CONS☰(L)

CONSi(L) 1.0

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In order to use `CONSi(L)` the following python libraries need to be installed: `opencv-python 4.1.2.30`, `NumPy 1.17.4`, `matplotlib 3.1.3`, `SciPy 1.4.1`, `sys` and `PyAutoGUI 0.9.50`. To start `CONSi(L)`, run the `all_pcr_functions.py` file. All entries in the command line need to be confirmed by pressing 'enter'. All the images you want to use, are required to be located in the same folder as the `all_pcr_functions.py` file. A list with all your used images and a prompt will appear which will ask you to

- either enter the name of your image of choice,
- the index displayed in the list above when you've already used this image before
- or to clear the list and enter a new image e.g. new_image.jpg

The function of 'clear' is to remove all your used images from the storage file, if your list has gotten too long.

The next step is to choose between the options for calculating the concentration or the size of your band of interest. Therefor type 'conc' or 'size'.

Concentration calculation:

First you start with entering the number of background samples you want to select. Then, a window, displaying your selected image will appear (this might open in the background). Here you select the number of backgrounds by pressing the left mouse button and holding it while dragging the mouse over your area of interest and then releasing the mouse button (this applies whenever you have to select something in an image). It works best, when you select more and smaller backgrounds, which benefits the calculation accuracy. Some of the background selections should be near the standard lane you want your sample band to compare to and some of them should be near the sample band (Fig. 1.). To confirm every selection press 'esc' after every drawn rectangle. If you are not content with the drawn rectangle, you can draw it again before pressing 'esc' and the last selected rectangle will be used for the current selection. When all backgrounds are selected, 'background selection done' appears on the upper left corner of the displayed image. Next you select the sample band of interest (Fig. 2. – 2) you want to compare to your standard band (Fig. 2. –
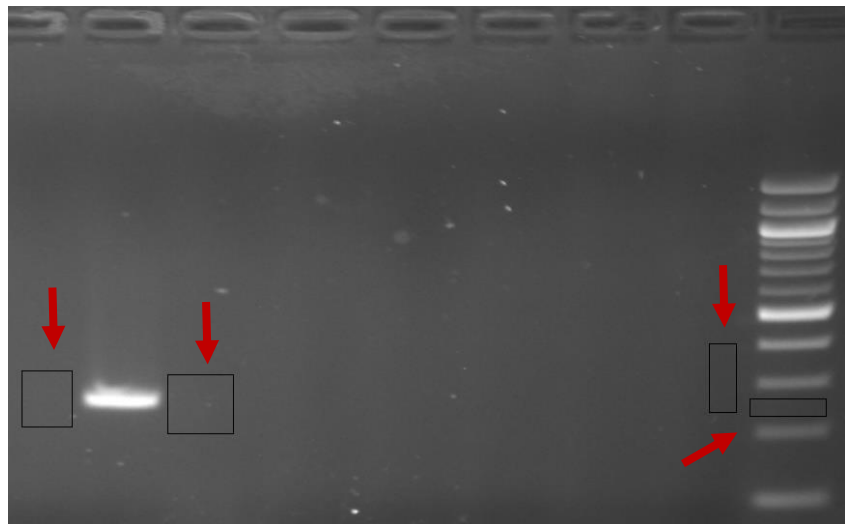

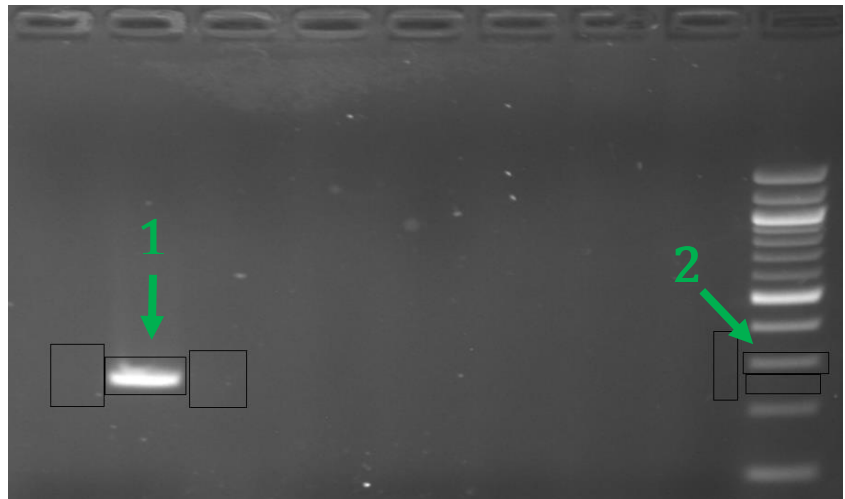Figure 1: background selection for concentration calculation

Figure 2: standard and band of interest selection

1) to. You confirm every selection through pressing 'esc', as in the previous steps. The best standard band to compare to is the one which is closest to your sample band in terms of migration distance. After that you will be prompted to enter which standard you used. In order to proceed, just enter the index of your used standard displayed in the list above and afterwards enter the index of the standard band you used for comparison. In Fig.2 this would be number 9 (counting from the top of the standard), because you need to start counting from 0. The concentration will then be displayed in the command line.

Size calculation

To start the size calculation, you start with entering the name of your image or the corresponding index again. When you are prompted to choose between 'conc' and 'size', you enter the command 'size'. Next you will be asked about your preferred sensitivity mode, which is an integer between 0 and 6, where 0 is the most sensitive mode and 6 the least. This is important because different images have different exposures and therefore have different bright lanes. If your image consists mostly of very bright bands, you should use a sensitivity mode of 5 or 6, whereas when your image is more on the underexposed side and the bands are hard to see, you might want to try a more sensitive mode like, 1 or 0. After that, you enter the index of the standard you used from the displayed list of supported standards. A window with your previous selected image will open. Here you need to select the whole standard (Fig. 3) and confirm your selection with pressing 'esc'. The same window will appear with now displaying all recognized bands in the standard and their center (according to their migration distance) shown by a small circle (Fig. 4). If the selection was correct or if the selection has to be improved, press 'esc' eitherway to get back to the command line. When all bands are correctly recognized you enter 'y', when too many bands are detected enter 'm', when bands are missing enter 'a' and if bands are detected where no bands should be and in addition bands are missing in the recognition, enter 'b'.

"m"

When too many bands are detected, enter the according indeces seperated by ',' (e.g. 1,2,3), which leads to the deletion from the list used for the size calculation but they will still be displayed in the image. With pressing 'esc' twice you continiue with the next step.

"a"

When bands are not present in the selection, enter the amount of bands missing when the prompt shows up in the command line. A window with the image and the recognized bands will show up again. Here you select the band(s) which should be added. To confirm every selection, press 'esc' (Fig. 4).
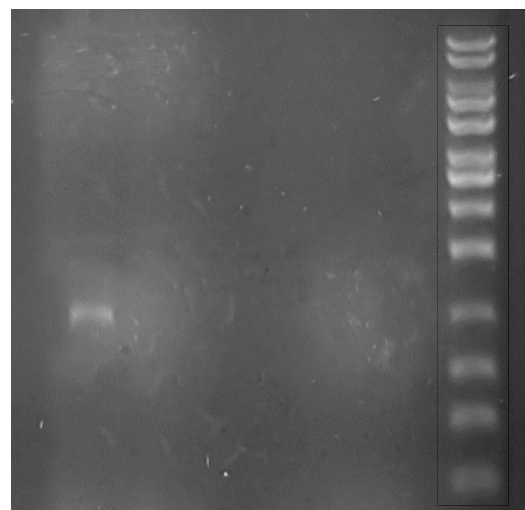

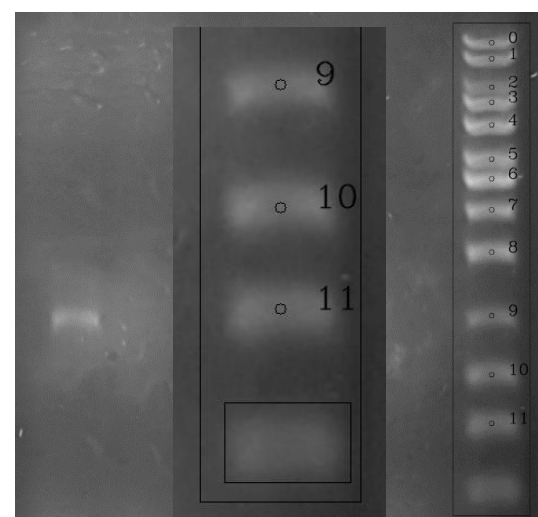*Figure 3: Standard selection for size calculation*

Figure 4: recognized standard bands and selection of band which must be added
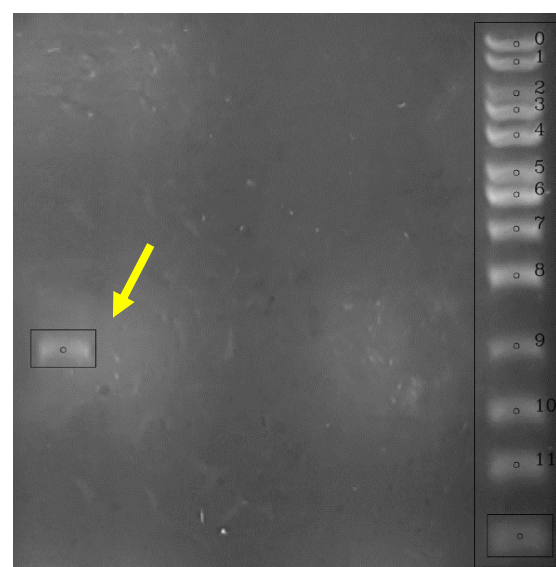

Figure 5: selected band for size calculation

The recognized middle of the band will show up afterwards. After pressing 'esc' again, you will see a prompt on the left upper corner of the image, which says 'select band of interest'. Now you select the band, whose size you want to determine. Confirm your selection with 'esc' (Fig. 5). The recognized center of the band will show up. After pressing 'esc' the calculated size for the band will be displayed in the command line.

"b"

If you selected 'b', both described methods will be run by program, starting with entering which bands are in excess and afterwards adding the missing bands as previously described.