



# **Forensic ANPR 3.1.0**

**User Guide**

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# 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.....	5-23
5.6.1 Summary ANPR results .....	5-23
5.6.2 Detailed ANPR results .....	5-24
5.6.3 Register-filtered results .....	5-25
5.6.4 MMR results .....	5-26
5.6.5 Exporting results to a PDF file.....	5-26
6 Vehicle register explorer.....	6-27
6.1 Database connection .....	6-27
6.2 Creating a new database.....	6-28
6.2.1 Import data – Common rules .....	6-29
6.2.2 Import data – Single file.....	6-29
6.2.3 Import data – Multiple files .....	6-30
6.3 Viewing the vehicle register .....	6-31
6.3.1 Filter fields .....	6-32
6.3.2 Result table.....	6-33
6.3.3 Score.....	6-34
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 3.1.0

Released: 2024/09/03

- Added filtering of results using vehicle register data
- Enabled export of results to a PDF file
- Simplified MMR settings with an option to calculate MMR for all detections
- Allowed selection of tracked license plate based on MMR results
- Improved display of results and previews
- Enabled opening saved projects in read-only mode
- Updated video processing libraries
- Updated LPM detector and MMR modules

### Forensic ANPR 3.0.2

Released: 2024/02/05

- Fixed rear view carbox detection
- Fixed connecting to database

### 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**

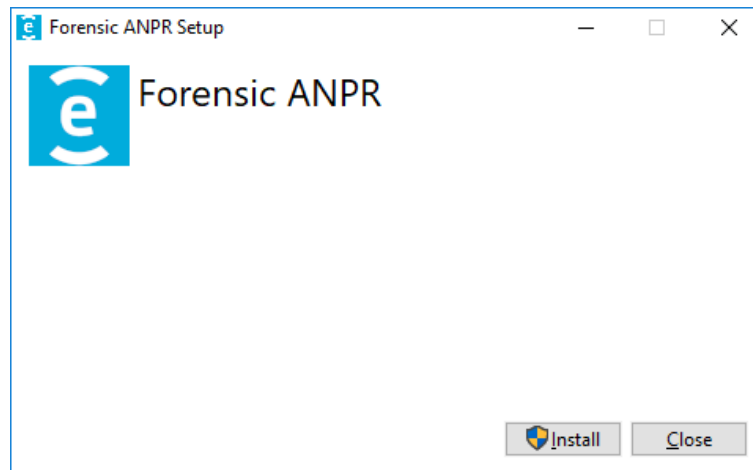
Released: 2019/04/12

- First release of the application

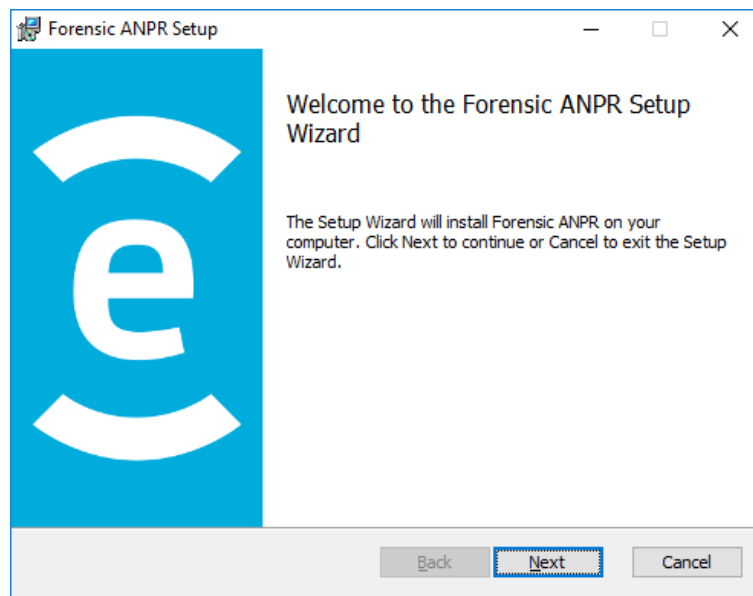
## 4 Installation and uninstallation

### 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.

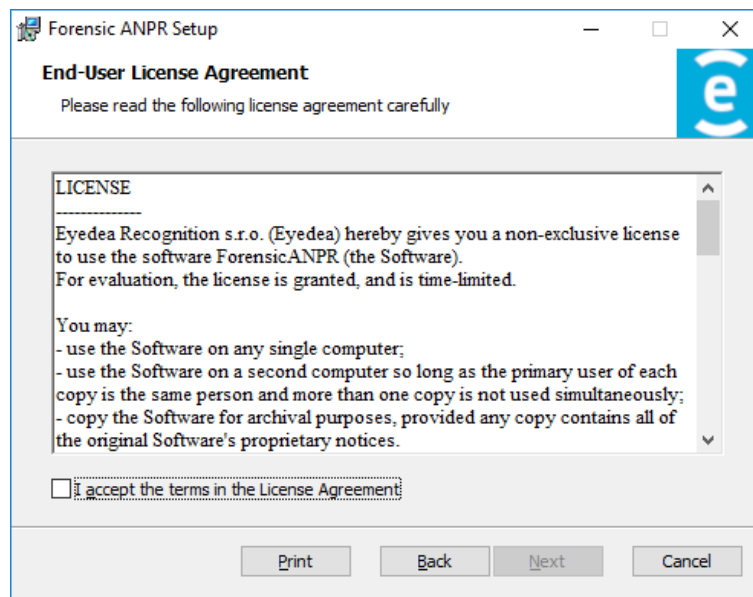


After pressing the **Install** button, the installation of important libraries for running Forensic ANPR takes place, then the following window appears.

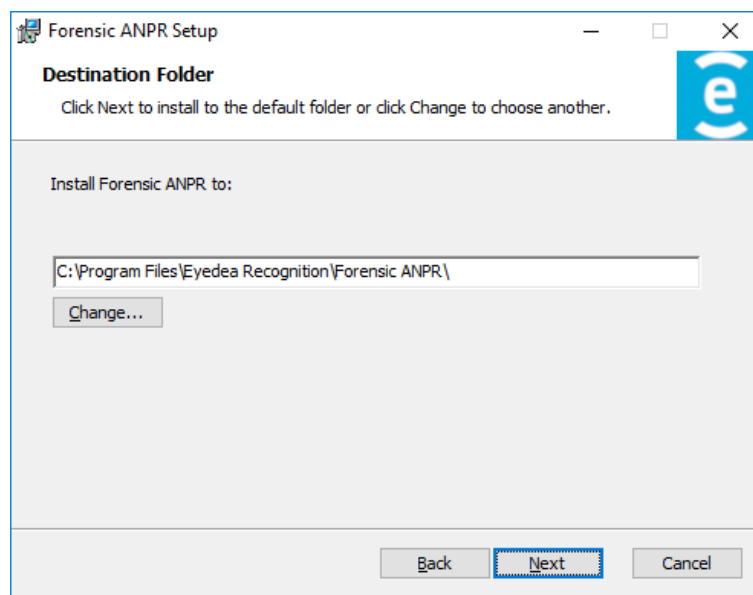




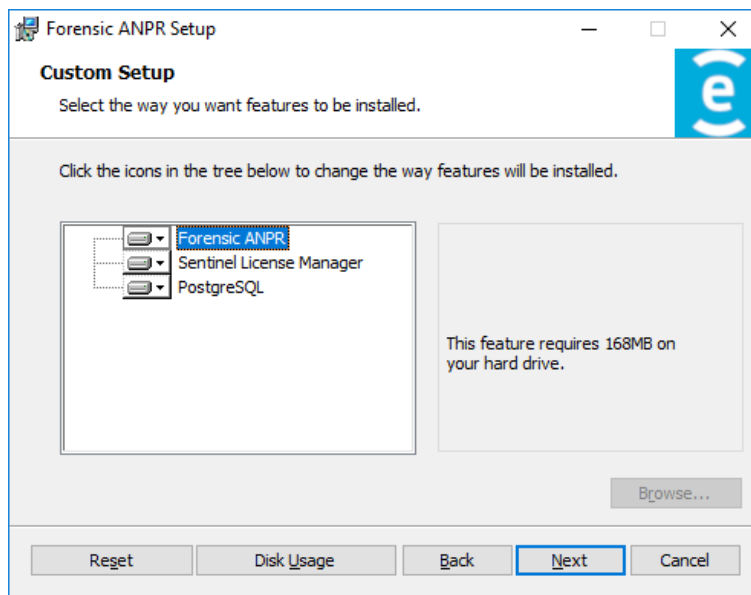
Clicking the Next button, the License Agreement is displayed.



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.



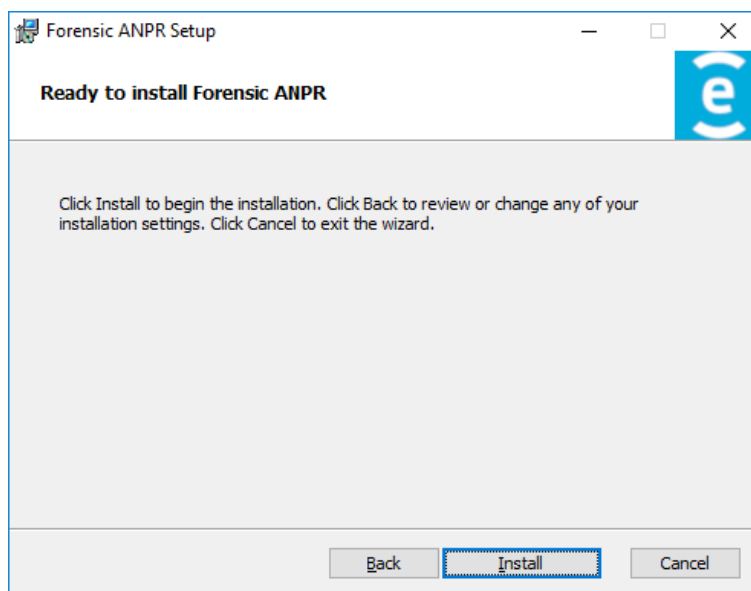
In this window, it is possible to change the folder alternatively, where the program is installed. Press the Next button.



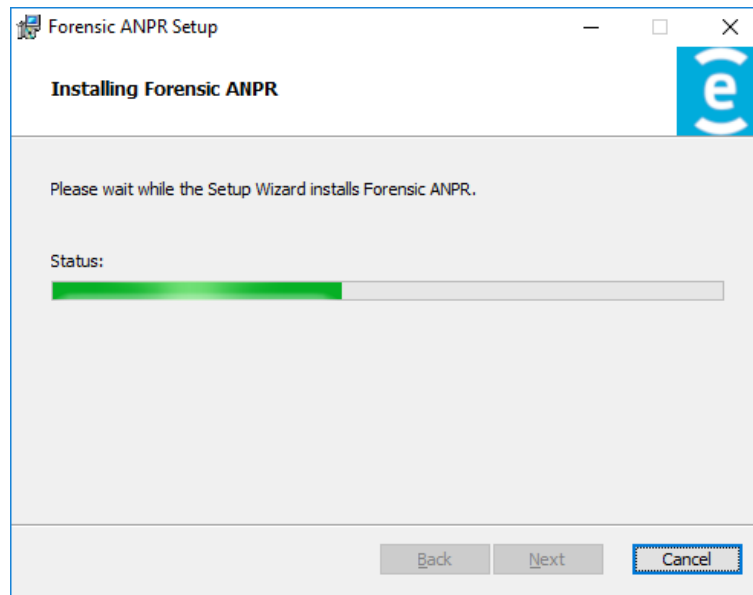
On the **Custom Setup** page, you can choose which components will be installed. The default installation contains all of them – **Forensic ANPR** is this application, **Sentinel License Manager** is used to verify the license and is required to run **Forensic ANPR** and **PostgreSQL** is a database 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.

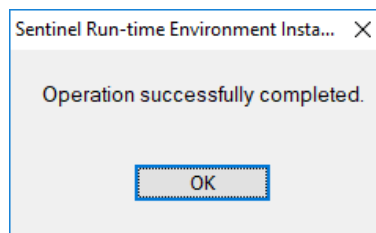
Press the **Next** button to continue to the last page before the installation.



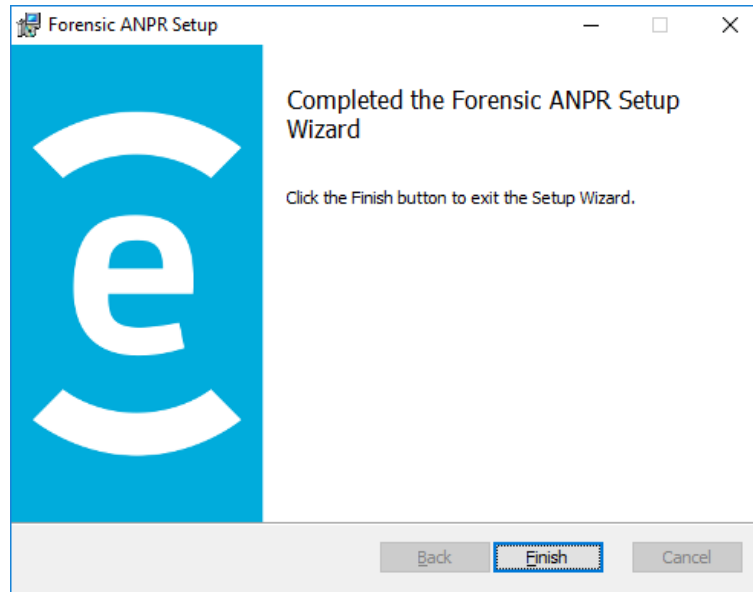
Now it is possible to start the installation itself using the **Install** button. This installation copies all necessary files and drivers selected on the previous page.



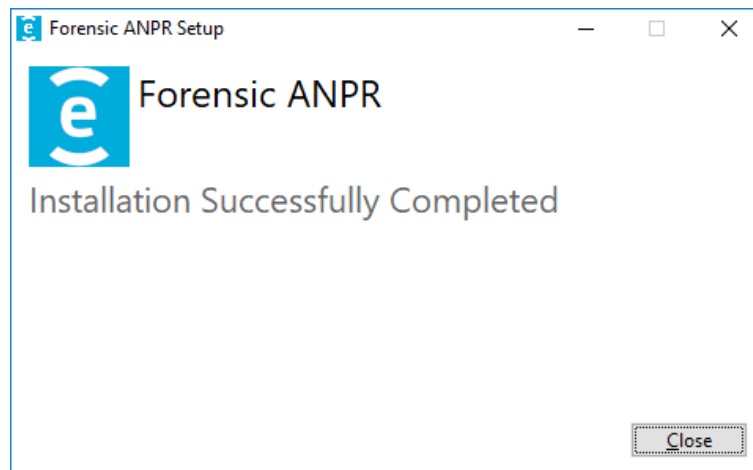
The installation of the hardware key driver takes place automatically, but it can require confirming a report on finishing the installation.



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

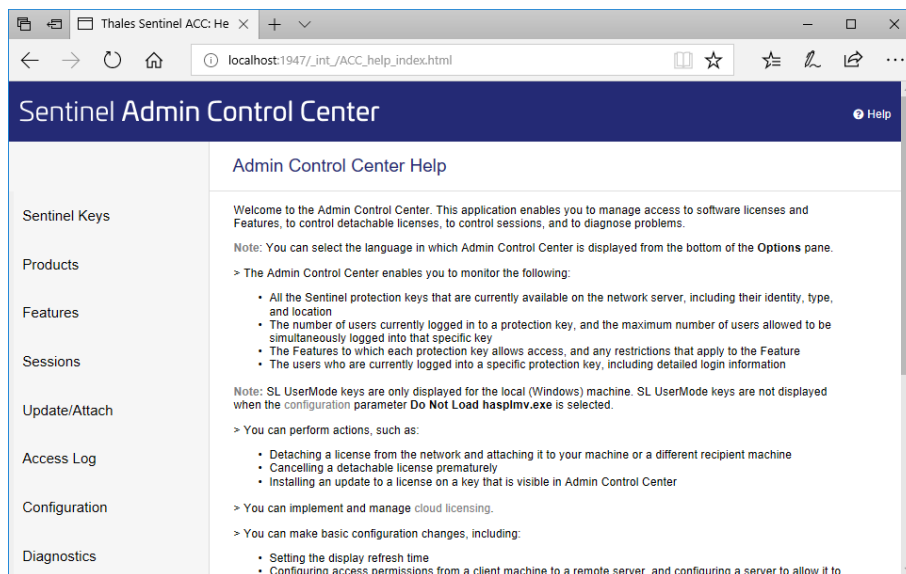


Now the application is installed and ready for use.



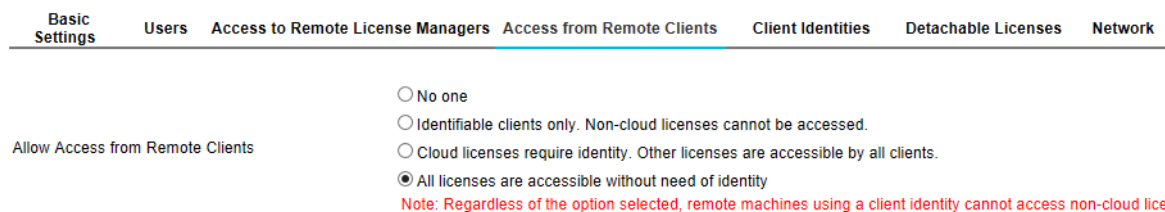
## 4.2 Network license setting

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).



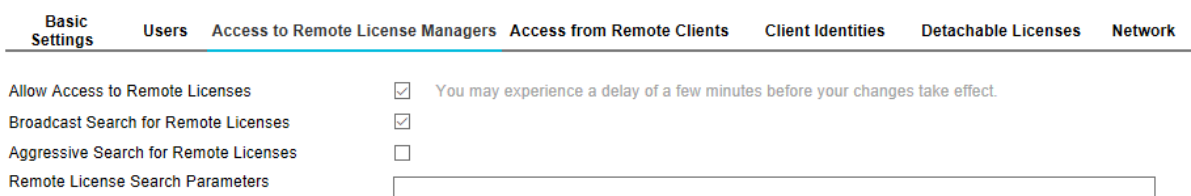
## Server configuration

To set the license server as a license provider, please open the address in your web browser [http://localhost:1947/\\_int\\_/config\\_from.html](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

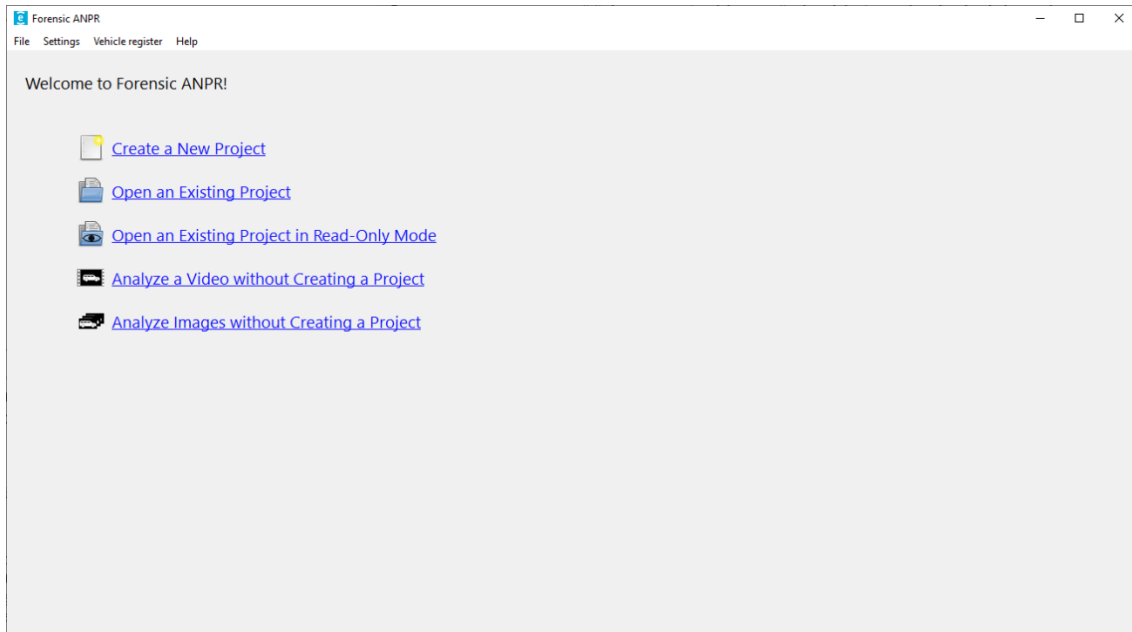
To set the license server as a client, open the address [http://localhost:1947/\\_int\\_/config\\_to.html](http://localhost:1947/_int_/config_to.html) in a web browser and choose the **Allow Access to Remote Licenses** option. If the license provider is in another network than the computer, put the server's 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

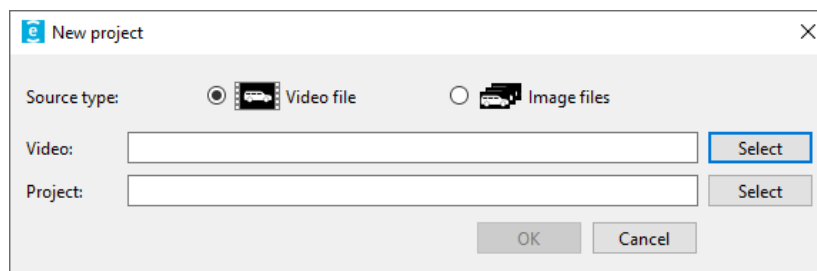
It is expected that the process to obtain the result usually needs to be documented, so the program allows the user to create a project for each analyzed license plate. The project file contains information about the status of the application, is automatically saved (always in the transition to the next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

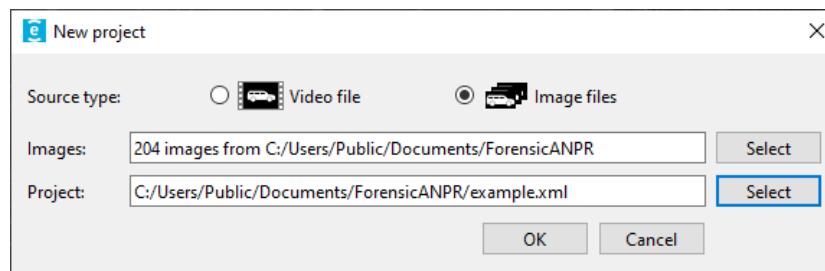
To display the dialog window for creating a new project, click the **Create a New Project** option on the welcome screen or select **File → New project** from the menu.



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<sup>1</sup>), 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. In normal mode, all changes are automatically saved. If this is not desired, it is possible to choose the **Read-Only Mode** (any modifications can be saved using the **File → Save project as** menu).

### 5.2.3 ‘Analyze Video / Images without creating a project’ option

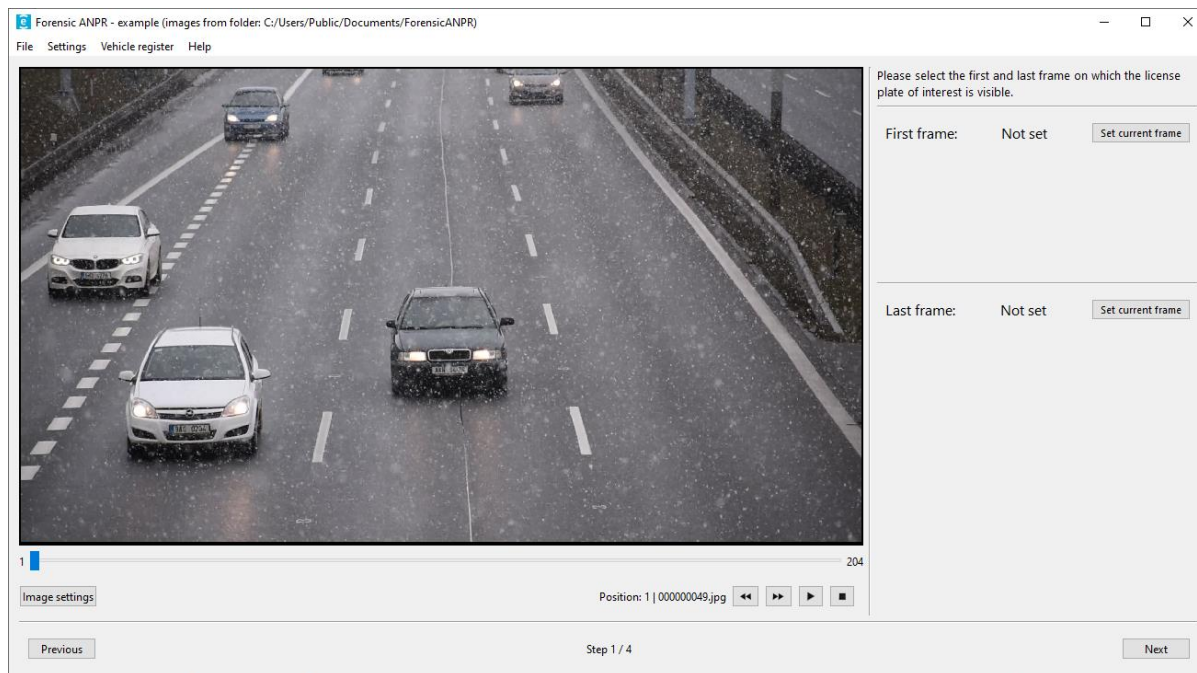
If you do not want to save the project at all or want to start analyzing a video or photos before saving the project, you can use either of the **Analyze Video / Images without creating a Project** options on the welcome screen. In these cases, the application does not automatically

<sup>1</sup> 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 anything during your work, but you can save the project at any time using the **File** → **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 using the + and - keys or by rotating the mouse wheel while holding down the **Ctrl** key.

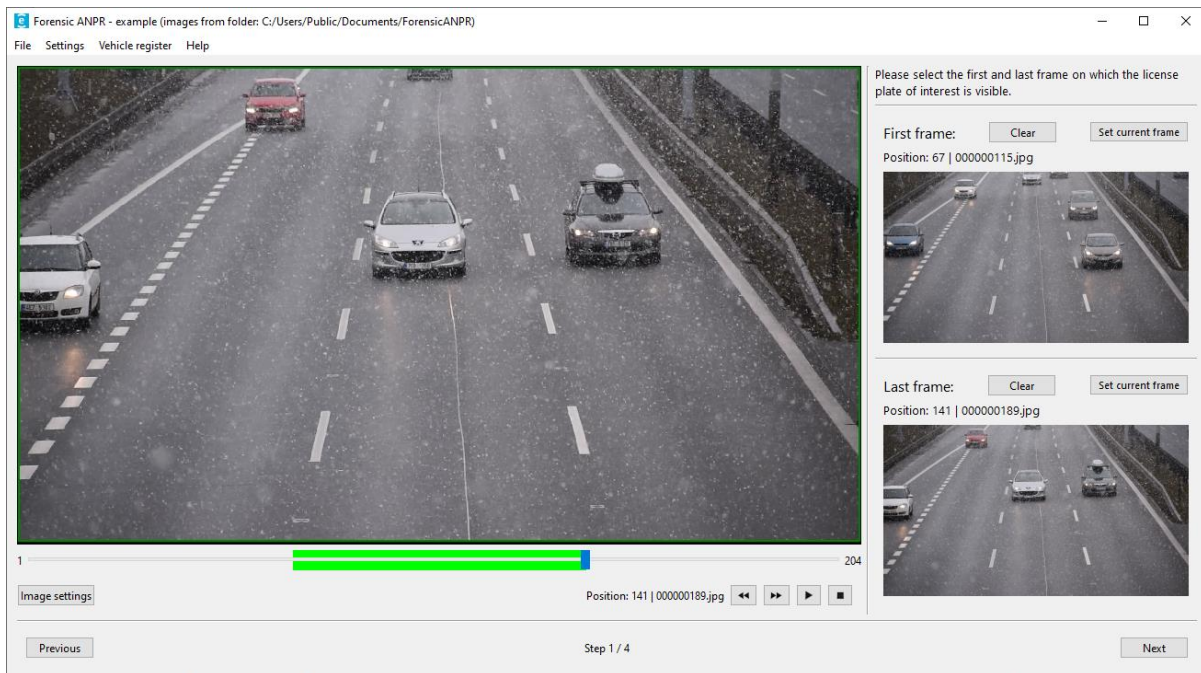
If the source is a sequence of photos, it is possible to set the playback speed in the **Settings** menu, see chapter 7.2 Application parameters. The same playback speed will be used in the next step.

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.

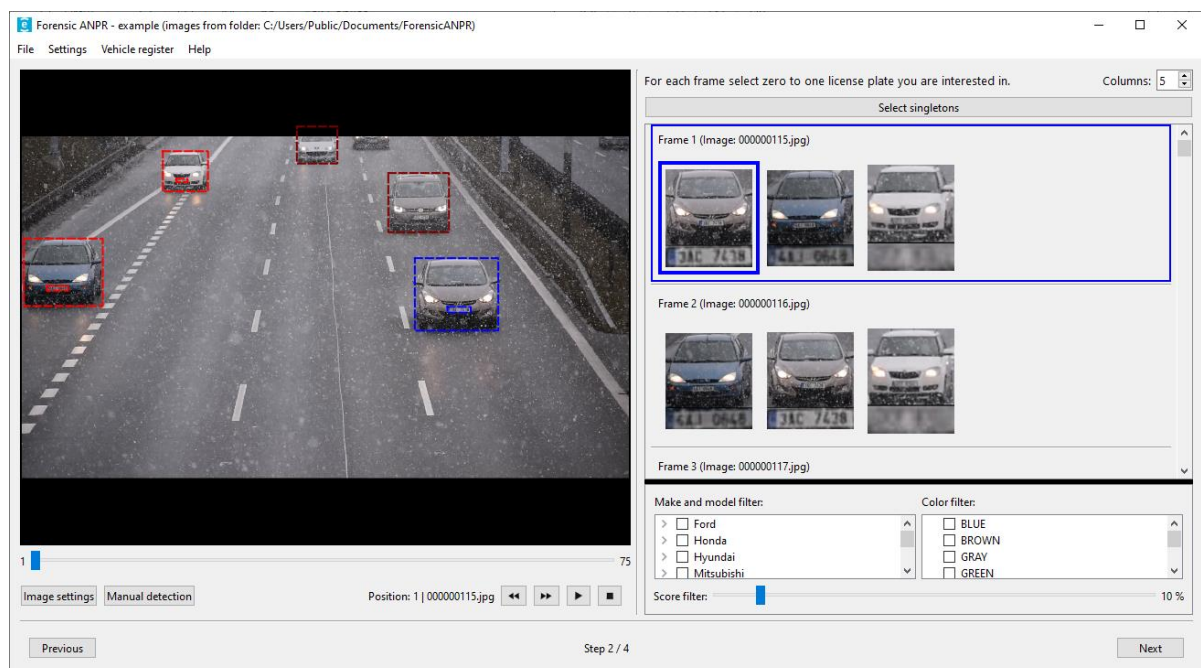




Once you have made your selection, you can move on by pressing the **Next** button at the bottom of the wizard. The application then reads the selected images into memory and detects the license plates. Conversely, by pressing the **Previous** button and confirming the dialog box, if you really want 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 (matching the specified filters, 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 is a filter area that can be used to hide results that do not match the specified parameters (without affecting their selection). The filter area is separated from the detection list by a thick black line, which you can move to change the size of these areas.

If MMR is enabled for all vehicles (see chapter 7.2 Application parameters), the make, model and color of the vehicle are recognized for each detection of the corresponding type; the values of these categories are then provided in the form of check boxes for practical filtering by vehicle make (and possibly model) and/or its color. If no field is checked in the filter list, the filter is ignored (i.e. the result is the same as if all its fields were checked).

The **Score filter** slider 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.

You can navigate between the frames using the video player in the same manner as in Step 1, by clicking the appropriate panel on the right and also by 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

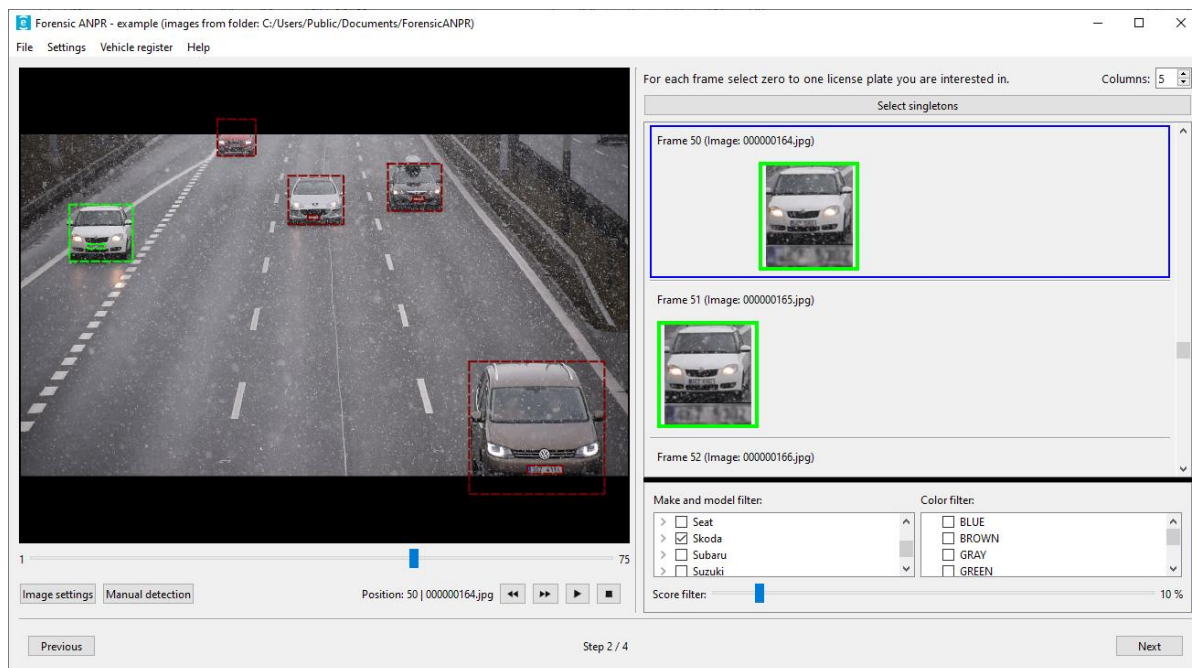
highlighted in blue again). Press the Left and Right keys to change the highlighted detection within a single frame.

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 filter settings). 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 filter settings 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 that does not match the current filter settings.



If your filters are set up so that only one vehicle matches them in many frames, you can select them in bulk by pressing the **Select singletons** button above the list of detections.

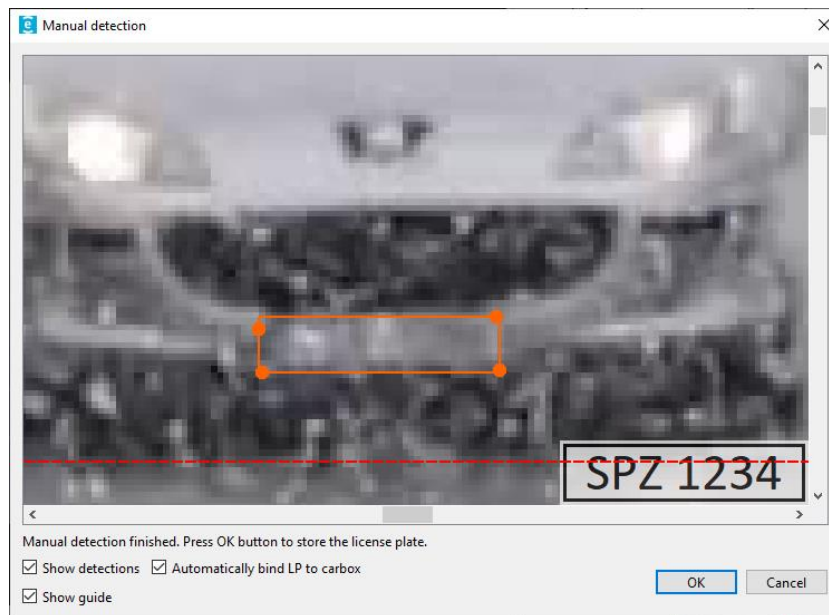
If you hover the mouse cursor over the detection preview, you will see a context box with all the information found so far. In this step these are the type of detection (license plate or carbox including the score), possibly the make, model and color of the vehicle (if MMR is enabled for all vehicles) 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 using the + and - keys or by rotating the mouse wheel while holding down the Ctrl key. Instructions appear below the image. If the **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.

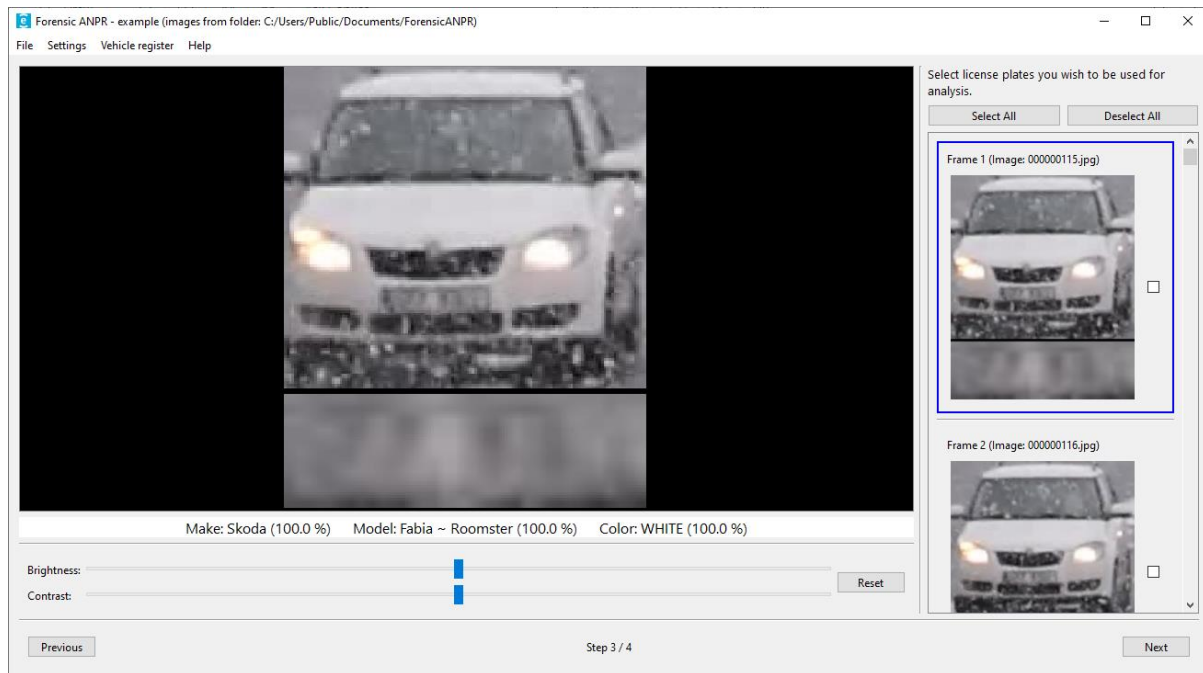


Manually entered detections are assigned the maximum possible score, so they appear leftmost among the thumbnail previews of the detections of the given frame. In the terms of running the program, they are treated in the same way as license plates detected automatically.

When the selection is complete, press **Next** to move on; if the MMR is enabled for selected vehicles, 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.



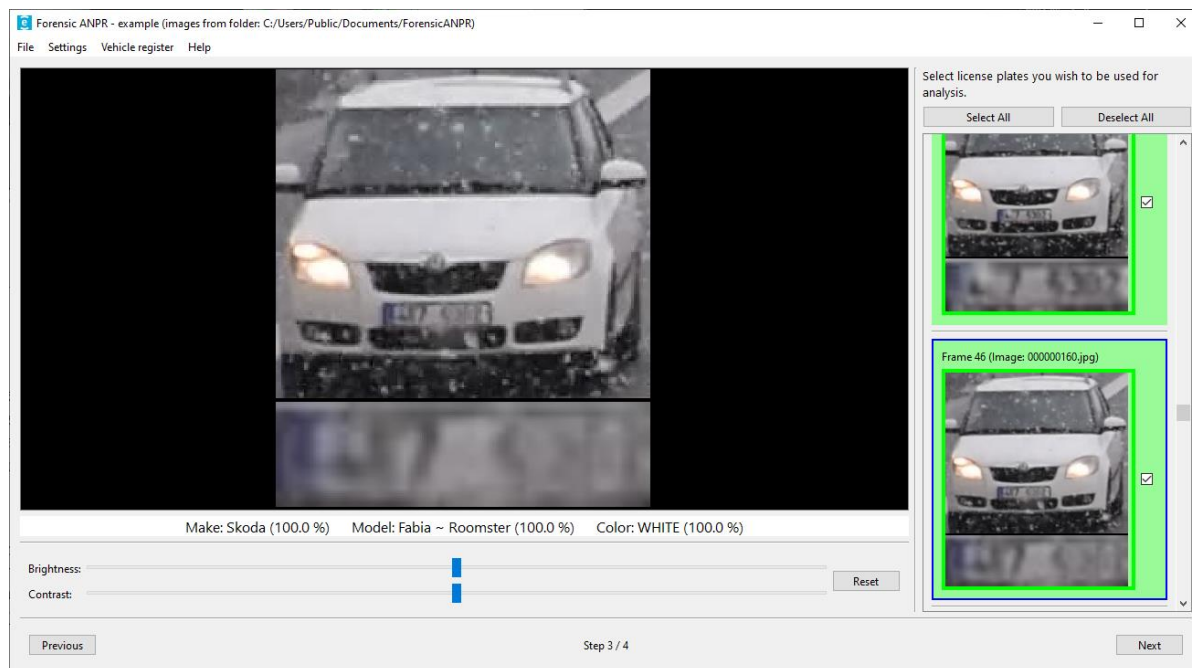
In the right part of the window are all the detections containing a license plate selected in the previous step, one of which is highlighted in blue. If a carbox has been detected, it is displayed together with the license plate, otherwise a cutout containing a preview of the vehicle is generated for 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.

Again, you can move between frames using the Up, Down, Home and End keys.

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

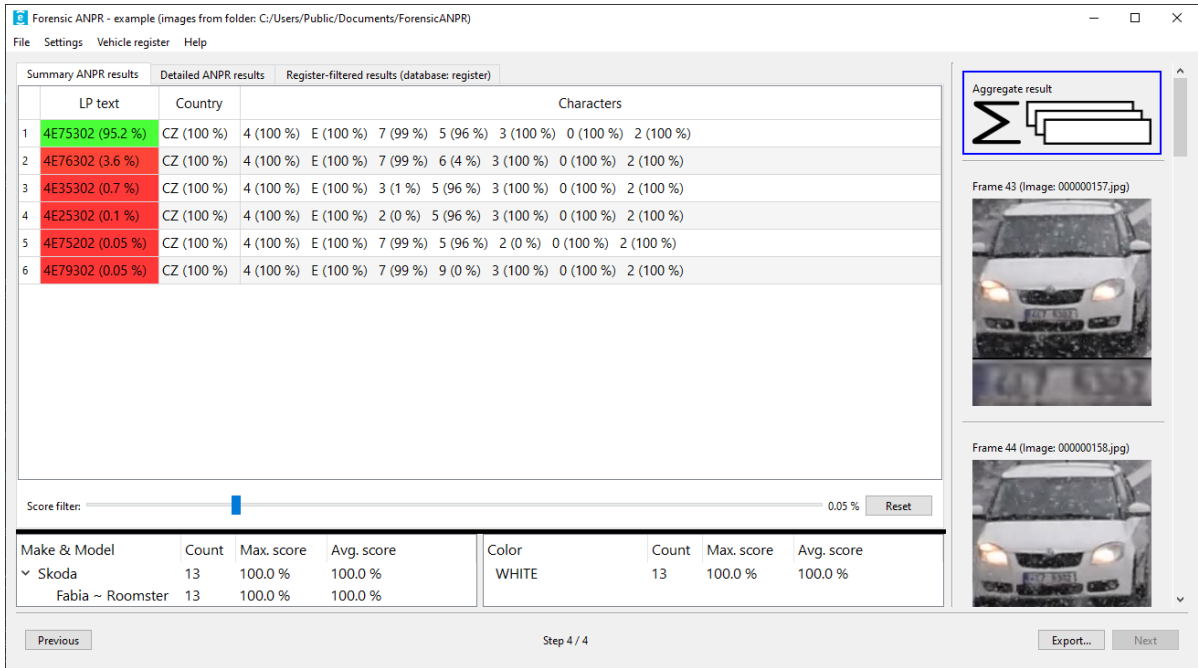
The last step of the wizard provides three views of the automatic number plate reading results – the possible overall forms of the license plate text are listed on the **Summary ANPR results** tab, while the **Detailed ANPR results** tab lists the variants by character; the **Register-filtered results** tab allows you to combine the results calculated by the application with information about real vehicles. If MMR is enabled, the MMR results are also displayed under these tabs.

The results are calculated separately for the individual frames selected in the previous step and for all these frames together – in the list on the right, their representative is marked as **Aggregate result**. 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.

### 5.6.1 Summary ANPR 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).

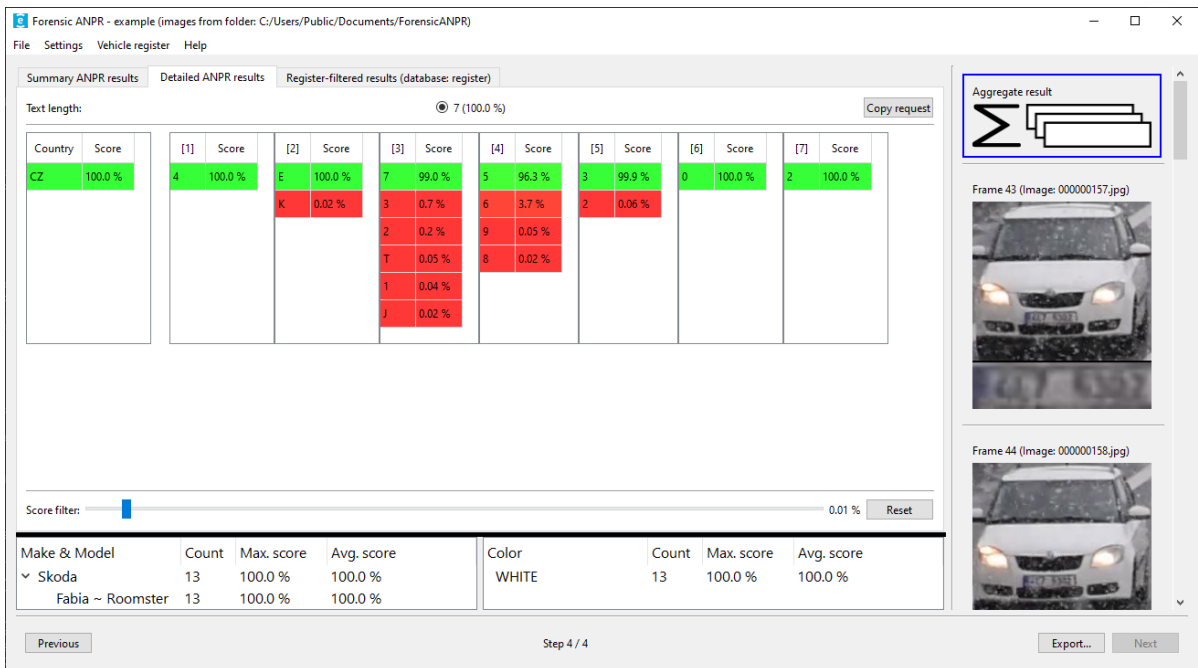
The **LP Text** column shows the license plate text, **Country** refers to the code of the country that issued it, and in the **Characters** column are itemized individual characters forming the text. For all these hypotheses based on the input data, the confidence is shown in the parentheses to qualify 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.



### 5.6.2 Detailed ANPR results

The Detailed ANPR results tab 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 after the Text length: label to select the number of displayed license plate characters (accompanied by score).





### 5.6.3 Register-filtered results

The Register-filtered results tab combines the detailed ANPR results view and the Vehicle register explorer, which automatically populates a filter for license plate text; the filters for country, color, make and model can be entered after checking the appropriate check box. The table below displays all records matching the filters along with the corresponding scores.

The screenshot shows the 'Register-filtered results' tab in the Forensic ANPR application. The score filter is set to 0.1%. The results table shows three records:

Score	LP text	Country	Color	Make	Model
95.2 %	4E75302	CZ	WHITE	ŠKODA	FABIA
3.6 %	4E76302	CZ	AZURE	ŠKODA	FELICIA LXI
0.1 %	4E25302	CZ	SILVER METALLIC	ŠKODA	FABIA COMBI

Below the table, a summary table shows the following data:

Make & Model	Count	Max. score	Avg. score	Color	Count	Max. score	Avg. score
Skoda	13	100.0 %	100.0 %	WHITE	13	100.0 %	100.0 %
Fabia ~ Roomster	13	100.0 %	100.0 %				

Since the evaluation and display of a large number of records is quite time-consuming and starts automatically when switching to another frame or changing a filter, the application has defined limits (hard 500000 and soft 10000 records), which, if exceeded, will display “Too many records!” under the table instead of results.

The screenshot shows the 'Register-filtered results' tab with a score filter of 0%. The LP text filter is set to 'U|C|H|B|D|O|Q|V|S|6|3|9|0|2|8|7|5|4|F|E|I|P|G|C|3|2|7|5|0|1|4|9|6|8|U|Z|X|V|T|O|U|F|0|8|9|6|3|5|4|1|D|H|2|0|7|2|3|7|1|4|0|9|5|8|6|Z'. The results table is empty, and the message "Too many records!" is displayed. A summary table at the bottom shows the following data:

Make: Skoda (100.0 %)	Model: Fabia ~ Roomster (100.0 %)	Color: WHITE (100.0 %)
-----------------------	-----------------------------------	------------------------

The operation of the Vehicle register explorer (in the form of a separate window), including database connection and data import, is described in more detail in chapter 6 Vehicle register explorer.

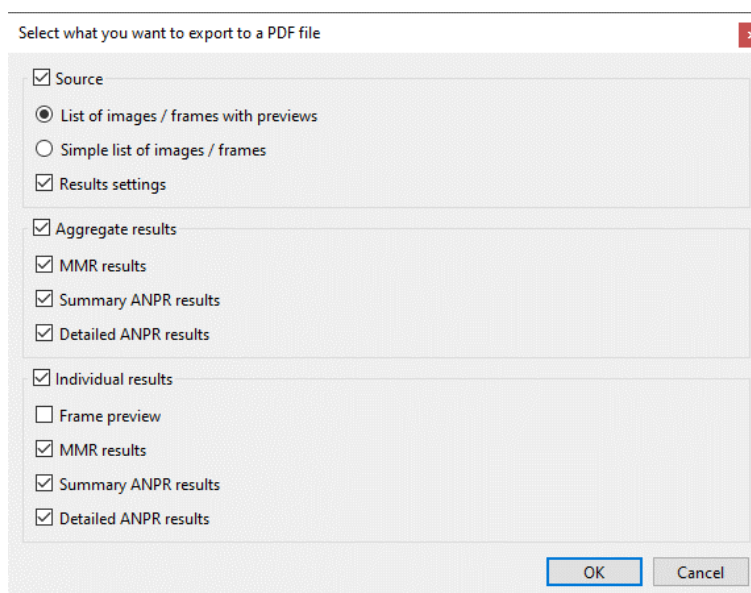
Note: The filters specified on the **Register-filtered results** tab are associated with the connected database, not the project, and therefore are not saved, unlike other settings and results. Results from this tab cannot be exported to PDF (see chapter 5.6.5 Exporting results).

### 5.6.4 MMR results

Under the automatic number plate reading results tabs, the MMR results (vehicle make, model and color) are displayed – for individual frames in the same form as in the previous step, and for the aggregate result, the individual variants are listed along with information about the number of times they occurred and the maximum and average scores. You can resize the MMR results section by dragging the thick black dividing line.

### 5.6.5 Exporting results to a PDF file

The results can be saved in a PDF document. Press the **Export...** button to open a dialog box for selecting the information you want the document to contain.



The **Source** section contains information about the source video or image files (either with or without previews) and optionally the score filters settings.

For aggregate and individual results, it is possible to save MMR results and summary and detailed results of reading the license plate text and its country. In the case of individual results, you can also choose to save previews of the detections.

Depending on the amount of data being saved, creating a PDF file can take up to several dozens of seconds. When the export is complete, a message will be displayed to indicate whether the export was successful.

## 6 Vehicle register explorer

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

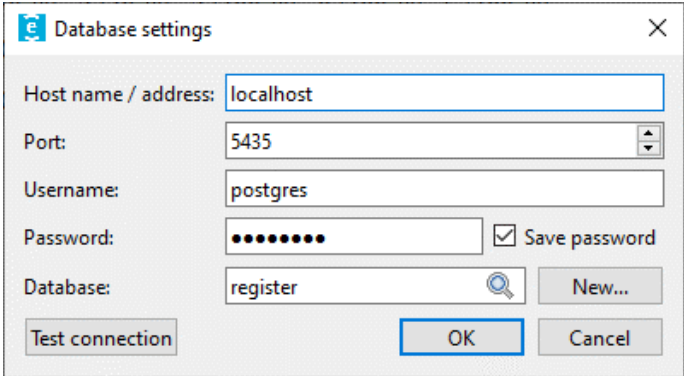
- license plate text,
- country in which the vehicle is registered,
- vehicle color,
- vehicle make and
- vehicle model.

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.



The screenshot shows a 'Database settings' dialog box with the following fields and controls:

- Host name / address: localhost
- Port: 5435
- Username: postgres
- Password: [masked with dots]  Save password
- Database: register
- 

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. Click on the magnifying glass image on the right side of the field to display a dialog box containing a list of possible databases. 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.

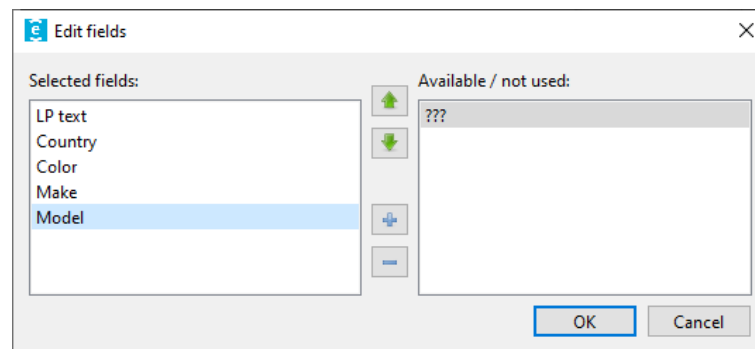
Along with creating a database, it is also possible to import data from one overall file or from multiple files by checking the **Import data** option and filling in the form in the **Source files** section. If you do not select this option and only create a database, you will have to transfer the data 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

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.

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 text, 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: LP text 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 text and Model, separated with a slash. The **Fields** section will contain:

1: LP text 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

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 Viewing the 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.

Vehicle register explorer - register

LP text:  Country:

Color:

Make:

Model:

Search

LP text	Country	Color	Make	Model

Show score Calculate score for all frames

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 calculation related fields 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.

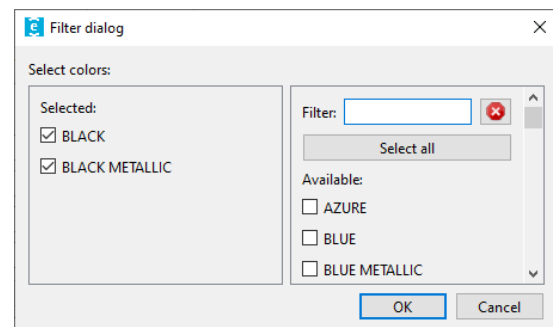
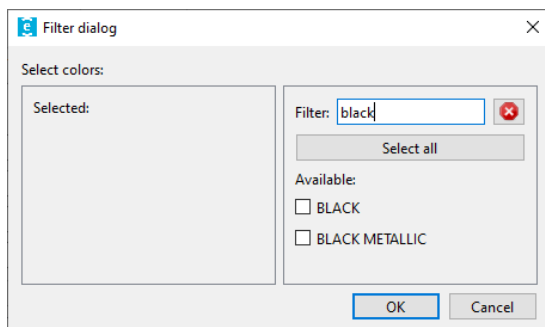
**LP text:** is a text field. You can type in any exact form of the license plate text you want to display, or you can combine parts of the license plate text with placeholders for any character or sequence of characters. You can specify multiple options with a logical “OR” separator and use parentheses 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 ANPR results** tab in the **LP text:** 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 ANPR 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 text is 7 characters long, beginning with “1A” and ending with “0”:

The screenshot shows a window titled "Vehicle register explorer - register". It contains the following filter fields:

- LP text: 1A\_\_0
- Country: CZ
- Color: BLACK, BLACK METALLIC
- Make: ŠKODA
- Model: ŠKODA: OCTAVIA, OCTAVIA COMBI, OCTAVIA GLX, OCTAVIA GLXI, OCTAVIA SLX, OCTAVIA SLXI

A "Search" button is located at the bottom of the filter section.

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: **LP text**, **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 text filter obtained using the **Copy request** button from the **Detailed ANPR results** tab (see chapter 5.6.2 ) or by copying the value of the **LP text:** field from the **Register-filtered results** tab (see chapter 5.6.3 ) and knowing that it belongs to a Škoda vehicle:

Vehicle register explorer - register

LP text: 4E(7|3|2)(5|6)302 Country: CZ

Color: Make: ŠKODA Model:

Search

	LP text	Country	Color	Make	Model
1	4E25302	CZ	SILVER METALLIC	ŠKODA	FABIA COMBI
2	4E75302	CZ	WHITE	ŠKODA	FABIA
3	4E76302	CZ	AZURE	ŠKODA	FELICIA LXI

3 records found.  Show score **Calculate score** for all frames

### 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.

The **Calculate score** button in the lower right corner of Vehicle register explorer sends the application a list of all the license plate texts displayed in the explorer and requests their score to be calculated against the frames selected in Step 3 of the wizard or their subset – the selection can be made using the form that appears after clicking on the appropriate field on the far right. If you change the set of selected frames (and therefore the displayed score values are no longer current), the **Calculate score** button is highlighted with a black border.

Vehicle register explorer - register

LP text: 4E(7|3|2)(5|6)302 Country: CZ

Color: Make: ŠKODA Model:

Search

	Score	LP text	Country	Color	Make	Model
1	95.2 %	4E75302	CZ	WHITE	ŠKODA	FABIA
2	3.6 %	4E76302	CZ	AZURE	ŠKODA	FELICIA LXI
3	0.1 %	4E25302	CZ	SILVER METALLIC	ŠKODA	FABIA COMBI

3 records found.  Show score **Calculate score** for all frames

Note: Selecting any combination of frames for which scores are calculated is only possible in a separate window of the Vehicle register explorer, which is the primary focus of this chapter; the explorer integrated on the Register-filtered results tab calculates scores automatically, either for all frames selected in step 3 or for these frames individually.

# 7 Settings

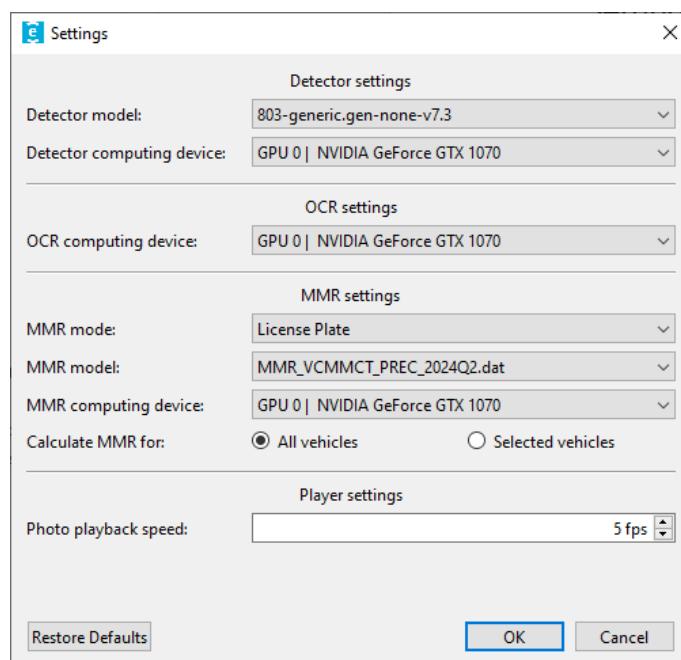
## 7.1 Language

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 all detections between steps 1 and 2, or for selected detections between steps 2 and 3, depending on the *Calculate MMR for* choice. By changing the MMR mode or model, recalculation of the already obtained results can be achieved.

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, the application automatically changes the *MMR Model* accordingly.

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\Eyedeia Recognition\Forensic ANPR.

**T A**  
**Č R**

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