"Intelligent Analysis of Medical Images" Course Assignment

Practical Part (30 Marks)

The objective of this exercise is to acquaint ourselves with the CellProfiler software, a crucial tool for automating biological data analysis in laboratories. In this task, we aim to streamline the process by designing a pipeline to assist a research laboratory in the Venk neighborhood focusing on specific samples related to a new disease. Leveraging our expertise in the CellProfiler software, we plan to automate the analysis for them.

\*\*Part I: Preliminary Preparation\*\*

1. Begin by downloading the latest version of the software from [this link].

2. Load the provided incomplete pipeline.

3. Images: Import both images located in the Image folder within the software.

4. Metadata: No metadata extraction is required for this exercise; hence, no changes are needed in this section.

5. NameAndType: Automate the separation and naming of mask images and test samples. Assume test sample images start with "-1" and mask images contain the expression "PlateTemplate." Assign the OrigColor statement to test sample images and the PlateTemplate statement to mask images. Set test sample image type to ColorImage and PlateTemplate image type to BinaryMask.

6. Groups: Since image grouping is unnecessary for this exercise, no changes are required in this section.

\*\*Part II: Preparing the Pipeline\*\*

7. Utilize the ColorToGray module to separate the RGB channels of our samples. Name the red channel OrigRed, the green channel OrigGreen, and the blue channel OrigBlue.

8. Correct uneven lighting using three CorrectIlluminationCalculation modules for each main image channel. Produce an "IlluminationCorrectionFunction" for each channel. Set Background and BlockSize to 22. Set the output names of the red channel module to IllumRed, and the rest accordingly.

9. Correct the images of each channel using a CorrectIlluminationApply module. Set the input image to the images obtained from step 6 and the operation type to Subtract. Set the output names of the modules according to each channel, e.g., CorrRed.

10. Combine blue and green channel images with the ImageMath module. Set the output name to CombinedImage, the combination method to Add, and multiply the result by 0.5.

11. Align the PlateTemplate image, red channel corrected image, and combined image using the Align module. Set KeepSize, name the outputs as AlignedPlate, AlignedRed, and AlignedCombined, respectively. Set Alignment to Similarity.

12. Apply the desired mask using the MaskImage modules on the aligned images. Name the outputs MaskedRedPlate and MaskedCombined to remove areas outside the plate.

13. To detect the Redness of each clone, subtract the combined image from the red image using the ImageMath module. Name the output SubtractedRed and consider negative values as zero.

The remaining pipeline items are specialized and require no changes. Upon running all modules, save the resulting image and two CSV files. Please include them with your report.