

Development of MATLAB Based User Interface (Med i TexLab) to Manipulate DICOM Images and Extract 93 Different Texture Features

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Studying the texture of biomedical images is an essential aspect of modern biomedical research, image segmentation workflow, and medical diagnostics. This involves the extraction of quantitative insights from complex imaging datasets. With the proliferation of DICOM imaging modalities, the demand for sophisticated software tools that capable of robustly processing, meticulously analyzing, and insightfully interpreting DICOM datasets has become paramount. To satisfy this demand, Med *i* TexLab developed a MATLAB-based graphical user interface (GUI), offering a suite of functionalities meticulously designed for DICOM image manipulation, texture feature extraction, and analysis. Before applying the application in vivo, proceeding with a descriptive scientific evaluation of its functionalities, architecture, and performance is essential. Therefore, this abstract on technical aspect of the software addresses this gap by meticulously exploring the Med *i* TexLab codebase, drawing upon established principles from software engineering, human and computer interaction, image processing, and biomedical informatics. The developed computer application allows the researchers to extract 93 different texture features in several perspectives like Fractal Features, Wavelet Transform, Gray Level Co-occurrence Matrix (GLCM), Local Binary Patterns (LBP), Gray Level Run-length Matrix (GLRM), and Texture Spectrum. Also, it allows to save the extracted texture features in a CSV file for further analysis. However, the Med *i* TexLab has positioned itself as a unique paradigm, allowing the user to access, manipulate, and extract texture features from DICOM images. To demonstrate the functionality of the application, we have loaded five different sequences of magnetic resonance imaging (MRI) brain and breast images (T1, T2, T2*, diffusion and proton density-weighted image), computed tomography (CT) images of brain and abdomen, ultrasound images of abdomen, mammograms as well as clinical X-ray images of chest, shoulder and digital dental X-rays. With each demonstration, the interface provided promising results and was able to collect texture feature details to a CSV file as programmed. Also, the user-friendliness of the application was evaluated by an expert in human and computer interaction (HCI). The evaluation process was based on several components like usability, functionality, accessibility, user experience, and context of use. The result of the as follows: Usability: 85/100, Accessibility: 65/100, and Functionality: 95/100, User Experience (UX): 85/100, Context of Use: 50/100. The robust image processing capabilities of the interface bridge the gap between sophisticated analytical techniques and user-friendly accessibility. Since this is the only available computer application that includes all the aforementioned features and functionalities with a simple four-step process (image loading, zoom in/out, draw region of interest, calculate texture features) the application becomes unique and timely needed tool for researchers who involved in studies based on DICOM images and clinical practice to develop enhancements, and advancements as well as identifying reference texture feature values of specific tissues from healthy /unhealthy individuals.

Keywords: Biomedical Image Analysis, DICOM, MATLAB, Graphical User Interface, Software Evaluation, Optimization