COVID-19 Diagnosis System

Covid5s

Version 10.2.2.719

MANUAL

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CONTENT

1 Introduction

Welcome to the VibraImage World! Thank you for using COVID5s system. This Manual written to help you be sure in the results of COVID-19 diagnosis.

COVID5s diagnoses COVID-19 by reflex head movement analysis basis vibraimage (VI) technology and artificial intelligence (AI) automatically during 5-second video processing of facial image (or 20-second video for more accuracy).

Vibraimage is the image reflects spatial and temporal parameters of vibration and movement of an object. VibraImage technology relates to biometrics, and can be used for measuring, processing and analysis of the psychophysiological state of living biological objects, fixed in space (quasi-stationary), e.g., standing or sitting in one spot.

1.1 Basic applications

COVID5s is designed to diagnose COVID-19 by behavioral parameters processing during 5 (or 20) second testing. COVID5s could be apply for real time testing in shops, café, airports railway stations and any other places for express detection of COVID-19 infected.

1.2 Computer and Camera Requirements

1.2.1 Basic parameters

- Resolution, TVL, more than 400
- Noise level of vibraimage, bit, less than 0,1
- Frame speed, FPS, not less than 25

1.2.2 Digital (web) camera requirements

- Resolution, pixel, not less 640 x 480
- USB compatible USB 2.0, USB 3.0
- Frame speed, FPS, higher 25
- Exposition control main and auto
- Color mode (b/w preferable in settings) b/w
- Flicker mode Flicker 50 Hz and 60 Hz

1.2.3 System requirements for computer

- Operation System Windows 7/8/10 or later 64-bit only
- Processor Intel I5 or higher
- RAM more than 4 Gb

- HDD — more than 100 Mb free space
- USB port — 1 free USB ports version USB 2.0 or higher
- Video capture — WDM-compatible video device

1.3 Package contents

1. COVID5s software - 1
2. Activation code or dongle - 1
3. User's manual - 1
4. Digital USB camera (hardware) - 1 (option)
5. Microphone (hardware) - 1 (option)
6. Personal computer (hardware) - 1 (option)

Attention!

Hardware with the specified parameters isn't included in the delivery. User gets the hardware for the COVID5s system themselves.

Recommended to use Microsoft LifeCam Studio webcam or similar with parameters not worse than this webcam.

1.4 Requirements for checkpoints

The basis of the COVID5S program is vibraimage technology which can provide a high-quality result only by analyzing high-quality video. To do this, you must fulfill all requirements of paragraph 1.2.2, 1.2.3. As well as to meet the requirements of paragraph 1.2.1 it is necessary:

- investigated person stand or sit in front of a camera and not leaning his head to any object;
- fix a camera (on the wall, on the tripod, etc.) in front of the tested person;
- face lighting should be uniform;
- camera should be focused on the person's face
- facial image on a monitor must be contrast to background

Fig. 1.1 shows standard position of sitting subject in front of the camera, and fig. 1.2 – the standard image of the subject in the frame.

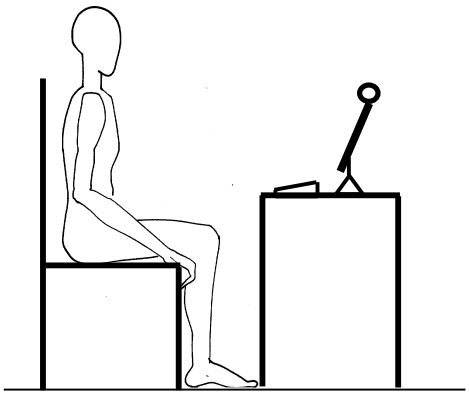


Fig. 1.1 Test conditions

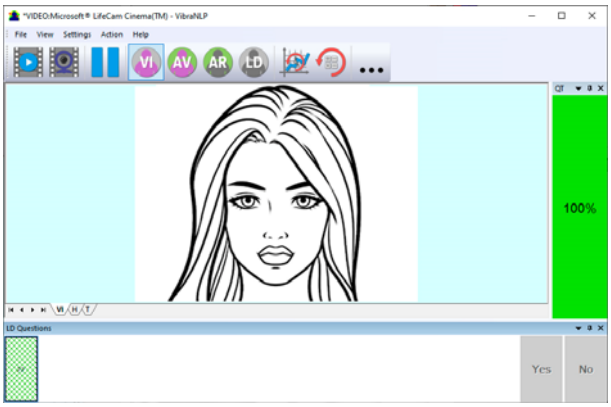


Fig. 1.2 Image of a subject in the frame

For convenience by default, the automatic video Quality Test is enable (see section 2.4.5), then an assessment as a percentage of video quality will appear on the right side of the program.

2 COVID5s software installation

It is necessary to execute the following actions for COVID5s program installation on your computer:

1. Go to Web page http://www.psymaker.com/support/downloads/
2. Download file setupCOVID5s.exe by link http://www.psymaker.com/downloads/setupCOVID5s.exe
3. Run file setupCOVID5s.exe
4. Select language for installation procedure.
5. Press button «Next» in the appeared window of the beginning installation.
6. Accept the license agreement and to press button «Next» in the appeared window.
7. In the appeared window, specify a way to the catalogue where files of the program will be written down, then to press button «Next».
8. Press button «Next» in the appeared window, allows installation of software files on your computer.
9. Selecting an additional icon allows to display the icon on the computer desktop.
10. Press button «Install» at the start of installation.
11. Press button «Finish» at the end of installation.
12. COVID5s program icon appears after the end of installation in system menu on desktop of your computer.
13. To reboot a computer.
14. Verify that the camera is connected to the computer and run the program.

2.1 COVID5s software activation

Note: COVID5s has 10 free starts without activation procedure however with requirement an access to the Internet.

1. Procedure of activation is done once at the first start of the program.
2. Before the program activation it is need to buy this version of the program in the online store Psymaker http://www.psymaker.com/store/
3. Activation procedure requests access to the Internet for receiving answer code from server.
4. Activation code has the structureVI10_xxxxxxxx_C5S.
5. COVID5s supports dongle of Vibraimage PRO and 5s dongle.

2.1.1 Standard activation

1. Run COVID5s program to begin an activation.
2. At the first start of the program, the activation window could be displayed (Fig. 2.1).

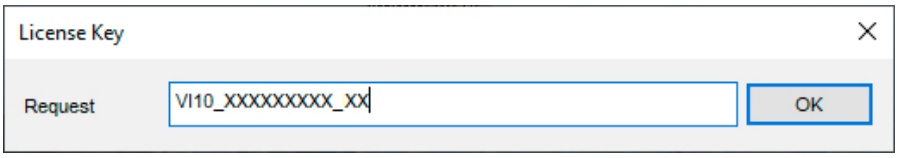


Fig. 2.1 Activation window.

3. In the field «Request» it is necessary to enter the activation code received by e-mail or specified by the seller (Fig.2.1).

Attention!

Please, be careful and paste code without additional gaps!

4. After input of activation code to press the button «OK».

5. The activation code will be checked up through the Internet and, COVID5S will start automatically in case of successful end of activation procedure.

6. Start to work with the system in accordance with this manual.

2.2 COVID5s reinstallation

Note, it is recommended to uninstall the COVID5s program before any upgrade software or hardware on PC and to reinstall after this upgrade.

For this purpose, it is necessary to execute the following actions:

1. Connect to the Internet a computer on which one of COVID5s has been installed.
2. Start program to reinstall on a new computer.
3. In the menu «Help» (Fig. 2.2) choose the item «About COVID5s…» (Fig. 2.2).

Fig. 2.2 Menu «Help».

4. In the opened window press the button «**Unregister key**» (Fig. 2.3).
5. Close the program.
6. Connect a new computer to Internet.
7. On the new computer install the program and make registration of an «old» modification activation code through the Internet, according to recommendations of section 2.1.
8. After successful program registration the given activation code will be fixed to the given computer.

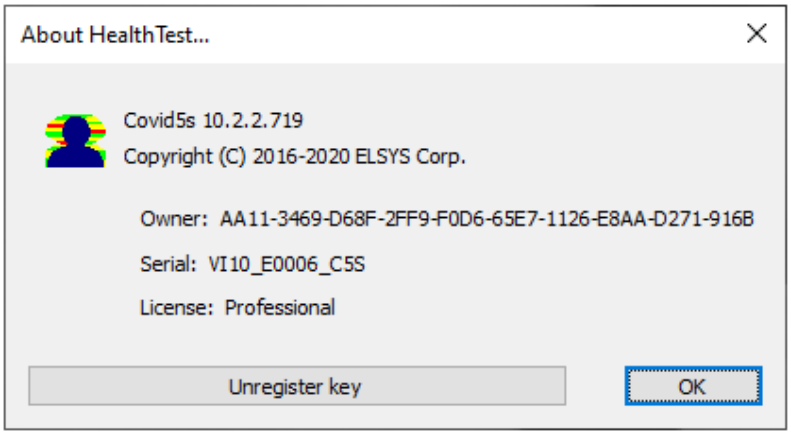


Fig. 2.3 Information about the program.

2.3 First start and COVID-19 diagnosis

1. After successful activation of the program at the first start, if you are not connected to a camera, you will see the program window shown on Fig. 2.4.

Fig. 2.4 First start.

2. Select program language (Fig. 2.5) in the menu **«Settings»** => **«Language»**. By default language is English.

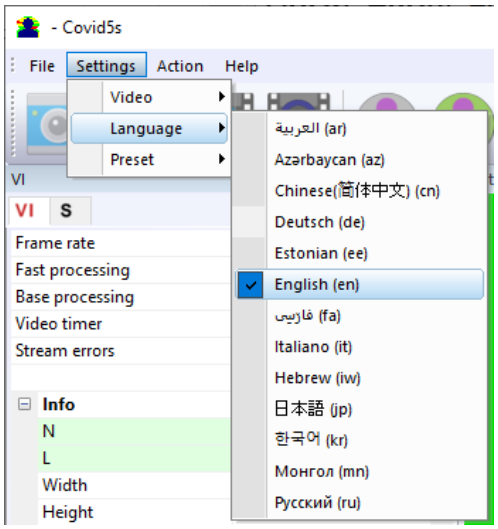


Fig. 2.5 Selecting a language.

3. Select a camera in the menu **«Settings»** => **«Video»** (on a Fig. 2.6 – Microsoft Lifecam Cinema).

   If the program does not see your camera, check the connection of the camera to the computer. After selecting a camera, an image will appear on the screen.

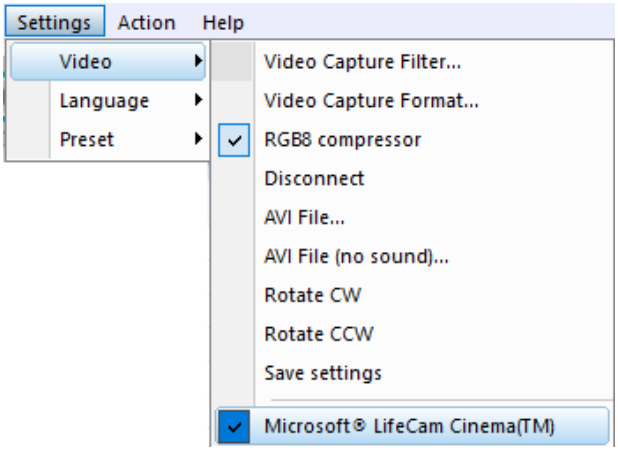
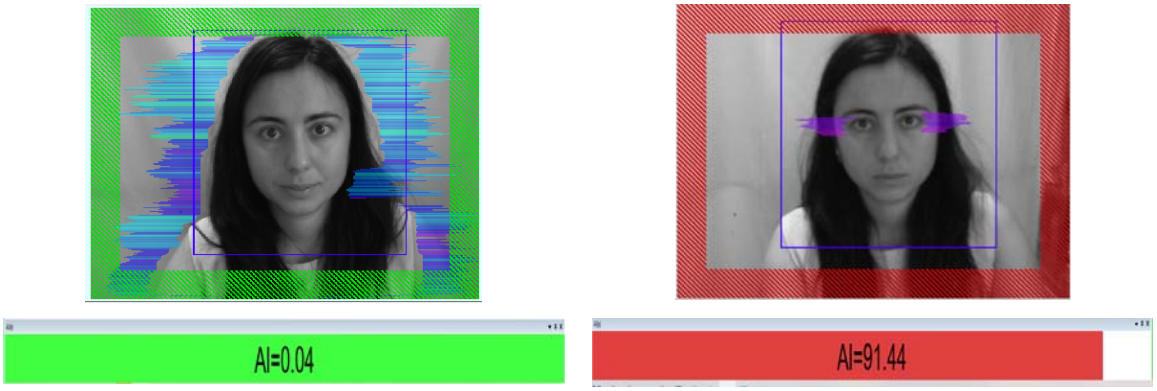


Fig. 2.6 Selecting a camera.

4. Set the camera parameters (see section 2.4).
5. Check video quality (see section 2.4.5). It should be more than 80%, that is, the column on the left side of the program should be green and, if necessary, eliminate the causes of low-quality video (1-5 errors).
6. Specify the catalogue where video files, files of images and files of statistics will be save (see section 3.4.4).
7. Measurement starts automatically when face is detected. Duration of a measurement is 5 sec by default.
8. Result is displayed in main window in 5 seconds automatically (Fig. 2.7).



*a) Result **HEALTHY*** *b) Result Probably **COVID-19***

Fig. 2.7 Test results.

Red result repeating means necessity to CONSULT A DOCTOR of selftesting person or to stop access of detected person with COVID-19 probability to controlled place.

To improve test accuracy measurement duration can be changed from 5 seconds to 20 seconds by pressing button  in the main toolbar.

After end of the test program Vibra5s automatically creates result file **YYY-MM-DD hh_mm_ss_M.xml** in the directory «C:\Users\user\Documents\Covid5s». In all files in names **YYYY-MM-DD** and **hh_mm_ss** date and time of measurement.

2.4 Camera's setting

Correct camera settings are very important for the next vibraimage processing, because mistakes in image quality have great influence to the vibraimage processing results.

2.4.1 Video camera choice

It is necessary to select in the main menu **«Settings»** => «**Video**» => «.../**name used camera**/...». In figure 2.6 the process of selecting camera «Microsoft LifeCam Cinema» is shown. If the camera is connected, selected and works, then on the left of the name there will be an icon «✔» (Fig. 2.7), and the menu will be extended with the **«Video capture filter...»** and **«Video capture format...»**.

COVID5S system allows to processing as the «alive» video signal acting from a video camera, and the video data, before written down and saved as an AVI-file. On default the system works with a signal from a video camera. Subitems **«AVI File … F3»** and **«AVI File (no sound)… Ctrl+F3 »** are intended for a choice for the analysis of an external videofile.

2.4.2 Video capture filter

Select «**Video capture filter.....**» in the submenu «**Video**» (Fig. 2.6) for open menu of the camera settings. Item «**Video capture filter...**» appears in the menu only in case of the correct installation of camera drivers and correct choice of operating camera.

After a choice of the «**Video capture filter...**» the window «**Settings**» will open. Settings window differs depends on camera type. The first tab of this window is usually devoted to the image setup (Brightness, Contrast, etc.). In a figure 2.8 the window «**Settings**» for the camera «**Microsoft LifeCam Cinema**» is shown. Camera Microsoft LifeCam Cinema has low noise level and is preferable for vibraimage applications among webcams., even better to use «**Microsoft LifeCam Studio**».

After a choice of the **«Video capture filter…»** the window **«Settings»** will open. Settings window differs depends on camera type. Figure 2.8 shows the **«Properties»** window for the Microsoft LifeCam Cinema.

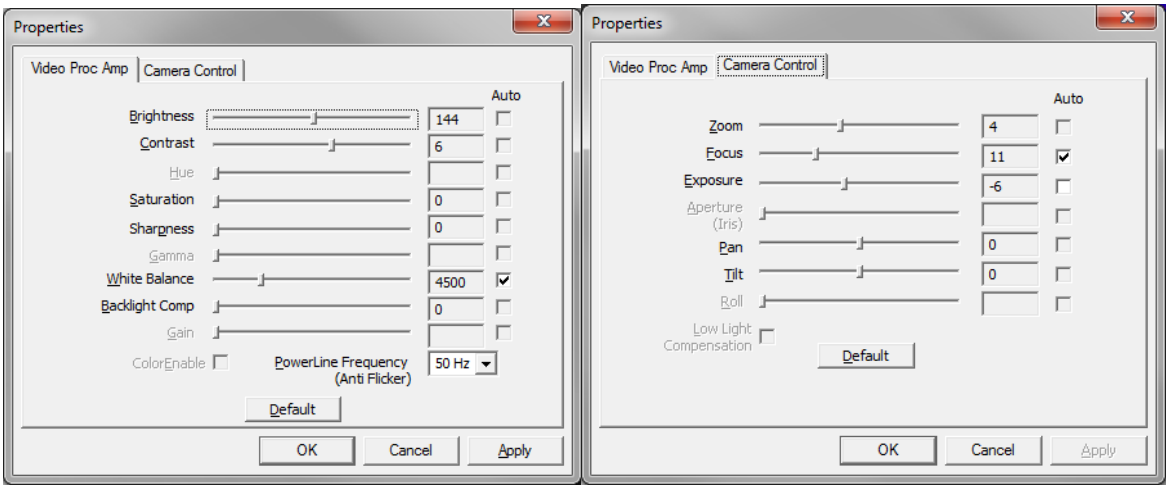


Fig. 2.8 Windows with settings for «Microsoft LifeCam Cinema».

- When adjusting the camera settings, you must fulfill the following general requirements:
- The **«Brightness», «Contrast»** and others parameters should be configured so that the image of the object was the maximum contrast.
- Switch on **«Flicker»** mode for setting lighting power line frequency (repayment flicker), in most countries it is 50 Hz.
- If your camera supports, then switch on the black-and-white image **«B/W mode».** If the camera works only in color mode, it is recommended to set **«Saturation»** parameter to minimum value.
- Depending on the experimental conditions and light to use automatic or manual setting **«Exposure»** parameter. If constant lighting, it is recommended to use the manual adjustment. If changes (for example, an object depends on the lighting street lighting), it is better to use the automatic adjustment mode setting.

Parameters «**Zoom**» and «**Focus**» is recommended to use in the manual mode and change their values not due to electronic image processing, but by approaching/removing the camera from the object.

Note, program settings are set by default at each new turn on the camera. If the video conditions don't change it is recommended to save your settings using item «Save Settings» from the submenu «Video» (Fig. 2.6).

2.4.3 Video capture format

Select «**Video capture filter...**» in the submenu «**Video**» (Fig. 2.6) for open menu of the camera settings. Item «**Video capture format...**» appears in the menu only in case of the correct installation of drivers of the camera and a choice of the working camera. Frame rate is necessary to set 30 and the frame size to set («Output Size») not less than 640 x 480 px (Fig. 2.9).

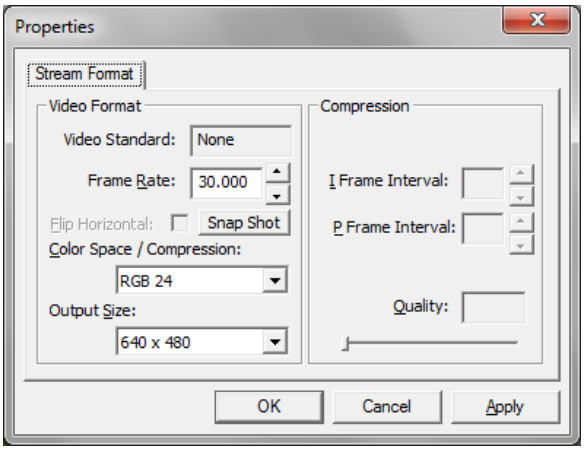


Fig. 2.9 Window «Video capture format».

Note, after changing camera settings in the program COVID5s frame rate «In» must be in the range of 25 – 30 FPS.

2.4.4 Checking the settings on the test table

During the first start of Vibraimage system and periodically it is recommended to test image quality by the test table. It is required to place a test pattern opposite to the camera so that the image of the table occupies the entire space of the frame. To achieve the optimal contrast range of object is need to stand in camera settings auto regulation of illumination in case of unstable illumination (Fig. 2.10) and manual regulation of illumination in case of a constant illumination (Fig. 2.11). The inscription «Warning! Low quality (1)» in the upper left corner of the image is normal, because there is no a person's face on the video.

Fig. 2.10 Checking the camera settings on the test table, automatic regulation of the exposure (mode is recommended for unstable object illumination).

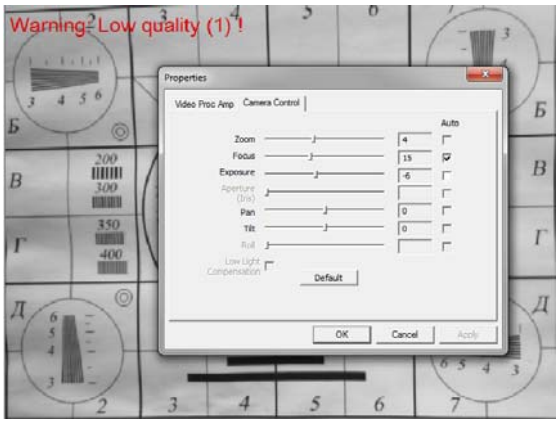


Fig. 2.11 Checking the camera settings on the test table, manual regulation of the exposure (mode is recommended for stable object illumination).

2.4.5 Video quality auto checking function

The COVID5S program has built-in automatic quality control function image quality control during the test. Since the calculation of human reaction using the video image, the quality control for the processed video is necessary to obtain a correct test result. Error message and the low quality of video will appear on top of the **QT** column on the left side of the program (Fig. 2.12), but only if the **«Quality test»** mode in information panel (mode S) is switch on as by default.

If the quality test is enabled, the final result will appear only if there is no video error message for more than 80% of the measurement time.

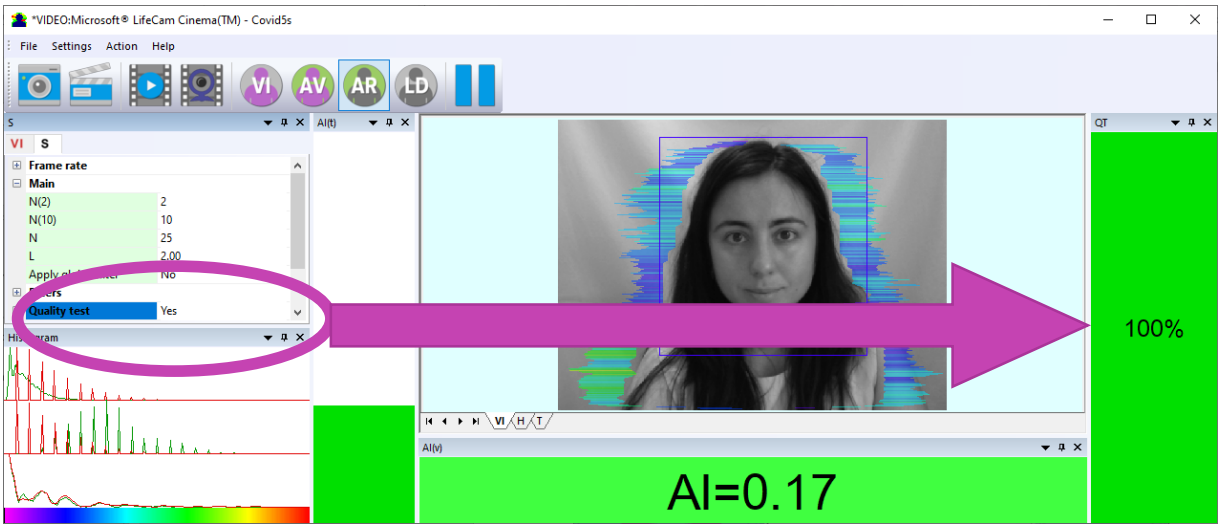


Fig. 2.12 Switch on «Quality test».

Program gives error indication if the image quality is lower than standard vibraimage requests:

- **Error 1** – indicates when facial image is lower than necessary. For cancel this error is need to move checked person closer to camera (it is recommended) or start zoom function on camera. (Fig. 2.13).

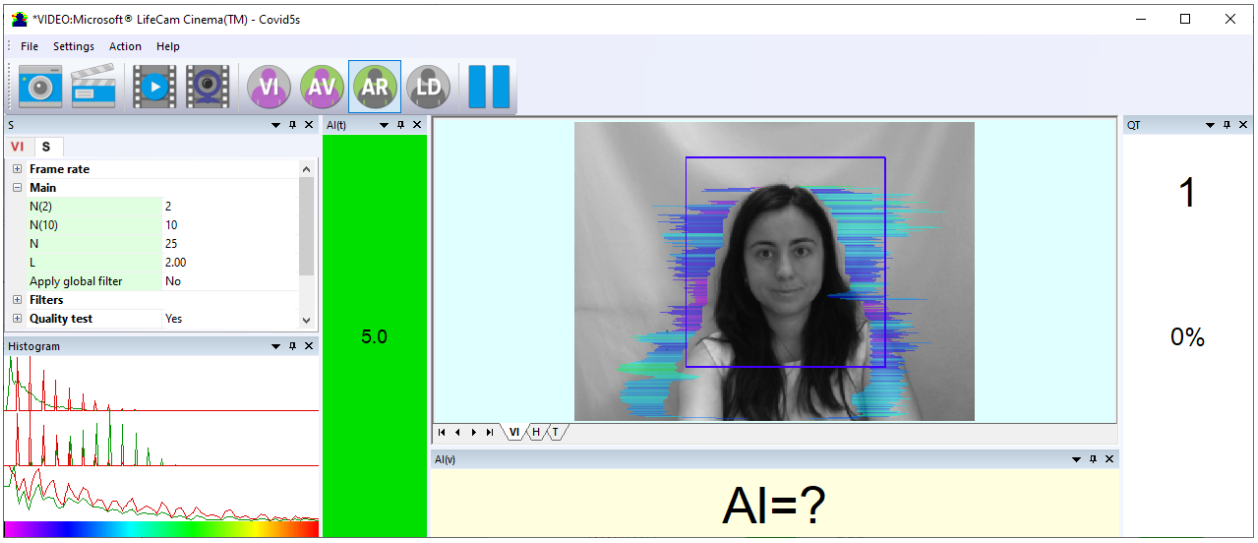


Fig. 2.13 Error 1 at the low video quality. Checking the cause is convenient in AR mode.

- **Error 2** – indicates when camera noise level is higher than necessary. The reason of this error could be low illumination, incorrect camera settings or camera vibration. (Fig. 2.14).

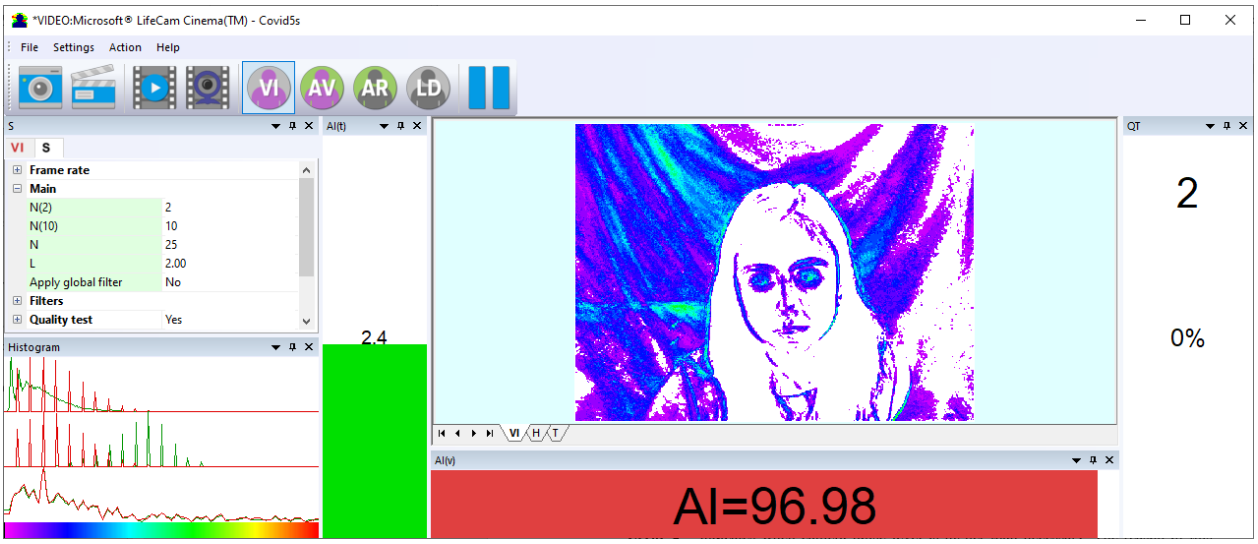


Fig. 2.14 Error 2 at the low video quality. Checking the cause is convenient in AV mode.

- **Error 3** – indicates when computer input frame rate is lower than necessary. Requested norm for processed frame rate is more than 25 f/s. This errors indication was done for deleting unqualified staff influence during results control. If the actual input speed is less than 25, then the program will show error 3 (Fig. 2.15).

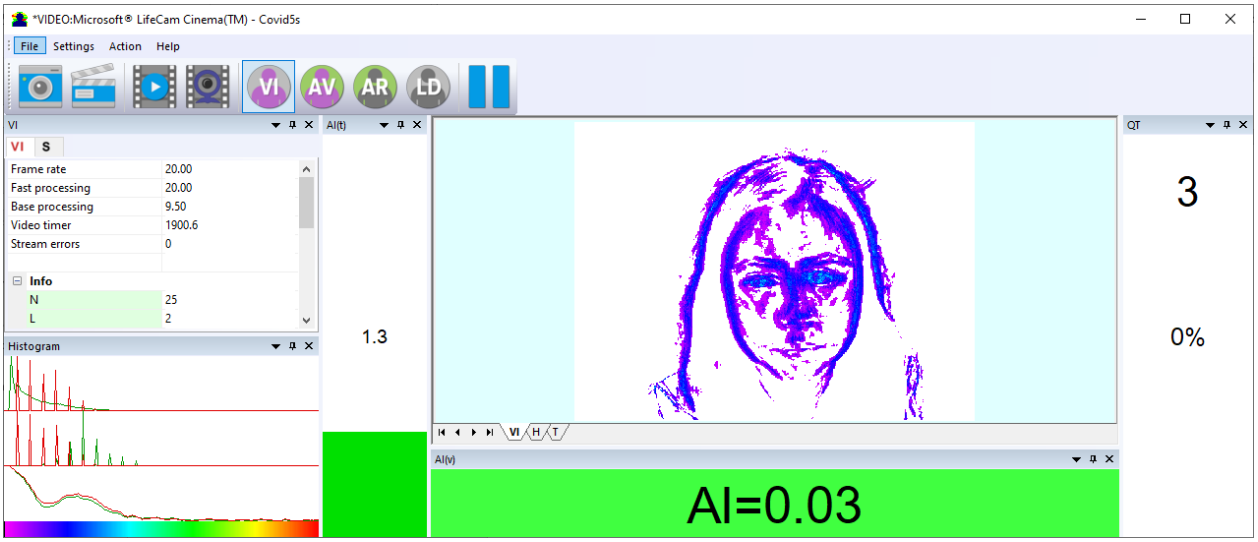


Fig. 2.15 Error 3 at the low video quality. Checking the cause is convenient in AR mode.

- **Error 4** – error-contrast image (Fig. 2.16).

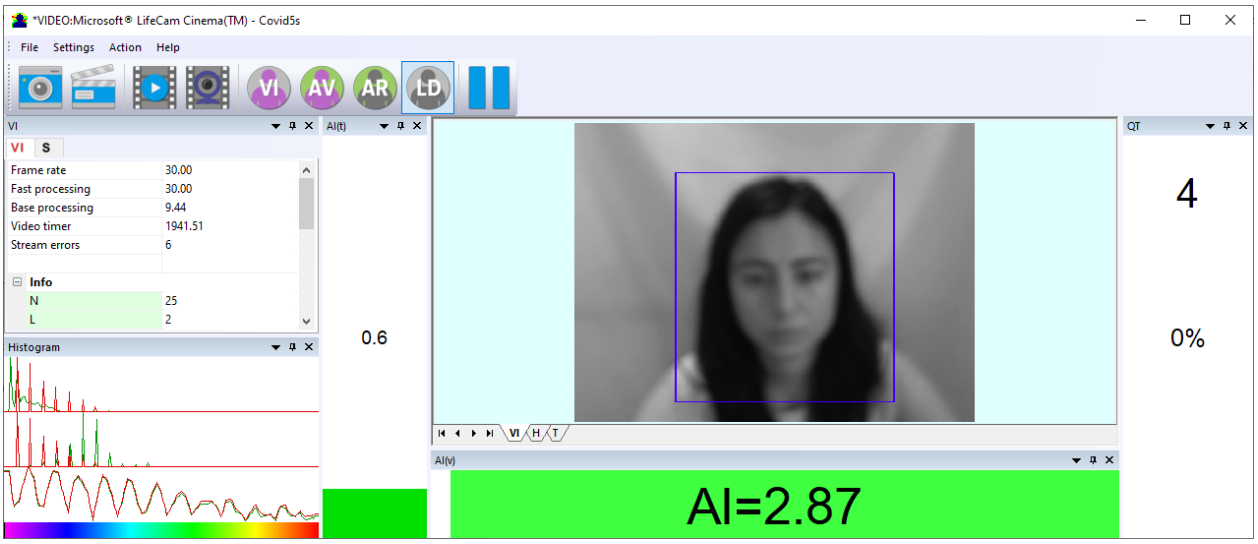


Fig. 2.16 Error 4 at the low video quality. Checking the cause is convenient in AR mode.

- **Error 5** – due to nonuniformity lighting of the face (Fig. 2.17).

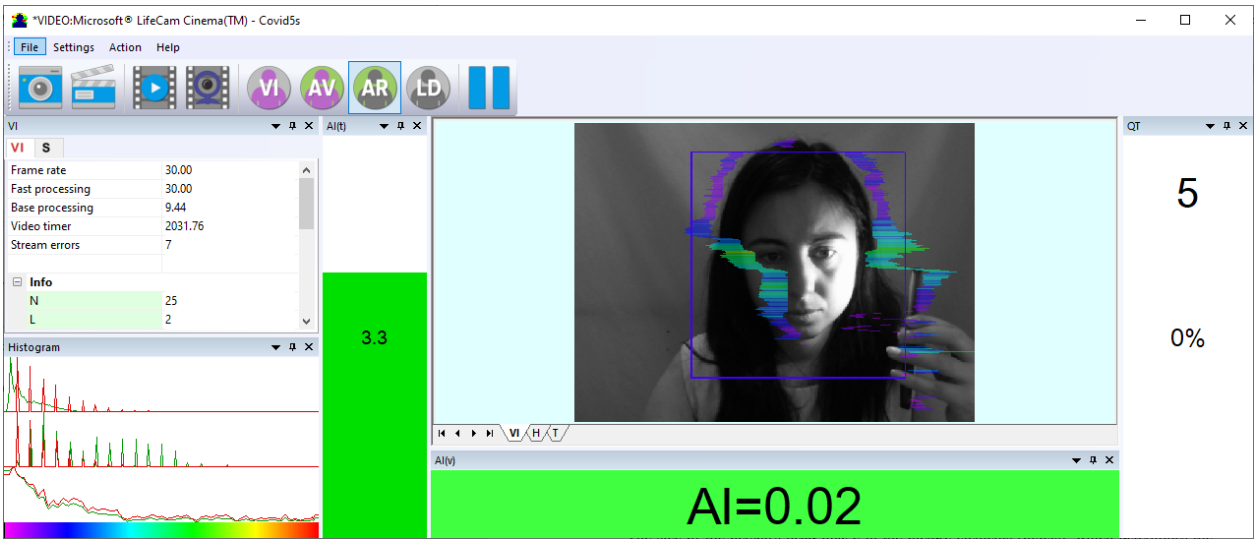


Fig. 2.17 Error 5 at the low video quality. Checking the cause is convenient in AR mode.

Error 1

The size of the person's head image in the picture elements (pixels), which determines the accuracy of recorded vibrations, requires constant monitoring during testing. When tested with a video image analysis there are no severe restrictions on the movement of the test person, as required by the contact method. This person feels natural, which increases the accuracy of test results.

However, the natural behavior can lead to the fact that during the test response deviates from the camera and the size of the human head image becomes less than required. To resolve this issue vibraimage system constantly monitors a person's head size of the image and displays an error message (1) in the window «QT» in the case of reducing the size below the limit. In addition,

vibraimage program includes a permanent face detection algorithm, which ensures elimination of errors from a lack of a real image of the person in the frame during testing.

Error 2

Temporary noise signal from the video camera includes a video camera noise and illumination instability and can significantly affect the test results. In this case, at the slightest noise level exceeds the specified threshold, the system automatically displays an error message (2) in «QT» column.

Error 3

Despite the fact that the television camera may transmit to 30 frame/sec with the set resolution, it does not guarantee that the computer receives and processes the incoming video data in real time. And any deviation from the information processing in real time resulting in a loss of information and hence reduce the reliability of the test. By reducing the actual input frames frequencies and processing frequencies below the set limit, the system automatically displays a warning error (3). To fix the error, reduce the Zoom of the camera, if you used it to increase the size of the face. Check the processor load of your computer, close the resource-intensive programs.

Error 4

It occurs with uneven illumination of a person's face. For example, light falls on the side. Try turning the test person to the light or changing the angle of incidence of the light from the lamp. Also occurs if the test person is at an angle to the camera.

Error 5

It occurs if the image is not contrast, for example, when the camera is not properly focused. To fix the cause of the error manually or automatically adjust the focus of the camera.

Note, before the start of the test should ensure that the program processed the image of a human WITHOUT ERRORS or disable the quality test.

3 COVID5s. Users manual

Video from camera or video file are displayed in basic window after starting the COVID5S.

3.1 Basic window

In heading of the basic window the following information is indicated (Fig. 3.1):

- type of video source: Video camera or AVI file;
- model of video source: Video camera model or AVI file name;
- name of the program.

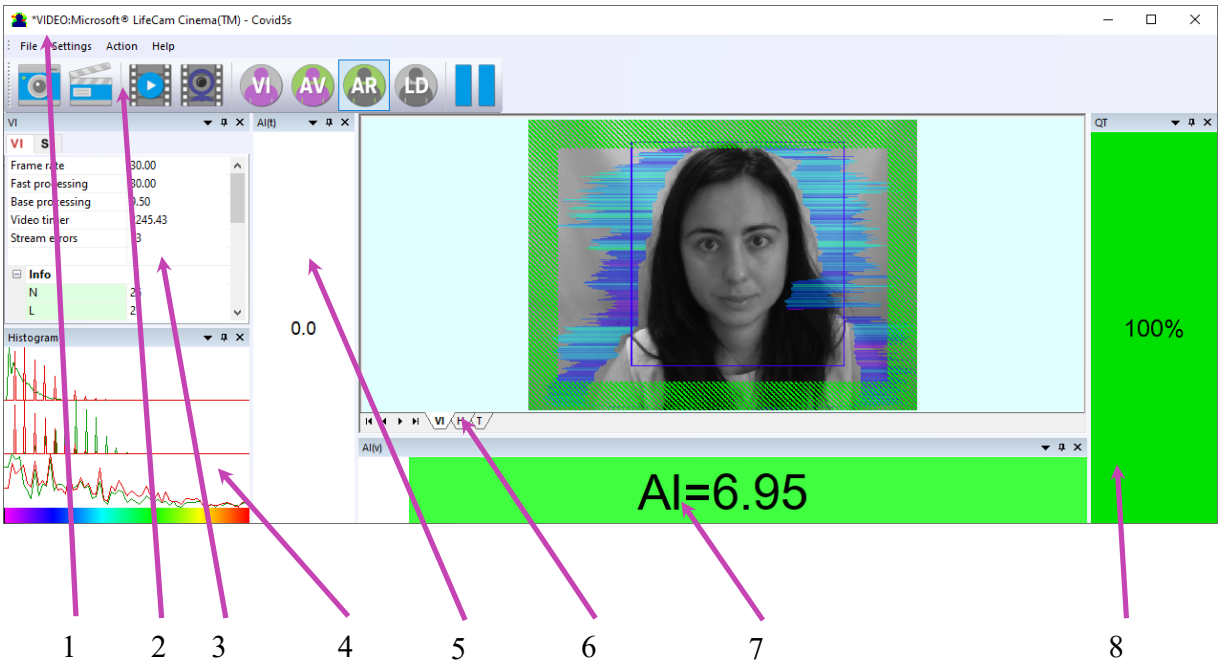


Fig. 3.1 Basic window COVID5s.

Note, double-clicking with the left mouse button in the image area **resets** all accumulated information about the inter-frame difference and starts a new cycle of data accumulation.

3.1.1 Basic window design

In total in the main window of the program in addition to the video area, you can see an additional 8 windows that display information about the parameters of mental and emotional state of a person, and program settings (on Figure 3.1 the windows labeled corresponding numbers):

1. File, Settings, Action, Help – main menu.
2. Main toolbar.
3. VI, S – information panels.

4. Histogram – window for vibraimages parameters histogram in real time mode.
5. AI (t) – timeline of measurement
6. Images window for displaying vibraimage (VI), information-energy graph (T), result.
7. AI – result of Artificial intelligence work window
8. QT – image quality window.

3.1.2 Windows position control

The user can control the placement of additional windows on the screen and the size using the controls elements on the left side of each window title. For each window it is available control menu (fig. 3.2). This menu also appears when you click the left mouse button in finding the mouse pointer in the desired window. In «Docking» mode, window position and size are fixed, and when opening/closing the window will open in a given position. The mode «Floating» window position and size can be changed by the user.

If the window is in a random location on the screen, then double-click the left mouse button on the window, the window will move on the screen in the «default» position.

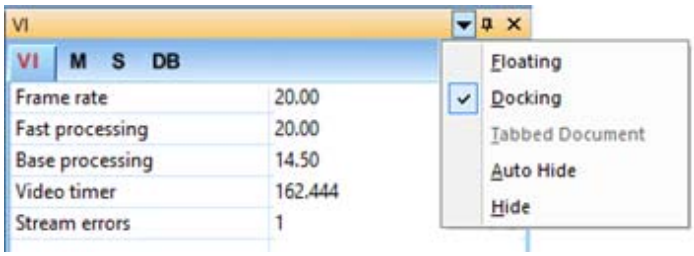


Fig. 3.2 Window control element.

Each window can be closed, or by using the window menu or by using a separate control element (Fig. 3.3).

Fig. 3.3 Control element «close window».

Each window can be temporarily minimized and moved to the border of the main program window (Fig. 3.4). Figure 3.5 additional windows hided and moved to the border of the main window and they icons are highlighted in orange color.

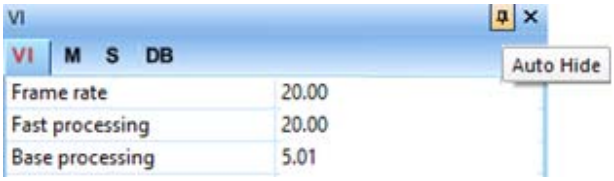


Fig. 3.4 Control element «hide window».

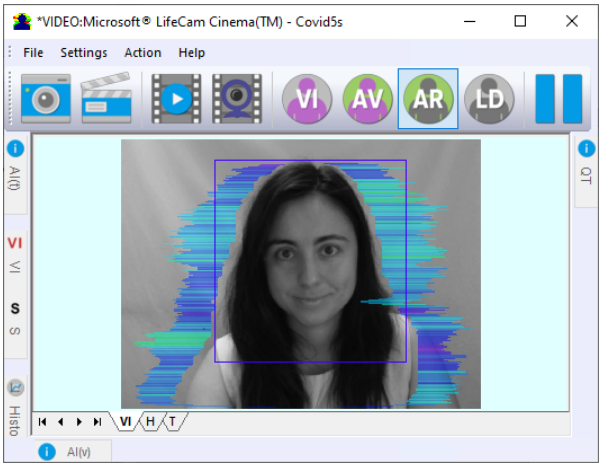


Fig. 3.5 All additional windows are hide.

3.2 Main menu

The main menu contains the following items:

- «**File**»
- «**Settings**»
- «**Action**»
- «**Help**»

3.2.1 Menu «File»

Menu «**File**» (Fig. 3.6) **contains following items**:

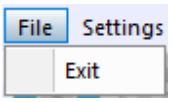


Fig. 3.6 Menu «File».

Item **«Exit»** – exit the program.

3.2.2 Menu «Settings»

Menu «**Settings**» (Fig. 3.7) allows choosing video (Fig. 2.6), language (Fig. 2.5), preset, AI20 (changes measurement duration to 20 seconds) and contains the following items:

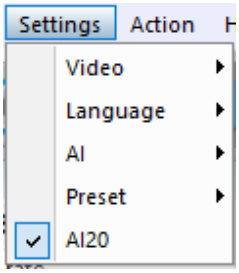


Fig. 3.7 Menu «Settings».

3.2.2.1 Submenu «Video»

Submenu **«Video»** contains settings of video modes. It can differ depend on connected devices. For example, this menu contains the following items (Fig. 2.6). You can choose as video source one from many installing in PC video-devices or load external video file.

Subitem **«Video Capture Filter…»** − by pressing the window of video device setting (contrast, exposition, brightness) opens. Each device has the especial window of settings.

Subitem **«Video Capture Format…»** − change video capture format.

Subitem « **RGB8 compressor** » are intended for management of a videofile record format. If this item is chosen, that, for economy of a space on a hard disk, the videofile saved in a black-and-white format.

Subitem **«Disconnect»** allows to disconnect all video camera or videofile

Subitems «**AVI File…**» and «**AVI File (no sound)…**» [AVI File (no sound)…] are intended for selecting for the analysis of an external video file

Subitems **«Rotate CW»** and **«Rotate CCW»** allow to make turn of an input video image on 90 and 270 degrees before its processing in the COVID5S.

Subitem **«Save settings»** allows to save current camera settings in the Windows registry in order to load them at next startup programs with this camera

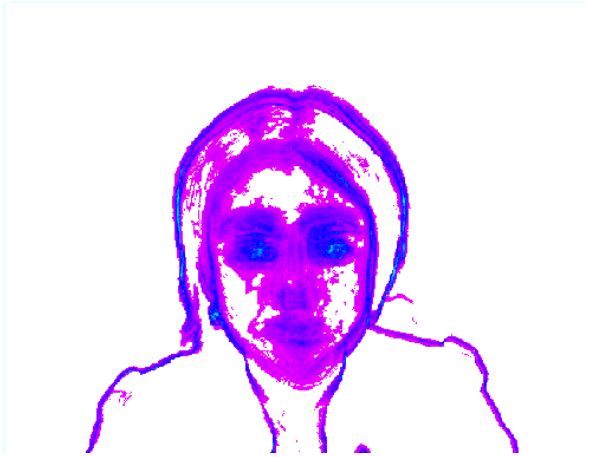
The bottom menu allows you to choose a used device video capture from multiple installed on this computer.

3.2.2.2 Submenu «Preset»

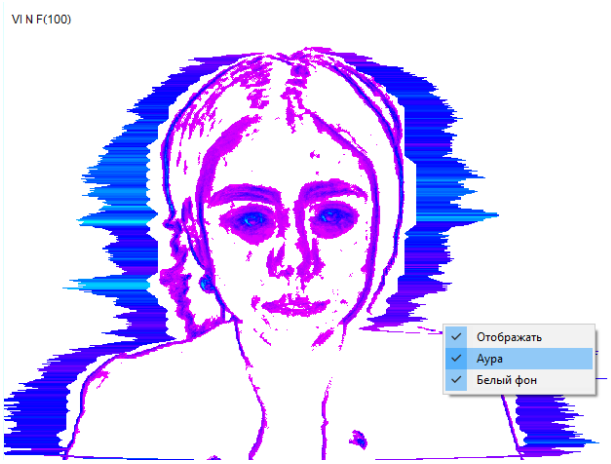
Submenu «**Preset**» defines the type of the display image:

Item **«Presets»** (Fig. 3.8) intended to choice one basic mode in image area.

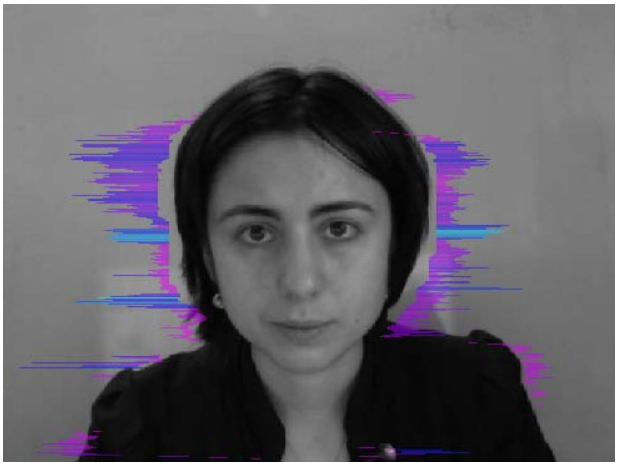
- In **«VI»** mode [«VibraImage mode»] displays vibraimage of person. Color for every image pixel depends on its amplitude or frequency of vibrations (Fig. 3.8a).
- In **«AV»** mode [«Aura − Vibraimage mode»] the contour of the object allocated around the vibraimage. Vibra-aura line size depends on medium line vibration amplitude. Vibra-aura line color depends on maximum line vibration frequency inside vibraimage contour (Fig. 3.8b).
- In **«AR»** mode [«Aura on the Real image»] the vibra-aura of the person is shown around his real image (Fig. 3.8c).
- In **«LD»** mode [«Lie Detector mode»] image area shows real object image (Fig. 3.8d).



3.8a Mode VI



3.8b Mode AV



3.8c Mode AR

3.8d Mode LD

3.8 Image area in different modes.

3.2.3 Menu «Action»

Menu «**Action**» (Fig. 3.9) contains the following items:

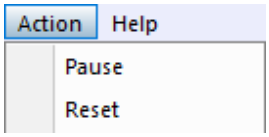


Fig. 3.9 Menu «Action».

Item **«Pause»** − stop last accepted frame of data in image area of windows.

Item **«Reset»** − reset all saved up information and statistics about frames and start new cycle collection of information.

3.3 Toolbar

COVID5S toolbar (Fig. 3.10) contains following buttons.

Fig. 3.10 COVID5s toolbar.

All toolbar buttons (Fig. 3.10) duplicated the corresponding items in the menu system. When the tool tip determines the assignment of toolbar buttons. Note, the selected toolbar button is highlighted in color or volume, depending on the main window style.

 – screen image capture in jpg format;

 – AVI file record for next analysis;

 – AVI files download for COVID-19 diagnosis;

 – live video camera connection;

 – choice of internal vibraimage mode (VI);

 – choice of external vibraimage (vibra-aura) around internal video image mode (AV);

– choice of external vibraimage (vibra-aura) around real video image mode (AR);

– choice real video image mode (LD);


– pause on image and program operations;

– high measurement accuracy during 20 seconds.

3.4 Information column

Indication of information column (Fig. 3.11) depends on using mode:

Fig. 3.11 Modes of the information column.

- In the mode «VI» information about adjustments of system and results of data vibraimage processing is displayed;
- In the mode «S» settings of basic parameters for vibraimage processing are configured.

Note, values of parameters in fields which are allocated by a green font, can be changed by the user (Fig. 3.13, parameters N, L − it is possible to change in Information table). For this purpose, it is necessary to bring the mouse pointer to the chosen field and twice to click the left button of a mouse.

In the down part of information panel displays three windows with results of the frequency analysis (Fig. 3.12). In the first window the frequency analysis vibraimage on the whole frame (by red color − amplitude, green color − frequency of vibration pixels) is displayed. In the second window the frequency and amplitude histograms for external vibraimage (aura), and in the third − spectrums of the frequency analysis with application of FFT of two parameters (A1X and F1X) are displayed.

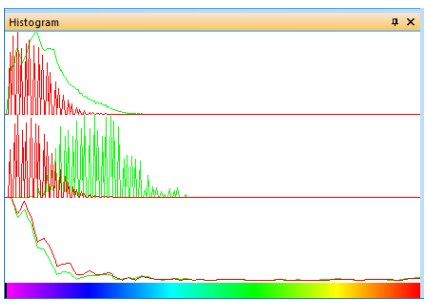


Fig. 3.12 Histograms windows.

3.4.1 Information column. VI mode

In the mode «**VI**» information panel (Fig. 3.13) displays following information:

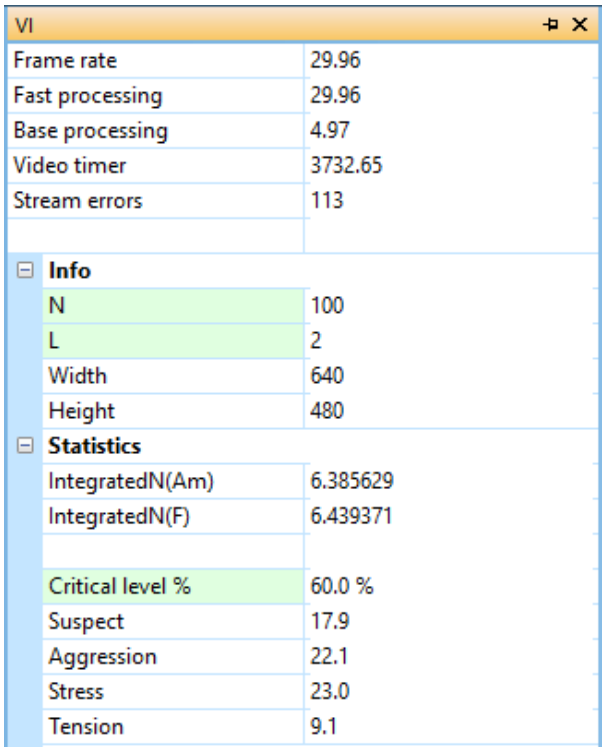


Fig. 3.13 Information column in the VI mode.

Frame rate:

- «**In**» – Number of the frames per second, received from the video source;
- «**Fast processing**» – Maximum number of the processed frames per second used for calculation. Selected by user;
- «**Base processing**» – Number of the processed frames per second used in base algorithm. Selected by user;
- «**Video Timer**» – For camera mode-displays time of supervision. For recorded video – time of current video-file record. For viewing a video-file - time from the file beginning);
- «**Stream errors**» – The counter of mistakes that increases if time between the next accepted frame unstably. This mistake can arise, if productivity of a computer suffices or poor-quality video is loaded;

Info:

- **N** – Number of the frames for accumulation. Selected by user;
- **L** – Palette Threshold. Defines a threshold in the displayed image, value of brightness less threshold is considered «black». Selected by user;
- **Width** and **Height** – Displays the current video camera or avi file resolution;

Statistics:

- **IntegratedN(Am)** – Average frame amplitude vibraimage intensity processed for the N frames;
- **IntegratedN(F)** – Average frame frequency vibraimage intensity processed for the N frames;

- «**Critical level %**» – Threshold of a psychoemotional status of the person exposed in % in case of which exceeding on the remote terminal the warning message will be issued;
- «**Suspect»** – Calculated level of suspect for object in frame;
- **«Aggression»** – Calculated level of anger for object in frame;
- **«Stress»** – Calculated level of stress for object in frame;
- **«Tension»** – Calculated level of tension for object in frame;

3.4.2 Information column. S mode

Information table (Fig. 3.14) allows adjusting vibraimage parameters and displays the following information:

Frame Rate Settings	
Fast processing	Frequency (fps) for processing «fast» parameters of vibraimage, noted by a word «fast»
Base processing	Frequency (fps) for processing «base» parameters of vibraimage, noted by a word «base»
FPS proc. period	Frequency of the frames (fps) during calculation period
Downrate	Reduce input frame rate. At value 3, will be processed every third frame.

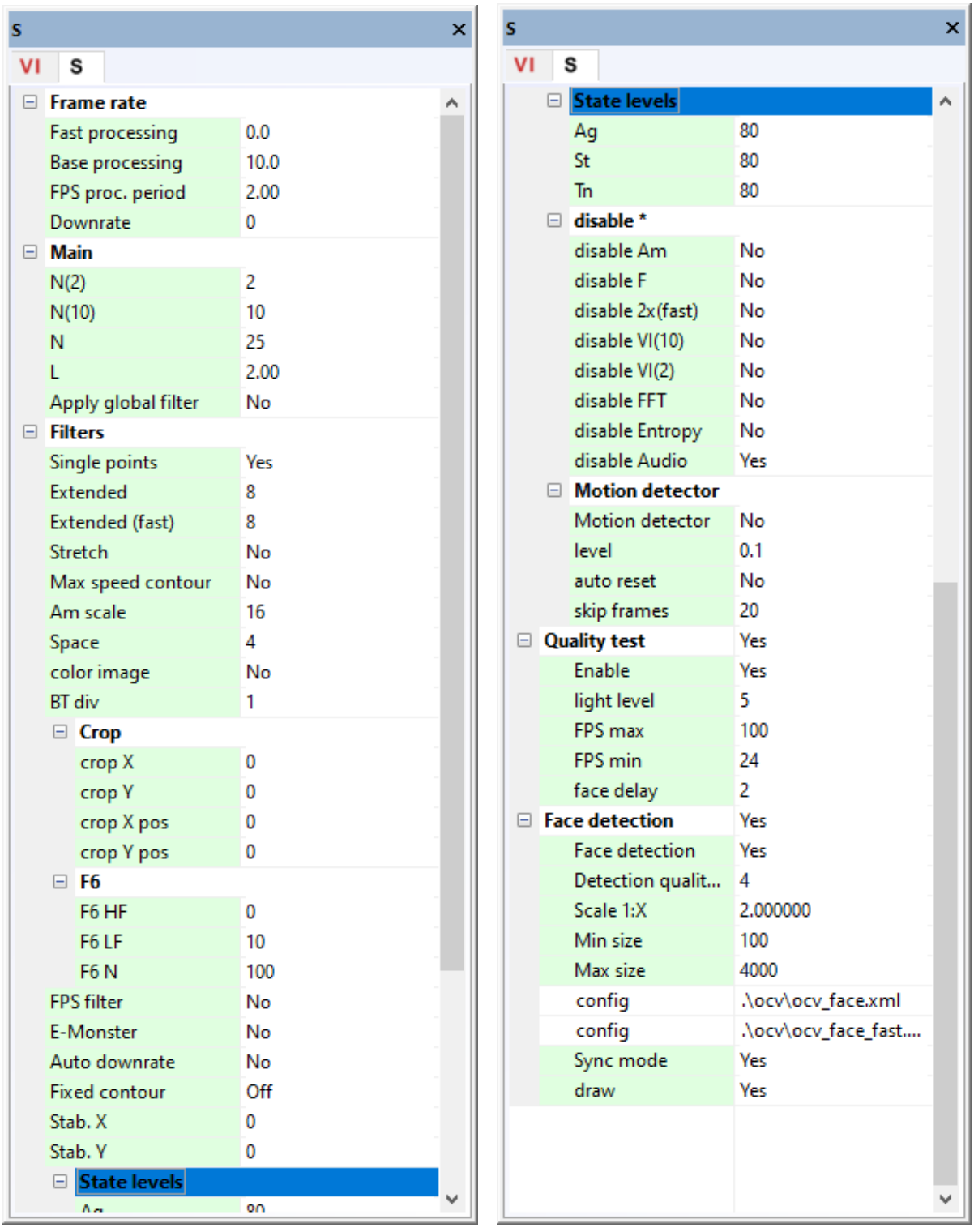


Fig. 3.14 Information column. S mode.

Main settings

N(2)	Minimum number of accumulated frames. By default, 2.
N(10)	Average number of accumulated frames. By default, 10.
N	Maximum number of accumulated frames. By default, 25.
L	Threshold of a palette. Defines a threshold of displayed image, value of less brightness considers as «black»
Apply global filter	If this parameter is included, all the remaining calculated parameters change on processed by filters.

Filters

Single points	Removes single points, surrounded by black.
Extended	It is intended for reduction of noise of a video camera. Delete video noise in bit. By default, 8. This filter is important, when the object is motionless, and values changed because of camera noise .
Extended (fast)	Delete video noise for fast processing.
Stretch	Scale normalization filter to a range 0-255 after its «trimming» by filter Extended.
Max speed contour	At the included mode, calculation fast parameters are made only inside of aura contour, at switched off − on the whole frame.
Am scale	Multiplication factor used for vibraimage visualization in a «amplitude» mode.
Space	Reduce vibraimage on borders of motionless contrast objects
Color image	No – Black and white real image in image area. Yes – color image in image area.
Crop X, Crop Y	If real image size more than 640x480 pixels, than will be use only 640x480 pixels from center part of image.
Crop X pos, Crop Y pos	When cropping images define the coordinates (position of the upper-left corner) of the clipping region.
F6 HF	Sets in % frequency of a cut for the filter of high frequencies at processing F1_fast parameter.
F6 LF	Sets in % frequency of a cut for the filter of low frequencies at processing F1_fast parameter.
F6 N	Number of averaging frame at calculation of F6 parameter.

FPS filter	It is used for exact synchronization with a binding to the concrete frame at work with AVI files. Frequency of the input frame from the camera divided on set Base processing frequency and for processing will undertake each N frame.
E-Monster	Switch to the E-monster mode. The program opens the person face deformed by latent emotions though externally he can constrain these emotions. If the emotional condition of the person is like to normal, then the program image is like to real video. Accordingly, than more emotions overflows the person and then more especially deformed his image in Monsters Detector mode (E-Monster).
Auto downrate	Automatic calculation of **Downrate** parameter is made in view of frequency of the input frames, Base processing frequency and computing capacity of a computer.
Fixed contour	In this mode vibra-aura around the human contour will be built around a fixed path, and not to repeat the contours of the body.
Stab. X	Image stabilization in the X coordinate entered when significant vibrations image on the X-axis.
Stab. Y	Image stabilization in the Y coordinate entered when significant vibrations image on the Y-axis.
State levels Ag, St, Tn	Suspicious level in the Aggression parameters (Ag), «Stress» (St), «Tension» (Tn) is set. When exceeding level of danger the system gives out a sound signal and fixes a frame.
Disable	**Note**: Canceling of parameter calculation is use for increase calculation speed of other parameters.
Disable Am	Canceling of vibration amplitude calculation.
Disable F	Canceling of vibration frequency calculation.
Disable 2x(fast)	Canceling of 2 frames parameters fast calculation.
Disable VI(10)	Canceling of 10 frames parameters calculation.
Disable VI(2)	Canceling of 2 frames parameters calculation.
Disable FFT	Canceling of Fast Fourier Transformation frequency processing.
Disable Entropy	Canceling of Entropy processing.
Disable Audio	Canceling audio analysis.

Motion detector

Motion detector	Delete emotion calculation for object with motion amount less than threshold.
Level	Threshold level of Integrated10 for emotion calculation.
Auto reset	Reset emotion calculation for macro movement.
Skip frames	Skip frames with the frame difference more than threshold.

Quality test

Enable	Switch on mode of automatical check of image quality (see p. 2.4.5)
Light level	Parameter use for define image noise level when illumination is low.
FPS max, FPS min	Maximum and Minimum allowable input frame rate.
Face delay	This parameter determines how long (in seconds) the program can not recognize a human face in the frame before you will get an error message.

Face detection

Face detection	Yes – face detection mode is used. No – without face detection.
Detection quality	Quality of face capture. 1 – capture one large person face in the frame (loading of the processor is minimal), 4 – search of all (even small) persons face in the frame (loading of the processor is maximal).
Scale 1:X	Before Face detection image scale is changed to this number. More scale means more operating speed and less quality
Min size, Max size	Sets in pixels the size of rectangle for search of persons
Config	In COVID5S software for person search use basic algorithm ocv_face.xml only.
Sync mode	
Draw	No – not draw rectangle around face, Yes – draw rectangle around more danger single person, All – draw rectangle for all person in frame. For non-danger person rectangle draw green color, but if person suspect level more than «Critical level», than rectangle draw red color.

4 COVID-19 Diagnosis

4.1 COVID-19 diagnosis results

Upon completion of testing, COVID5s automatically creates a file with the results of diagnosing the likelihood of COVID-19 disease in the root of the directory where the Covid5s program is installed. The file name coincides with the time of its creation

YYY-MM-DD hh_mm_ss_M.xml

By default, files created in the C:\Users\ user\Documents\Covid5s directory. All files names include measurement data and time YYYY-MM-DD and hh_mm_ss .

Below is an abbreviated example of such a file:

<?xml version="1.0" encoding="UTF-8"?><ai>

<ai_data ai="0,1" qt="100" src="*VIDEO:Microsoft® LifeCam Cinema(TM)" profile="[neuro_50.txt],116386,[2021-08-30 13:48:10]">

<item n="001" t="123,6991" tv="117,0495" qt="16,3793" ai="0,0000">0.2297104597091675,0.2687236070632935,0.2231276929378510,0.2955459356307983,0.7900850772857666,0.6546612977981567,0.1420421153306961,0.7223731875419617,0.1475625187158585,0.0323628447949886,0.3161838054656982,0.3223409652709961,inf,inf,inf,inf,inf,inf,inf,inf,inf,inf,-nan(ind),inf,inf,inf,inf,inf,inf,inf,inf,inf,inf,-nan(ind),inf,0.6907390356063843,0.1456210315227509,0.6029385081105391,0.5000000000000000</item>

…

<item n="050" t="128,6023" tv="121,9774" qt="100" ai="0,0000">0.2347995340824127,0.3807075023651123,0.2315232455730438,0.2853945195674896,0.7067834734916687,0.4566147327423096,0.0869255959987640,0.5816991329193115,0.1824990957975388,0.0644715502858162,0.3496805727481842,0.3057924807071686,0.1175080369322889,0.0595161912247909,0.0426153945238759,0.0350001969008629,0.0713450627582859,0.0819606147660696,0.0488700139436146,0.0618430205126881,0.0619010628010963,0.2250655023879556,0.0245320173764742,0.0068510862744123,0.3069580247492443,0.2108990780692110,0.3305392984245286,0.1312431203889354,0.0942796920004786,0.1425700910026923,0.2588024109618272,0.0928840376079072,0.2747102857637179,0.7990684446332809,0.0756415538460710,0.0216257135044947,0.4377410638332367,0.2938888558745384,0.3383142700748959,0.0167425274848938</item>

</ai_data>

</ai>

This file includes:

1. <ai_data − the beginning of information block for analyzing AI diagnosis coefficient (DIC) with the result of 5-second DIC averaging during COVID5s program testing.
2. ai = "0,1" the top line shows AI diagnosis coefficient DIC (the probability of Covid-19) calculated by AI. The result ai = 0-0.5 indicates the absence of the disease. The result

   ai = 0.5-1.0 indicates the presence of the disease. DIC higher means the higher probability of the COVID-19.
3. qt = "100" in the top line indicates the level of image quality for the time of testing. The minimum required level of the image quality index should be at least 50% for reliable diagnosis of the disease.
4. src = "* VIDEO: Microsoft® LifeCam Cinema (TM)" in the top line denotes the video signal source during measurement, in this case webcam − Microsoft® LifeCam Cinema.
5. profile = "[neuro_50.txt], 116386, [2021-08-30 13:48:10]" in the top line indicates the version of AI file processing the diagnostic result.
6. <item is the beginning of the block of information at sample n = "001" at time t = "123.6991" with tv = "117.0495" and image quality value at time qt = "16.3793". Further in the block are the 40 behavioral parameters values, measured at testing time using the COVID5s program. At the end of each such block, there is a closing module </item>.
7. In 5 seconds, 50 blocks of 40 behavior parameters measured, since the measurement of behavioral parameters is carried out 10 times per second. After the last account, there are closing blocks </ai_data>, </ai>. Accordingly, 200 blocks of behavioral parameters are determined for a 20-second measurement.

Processing method of COVID-19 diagnosis by 5-second video processing described in publication

4.2 Video recording mode for the next processing and database storage

Clicking button  cancel all other processing and start video capturing.

Second click to  button finished video processing and start COVID-19 probability measurement. Recorded video file in format avi by default placed on c/my/Covid5s folder.

Standard 200s video file without compression in avi format tale place about 2,0 Gb so you need be sure that free place on the disc is ok for storage video files.

Note. As Video Quality (QT) indicator is not operating in video recording mode you need to test video quality before clicking  **button for video recording.**

5 Warranty

Maintenance service and service regulations of COVID5s system is carried out according to this Manual and instructions of used hardware maintenance (a computer, the camera, etc.).

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