EPAM'S ULTRASOUND IMAGING TOOL AUGMENTS PRE-CLINICAL ACCURACY & EFFICIENCY

EPAM'S INNOVATIVE TOOL TO AUGMENT PRE-CLINICAL INVESTIGATION ACCURACY & EFFICIENCY

The client is a global healthcare leader committed to improving the health and lives of people around the world. Offering a wealth of pharmaceutical products engineered to treat heart and respiratory health, infectious diseases, women's health, and more, the company devotes extensive time and energy to increasing access to medicines and vaccines through far-reaching programs that donate and deliver their products to those who need them.

THE CHALLENGE: AUTOMATICALLY SEGMENT ULTRASOUND IMAGES FOR ANALYSIS

To aid in its research on the development of peripheral vascular diseases like atherosclerosis, the client was looking to create a new, innovative tool that optimizes experimental processes for examining rodents in the pre-clinical stage of drug development. The ultimate goal of this research was to observe changes in vessel parameters, how the vessels change in the treated group compared to the control group, and whether there is an effect on the vessels when administering the tested drug over a long period of time. Since mice are used as test subjects in pre-clinical investigations, the tiny size of rodent blood vessels make the process more challenging.

In order to eliminate manual work and ensure the integrity of mice artery walls identification, the client requested that EPAM develop an algorithm that, when implemented, performs the automatic segmentation of vascular bed images with pinpoint accuracy. The client called for a solution that would determine the external and internal boundaries of artery walls, thus allowing doctors and biologists to analyze segmented realms of ultrasound images.

To be successful, the tool would enable the user to load images to the user interface (UI), manually select the fragment of the artery, and perform the segmentation of the image within the prescribed artery section. From there, the tool would process files for segmentation according to the developed algorithm, resulting in the ability to measure quantitative characteristics of selected artery areas and store this data in the proper format.

CASE STUDY:

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THE SOLUTION: EPAM'S PROPRIETARY ULTRASOUND IMAGE SEGMENTATION TOOL

Based on the client's specifications and our own independent research, EPAM created a tool to perform ultrasound image segmentation within a defined artery section by applying an effective algorithm. With the Ultrasound Image Segmentation Tool, users can easily accomplish the following objectives:

- Compute the quantitative characteristics (size, square of cut, volume, etc.) of selected artery areas using the determined artery boundaries

- Verify the automatic segmentation results by comparing them to the manual segmentation results, or to the results obtained using other software tools

- Investigate the influence of the approximation parameters on the obtained result

- Manually define the artery's axis and artery wall in one longitudinal axis section

- Generate the report in the approved format

In addition to enabling users to explore every facet of each segmented ultrasound image, the tool is extremely powerful and possesses the following data utilization and visualization capabilities:

- Visualize the read data as axial sections on three orthogonal coordinates (axis)

- Visualize the vessel's internal and external surfaces using strip rendering

- Plot and generate 3D heatmaps for the intensity distribution in the vessel's cross-sections

- Scale the images, limit the selected area, and normalize the image area

- Transform the image using the sigmoid filter in order to render the most probable ranges of grey color

- Apply the segmentation algorithm to the defined artery wall fragments, and apply the alternative method for approximation of the internal vascular wall using two-dimensional B-splines

- Batch process files and summarize in an output file

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THE RESULT: NEW LEVEL OF PRE-CLINICAL DRUG TESTING ON MICE

With the creation and implementation of EPAM's interactive Ultrasound Image Segmentation Tool, the client and its partners were able to conduct a large number of experiments that would not have been possible manually. For scientists and clinicians, the tool's implementation results in the following advantages:

- More ease and accuracy in pinpointing problem areas, such as cholesterol buildup, within arteries and other vessels

- A better understanding of how drugs activate and work within vessels

- Improved data collection and storage capabilities to help recognize health trends related to state and appearance of vessels

On a grander scale, the novel technology developed for the Ultrasound Image Segmentation Tool paves the way for further advancement in pre-clinical drug development. If your company is interested in pursuing future technological innovations in the field of Life Sciences, please contact EPAM today.