to change the location of a point, press the right mouse button to remove the last point entered. After entering the last point, the plate area is framed by an orange rectangle.

Then you can press OK to confirm the detection. If the license plate lies inside a detected carbox, they can be paired; if the Automatically bind LP to carbox option is checked and the plate is overlapped by a single carbox, the assignment is made automatically, otherwise a dialog is displayed to select the appropriate carbox.

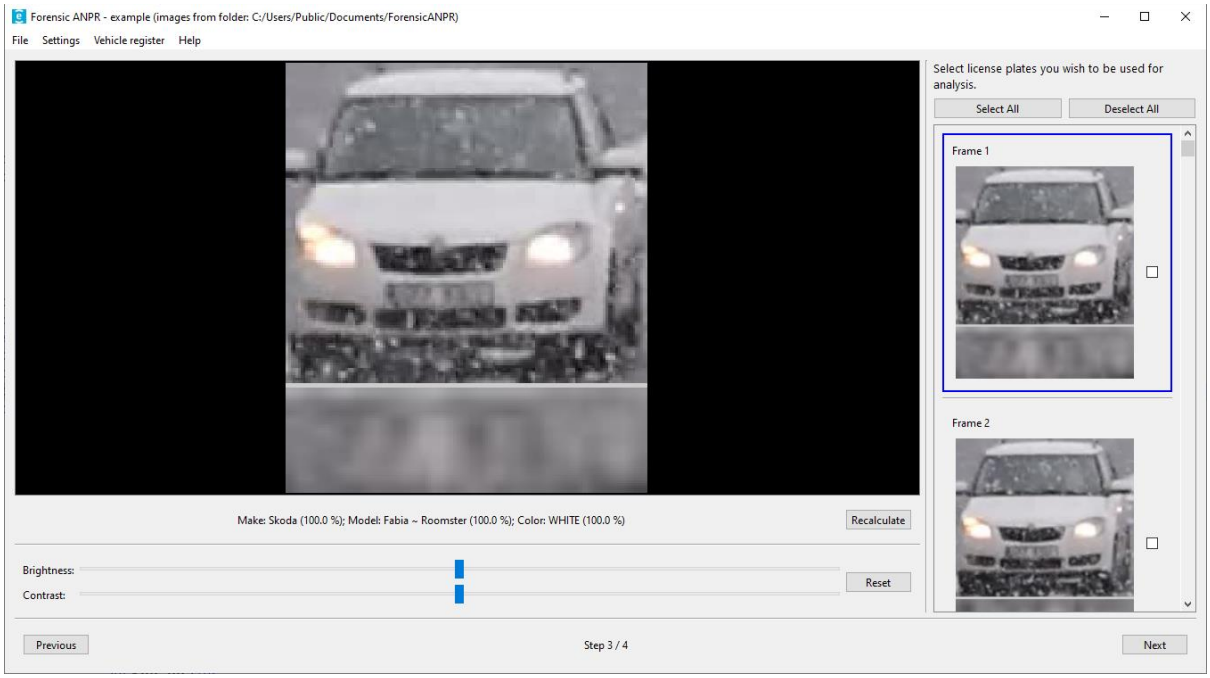


Manually entered detections are assigned the maximum possible score, so they appear leftmost among the thumbnail previews of the detections of the given frame. In the terms of running the program, they are treated in the same way as license plates detected automatically.

When the selection is complete, press Next to move on; if the MMR is enabled, the application will try to recognize the make, model and color of vehicles belonging to the selected detections. The Previous button returns to the interval selection.

5.5 Step 3 – Selection of analyzed images

While in the previous step, the goal was to select all license plates belonging to a single tracked vehicle, now you are about to select those from which the text hypotheses will be calculated. For this purpose, we recommend trying several combinations of higher quality images in case of insufficient confidence of the result.



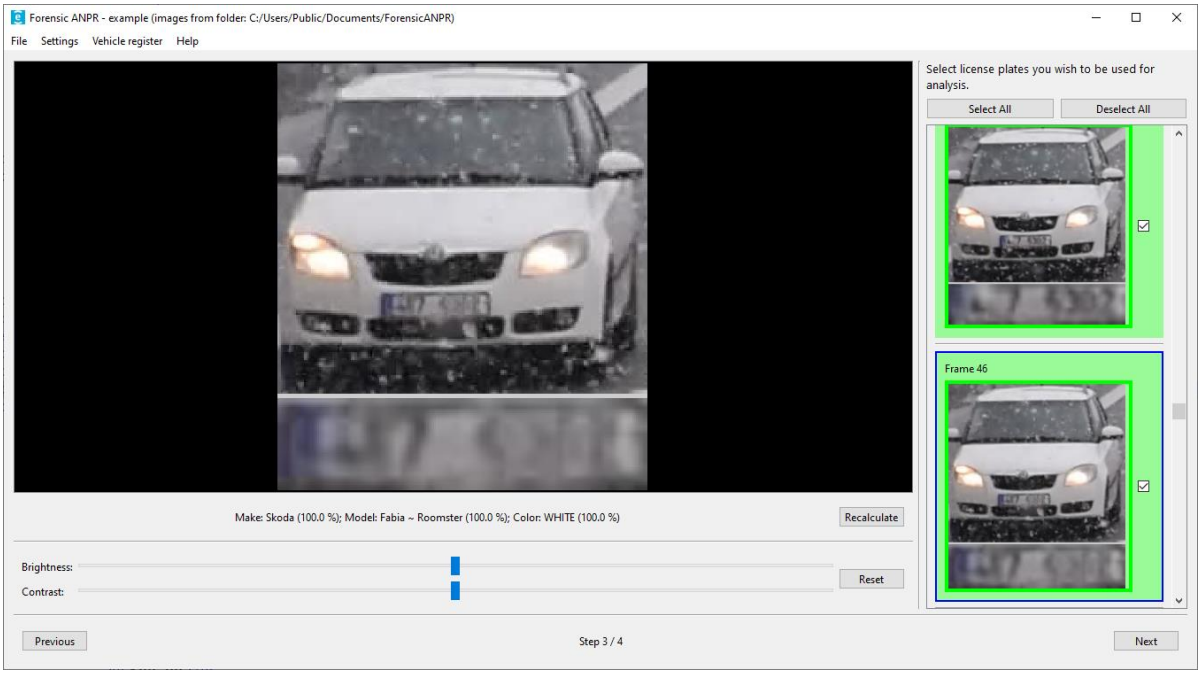
In the right part of the window are all the detections containing a license plate selected in the previous step, one of which is highlighted in blue. If a carbox has been detected, it is displayed together with the license plate, otherwise a cutout containing a preview of the vehicle is generated for better clarity (which, however, does not participate in any way in the analysis performed by the application). Vehicle previews are always marked with a red triangle in the upper right corner.

In the left part of the window, you can see a detail of the license plate and the carbox (or a preview of the vehicle). If the MMR (vehicle make, model and color recognition) is enabled, its result for the current frame is displayed under the detection detail. Pressing the Recalculate button updates the MMR result (this option is useful when changing the MMR settings; if you want to recalculate all MMR results, it is recommended to go back one step and let the application perform the automatic calculation in the following transition from step 2 to step 3).

Use the up, down, Home and End keys to move back and forth between images.

Select images for the final calculation by checking the appropriate check box, double-click on the thumbnail, or press the space bar. Pressing the space bar again cancels the selection as well as right-clicking on the preview.

You can easily select / deselect all images by clicking the Select All or Deselect All button, respectively.



Press Next to start the calculation.

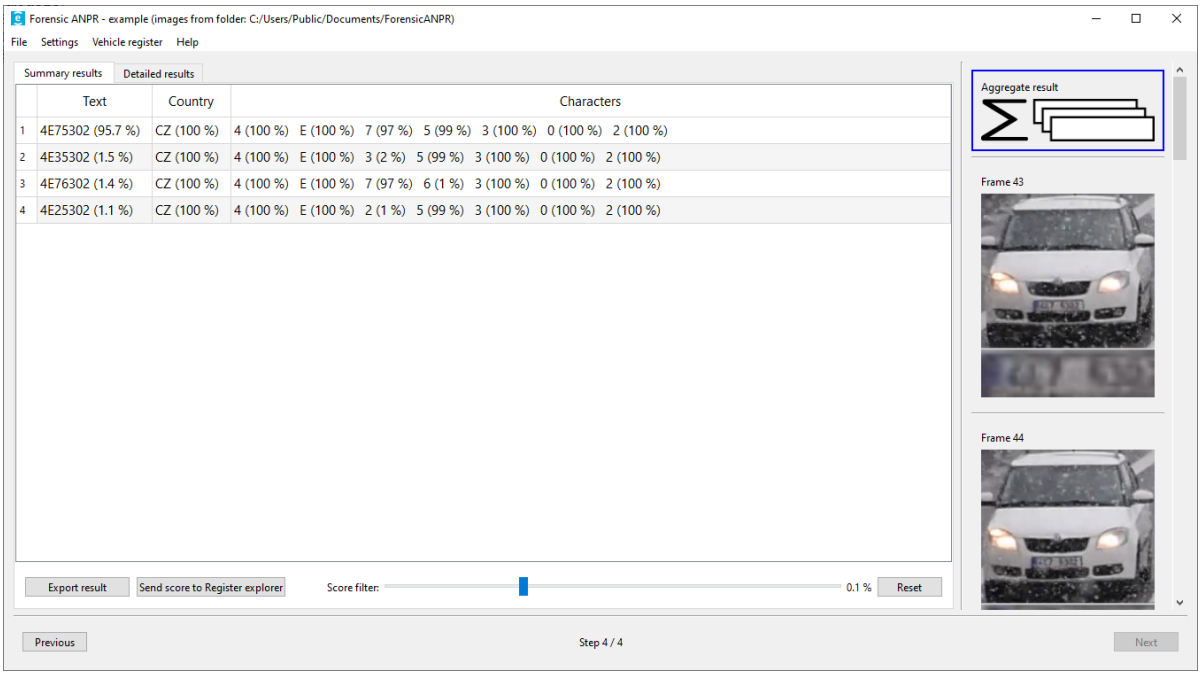
5.6 Step 4 – Results

The last step of the wizard provides two views of the results – the possible overall forms of the license plate text are listed on the Summary results tab, while the Detailed results tab lists the variants by character.

5.6.1 Summary results

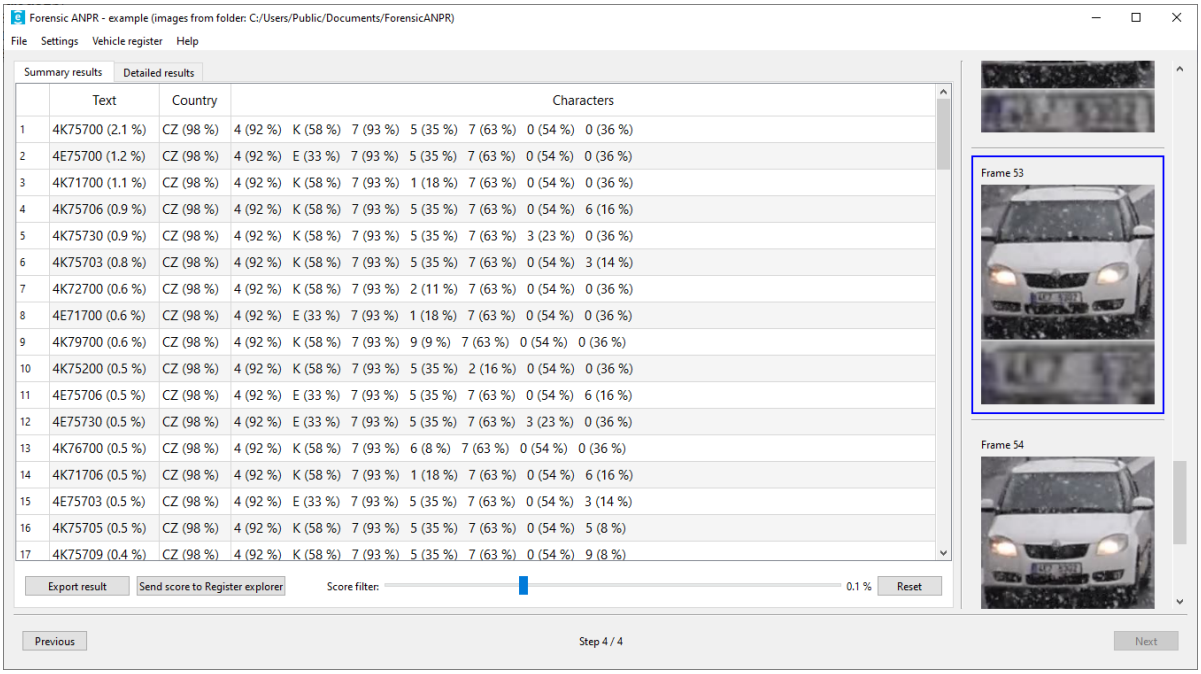
The result is a list of the most relevant predictions of the captured license plate text that are listed in the table in the left part of the window. The number of displayed hypotheses can be set using the Score filter slider in the bottom part of the window (limited to 100 hypotheses). In the list on the right, an icon for aggregate result is first placed, followed by each frame selected in the previous step that participated in the calculation; if you hover the mouse cursor over the detection preview of a frame, the context box with information about the detection, the MMR results and the most likely hypothesis for the prediction of the license plate text is displayed.

The Text column shows the license plate text, Country refers to the code of the country that issued it, and in the Characters column are itemized individual characters forming the text. For all these hypotheses based on the input data, the confidence is shown in the parentheses to qualify their relevance estimated by the analytical core of the system. It is therefore an estimate of the relative weight of a given hypothesis, not an "objective" probability that the hypothesis is correct.



The aggregate result hypotheses can be exported to a CSV (comma-separated values) file using the Export results button. Press the Send score to Register explorer button to pass the list of the currently displayed hypotheses along with their score, so you can compare the analysis results with existing license plates (see chapter 6 Vehicle register explorer)

When selecting a single license plate image, the same hypothesis table for that image appears. In this way, it is possible to identify which images should be excluded from the selection for recalculation in the previous step.

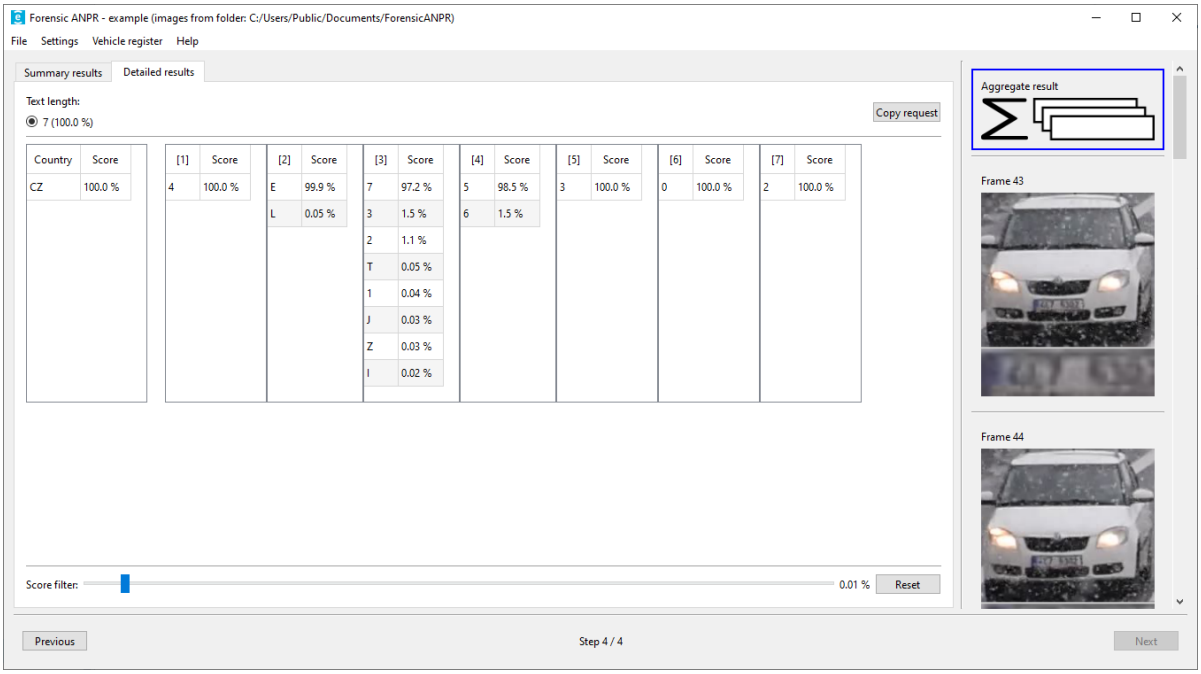


5.6.2 Detailed results

In case that the best hypotheses displayed on the Summary results tab are not very convincing, the view offered by the Detailed results tab is usually more suitable. This view displays the hypotheses for each character, country and length of the license plate text separately. By adjusting the Score filter slider at the bottom of the window, you can more clearly identify positions in which the application is sufficiently sure and where the result is too unclear.

The Copy request button copies the query to the clipboard (like common key combination Ctrl+C in other programs) in a format in which Register explorer is able to display real license plates corresponding to the combinations of the characters currently displayed. Use the radio buttons (accompanied by score) under the Text length: label to select the number of displayed license plate characters.

Also on this tab it is possible to display the aggregate result for all the frames selected in the previous step as well as for individual frames.


Forensic ANPR - example (images from folder: C:/Users/Public/Documents/ForensicANPR)
File
Settings
Vehicle register
Help
Summary results
Detailed results
Text length:
7 (100.0 %)
Copy request
Country
Score
CZ
100.0 %
[1]
Score
4
100.0 %
[2]
Score
E
99.9 %
L
0.05 %
[3]
Score
7
97.2 %
3
1.5 %
2
1.1 %
T
0.05 %
1
0.04 %
J
0.03 %
Z
0.03 %
I
0.02 %
[4]
Score
5
98.5 %
6
1.5 %
[5]
Score
3
100.0 %
[6]
Score
0
100.0 %
[7]
Score
2
100.0 %
Score filter:
0.01 %
Reset
Aggregate result
Frame 43
Frame 44
Previous
Step 4 / 4
Next

6 Vehicle register explorer

Forensic ANPR includes Vehicle register explorer which can be connected to the PostgreSQL database containing the following data:

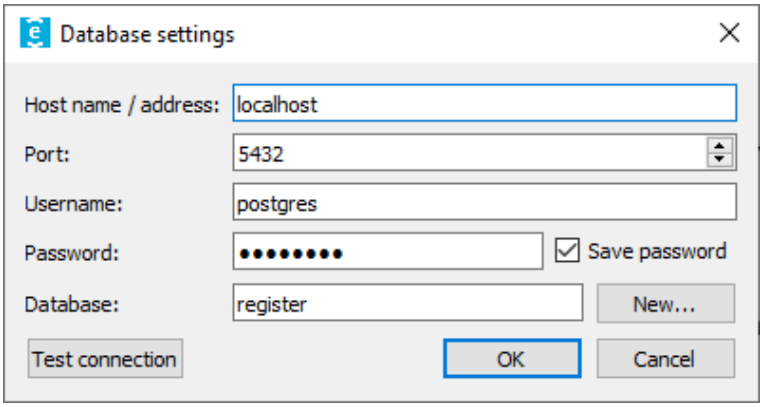
- license plate text,
- country in which the vehicle is registered,
- vehicle color,
- vehicle make and
- vehicle model.

The source of the data can be various – for example, data exported from the official vehicle register. However, these data are not part of the application.

Vehicle register explorer is used to compare the records of the image analysis with the data in the vehicle register, i.e. to narrow down the possible hypotheses by cross-validation against the data in the database. This combined approach significantly increases efficiency and the ratio of successfully resolved cases.

6.1 Database connection

The dialog window for setting the parameters necessary to connect to the database is displayed via the Vehicle register -> Connection setup menu.



If you are connecting to a local database (installed on the same computer as the application), select Host name / address: "localhost"; by default, PostgreSQL runs on port 5432 and uses both username and password "postgres". If you are connecting to another database server, ask its administrator for access data.

In the Database: field, enter the name of the database to which you want to connect. To create a new database, press the New... button. How to create it is described in the following chapter 6.2 Creating a new database.

By pressing the Test connection button you can test whether you can connect to the database with the above parameters. The application will inform you about the result and the Database settings window will remain open.

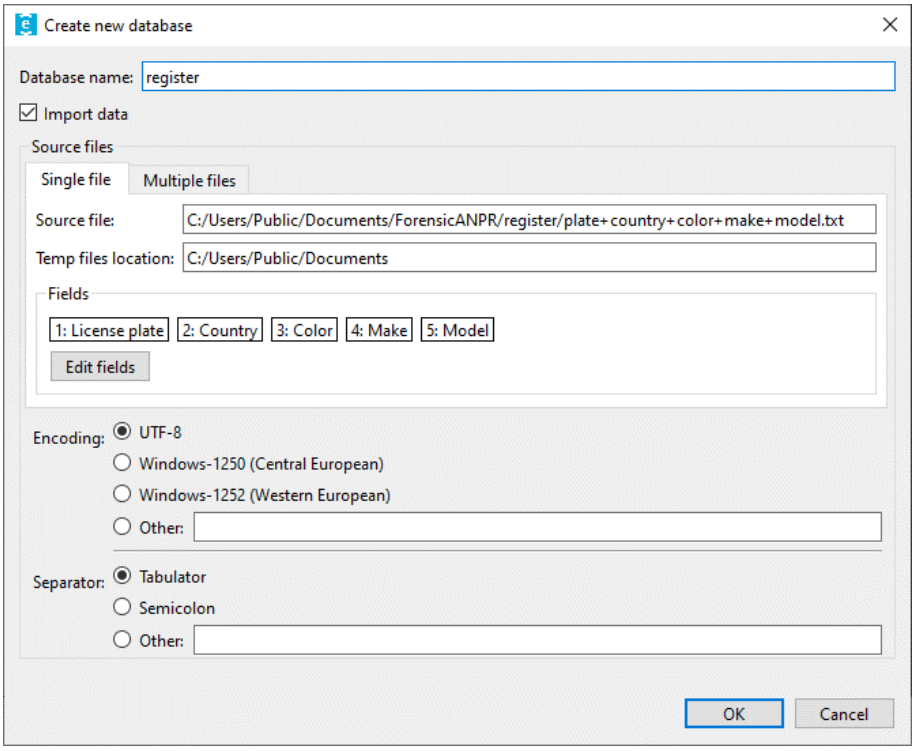
Press OK to connect to the database; if the connection fails, the application will inform you about the cause as in the case of the connection test. However, regardless of the result, the Database settings window will close. Click Cancel to close the dialog window.

6.2 Creating a new database

Using the Create new database dialog window, which is displayed by pressing the New... button in the Database settings window (see chapter 6.1 Database connection), you can create a vehicle database that the application is able to work with.

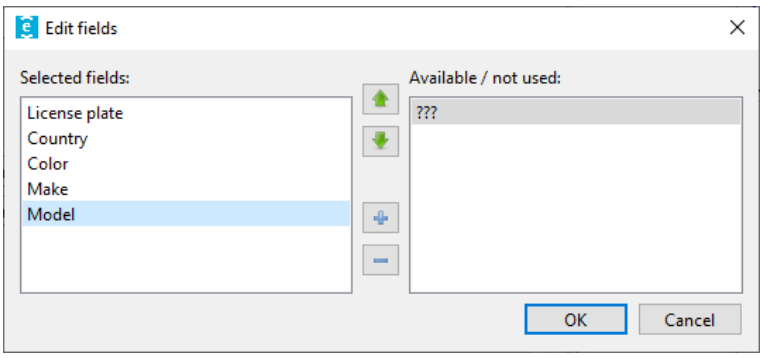
Along with creating a database, it is also possible to import data from one overall file or from multiple files by checking the Import data option and filling in the form in the Source files section. If you do not select this option and only create a database, you will have to transfer the data to the database in another way (e.g. by inserting into tables via pgAdmin application), as Forensic ANPR does not allow you to add or edit records in an existing database – except to overwrite them completely. For this reason, we recommend always importing data when you create a database.

The Database name: field is automatically pre-filled according to the database name in the Database settings window. If you wish to create a database with a different name, you can change it here. Press OK to let the application create the database (and possibly import data). If a database with the given name already exists, the application will ask whether you want to overwrite it (if you choose No, you can use a different database name). The Cancel button closes the dialog window.



To import data along with creating a database, check the Import data check box. The Source files section appears, in which you need to specify the source text file(s) and their format.

The simplest way is to have all data in a single text file. In that case, on the Single file tab, fill in the Source file: field (click on the field to open the file selection dialog) and specify which fields and in which order the file contains (press the Edit fields button to open the fields selection dialog). If the file contains a field not recognized by the application (e.g.: "Note"), select "???" field instead.



Another option is to fill in the Multiple files tab form to import files representing codebooks of countries (optional), colors, makes and models, and a file with license plates referring to these codebooks. The file selection dialog is opened by clicking in the corresponding field. All these files must be specified (if countries are not used, uncheck the option), must be saved in the same encoding and use the same delimiter. The exact specification of the source files is described below.

Regardless of whether you import one or more files, specify the file encoding (if it is different from UTF-8, Windows-1250 and Windows-1252, choose Other: and type its name in the adjacent field) and the fields delimiter (select the separator character used; if it is not a tab or semicolon, choose Other: and type it in the adjacent field).

6.2.1 Import data – Common rules

The source files are saved in text format (i.e. formats such as TXT or CSV, but *not XLSX or DOCX*). There is exactly one record per line. Each line contains a prescribed number of fields separated by a delimiter – just one character. Any record field must not contain this separator (for example, if we choose a comma as the separator, it is not possible to use "*Blue, light*" as the color name).

6.2.2 Import data – Single file

Each file row contains fields specified in the Fields section. Technically, the number of fields in the imported file is not limited; it must be the same on each line and one of the fields must contain the license plate. Any field in the imported file can be blank (there is no text between the separators).

Example – many fields:

> Imported file contains the following fields: License plate, Country, Region, Color, Make, Model and Note, separated with a semicolon. However, Register explorer does not work with Region and Note. So, the Fields section will contain:
>
> 1: License plate 2: Country 3: ??? 4: Color 5: Make 6: Model 7: ???
>
> The content of the file may be:
>
> ```
> ABCD1234;CZ;;White;Skoda;Fabia Combi;some note
> ```

```
F9876;CZ;;Black;Volkswagen;;
V9999;CZ;;;Skoda;105;historical car
HAL9000;;;Black;;;watch out for him
```

Example – just two fields:

Imported file contains just the following fields: License plate and Model, separated with a slash. The Fields section will contain:

1: License plate 2: Model

The content of the file may be:

```
ABCD1234/Skoda Fabia Combi
F9876/Volkswagen
V9999/Skoda 105
HAL9000/
```

Note: In this example, Model field contains both make and model of the vehicle. This approach is only recommended for smaller databases; for large databases (with thousands of different models), filtering results may be less convenient.

6.2.3 Import data – Multiple files

All imported files must be in a directory that the Postgres client has access to – for example, Public Documents or a folder on the C drive that is accessible to all users of the computer.

Codebook entries always contain their own identifier, hereinafter referred to as the ID (of the codebook). For each such ID, it must be an integer that is unique within the code list – for example, it is not possible for two color records to have the same ID = 10.

Colors, makes and models are mandatory, countries codebook is optional.

Countries (codebook, optional):
Each country codebook row contains a pair of values in the following order: **name** and **ID (of the country)**.

Example:

```
Unknown;0
CZ;1
D;2
```

Colors (codebook):
Each color codebook row contains a pair of values in the following order: **name** and **ID (of the color)**.

Example:

```
Unknown;0
White;1
Black;2
```

Makes (codebook):
Each make codebook row contains a pair of values in the following order: **name** and **ID (of the make)**.

Example:

```
Unknown;0
Skoda;1
Volkswagen;2
```

Models (codebook):
Each model codebook row contains three values in the following order: **make ID**, **name** and **ID (of the model)**.

Example:

```
0;;0
1;105;1
1;Felicia;2
1;Fabia;3
1;Fabia Combi;4
1;Octavia;5
2;;6
2;Passat;7
```

Vehicles:
Each vehicle file row contains four or three values in the following order: **license plate text**, **country ID** (if Countries: is checked), **color ID** and **model ID** (*note: make ID is not included here, as this value can be obtained through the model codebook*).

Example – with countries:

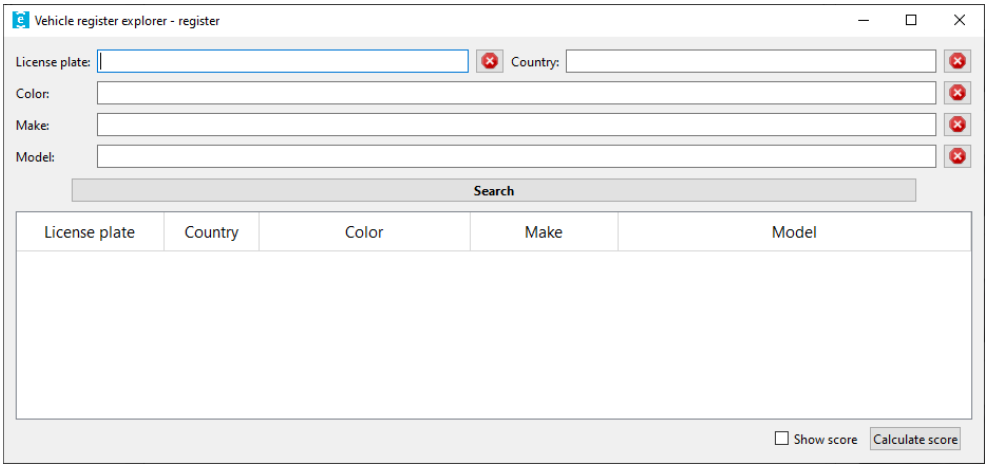
`ABCD1234;1;1;4`	ABCD1234, CZ – white Skoda Fabia Combi
`F9876;1;2;2`	F9876, CZ – black Volkswagen (unknown model)
`V9999;1;0;1`	V9999, CZ – Skoda 105 of unknown color
`HAL9000;0;2;0`	HAL9000 – black vehicle of unknown model, make and country

Example – without countries:

`ABCD1234;1;4`	ABCD1234 – white Skoda Fabia Combi
`F9876;2;2`	F9876 – black Volkswagen (unknown model)
`V9999;0;1`	V9999 – Skoda 105 of unknown color
`HAL9000;2;0`	HAL9000 – black vehicle of unknown model / make

6.3 Displaying vehicle register

To access the Vehicle register explorer, use the Vehicle register -> Register explorer menu. If you have not yet connected to the database, a connection dialog window is displayed first, see chapter 6.1 Database connection. Then the following window appears.



After the dash, the window title bar shows the name of the database with which you are

working. There are filter fields in the upper part of the window, then a result table, and score related check box and button at the bottom.

6.3.1 Filter fields

The filter fields are used to specify what conditions the registry entries you want to view must meet. If a field is empty, the condition is met for any value of that category. If more than one filter field is filled, the logical "AND" relationship applies – the record must meet all conditions of these categories.

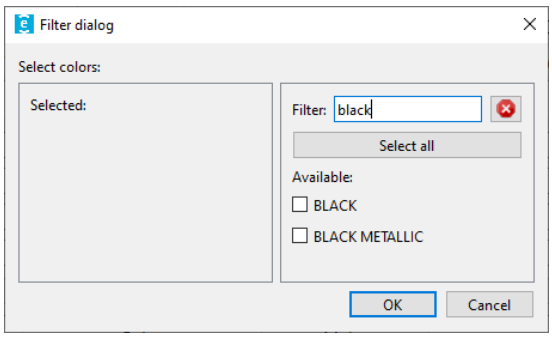
License plate: is a text field. You can type in any exact form of the license plate text you want to display, or you can combine parts of the license plate text with placeholders for any character or sequence of characters. You can specify multiple options with a logical "OR" separator and use parentheses to form character groups. A more detailed description of the special symbols is given in the following table.

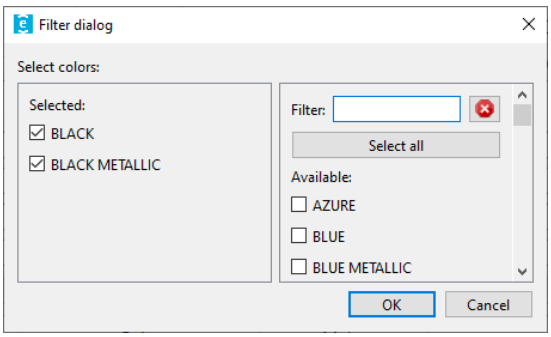
Symbol	Meaning	Example
_	Any single character	ABC000_
%	Any sequence of 0 or more characters	ABC%
|	Alternation (either of two alternatives)	ABC0000|ABC0001|ABC0002
()	Group items into a single logical item	ABC000(0|1|2)

You can also enter a query from the Detailed results tab in the License plate: field by using the shortcut Ctrl+V, if you copied it into the clipboard using the Copy request button (see chapter 5.6.2 Detailed results).

The remaining four fields – Country:, Color:, Make: and Model: offer a selection of codebook values. Clicking in the appropriate field displays a dialog box for selecting the appropriate filter.

In the left part of the window are selected values. The remaining values are listed on the right side with filtering possibility. For example, if you want to select all colors that contain the string "black", type this text in the Filter: field; only "BLACK" and "BLACK METALLIC" are left from the offered colors – you can select them either individually or all at once using the Select all button. The filtering is case-insensitive and you do not need to use the diacritics (if you enter "skoda" in the Filter: field, "ŠKODA" may appear among available makes).



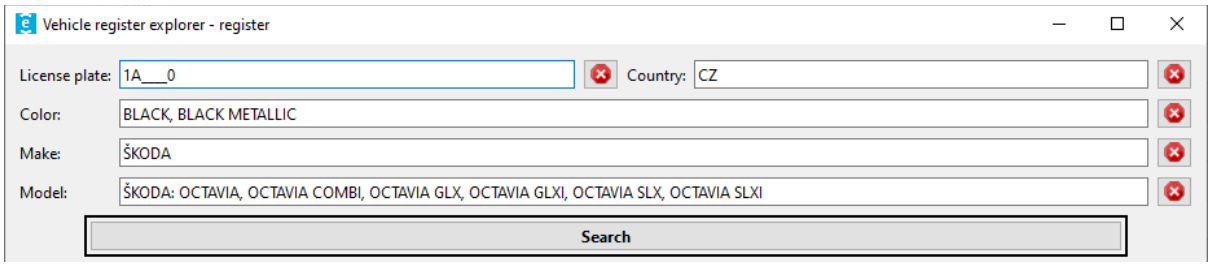


Before selecting a filter for models, select makes first – the model filter dialog will show only models of the selected makes.

If you want to clear a filter, you can either deselect all selected options in the Filter dialog or press the red cross button to the right of the corresponding field in the Vehicle register explorer.

While between category filters is an “AND” relationship, when you select multiple options within one category, a logical “OR” relationship is applied between these options.

For example, the following query will show all Škoda Octavia (or its subtypes) vehicles of black or black metallic color, whose Czech license plate is 7 characters long, beginning with “1A” and ending with “0”:



Press the Search button or the Enter key to apply the selected filters and display the results in the table below. The size of the table is not technically limited, but when displaying a large number of results (hundreds of thousands or more), the application may have considerable memory requirements and a long response time.

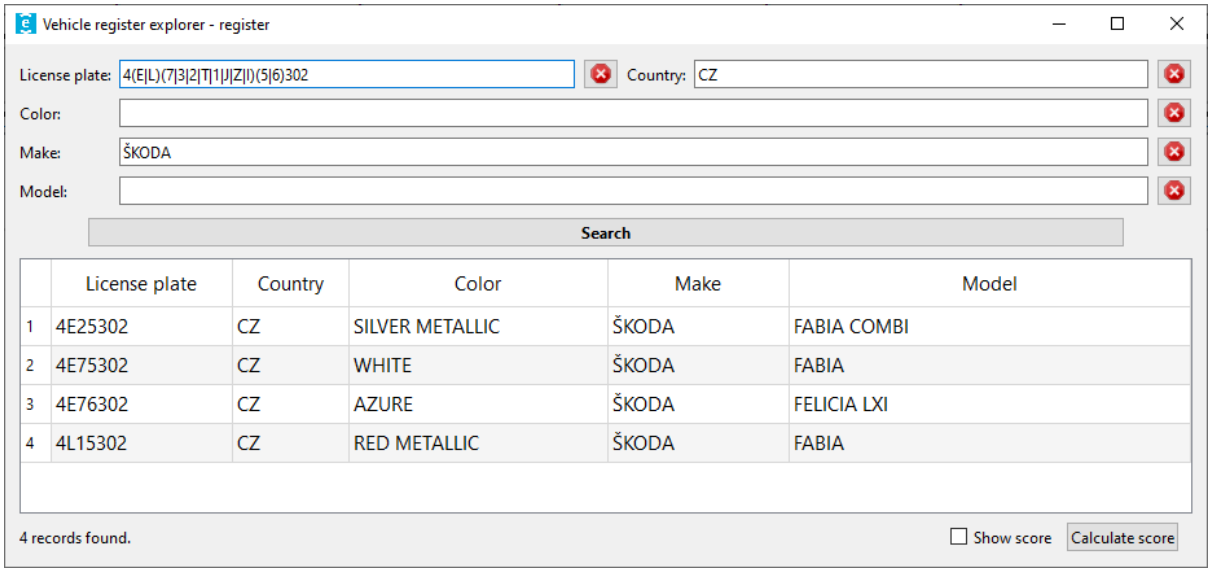
If you change the search parameters from the currently displayed results, the Search button will be highlighted with a black frame.

6.3.2 Result table

In basic mode, when the Vehicle register explorer is used as a standalone database explorer, the result table has five columns that correspond to the imported values into the database: License plate, Country, Color, Make and Model. If Show score is checked, the above columns are preceded by the Score column, which is discussed in the next chapter.

The records in the table are sorted in descending order by score (if available; the column does not need to be displayed) and records with the same score order alphabetically by the license plate text. You can select and copy the table entries as usual using Ctrl+C.

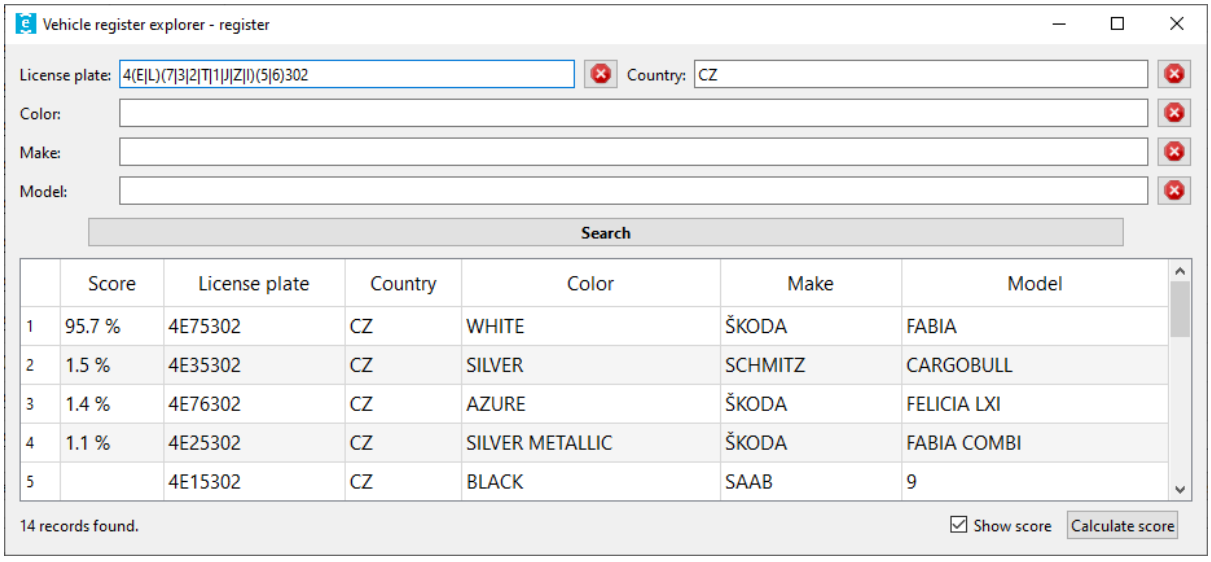
The following example shows a database search result for a license plate filter obtained using the Copy request button from the Detailed results tab (see chapter 5.6.2 Detailed results) and knowing that it belongs to a Škoda vehicle:



6.3.3 Score

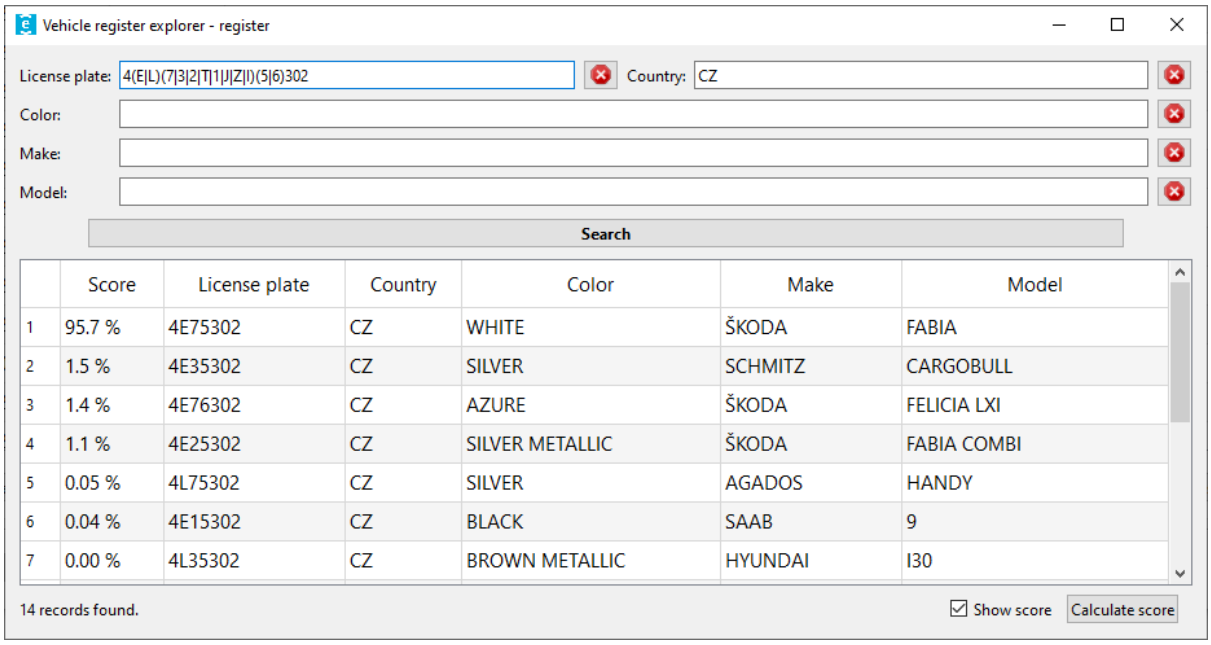
Check Show score to show the corresponding column in the result table. If the score value is unknown, the table cell will remain empty. Vehicle register explorer has two options for obtaining the correspondent values. *(In the following examples, only the license plate filter is used to match more records to the query and to make the use of the score method more illustrative.)*

By sending the score from the Summary results tab:
If Vehicle register explorer is open when you press the Send score to Register explorer button on the Summary results tab, it will receive a list of the currently displayed license plates and their scores from the application. If any of these license plate texts is present in the Register explorer, the corresponding Score value will be filled. In this way it is possible to compare the vehicle register with both the aggregate result as well as the results for individual frames.



Using the Calculate score button:

The Calculate score button in the lower right corner of Vehicle register explorer sends the application a list of all the license plates displayed in the explorer and requests their score to be calculated against all the frames selected in Step 3 of the wizard (the aggregate result).



7 Settings

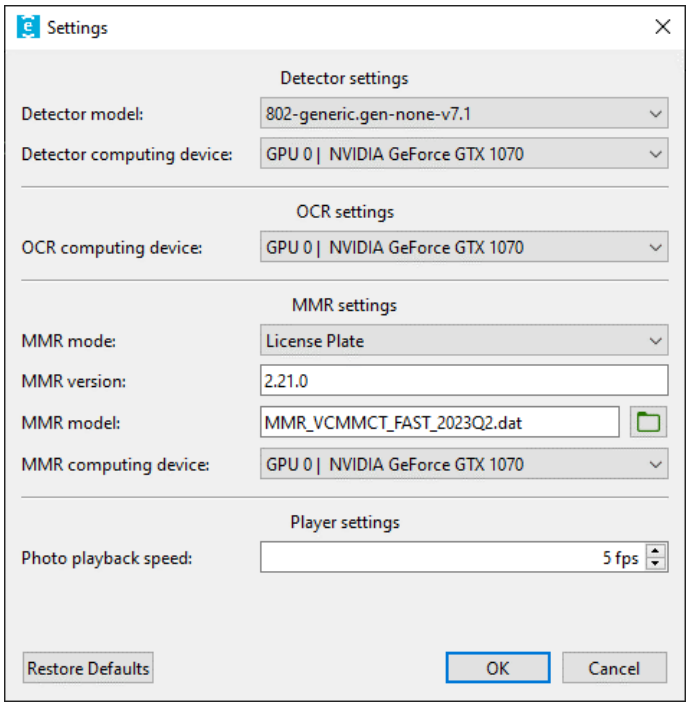
7.1 Language

The Forensic ANPR application supports Czech and English. The default language setting depends on the operating system of the computer on which it is installed – it is Czech for Czech version of Windows, English otherwise.

You can change the initial language setting in Settings → Language menu (Nastavení → Jazyk in Czech).

7.2 Application parameters

The application allows you to adjust some calculation parameters via the Settings → Settings... menu.



Detector settings:
In the Detector settings, you can choose the configuration of the detector that detects license plates and potentially carboxes between steps 1 and 2. The drop-down list for selecting the detector model lists the LPM modules located in the *SDK\LPM\modules-v7\x64* directory of the directory where the application is installed.

The *Detector computing device* can be either a CPU or a computationally faster GPU (if supported).

OCR settings:
OCR recognizes the text and country of the license plate and runs between steps 3 and 4.

The *OCR computing device* can be either a CPU or a computationally faster GPU (if supported).

MMR settings:
MMR recognizing the make, model and color of the vehicle is optional in the Forensic ANPR application – it provides more information about the vehicle being examined (and, based on the results obtained, filter the records in the Vehicle register explorer appropriately), but it is not necessary for reading the registration plate itself. If enabled, it is triggered automatically for selected detections between steps 2 and 3, while the user can run it in step 3 for individual detections.

The input to the MMR is either a license plate or carbox detection. The type of detection for which the MMR calculation will be performed must be selected in the *MMR mode* field; if you do not want to use the MMR, select the "Disabled" option. When changing the MMR mode between the registration plate and the carbox, it may be necessary to change the *MMR Model* as well – license plate detections are now handled by models starting with "MMR_", while carboxes are now handled by models starting with "MMRBOX_" (but this may change in future versions of MMR).

The *MMR version* tells the application in which *SDK\MMR* subdirectory the used MMR version is located.

The *MMR computing device* can be either a CPU or a computationally faster GPU (if supported).

Photo playback speed:
Specifies the number of images displayed per second in the player when playing if the source is an image sequence (this setting does not affect the video playback speed).

Use the Restore defaults button to overwrite the current values with default ones.

7.3 Saving settings

All application settings are stored in the registry HKEY_CURRENT_USER\Software\Eyedea Recognition\Forensic ANPR.

T A

Č R

Tento software Forensic ANPR byl vytvořen s finanční podporou TA ČR.

This software Forensic ANPR was developed with financial support from TA ČR.