DEMO APPLICATION

for Video Stabilizer library version 3.0.0

DESCRIPTION

The demo application is intended to evaluate the quality of the **Video Stabilizer** library version **3.0.0**. The application allows you to evaluate the operation of the algorithm with different parameters. It is console application and serves as an example of using the Video Stabilizer library. The application uses the OpenCV library (version 4.5.5) for capturing video, recording video, displaying video, and forming a simple user interface. The application is intended for the **Windows 64bit** operating systems version 7 and higher.

LAUNCH AND USER INTERFACE

The demo application does not require installation. The directory with the demo application includes the following files.

Table 1 – Application files.

File	Description
VideoStabilizerDemoApplication.exe	Application executable file.
VideoStabilizerDemoApplication.json	The parameters file of the VideoStabilizer library. The values of the stabilization algorithm parameters will be set before the video processing starts. Description of the parameters is given in Tables 2 and 3.
opencv_videoio_ffmpeg454_64.dll	OpenCV library file version 4.5.5.
opencv_world454.dll	OpenCV library file version 4.5.5.
opencv_videoio_msmf454_64.dll	OpenCV library file version 4.5.5.
VC_redist.x64.exe	Installer of necessary system libraries.
src	Folder with application source code.
test.mp4	Test video file.

If a message about missing system libraries appears when launching the application, you must install the VC_redist.x64.exe program, which will install the system libraries required for operation. After starting the application reads parameters from the VideoStabilizerDemoApplication.json configuration file. The parameters file of the VideoStabilizer library looks like this:

```
{
```

```
    "videoStabilizerParams":
    {
        "filterCoeffX":0.95,
        "filterCoeffY":0.95,
        "filterCoeffAlpha":0.97,
        "xOffsetLimit":150,
        "yOffsetLimit":150,
        "alphaOffsetLimit":0.1,
        "scaleFactor":1,
        "only2dStabilizationFlag":false,
        "transparentBorderFlag":true
    },

    "videoSourceParams":
    {
        "videoSourceInitString":"file dialog",
        "scaleFactor":2
    }
}
```

Table 2 – VideoStabilizer library parameters description in config file (section videoStabilizerParams).

Parameter name	**Description**
filterCoeffX Type: **double** Range: от **0** до **1** Default value: **0.95**	Smoothing coefficient of the constant horizontal camera motion. The constant component is subtracted from the calculated transformation parameters between two neighboring video frames to adapt to the constant camera motion and compensate for random perturbations. Calculation of the horizontal constant component of motion is performed according to the following expression: $$fDx^t = fDx^{t-1} \times \text{filterCoeffX} + Dx^t \times (1 - \text{filterCoeffX})$$ where: fDx^t – new value of the constant component of the horizontal displacement; fDx^{t-1} – the previous value of the constant component of the horizontal displacement; Dx^t – current calculated horizontal displacement. If the camera moves with a constant speed, it is recommended to set high values of the parameter (for example, 0.97). If the camera moves chaotically, it is recommended to set the parameter to a lower value (for example, 0.9).
filterCoeffY Type: **double** Range: от **0** до **1** Default value: **0.95**	Smoothing coefficient of the constant vertical camera motion. The constant component is subtracted from the calculated transformation parameters between two neighboring video frames in order to adapt to the constant camera motion and compensate random perturbations. Calculation of the vertical constant component of motion is performed according to the following expression: $$fDy^t = fDy^{t-1} \times \text{filterCoeffY} + Dy^t \times (1 - \text{filterCoeffX})$$ where: fDy^t – new value of the constant component of the vertical displacement; fDy^{t-1} – the previous value of the constant component of the vertical displacement; Dy^t – the current calculated vertical displacement. If the camera moves with a constant speed, it is recommended to set high values of the parameter (for example, 0.97). If the camera moves chaotically, it is recommended to set the parameter to a lower value (for example, 0.9).

Parameter name	Description
filterCoeffAlpha Type: **double** Range: от **0** до **1** Default value: **0.97**	The smoothing coefficient of the constant rotation of the camera. Calculation of the constant rotation component is performed according to the following expression: $$fDa^t = fDa^{t-1} \times filterCoeffAlpha + Da^t \times (1 - filterCoeffAlpha)$$ where: fDa^t – новое значение постоянной составляющей поворота; fDa^{t-1} – предыдущее значение постоянной составляющей поворота; Da^t – текущей рассчитанный угол поворота.
only2dStabilizationFlag Type: **bool** Default value: **false**	Flag indicating the need to compensate only horizontal and vertical displacements (2D stabilization). The default value of the parameter is **false** (3D stabilization).
transparentBordersFlag Type: **bool** Default value: **true**	Flag indicating the need to leave the edges of the frame transparent. If **true**, then the unfilled parts of the frame will have the values of the previous stabilized frame after it is rotated.
xOffsetLimit Type: **int** Range: от **1** до **1000** Default value: **100**	Maximum permissible horizontal offset of the frame relative to the previous frame, which will be compensated. If the current displacement of the frame was larger, then as the current displacement will be taken as the calculated displacement of the previous processed video frame.
yOffsetLimit Type: **int** Range: от **1** до **1000** Default value: **100**	Maximum permissible vertical offset of the frame relative to the previous one, which will be compensated. If the current displacement of the frame was larger, then as the current displacement will be taken as the calculated displacement of the previous processed video frame.
alphaOffsetLimit Type: **double** Range: от **0** до **3.14** Default value: **0.1**	Maximum allowable angle of image rotation that will be compensated (radians). The values are set in radians. If the angle of image rotation to any side was higher, then as the current rotation will be taken by the rotation calculated on the previous processed video frame.
scaleFactor Type: **int** Range: от **1** до **8** Default value: **1**	Scale factor of the input video frames (how many times to compress the video frame). The default setting is 1 (no scaling). At values greater than 1 the algorithm compresses the input frame by the specified number of times to speed up calculations.

Table 3 – Description of video source parameters (videoSourceParams section).

Parameter name	Description
videoSourceInitString	Video source initialization string. If the parameter is set to "file dialog", then after start the program will offer to select video file via file selection dialog. The parameter can contain a full file name (e.g. "test.mp4") or an RTP (RTSP) stream string (format "**rtsp://username:password@IP:PORT**"). You can also specify the camera number in the system (e.g. "0" or "1" or other). When capturing video from a video file, the software plays the video with repetition i.e. when the end of the video file is reached, playback starts again.
scaleFactor	The video scaling factor for displaying to the user. Can take integer values greater than or equal to 1. The software does not scale the video for displaying to the user. If video frame size is greater than monitor resolution, the user will only see part of the picture. If scaleFactor > 1, the software will reduce the resolution of the video for display to the user by the specified number of times.

After starting the application (running the executable file VideoStabilizerDemoApplication.exe) the user should select the video file in the dialog box. After that the user will see the user interface as shown in Figure 1.

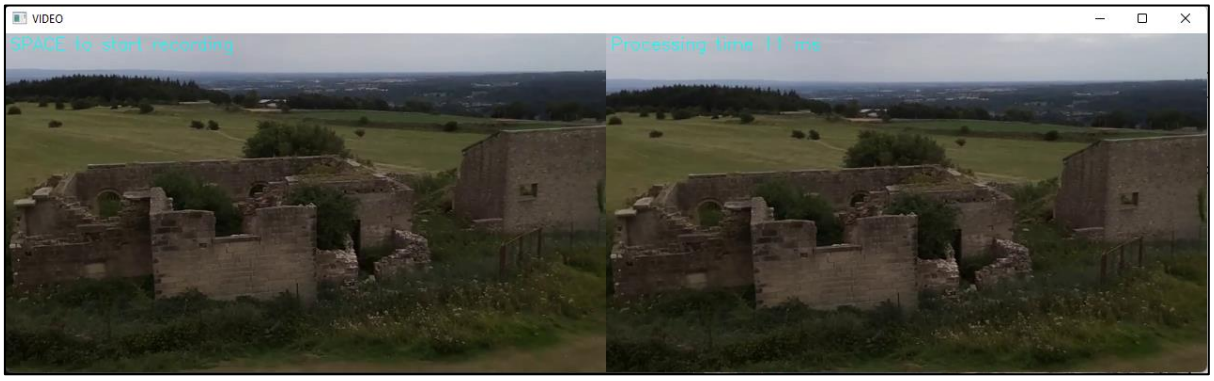

Figure 1 – User interface (original video on the left, processed video on the right).

The window shows the original video (left) and the video processed by the stabilisation algorithm (right). The upper part of the window shows the processing time of the current frame by the stabilisation algorithm in milliseconds. In the upper left corner of the window the active video recording mode is displayed.

CONTROL

To control the application, it is necessary that the main video display window was active (in focus), and also it is necessary that the English keyboard layout was activated without CapsLock mode. The program is controlled by the keyboard.

Table 4 – Control buttons.

Button	Description
ESC	Exit the application.
R	Reset stabilization algorithm.
SPACE	Enabling and disabling video recording. When video recording is enabled, a file **record_mix_[date and time].mp4** is created in the directory with the application executable file containing a combination of source and stabilized video, and a file **record_[date and time].avi** containing only stabilized video. Recording is performed of what is displayed to the user. To stop the recording, press the SPACE key again.