MATLAB PROFESSIONAL AS A TOOL TO DIAGNOSES NEUROVISUAL EXPRESSIONS

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Abstract

The project result is in a MATLAB program that serves as a substitute for medical devices for the investigation of the optic nerve. This device is used in the fields of neurology and ophthalmology. When using the patient monitors and computer monitor is for him to stimulate the optic nerve. Optic nerve is stimulated by a special pattern - two rotating concentric circles with white and black sections. Concentric circles with defined spin speed and direction. You can also change the number of clipped both circles.

1   Introduction

In practice there are investigative unit for the analysis of feedback events evoked potentials. In neurology, ophthalmology and psychology are used concentric circles rotating against each different rotation frequencies. The result is a test speed of reaction of the optic nerve. In practice, it is a hardware device that can mimic by computer simulations suitable shapes on the screen.

As this device or program investigated the human eye, but is replaced by the equipment as to which one looks investigated. The actual measurement of impulses in the optic nerve is another device such as ophthalmoscope. To measure the impulses in the optic nerve, we need to achieve their generation. This is achieved just by the examinee follows the shape that this program portrays.

Pattern are two spinning circles concentric separated annulus. The circles around the perimeter of the circular sections in alternating black and white. How do these circles revolve, makes the emergence of impulses on the optic nerve. Annulus is left black. The rings can rotate in opposite pin direction with different frequencies.

Because depending on the type of needs assessment and excitation pattern generating the numbers of sections, directions and speeds of rotation, and individual dimensions of the device is programmed in this way the high variability of the program.

2   User Interface

User interface with different words, the appearance is due possibilities GUI MATLAB. The appearance of the program was solved less variable manner. The size of the main window can not be varied continuously, but this does not detract from the functionality of the program. In this chapter we will observe all elements of the visualization program because they are described in the following chapters, but you'll notice the bottom of the information box (the reader will certainly come alone on it, where it is in the picture window) and three buttons that are coincidentally located just like the last three below.

Information window, which is situated at the bottom of its window and occupies the entire width of the window, serves only two purposes. One indicator is the animating shapes, and the second is to display information about the number of animation frames, playback speed and size resolution. The Help button displays the exact help to control the program. The key program dialog in which you learn the version and date of the program.
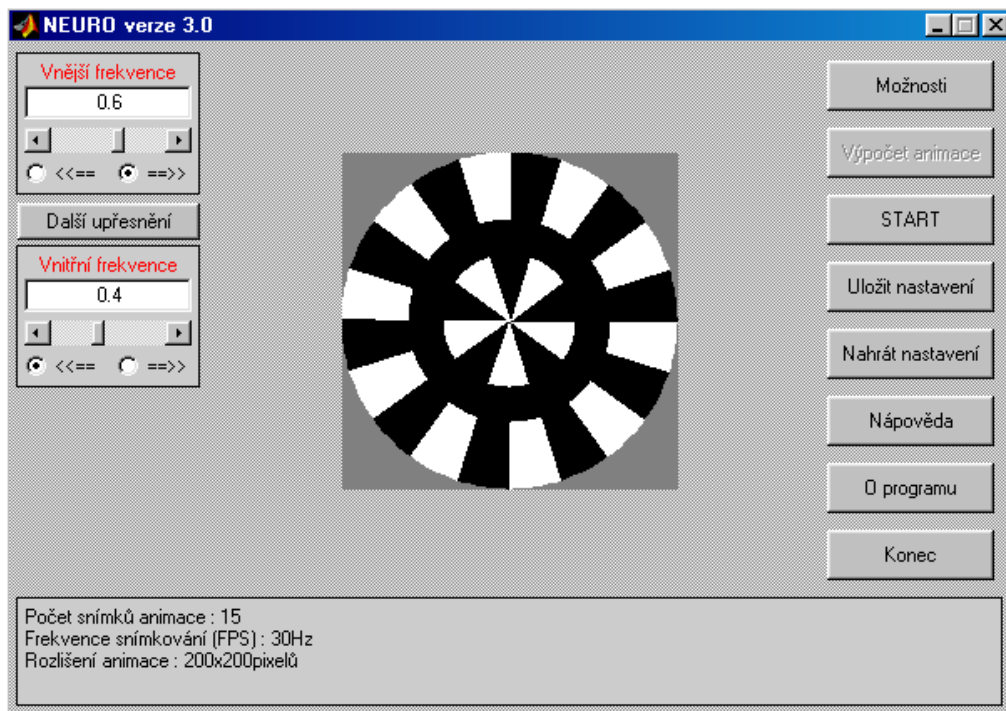
Figure 1: User Interface of Neurovisual Expression.

2.1 Display and Resolution

Given that the window can not be arbitrarily enlarged or reduced, there is a problem when requesting the physical size of the circles. If we want to achieve larger sizes shapes, we have a choice of three options:

- First Zoom eye more to the screen

- Second Buy a bigger monitor.

- Third Reduce resolution Windows.

The size of circles, the program automatically converts from a specified distance from the screen and the size of angles (see frequency and angles). The program is not omnipotent, if you are Windows user, so the resolution is changed, you must restart the program not only NEURO, but the entire MATLAB, because Windows will cause an internal error that MATLAB gets information and change the resolution so as to decrease when the resolution, the program still retains the same information and the results calculated by not correspond to physical reality. This and any other relevant information, see the section Important to know.

The screen size is not longer the case. Such a program can not find himself so he must enter the monitor size. This is happening in the Options dialog box. For more information on how to enter and what affects the entire program, see NEURO options.

3 Program Conception and Operations

The whole concept of the program is based on MATLAB visualization possibilities it's amazing what you can do in MATLAB. The beginnings of this program were therefore very difficult. Eventually I found a solution that satisfies the relevant requirements.

3.1 Animating Shapes

The whole problem was that the resulting image most resembled the real turning the gears. I achieved this using the movie function, which alone is able to smoothly and most importantly, constant speed play individual frames moving the gears. Yet as mentioned earlier, MATLAB is built on a calculation and not on visualization, and this feature is somewhat lagging, playing alone is not

always smooth. Espetially at the beginning of the play is mostly played very fast, the animation and then are given only with a copy speed of play (the animation is played over and over again).

3.2   Play the Animation

Animation can be run at different times. This play time is necessary to specify in advance, because MATLAB can not play during the animation suspend this activity, so I could implement a function to stop the running animation.

This button can start the animation. After pressing this button, the program asks for the length of the animation plays, which is entered in seconds. The maximum length of the animation can be set by clicking Options. If you have changed some parameters, so the program will first ask if it is to convert animation again.

3.3   Calculation of Animation

Before you can start the animation, it must first be calculated. Calculation of the actual animation is the cornerstone of the program, even if the idea is ultimately not so complicated as it first seems. To calculate these animations are important parameters:

- The frequency and directions of individual circles.
- Number of clipped rings.
- Frequency scanning (Frame Per Second), ie the number of frames played per second.
- The maximum number of frames of animation.
- Accuracy preservation parameters.
- To make the animation must calculate these values:
- The actual frequency of turning circles.
- The total number of frames of animation.

The calculation of these values is not performed on these 3 steps:

First Calculation of the differential frequency. This is especially so, find out which image to be separate circles meet again in its original condition so that it can from this position to repeat the animation. It is thus not a mere deduction frequencies, but minus the frequencies are multiplied by the number of clipped rings. This is because in order to reduce the number of animation frames. If the accident rate differential is zero (eg 1 Hz-5 clipped together with a 0.5 Hz-10 intervals) shall be taken as a differential rate, the frequency of one of the circles.

Second Calculation of the final image. The calculated differential frequency is determined by meeting time, and this value is determined by FPS and the final image. It may not always be an integer. (The truth is that there is rarely an integer.) It is done rounding frequencies so that the final snapshot of the entire number. This rounded off value frequency and the final image is back-tested so that the irregularities climbed onto the preservation of accuracy parameters. If the condition does not meet the accuracy and the time added to the final initial final time (first time gathering) and tested again. This is repeated until the condition is accuracy.

Third Conversion rate is already trivial matter, when, with a finite number of frames, FPS, and time of the first meeting back converted values of frequencies, with whom then calculates the animation.

When he finally calculates the necessary values may not always be the number of animation frames is less than the maximum number of animation frames (Reasons for the maximum number of frames are listed in the Options section NEURO). When this occurs, the program will require information about whether to increase the number of frames, or reduce the FPS so that the number of frames maintained at maximum. Another option is to choose the option to cancel animate and set these values manually in the dialog box.

Creating images is done as part of the calculation of the final animation. It happens always, that after drawing one frame is stored in the image matrix (animation) and renders the other. Status animating the entire period shown as the percentage of the total animation in the bottom information window. After the animation is displayed in the lower window frame, FPS and resolution animation.

3.4 Frequency and Angles

As seen in the pictures is very easy to set frequency. It can be set using SlideBar or directly by entering a specific number. RadioButton allow to determine the direction of rotation circles. In the program, this window (whether external or internal frequency) represents only one variable. Thus, a total of 2 variable frequencies in which the direction of rotation determines the sign. How these variables are still processed in the animation process subchapter describes the calculation of animation. To calculate animation however, the program needs to specify additional information to be entered in the dialog box that activates the button.
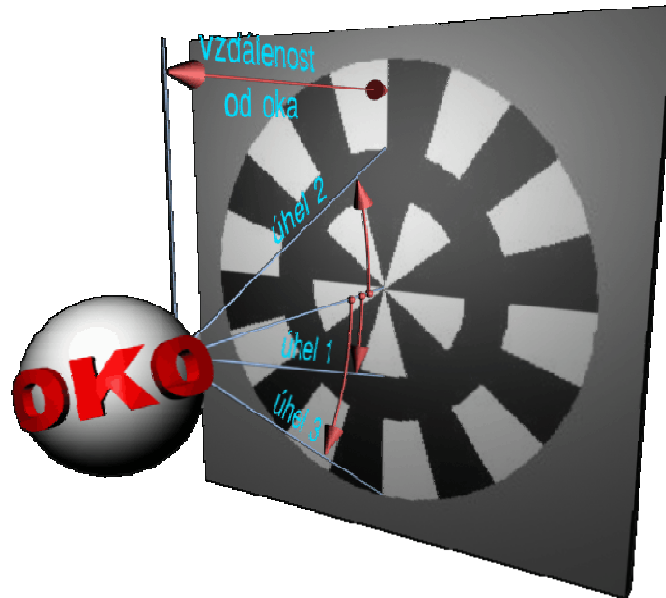

Figure 2: Description of program setting due to real dimension of diagnostics scene.

This button invokes precisely this dialogue. In the upper section of the dialog there are places where you can specify the number of clipped rings. It actually the number of section is always double than the specified parameter and it is because the parameter Do not take that you enter only the number of black sections, not the total number of sections.
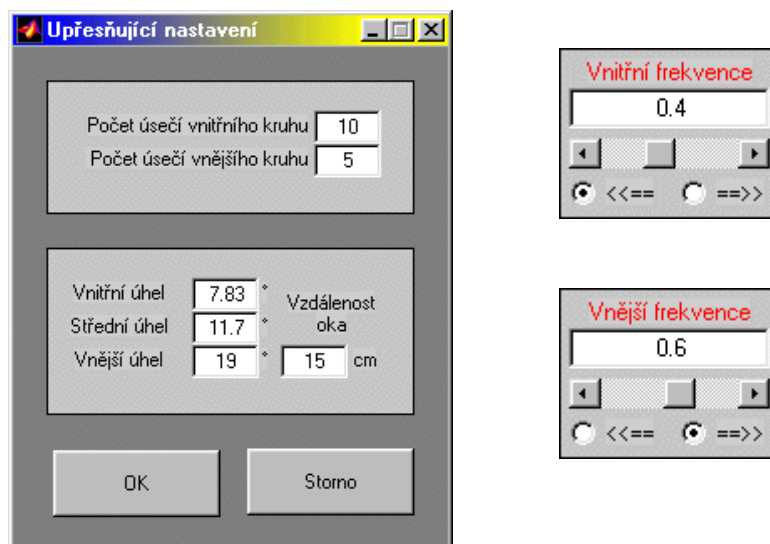

Figure 2: Pop Up windows for program parameters settings.

In the lower section of the dialog box for setting parameters are the size of individual parts of circles (in other words, setting the radii of circles and resolution, ie. the size of shapes, animation). Setting the parameters is very simple. Just set all the angles and distance from the screen diagnosed patient. Here is a great benefit program that will automatically calculate the total size of the patterns of

resolution in Windows (or in another system) and monitor size. Of course it may happen that the resulting pattern to the maximum resolution cannot comes the animation, then the individual program parameters adjusted to fit to the limit. Ie. that if you change the angles (or external angle) so that the size exceeds the maximum resolution is shortened distance from the eye. Conversely, of course, the program handles well, the distance will increase to a relative reduction of all angles. The whole situation with angles and distances are distorted by the following figure.

3.5   Program Set on Possibilities

Options are some what misleading title of the chapter title. This chapter covers not only the capabilities of the program itself, but also the dialogue itself called Options.

This button invokes a dialog for saving the settings. Save the settings are made to save the command file that the user enters. It is therefore a standard storage MATLAB binary files. Was chosen as a suffix abbreviation NEU. If the animation is calculated, it is stored as well as the entire animation. This will allow you to prepare ahead of animation and later as needed only an animation loaded from disk, which is considerably faster than her re-count.

This button can be re-stored data to re-record the program. The program automatically detects if the data is stored and whether the resulting animation and this animation corresponds to stored data.

This one clickable thing can cause a dialog where the program asks you for the necessary settings. This is mainly due to certain restrictions on computer hardware, which are also summarized in chapter Important to know . It is caused by the following dialogue.

Accuracy preservation parameters animate

This is the percentage of accuracy of maintaining the set of frequencies. For more information on how the accuracy of the counts in the section calculate the final image. The specified accuracy mainly affects the memory usage (RAM) computer. The calculations to be accurate, it is usually greater overall length of animation, and thus its size. Minimum for this item is 0.01% and a maximum of 5%.

Maximum resolution animation

provides some quantitative restrictions in the occupied space animation memory. The number of pixels is larger, the more animation takes. Not always, however, animation occupies the entire number of pixels can sometimes be the case (and often) that will set the angle and distance from obrazeovky such that it is not necessary to use the total number of pixels. Minimum is 100 pixels and 300 pixels high.

Number of animation frames per second (FPS)

This is a scan frequency setting. This item also has an effect on the memory requirements of the program. The higher the frequency, it will be more shots per second, and the animation will occupy more space in memory. The minimum is the maximum 1Hz 60Hz.

Maximum number of frames animate

And this parameter also affects the memory requirements. It follows directly from the title of his office. Again, just when the computer and prosecute the animation is slow and tearing, or reading over the disk, it is appropriate to reduce the number of animation frames (or decrease the accuracy and reduce the frequency or imaging). Minimum for this item is 2 frames and a maximum of 10,000 snínků.

The maximum frequency

is a parameter that determines the maximum possible given the frequency of turning circles. If you would like to rotate the higher frequencies than the standard 1Hz, you need to enlarge this item. At higher frequencies, however, the influence of stroboscopic effect (eg, low FPS) gives the opposite impression of running the ring. To limit the impact it is necessary to increase the frequency scan (FPS). And if we want to maintain accuracy, we must also increase the number of animation frames, which result in greater memory requirements of the program. Minimum of 1 Hz and 100 Hz maximum.
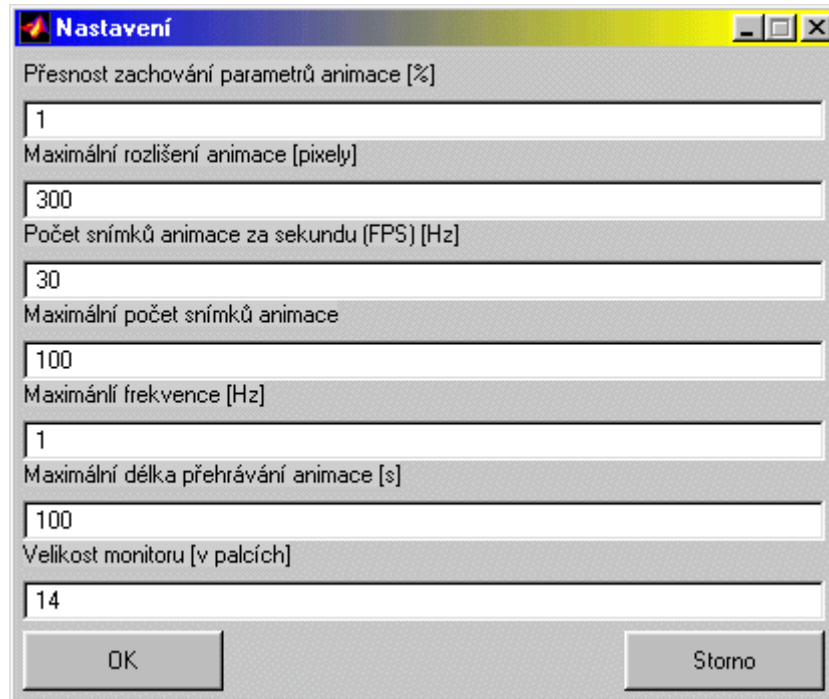
Figure 3: Program settings

3.6 Accuracy of Maintaining Parameters Animate

The maximum length of animate provides too much unwanted enter the duration of animation, because if you did, could it be that you have not done anything with MATLAB and had to forcibly terminate (WinNT - Terminate Process). The minimum is 1 second, but the maximum is not restricted.

Display size is quite clear item. To her influence on the calculations should be noted that the program automatically deducted in calculations of this entry is 1 inch. It is for this reason that the vast majority of monitors in a paper written as 14 ", but then the actual size of the display area (diagonal) is about 1 inch less then 13". If you want to achieve a truly accurate picture resolution adjust the aspect ratio is 4:3 (eg 640x480, 800x600) and measure the diagonal size of the actual image and add it to one inch and type the item size monitor. The following items are entered as decimal numbers. (1 "= 2.54 cm)

4   Software Limitation

This chapter discusses the hardware requirements of the program and notify you of certain limitations that should be familiar with the operation of the NEURO, to avoid the possible inconvenience or misunderstanding.

Hardware limitations mainly relate to the size of memory and processor speed and graphics card. Considering today's commercially available computer technology, these remarks more or less useless, but the size of memory and CPU power is needed to be addressed. For scanning frequency to 30 Hz is sufficient processor Intel Pentium MMX. For higher frequencies suggest greater use Processor Intel Pentium or. more.

Performance not process dependent (at least not much) on the platform where MATLAB running, but the size of available memory for animation is already dependent. The program was tested using Microsoft Windows 7, 4GB RAM, 2.9 GHz These conditions provide reliable performance for aniamcei size of 100 frames. If you want to allow for more accurate frequencies is necessary to increase the maximum number of images and animations, and if necessary upgrade the computer memory. Of course, memory requirements also increase, if you are running multiple applications at once, so users with little RAM recommended when operating NEURO close all unnecessary applications.

Limitation of the operating system mainly relate to the Microsoft Windows 98 On other platforms tested were found problems. In Win98 is a major problem and that, after changing the screen resolution system does not send information to process it that it happened and all the processes you think it is still a resolution (in which were started). So if you change the resolution, I recommend the MATLAB restart again.

Conclusion

The program itself, however, investigated the human eye, but only one device is replaced, the man who looks investigated. The actual measurement of impulses in the optic nerve is another device (eg, ophthalmoscope). To measure the impulses in the optic nerve, we need to achieve their generation. This is achieved just by the examinee follows the shape that this program portrays.

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Acknowledgement

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