Registration of Medical Images - MRI & Mammography of Breast Cancer

אוניברסיטת אריאל בשומרון

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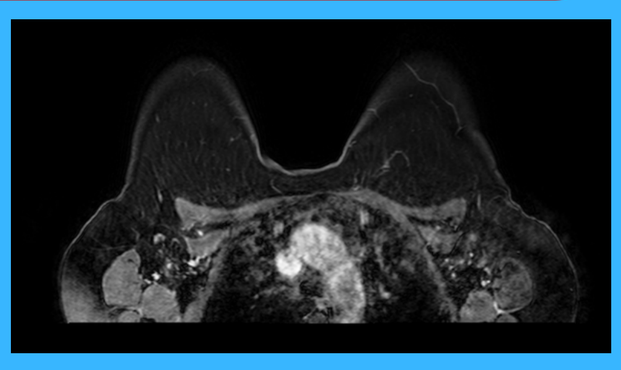
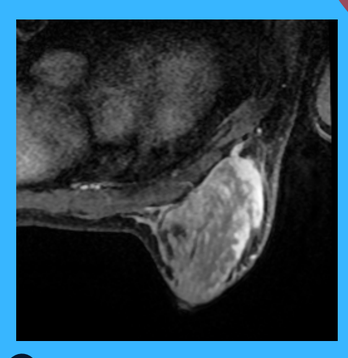
Project's goal

Our primary objective is to enhance the efficacy and affordability of breast cancer removal surgeries by focusing on the registration of MRI and Mammography images. This will allow us to accurately pinpoint the tumor's location with regards to posture changes.



Introduction

Breast cancer is a common cancer among women, and current surgeries have limitations and risks. We propose a non invasive method for precise cancer analysis to improve surgical success. Our framework focuses on adjusting the patient's posture to ensure accurate tumor removal. This project aims to reduce re-operations, costs, hospitalization, and surgery complications through an Augmented Reality application.



Methods

We utilized a package called VoxelMorph, designed for learning-based image registration using the U-net architecture. With VoxelMorph, we attempted to understand the movement between standing and lying positions. We also used PoseNet, a package designed to detect a person's position in an image, to enhance our picture analysis.

Selected Approach

The project's model will be based on:

- Registration of MRI and Mammography images.
- Projection on the patient's body by Augmented Reality (AR).

Solution Description

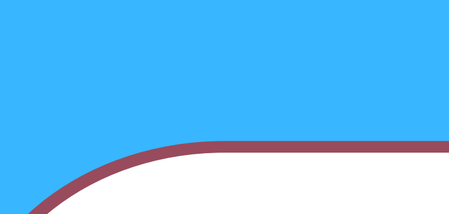
VoxelMorph: A package developed for learning-based image registration, leveraging the U-net CNN architecture.

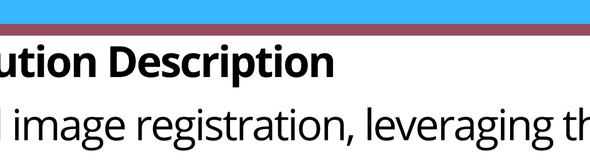
Unet: This CNN architecture, designed for biomedical image segmentation, has proven to yield more accurate results with less training data. The architecture comprises two stages. The first stage involves the concatenation of convolution, ReLU, and pooling layers to downsample the image. In the second stage, we upsample and merge data from the corresponding level in the downsampling stage. This architecture provides us with valuable spatial information and high-resolution images.

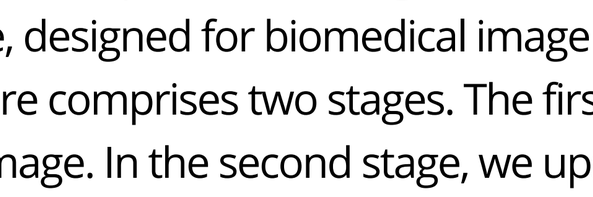
Data Augmentation: Since there is a lack of medical data, we had to collect our own data set and apply different augmentation methods to it in order to increase the dataset size.

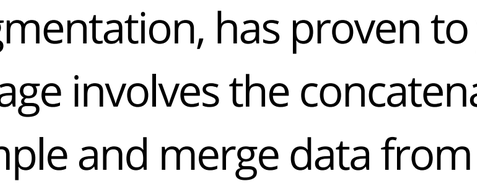
Detailed Description of the Proposed Research

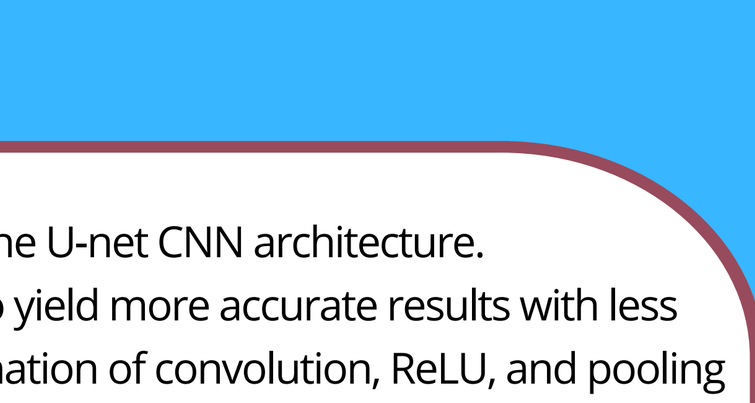
Our approach involves a multiscale coarse-to-fine image registration. The first stage is a Coarse – Posture to Posture (P2P) registration, which addresses the significant patient's MRI-Mammogram postures variability. The second stage is a Fine – Lesion to Lesion (L2L) registration, which allows for more accurate and local non-rigid lesion registration, fine-tuning the coarse one.











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